A Member of the Texas Tech University System

Course Syllabus: Teaching Science in Middle School/High School

West College of Education

Fall 2024, revised Aug 2024

Instructor: Dr. Dittika Gupta
Office: Bridwell 220
Office hours: Monday 9:00-10:30am, Wednesday 9:00-10:30am, and Thursday 10:00-12:00pm. I am also happy to meet outside of office hours if there is a need. Don't hesitate to contact me to find a convenient time for both of us.
Office phone: 940-397-4269
E-mail: dittika.gupta@msutexas.edu

Instructor Response Policy

We will be working and communicating constantly throughout the semester. Email is great however you will also be a part of class GroupMe which will provide more flexibility in communication. I will try my best to answer all emails and texts within 24 hours, however you will get a response within 48 hours (2 days). Any emails or texts received during weekends will not receive a response till the following Monday. No emails or texts will be answered over the weekend.

Textbook & Instructional Materials

No textbooks. All materials will be on D2L in the form of links, videos, articles, readings, and other documents.

Course Description

This field-based, 3-credit course focuses on middle and secondary school science pedagogy with emphasis on instructional strategies and models, the use of technology in the learning/teaching process, effective practices, professionalism, curriculum, and lesson design. Different teaching strategies include appropriate use of creative approaches to the learning/teaching process, cooperative learning, direct instruction, inquiry, concept attainment, etc. An important component of this field-based block of classes is the course time spent in active participation in field (classroom) experiences

Prerequisite(s): EDUC 3163, EDUC 3183, EPSY 3153, and SPED 3613 & Admission to the teacher education program.
Co-requisite(s): Concurrent enrollment in ETEC 4003.

Course Objectives

- Learners will be able to understand, describe and implement learning and thinking in science in middle/high school level.
- Learners will be able to develop curriculum and use effective instructional planning skills.
- Learners will be able to develop appropriate assessment tools to assess students' learning and use the assessment data to design appropriate learning activities.
- Learners will be able to develop lesson plans that involve students in an active learning environment, including flexible instructional strategies and differentiation.
- Learners will be able to develop lesson plans/unit plans that incorporate national standards and state standards in science.
- Learners will be able to develop technology integrated instructional and assessment strategies and activities.
- Learners will be able to develop and implement effective teaching strategies including learner-centered instruction, integrating effective modeling, questioning and self-reflection strategies.
- Learner will be able to effectively implement discipline management procedures and communicate clear expectations for achievement and behavior for their students.
- Learners will be able to develop and implement learning environments (positive, equitable, engaging) that utilize various teaching/learning strategies, integrating critical thinking, inquiry, and problem solving.
- Learner will be able to assume various roles in the instructional process (facilitator, instructor, audience, …)
- Learner will be able to provide quality and timely feedback to students.
- Learner will be able to differentiate instruction to meet the academic needs and behavioral needs of students with disabilities and LEP-ELL and to provide appropriate ways of the students to demonstrate their learning.
- Learner will be able to collaborate with professionals in meeting the needs of students with disabilities.
- Learner will be able to understand and adhere to federal and state laws and district and campus policies regarding Students with disabilities and LEP-ELL students and implement IEP decisions and assessments related with IEP goals and objectives.
- Learner will be able to model and teach the forms and functions of academic English in content areas.
- Learner will be able to build and maintain positive rapport with students and their families.

See Appendix A for a complete list of standards, competencies, and other expectations.
See Appendix B: Required assignment/standard alignment matrix

Study Hours and Tutoring Assistance

The TASP offers a schedule of selected subjects tutoring assistance. Please contact the TASP, (940)397-4684, or visit the TLC homepage for more information. Tutoring & Academics Supports Programs

Student Handbook

Refer to: Student Handbook

Academic Misconduct Policy & Procedures

Academic Dishonesty: Cheating, collusion, and plagiarism (the act of using source material of other persons, either published or unpublished, without following the accepted techniques of crediting, or the submission for credit of work not the individuals to whom credit is given). Additional guidelines on procedures in these matters may be found in the Office of Student Conduct. **Refer to**: Office of Student Conduct

Grading/Assessment

Table 1: Points allocated to each assignment.

Assignments	**Grade Points**
Lesson Plan (50, 75, and 100)	225 points
Classroom Observation (best of the two)	200 points
Technology Assignments	25 points
Lab presentations (Individual)	40 points
Group Presentation	100 points
Lab Safety	50 points
Article Analysis	50 points
Reflection Assignment	12 points
Participation, Attendance, and Classroom Disposition (given in 30, 40, and 40 points)	110 points
Final Exam (Unit Plan)	108 points
TOTAL	**920 points**

***Grading points may change as per the needs of the class and students.**

Table 2: Total points for final grade.

Grade	**Points**
A	90% - 100%
B	80% - 89.99%
C	70% - 79.99%
D	60% - 69.99%
F	Below 59.99%

***Note that an "A" is 90% to 100%. There will be NO rounding and grades will be calculated with two decimal points.**

Written Assignments

There are written assignments throughout the semester such as article analysis, lesson plans, reflection, and unit plans that build your understanding of thinking about how children assimilate science and also prepare you to become aware of research-based practices in teaching science. Details for each of them will be provided in class and also available on D2L.

Presentation/Mini-Teaching

There will be two mini-teaching/presentation during the course to provide you with a space to practice teaching and get peer and instructor feedback. One teaching would be individual and one would be a group teaching in a co-teaching model, thus providing you with different pedagogies in teaching. Details about the expectations, rubric, and implementation will be provided in class and also available on D2L.

Technology Assignment

Integration of technology needs to be purposeful and intentional in teaching of science. During the semester, you will be exposed to numerous technologies and also have opportunities to demonstrate your understanding of integrating technology. The assignments will provide variety and space to express your understanding in different ways. Details about the assignment along with rubrics will be shared in class

Lesson Planning

Teacher candidates must demonstrate the ability to plan, assess, and implement instruction. This begins in the Foundational block where the teacher candidates create and write lessons for effective teaching. Teacher candidates are required to develop lesson plans. The specific format can be adapted, but should always include the objectives (TEKS), procedures, materials/resources, and assessment. Student engagement is a key element in a good lesson with a goal of student learning/success is the ultimate goal.

Candidates must form an assessment strategy to determine the extent to which students are able to master learning of objectives. Candidates also describe the instructional delivery method addressing the following step-by-step procedures:

1. Questions and concerns listed in the directions given to you by your instructor
2. Setting purposes ("Today we will be…I want you to…because you will…")
3. Method(s) for engaging students in the lesson
4. Any questions asked during the lesson should be in bold
5. Higher order thinking reflected in questions
6. Instructional Strategies: Modeling, Discussion, "Hands-on", Inquiry, etc.
7. Grouping: when and how
8. Instruction that addresses learners' needs (ELLs, Special Education, 504, Gifted, Struggling Learner)
9. Closure

After teaching the lessons, candidates are then required to reflect on the lesson delivery, appropriateness of instructional strategies, impact for future planning, and opportunities for collaboration with mentor teacher. The skills acquired during lesson planning provides the foundation and are also built upon for unit planning and other key assessments.
See Appendix B for other learning experiences at WCOE.

Unit Planning

Unit Plan is a WCOE key assessment. Teacher candidate's ability to demonstrate the ability to plan, assess, and implement instruction continues in the professional block with the Unit plan assessment. The unit plan assessment is a modified form of Midwestern Impact on Student Learning (MISL) that requires teacher candidates to plan a unit of teaching. Candidates are required to determine a set of multiple learning objectives aligned to state content standards Texas Essential Knowledge and Skills (TEKS) appropriate to the lesson(s) the candidate is preparing.

As you complete the assignments for this class, you will demonstrate skills from the following five categories and will assessed based on them:
Domain I: Planning and Preparation - demonstrate knowledge of content and pedagogy; demonstrate knowledge of students; select instructional goals; demonstrate knowledge of resources; design coherent instruction; assess student learning.

- Plan *minds-on* lessons in a unit around *powerful ideas* that have students actively involved in the learning process.
- Use the TEKS and district assigned standards for science instruction.
- Curriculum and NCTM standards, to develop and present the lessons.
- Content understanding and learning goals are assessed.
- Data collection and analysis.

Domain II: Classroom Environment - establish a culture for learning.

Field experience observation: Teach one Science lesson in your field experience placement. Submit Lesson Plan to me AND your mentor teacher *five school days in advance*. Lesson cannot be taught until approved by both of us and must be observed by me.
Domain III: Instruction - communicate clearly and accurately; use questioning and discussion techniques; engage students in learning; provide feedback to students; demonstrate flexibility and responsiveness.

- Field experience observation.
- Peer instruction and reviews.
- Classroom activities
- Problem-solving

Domain IV: Professionalism - Reflect on teaching; show professionalism; contribute to the school and/or district.

- Reflection required after Science lesson taught.
- Being *present* in class in a prompt manner.
- Classroom Participation.

Domain V: Technology Integration - demonstrate the use of technology in the learning/teaching process.

- Integrate technology by being aware of various resources and its effectiveness and application to the curriculum.
- Integrate technology and correlate it to the Science TEKS by critically analyzing technology for teaching science.
- Assignments accurately posted through D2L and TK20.

Extra Credit

Extra Credit opportunities will be given and will depend on the flow and needs of the class.

Late Work

25% off per day per assignment (including Saturday and Sunday). So, if the assignment is for 100 points, you can make a maximum score of 75 after one day, 50 after two days, 25 after three days, and zero after 4 days if all your answers are correct. There is NO late work on discussion boards or quizzes! All this is non-negotiable!!! If there are any issues/confusions, contact me BEFORE the assignment is due (at least 48 to 24 hours before the assignment is due). Time shown as on D2L or email be used.

NOTE: *Computer or D2L issues do not provide an excuse*. Extensive use of the MSU D2L program is a part of this course. Each student is expected to be familiar with D2L as it provides a primary source of communication regarding assignments, examination materials, and general course information. You can log into D2L through the MSU Homepage. If you experience difficulties, please contact the technicians listed for the program or contact your instructor. *Do not wait till the last minute to submit the assignment.* Delays or sending through email will be counted late!

Make Up Work/Tests

There will be no make-up or resubmissions allowed on assignments, quizzes, discussion boards, or any other activity in class.

Important Dates

Last day for term schedule changes: August 26-29, 2024. Check date on Academic Calendar.
Deadline to file for graduation: October 7, 2024. Check date on Academic Calendar.
Last Day to drop with a grade of "W:" October 9, 2024. Check date on Academic Calendar.
Refer to: Drops, Withdrawals & Void

Desire-to-Learn (D2L)

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Computers are available on campus in various areas of the buildings as well as the Academic Success Center. ****Again, your computer being down is not an excuse for missing a deadline!!*** There are many places to access your class! If you have technical difficulties in the course, there is also a student helpdesk available to you. The college cannot work directly on student computers due to both liability and resource limitations however they are able to help you get connected to our online services. For help, log into D2L.

Attendance

Absence Policy - Professional teachers are dependable, reliable, and responsible. Therefore, candidates are expected to be on time and in attendance at **every** class, and to stay for the **entire**

class. Tardiness, leaving early, and excessive absences (3) are considered evidence of lack of dependability, and are taken seriously. *Candidates will receive a grade of F on the third absence. If a candidate is taking 'blocked' courses that are taught at a Professional Development School, requiring field experience, the candidate will be dropped with an F from those classes as well.*

After an absence from the course, it is imperative that a student schedule an appointment with the course instructor to discuss attendance. Failure to schedule and attend a conference will result in the loss of classroom participation and disposition points and also in the overall grade being lowered by one letter. It is the candidate's responsibility to make up any missed work. It is also expected that you will complete all course field experience hours in a professional manner. Professional conduct is expected when observing or participating in school settings (e.g., dressing appropriately, arriving on time, remaining for the entire pre-arranged time, not canceling, and demonstrating respect in all interactions with young people, parents, teachers, and staff). If you must miss your field experience for any reason, you are expected to call the school and the teacher you are working with **before** school begins for the day. You must also contact the course instructor by e-mail or phone to let me know you will not be present and arrange a time with me when we can discuss the most appropriate way to make up that absence. Excessive tardiness (determined by the professor) can be defined as an absence and subject to the absentee policy. Three instances of tardy arrival will be counted as one absence.

In the event that a class member is absent, for whatever reason, that individual assumes responsibility for contacting the instructor to account for missed work and to turn in work. **It is impossible to provide a summary of all that takes place during any given class via email.** If a student is going to be absent, they have the responsibility to contact the instructor to turn in assignments and obtain copies of any handouts from the missed class. Tentative assignment due dates are listed on the course schedule. While the actual due dates may vary due to the flow of the class, all assignment due dates will be finalized and announced in class well in advance of the specific date. Late work, unless arrangements are made by the student and approved **in advance** by the instructor, **will not be accepted for full credit**.

During your field observations, you are required to submit time logs in TK20 to your cooperating teacher for attendance and participation verification. You must accumulate a minimum of 50 hours total prior to clinical teaching, which need to be approved by the cooperating teacher. This should be done weekly, and you should periodically check TK20 to ensure that your time logs have been approved. For this course, a minimum of 20 hours in the classroom should be dedicated to engaging with students in instructional or educational activities, although you will likely spend more than 15 hours doing so. Prior to your clinical teaching experience, you should have at a minimum of 50 hours of field-based experiences, 30 of which show active engagement in instructional or educational activities. All time log entries must have a detailed description/reflection explaining the instructional or educational activities. At the end of the course, on the date indicated on the calendar, you must upload a screenshot of every approved time log to the appropriate Dropbox in D2L

Class Participation

Students should participate in all activities of this course. It is important that students should meet all the deadlines as posted. In the case of any emergency situation (like death or illness in family, etc.) it is important that the student should report the same to the professor in a timely manner. It is your course, and the primary intention should be to reach the goals and acquire proficiency in the topics discussed in the course. Generally, students are graded on intellectual effort and performance rather than attendance, absences may lower the student's grade where class attendance and class participation are deemed essential.Excessive tardiness or absence (as determined by the professor), disruptive attitude, or failure to consistently class requirements might result in instructor-drop, if required. Being repeatedly late for class will also result in a grade reduction regardless of other marks. Tardiness will result in loss of classroom disposition points and three instances of tardy arrival will be counted as one absence.

Each student brings a unique perspective and life experience to the learning environment and is expected to participate actively and thoughtfully by making pertinent contributions. All students are expected to read assignments and be prepared to discuss them. Note that you are provided with focus questions that are designed to structure your reading of the assigned texts. Moreover, the course instructor may assign additional readings. ***Participating in class discussions and following expectations is a part of your grade***. Please come to class with questions or issues from the reading that you found central or worthy of further exploration. Students may also be asked to do activities and exercises related to the assigned readings or to lead discussions on a topic or reading. You will have many opportunities to participate in class and on D2L. These opportunities are a very important part of this course.

Instructor Classroom Policies

Students are expected to assist in maintaining a classroom environment which is conducive to learning. In order to assure that all students have the opportunity to gain from time spent in class, unless otherwise approved by the instructor, students are prohibited from engaging in any form of distraction—this includes but is not limited to pagers and cell phones. In the classroom or during virtual meetings, cell phones need to be put away so that they do not disrupt the learning environment for you and others. Inappropriate behavior in the classroom shall result, minimally, in a request to leave class and a Professional Fitness Form will be filed for review with the college. If the instructor must file a Fitness Alert Form for any reason, including failure to demonstrate appropriate teaching dispositions, the student may receive an instructor drop with an "F" for the course.

Any student who misses class (for any reason) remains responsible for contacting other students to obtain class materials. In the event that a class member is absent, for whatever reason, that individual assumes responsibility for contacting the instructor to account for missed work and to turn in work. It is impossible to provide a summary of all that takes place during any given class via email. If a student is going to be absent, they have the responsibility to contact the instructor to turn in assignments and obtain copies of any handouts from the missed class. Tentative assignment due dates are listed on the course schedule. While the actual due dates may vary due to the flow of the class, all assignment due dates will be finalized and announced in class well in advance of the specific date. ***Late work, unless arrangements are made by the student and approved in advance by the instructor, will not be accepted for full credit.***

Cheating, collusion, and plagiarism (the act of using source material of other persons, either published or unpublished, without following the accepted techniques of crediting, or the submission for credit of work not the individuals to whom credit is given) will not be considered. I use Turnitin for the written assignments and D2L directly syncs with it (you do not have to do anything). You will be able to see the plagiarism percentage and are welcome to make changes and resubmit ***BEFORE*** the due date. ***Any plagiarism of 30% and above is too much! Your plagiarized assignment will not be graded, receive a zero, and no make-up allowed.**

Self-plagiarism refers to submitting work for credit that is the same or substantially similar to work prepared or submitted for another course without appropriate citation. This includes reusing previous assignments, papers, presentations, or other submissions without instructor approval. Self-plagiarism gives the impression of original work when, in fact, the content has already been submitted for assessment elsewhere. To avoid self-plagiarism, communicate openly with your instructor about building on existing work or repurposing prior submissions. Provide proper citations for any previous work referenced. Unless the instructor indicates otherwise, all assignments submitted for this course must be newly prepared by you and you alone for this specific class. **Any self-plagiarism of 30% and above is too much! Your plagiarized assignment will not be graded, receive a zero, and no make-up allowed.**

Advances in Artificial Intelligence (AI) have now provided generative and creative applications such as Chat GPT, Google Bard, Guru, Microsoft Copilot, and others. Certainly, these tools can be quite useful in the learning process; however, the content they generate does not represent the effort and learning of the student. Since writing, analytical, and critical thinking skills are part of the learning outcomes of this course, all writing assignments should be prepared by the student. Developing strong competencies in this area will prepare you for a competitive workplace. Submitting AI generated work in place of the original and genuine work of the student will be considered a form of academic misconduct. Therefore, **AI-generated submissions are not permitted and will be treated as plagiarism. Any AI generated work of 30% and above is too much! Your assignment will not be graded, receive a zero, and no make-up allowed**.
You may type a question into ChatGPT, you may not exactly copy and paste its response, and turn it in as your own. If you use ChatGPT or any AI, please use it in ways that are ethical, accurate, and useful.

Any instance of plagiarism, AI-generated content, and/or self-plagiarism will be subject to disciplinary action in accordance with the Academic Integrity Policy outlined in the Student Handbook. It's important to remember that the consequences of violating this policy are serious and can have a lasting impact on your academic record. By enrolling in this course, you acknowledge and agree to comply with this plagiarism and AI-generated content policy. Your understanding and commitment to academic integrity are crucial to our learning community

Online Computer Requirements

It is your responsibility to have (or have access to) a working computer in this class. *Assignments are due by the due date, and personal computer technical difficulties will not be considered a reason for the instructor to allow students extra time to submit assignments, tests, or discussion postings*.

Computers are available on campus in various areas of the buildings as well as the Academic Success Center. Your computer being down is not an excuse for missing a deadline!!

As mentioned above, it is your responsibility to have (or have access to) a working computer in this class. *Assignments are due by the due date, and personal computer technical difficulties will not be considered a reason for the instructor to allow students extra time to submit assignments, tests, or discussion postings*.
Computers are available on campus in various areas of the buildings as well as the Academic Success Center. Your computer being down is not an excuse for missing a deadline!!

Instructor Drop

As per the College policies, an instructor may drop a student any time during the semester for excessive absences, for consistently failing to meet class assignments, for an indifferent attitude, or for disruptive conduct. Instructor will give the student a verbal or written warning prior to dropping the student from the class. The instructor-drop takes precedence over the student-initiated course drop of a later date. The instructor will assign a grade of either WF or F through the first 8 weeks of this semester. After this period, the grade will be an F. The date the instructor drop form is received in the Office of the Registrar is the official drop date.

Change of Schedule

A student dropping a course (but not withdrawing from the University) within the first 12 class days of a regular semester or the first four class days of a summer semester is eligible for a 100% refund of applicable tuition and fees. Dates are published in the Schedule of Classes each semester.

Refund and Repayment Policy

A student who withdraws or is administratively withdrawn from Midwestern State University (MSU) may be eligible to receive a refund for all or a portion of the tuition, fees and room/board charges that were paid to MSU for the semester. HOWEVER, if the student received financial aid (federal/state/institutional grants, loans and/or scholarships), all or a portion of the refund may be returned to the financial aid programs. As described below, two formulas (federal and state) exist in determining the amount of the refund. (Examples of each refund calculation will be made available upon request).

Services for Students with Disabilities

In accordance with Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, Midwestern State University endeavors to make reasonable accommodations to ensure equal opportunity for qualified persons with disabilities to participate in all educational, social, and recreational programs and activities. After notification of acceptance, students requiring accommodations should make application for such assistance through Disability Support Services, located in the Clark Student Center, Room 168, (940) 397-4140. Current documentation of a disability will be required in order to provide appropriate services, and each request will be individually reviewed. For more details, please go to Disability Support Services.

Students with Disabilities

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make necessary arrangements. Students must present appropriate verification from the University's Disability Support Services (DSS) Office during the instructor's office hours. Please note that instructors are not allowed to provide classroom accommodation(s) to a student until appropriate verification from DSS has been provided.

College Policies

Campus Carry Rules/Policies

Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes has prohibited. The new Constitutional Carry law does not change this process. Concealed carry still requires a License to Carry permit, and openly carrying handguns is not allowed on college campuses. For more information, visit Campus Carry.

Smoking/Tobacco Policy

College policy strictly prohibits the use of tobacco products in any building owned or operated by WATC. Adult students may smoke only in the outside designated-smoking areas at each location.

Alcohol and Drug Policy

To comply with the Drug Free Schools and Communities Act of 1989 and subsequent amendments, students and employees of Midwestern State are informed that strictly enforced policies are in place which prohibits the unlawful possession, use or distribution of any illicit drugs, including alcohol, on university property or as part of any university-sponsored activity. Students and employees are also subject to all applicable legal sanctions under local, state, and federal law for any offenses involving illicit drugs on University property or at University-sponsored activities.

Active Shooter

The safety and security of our campus is the responsibility of everyone in our community. Each of us has an obligation to be prepared to appropriately respond to threats to our campus, such as an active aggressor. Please review the information provided by MSU Police Department regarding the options and strategies we can all use to stay safe during difficult situations. For more information, visit Safety / Emergency Procedures. Students are encouraged to watch the video entitled "*Run. Hide. Fight.*" which may be electronically accessed via the University police department's webpage: *"Run. Hide. Fight."*

Obligation to Report Sex Discrimination under State and Federal Law

Midwestern State University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from sex discrimination of any kind. State and federal law require University employees to report sex discrimination and sexual misconduct to the University's Office of Title IX. As a faculty member, I am required to report to the Title IX Coordinator any allegations, personally observed behavior, or other direct or indirect knowledge of conduct that reasonably may constitute sex discrimination or sexual misconduct, which includes sexual assault, sexual harassment, dating violence, or stalking, involving a student or employee. After a report is made, the office of Title IX will reach out to the affected student or employee in an effort to connect such person(s) with resources and options in addressing the allegations made in the report. You are also encouraged to report any incidents to the office of Title IX. You may do so by contacting:

Laura Hetrick
Title IX Coordinator
Sunwatcher Village Clubhouse
940-397-4213
laura.hetrick@msutexas.edu

You may also file an online report 24/7 at File Report here

Should you wish to visit with someone about your experience in confidence, you may contact the MSU Counseling Center at 940-397-4618. For more information on the University's policy on Title IX or sexual misconduct, please visit Title IX

COVID

Scientific data shows that being fully vaccinated is the most effective way to prevent and slow the spread of COVID-19 and has the greatest probability of avoiding serious illness if infected in all age groups. Although MSU Texas is not mandating vaccinations in compliance with Governor Abbott's executive orders, we highly encourage eligible members of our community to get a vaccination. If you have questions or concerns about the vaccine, please contact your primary care physician or health care professional. Given the recent rise in cases, individuals are also strongly encouraged to wear facial coverings when indoors among groups of people, regardless of vaccination status. Although MSU Texas is not currently requiring facial coverings, they have been an effective strategy in slowing the spread.

Grade Appeal Process

Students who wish to appeal a grade should consult the Midwestern State University
Refer to: Undergraduate Catalog

Notice

Changes in the course syllabus, procedure, assignments, and schedule may be made at the discretion of the instructor.

Course Schedule

Disclaimer Notice: Changes in the course syllabus, procedure, assignments, and schedule may be made at the discretion of the instructor to meet the needs of the class appropriately.

All assignments are due on Monday by 11:30pm.

Please see attached document for a detailed course schedule

All science certification candidates should get a minimum of 50 field hours in their scinece methods course.

Other Expectations

As a part of your preparation for becoming a teacher, you are expected to begin acting in a professional manner – starting today. This includes, but is not limited to:

***Internship Experience* –** Throughout your internship experience, ask your mentor teacher to provide you with constructive feedback regarding your classroom presence, interactions with students and lessons that you present to the students. Use this information to make necessary improvements during the time that remains in the schedule. Always conduct yourself in a professional manner.

***Participation* –** It is not enough to just "show up." In other words, you cannot just sit there and breathe. You need to be prepared to discuss the readings that are assigned, contribute appropriately, and encourage the participation of your peers.

***Preparation* –** Complete all assignments on time. Written assignments (whether submitted online or in class) will be discounted by 25% for each late day. Complete readings assigned prior to class in order to be able to participate in class discussions and activities.
***Attitude* –** Demonstrate the following dispositions that are essential for learning:

- Curiosity (ask questions, look for additional answers, probe, reflect)

- Flexibility (take alternate points of view, be open-minded)
- Organization (plan ahead – literally, GET A PLANNER!)
- Patience (take time to reason, be persistent in efforts)
- Risk-taking (try things beyond your current repertoire)
- Passion (invest in ideas, processes, products, and most of all – other people)

Be aware that your attitude is conveyed to others by body language, conversation, neatness, completeness of work, willingness to assist and contribute and many other ways. A sense of humor and the ability to be flexible are crucial – not just in this class but from now on – that is the nature of the classroom.

***Respect* –** Be considerate of others. Do not talk while others are talking; do not use foul language; behave in an ethical manner. This is particularly important considering our classroom location - we are guests in the Wichita Falls school district and should behave as such.

***Professional Development* –** Remember that teaching requires a commitment to continual learning. You will be asked to complete several "chores" as the semester rolls along and the points earned for dispositions are affected by those "chores." Timely completion of tasks (or "chores") is an indication of your "fitness" to this profession.

References

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Appendix A: Standards/Competencies

WCOE Standards

The outcomes for graduates of professional programs are based upon knowledge, skills, and dispositions in the following elements:

1. Learner Development - understand how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and design and implement developmentally appropriate and challenging learning experiences.
2. Learning Differences - understand individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.
3. Learning Environment - work with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.
4. Content Knowledge - understand the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.
5. Application of Content - understand how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.
6. Assessment - understand and use multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.
7. Planning for Instruction - plan instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.
8. Instructional Strategies - understand and use a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.
9. Professional Learning and Ethical Practice - engage in ongoing professional learning and use evidence to continually evaluate his or her practice, particularly the effects of his or her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.
10. Leadership and Collaboration - seek appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Course Objectives

1. Learners will be able to understand, describe and implement learning and thinking in science in middle/high school level.
2. Learners will be able to develop curriculum and use effective instructional planning skills.
3. Learners will be able to develop appropriate assessment tools to assess students' learning and use the assessment data to design appropriate learning activities.
4. Learners will be able to develop lesson plans that involve students in an active learning environment, including flexible instructional strategies and differentiation.

5. Learners will be able to develop lesson plans/unit plans that incorporate national standards and state standards in science.
6. Learners will be able to develop technology integrated instructional and assessment strategies and activities.
7. Learners will be able to develop and implement effective teaching strategies including learner-centered instruction, integrating effective modeling, questioning and self-reflection strategies.
8. Learner will be able to effectively implement discipline management procedures and communicate clear expectations for achievement and behavior for their students.
9. Learners will be able to develop and implement learning environments (positive, equitable, engaging) that utilize various teaching/learning strategies, integrating critical thinking, inquiry, and problem solving.
10. Learner will be able to assume various roles in the instructional process (facilitator, instructor, audience, …)
11. Learner will be able to provide quality and timely feedback to students.
12. Learner will be able to differentiate instruction to meet the academic needs and behavioral needs of students with disabilities and LEP-ELL and to provide appropriate ways of the students to demonstrate their learning.
13. Learner will be able to collaborate with professionals in meeting the needs of students with disabilities.
14. Learner will be able to understand and adhere to federal and state laws and district and campus policies regarding Students with disabilities and LEP-ELL students and implement IEP decisions and assessments related with IEP goals and objectives.
15. Learner will be able to model and teach the forms and functions of academic English in content areas.
16. Learner will be able to build and maintain positive rapport with students and their families.

All Teacher Standards

(1) Standard 1--Instructional Planning and Delivery. Teachers demonstrate their understanding of instructional planning and delivery by providing standards-based, data-driven, differentiated instruction that engages students, makes appropriate use of technology, and makes learning relevant for today's learners.

(A) Teachers design clear, well organized, sequential lessons that build on students' prior knowledge.

(i) Teachers develop lessons that build coherently toward objectives based on course content, curriculum scope and sequence, and expected student outcomes.

(ii) Teachers effectively communicate goals, expectations, and objectives to help all students reach high levels of achievement.

(iii) Teachers connect students' prior understanding and real-world experiences to new content and contexts, maximizing learning opportunities.

(B) Teachers design developmentally appropriate, standards-driven lessons that reflect evidence- based best practices.

(i) Teachers plan instruction that is developmentally appropriate, is standards driven, and motivates students to learn.

(ii) Teachers use a range of instructional strategies, appropriate to the content area, to make subject matter accessible to all students.

(iii) Teachers use and adapt resources, technologies, and standards-aligned instructional materials to promote student success in meeting learning goals.

(C) Teachers design lessons to meet the needs of diverse learners, adapting methods when appropriate.

(i) Teachers differentiate instruction, aligning methods and techniques to diverse student needs, including acceleration, remediation, and implementation of individual education plans.

(ii) Teachers plan student groupings, including pairings and individualized and small-group instruction, to facilitate student learning.

(iii) Teachers integrate the use of oral, written, graphic, kinesthetic, and/or tactile methods to teach key concepts.

(D) Teachers communicate clearly and accurately and engage students in a manner that encourages students' persistence and best efforts.

(i) Teachers ensure that the learning environment features a high degree of student engagement by facilitating discussion and student-centered activities as well as leading direct instruction.

(ii) Teachers validate each student's comments and questions, utilizing them to advance learning for all students.

(iii) Teachers encourage all students to overcome obstacles and remain persistent in the face of challenges, providing them with support in achieving their goals.

(E) Teachers promote complex, higher-order thinking, leading class discussions and activities that provide opportunities for deeper learning.

(i) Teachers set high expectations and create challenging learning experiences for students, encouraging them to apply disciplinary and cross-disciplinary knowledge to real-world problems.

(ii) Teachers provide opportunities for students to engage in individual and collaborative critical thinking and problem solving.

(iii) Teachers incorporate technology that allows students to interact with the curriculum in more significant and effective ways, helping them reach mastery.

(F) Teachers consistently check for understanding, give immediate feedback, and make lesson adjustments as necessary.

(i) Teachers monitor and assess student progress to ensure that their lessons meet students' needs.

(ii) Teachers provide immediate feedback to students in order to reinforce their learning and ensure that they understand key concepts.

(iii) Teachers adjust content delivery in response to student progress through the use of developmentally appropriate strategies that maximize student engagement.

(2) Standard 2--Knowledge of Students and Student Learning. Teachers work to ensure high levels of learning, social-emotional development, and achievement outcomes for all students, taking into consideration each student's educational and developmental backgrounds and focusing on each student's needs.

(A) Teachers demonstrate the belief that all students have the potential to achieve at high levels and support all students in their pursuit of social-emotional learning and academic success.

(i) Teachers purposefully utilize learners' individual strengths as a basis for academic and social-emotional growth.

(ii) Teachers create a community of learners in an inclusive environment that views differences in learning and background as educational assets.

(iii) Teachers accept responsibility for the growth of all of their students, persisting in their efforts to ensure high levels of growth on the part of each learner.

(B) Teachers acquire, analyze, and use background information (familial, cultural, educational, linguistic, and developmental characteristics) to engage students in learning.

(i) Teachers connect learning, content, and expectations to students' prior knowledge, life experiences, and interests in meaningful contexts.

(ii) Teachers understand the unique qualities of students with exceptional needs, including disabilities and giftedness, and know how to effectively address these needs through instructional strategies and resources.

(iii) Teachers understand the role of language and culture in learning and know how to modify their practices to support language acquisition so that language is comprehensible and instruction is fully accessible.

(C) Teachers facilitate each student's learning by employing evidence-based practices and concepts related to learning and social-emotional development.

(i) Teachers understand how learning occurs and how learners develop, construct meaning, and acquire knowledge and skills.

(ii) Teachers identify readiness for learning and understand how development in one area may affect students' performance in other areas.

(iii) Teachers apply evidence-based strategies to address individual student learning needs and differences, adjust their instruction, and support the learning needs of each student.

(3) Standard 3--Content Knowledge and Expertise. Teachers exhibit a comprehensive understanding of their content, discipline, and related pedagogy as demonstrated through the quality of the design and execution of lessons and their ability to match objectives and activities to relevant state standards.

(A) Teachers understand the major concepts, key themes, multiple perspectives, assumptions, processes of inquiry, structure, and real-world applications of their grade-level and subject-area content.

(i) Teachers have expertise in how their content vertically and horizontally aligns with the grade-level/subject-area continuum, leading to an integrated curriculum across grade levels and content areas.

(ii) Teachers identify gaps in students' knowledge of subject matter and communicate with their leaders and colleagues to ensure that these gaps are adequately addressed across grade levels and subject areas.

(iii) Teachers keep current with developments, new content, new approaches, and changing methods of instructional delivery within their discipline.

(B) Teachers design and execute quality lessons that are consistent with the concepts of their specific discipline, are aligned to state standards, and demonstrate their content expertise.

(i) Teachers organize curriculum to facilitate student understanding of the subject matter.

(ii) Teachers understand, actively anticipate, and adapt instruction to address common misunderstandings and preconceptions.

(iii) Teachers promote literacy and the academic language within the discipline and make discipline-specific language accessible to all learners.

(C) Teachers demonstrate content-specific pedagogy that meets the needs of diverse learners, utilizing engaging instructional materials to connect prior content knowledge to new learning.

(i) Teachers teach both the key content knowledge and the key skills of the discipline.

(ii) Teachers make appropriate and authentic connections across disciplines, subjects, and students' real-world experiences.

(4) Standard 4--Learning Environment. Teachers interact with students in respectful ways at all times, maintaining a physically and emotionally safe, supportive learning environment that is characterized by efficient and effective routines, clear expectations for student behavior, and organization that maximizes student learning.

(A) Teachers create a mutually respectful, collaborative, and safe community of learners by using knowledge of students' development and backgrounds.

(i) Teachers embrace students' backgrounds and experiences as an asset in their learning environment.

(ii) Teachers maintain and facilitate respectful, supportive, positive, and productive interactions with and among students.

(iii) Teachers establish and sustain learning environments that are developmentally appropriate and respond to students' needs, strengths, and personal experiences.

(B) Teachers organize their classrooms in a safe and accessible manner that maximizes learning.

(i) Teachers arrange the physical environment to maximize student learning and to ensure that all students have access to resources.

(ii) Teachers create a physical classroom set-up that is flexible and accommodates the different learning needs of students.

(C) Teachers establish, implement, and communicate consistent routines for effective classroom management, including clear expectations for student behavior.

(i) Teachers implement behavior management systems to maintain an environment where all students can learn effectively.

(ii) Teachers maintain a strong culture of individual and group accountability for class expectations.

(iii) Teachers cultivate student ownership in developing classroom culture and norms.

(D) Teachers lead and maintain classrooms where students are actively engaged in learning as indicated by their level of motivation and on-task behavior.

(i) Teachers maintain a culture that is based on high expectations for student performance and encourages students to be self-motivated, taking responsibility for their own learning.

(ii) Teachers maximize instructional time, including managing transitions.

(iii) Teachers manage and facilitate groupings in order to maximize student collaboration, participation, and achievement.

(iv) Teachers communicate regularly, clearly, and appropriately with parents and families about student progress, providing detailed and constructive feedback and partnering with families in furthering their students' achievement goals.

(5) Standard 5--Data-Driven Practice. Teachers use formal and informal methods to assess student growth aligned to instructional goals and course objectives and regularly review and analyze multiple sources of data to measure student progress and adjust instructional strategies and content delivery as needed.

(A) Teachers implement both formal and informal methods of measuring student progress.

(i) Teachers gauge student progress and ensure student mastery of content knowledge and skills by providing assessments aligned to instructional objectives and outcomes that are accurate measures of student learning.

(ii) Teachers vary methods of assessing learning to accommodate students' learning needs, linguistic differences, and/or varying levels of background knowledge.

(B) Teachers set individual and group learning goals for students by using preliminary data and communicate these goals with students and families to ensure mutual understanding of expectations.

(i) Teachers develop learning plans and set academic as well as social-emotional learning goals for each student in response to previous outcomes from formal and informal assessments.

(ii) Teachers involve all students in self-assessment, goal setting, and monitoring progress.

(iii) Teachers communicate with students and families regularly about the importance of collecting data and monitoring progress of student outcomes, sharing timely and comprehensible feedback so they understand students' goals and progress.

(C) Teachers regularly collect, review, and analyze data to monitor student progress.

(i) Teachers analyze and review data in a timely, thorough, accurate, and appropriate manner, both individually and with colleagues, to monitor student learning.

(ii) Teachers combine results from different measures to develop a holistic picture of students' strengths and learning needs.

(D) Teachers utilize the data they collect and analyze to inform their instructional strategies and adjust short- and long-term plans accordingly.

(i) Teachers design instruction, change strategies, and differentiate their teaching practices to improve student learning based on assessment outcomes.

(ii) Teachers regularly compare their curriculum scope and sequence with student data to ensure they are on track and make adjustments as needed.

(6) Standard 6--Professional Practices and Responsibilities. Teachers consistently hold themselves to a high standard for individual development, pursue leadership opportunities, collaborate with other educational professionals, communicate regularly with stakeholders, maintain professional relationships, comply with all campus and school district policies, and conduct themselves ethically and with integrity.

(A) Teachers reflect on their teaching practice to improve their instructional effectiveness and engage in continuous professional learning to gain knowledge and skills and refine professional judgment.

(i) Teachers reflect on their own strengths and professional learning needs, using this information to develop action plans for improvement.

(ii) Teachers establish and strive to achieve professional goals to strengthen their instructional effectiveness and better meet students' needs.

(iii) Teachers engage in relevant, targeted professional learning opportunities that align with their professional growth goals and their students' academic and social-emotional needs.

(B) Teachers collaborate with their colleagues, are self-aware in their interpersonal interactions, and are open to constructive feedback from peers and administrators.

(i) Teachers seek out feedback from supervisors, coaches, and peers and take advantage of opportunities for job-embedded professional development.

(ii) Teachers actively participate in professional learning communities organized to improve instructional practices and student learning.

(C) Teachers seek out opportunities to lead students, other educators, and community members within and beyond their classrooms.

(i) Teachers clearly communicate the mission, vision, and goals of the school to students, colleagues, parents and families, and other community members.

(ii) Teachers seek to lead other adults on campus through professional learning communities, grade- or subject-level team leadership, committee membership, or other opportunities.

(D) Teachers model ethical and respectful behavior and demonstrate integrity in all situations.

(i) Teachers adhere to the educators' code of ethics in §247.2 of this title (relating to Code of Ethics and Standard Practices for Texas Educators), including following policies and procedures at their specific school placement(s).

(ii) Teachers communicate consistently, clearly, and respectfully with all members of the campus community, including students, parents and families, colleagues, administrators, and staff.

(iii) Teachers serve as advocates for their students, focusing attention on students' needs and concerns and maintaining thorough and accurate student records.

Science Standards

Standard I - The science teacher manages classroom, field and laboratory activities to ensure the safety of all students and the ethical care and treatment of organisms and specimens.

4-8 Science

Teachers of Students in Grades 4–8

The beginning teacher knows and understands:

1.1k safety regulations and guidelines for science facilities; 1.2k safety regulations and guidelines for science instruction;

1.3k procedures for the appropriate storage, handling, use, disposal, care, and maintenance of chemicals, materials, specimens, and equipment;

1.4k sources of information about laboratory safety;

1.5k procedures for the safe handling and ethical care and treatment of organisms and specimens;

1.6k procedures for responding to an accident in the laboratory, including first aid;

1.7k legal issues associated with accidents and injuries that occur in the classroom, field, or laboratory;

1.8k potential safety hazards in the field (e.g., insect bites, poisonous plants); and

1.9k the importance of providing laboratory space and equipment for all students, including those with special needs.

The beginning teacher is able to:

1.1s employ safe practices in designing, planning, and implementing all instructional activities (e.g., laboratory, field, demonstrations);

1.2s determine sufficient space and classroom arrangement for carrying out laboratory activities;

1.3s provide students with continuous instruction and training in safe techniques and procedures for all laboratory and field activities, student demonstrations, and independent projects;

1.4s read and interpret safety information about chemicals on a Materials Safety Data Sheet (MSDS) and on other chemical labels, including household products;

1.5s check equipment for safety (e.g., cracks in glassware, proper grounding of electrical equipment) prior to use;

1.6s create, implement, and enforce rules and safety procedures to promote and maintain a safe learning environment during laboratory and field activities;

1.7s implement regular procedures to inventory and maintain appropriate safety equipment; and

1.8 s optimize quick and safe access to all safety equipment (e.g., eyewash station, sink, safety shower, fire blanket, and extinguisher).

Life Science

The beginning teacher knows and understands:

1.1k safety regulations and guidelines for science facilities; 1.2k safety regulations and guidelines for science instruction;

1.3k procedures for the appropriate storage, handling, use, disposal, care, and maintenance of chemicals, materials, specimens, and equipment;

1.4k sources of information about laboratory safety;

1.5k procedures for the safe handling and ethical care and treatment of organisms and specimens;

1.6k procedures for responding to an accident in the laboratory, including first aid;

1.7k legal issues associated with accidents and injuries that occur in the classroom, field, or laboratory;

1.8k potential safety hazards in the field (e.g., insect bites, poisonous plants); and

1.9k the importance of providing laboratory space and equipment for all students, including those with special needs.

The beginning teacher is able to:

1.1s employ safe practices in designing, planning, and implementing all instructional activities (e.g., laboratory, field, demonstrations);

1.2s determine sufficient space and classroom arrangement for carrying out laboratory activities;

1.3s provide students with continuous instruction and training in safe techniques and procedures for all laboratory and field activities, student demonstrations, and independent projects;

1.4s read and interpret safety information about chemicals on a Materials Safety Data Sheet (MSDS) and on other chemical labels, including household products;

1.5s check equipment for safety (e.g., cracks in glassware, proper grounding of electrical equipment) prior to use;

1.6s create, implement, and enforce rules and safety procedures to promote and maintain a safe learning environment during laboratory and field activities;

1.7s implement regular procedures to inventory and maintain appropriate safety equipment; and

1.8s optimize quick and safe access to all safety equipment (e.g., eyewash station, sink, safety shower, fire blanket, and extinguisher).

Physical Science

Teachers of Students in Grades 6–12

The beginning teacher knows and understands:

1.1k safety regulations and guidelines for science facilities; 1.2k safety regulations and guidelines for science instruction;

1.3k procedures for the appropriate storage, handling, use, disposal, care, and maintenance of chemicals, materials, specimens, and equipment;

1.4k sources of information about laboratory safety;

1.5k procedures for the safe handling and ethical care and treatment of organisms and specimens;

1.6k procedures for responding to an accident in the laboratory, including first aid;

1.7k legal issues associated with accidents and injuries that occur in the classroom, field, or laboratory;

1.8k potential safety hazards in the field (e.g., insect bites, poisonous plants); and

1.9k the importance of providing laboratory space and equipment for all students, including those with special needs.

The beginning teacher is able to:

1.1s employ safe practices in designing, planning, and implementing all instructional activities (e.g., laboratory, field, demonstrations);

1.2s determine sufficient space and classroom arrangement for carrying out laboratory activities;

1.3s provide students with continuous instruction and training in safe techniques and procedures for all laboratory and field activities, student demonstrations, and independent projects;

1.4s read and interpret safety information about chemicals on a Materials Safety Data Sheet (MSDS) and on other chemical labels, including household products;

1.5s check equipment for safety (e.g., cracks in glassware, proper grounding of electrical equipment) prior to use;

1.6s create, implement, and enforce rules and safety procedures to promote and maintain a safe learning environment during laboratory and field activities;

1.7s implement regular procedures to inventory and maintain appropriate safety equipment; and

1.8s optimize quick and safe access to all safety equipment (e.g., eyewash station, sink, safety shower, fire blanket, and extinguisher).

Standard II - The science teacher understands the correct use of tools, materials, equipment and technologies.

4-8 Science

Teachers of Students in Grades 4–8

The beginning teacher knows and understands:

2.1k procedures for the storing, securing, and routine maintenance of scientific equipment used in instructional activities;

2.2k correct and safe operating procedures for scientific equipment used in instructional activities;

2.3k concepts of precision, accuracy, and error with regard to reading and recording numerical data from a scientific instrument;

2.4k the international system of measurement (i.e., metric system);

2.5k the use of grade-appropriate equipment and technology for gathering, analyzing, and reporting data; and

2.6k the use of technology to acquire, assess, analyze, interpret, and communicate information. The beginning teacher is able to:

2.1s select and use appropriate tools, technology, materials, and equipment needed for instructional activities;

2.2s instruct and monitor students' use of materials, tools, and instruments; 2.3s make science resources accessible to all students;

2.4s recycle, reuse, and conserve laboratory resources as appropriate;

2.5s use the appropriate number of significant figures to record and report numerical data;

2.6s perform unit conversions within the international system of measurement (i.e., metric system);
2.7s perform conversions within and across measurement systems; 2.8s use techniques to calibrate measuring devices as appropriate;
2.9s organize, display, and communicate data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations);
2.10s gather, organize, display, and communicate data using appropriate technology (e.g., Internet, graphing calculators, spreadsheets); and
2.11s evaluate the validity of data and data sources.

Life Science

Teachers of Students in Grades 7–12

The beginning teacher knows and understands:
2.1k procedures for the storing, securing, and routine maintenance of scientific equipment used in instructional activities;
2.2k correct and safe operating procedures for scientific equipment used in instructional activities;
2.3k concepts of precision, accuracy, and error with regard to reading and recording numerical data from a scientific instrument;
2.4k the international system of measurement (i.e., metric system);
2.5k the use of grade-appropriate equipment and technology for gathering, analyzing, and reporting data; and
2.6k the use of technology to acquire, assess, analyze, interpret, and communicate information.
The beginning teacher is able to:
2.1s select and use appropriate tools, technology, materials, and equipment needed for instructional activities;
2.2s instruct and monitor students' use of materials, tools, and instruments; 2.3s make science resources accessible to all students;
2.4s recycle, reuse, and conserve laboratory resources as appropriate;
2.5s use the appropriate number of significant figures to record and report numerical data;
2.6s perform unit conversions within the international system of measurement (i.e., metric system);
2.7s perform conversions within and across measurement systems; 2.8s use techniques to calibrate measuring devices as appropriate;
2.9s organize, display, and communicate data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations);
2.10s gather, organize, display, and communicate data using appropriate technology (e.g., Internet, graphing calculators, spreadsheets); and
2.11s evaluate the validity of data and data sources.

Physical Science

Teachers of Students in Grades 6–12

The beginning teacher knows and understands:
2.1k procedures for the storing, securing, and routine maintenance of scientific equipment used in instructional activities;

2.2k correct and safe operating procedures for scientific equipment used in instructional activities;
2.3k concepts of precision, accuracy, and error with regard to reading and recording numerical data from a scientific instrument;
2.4k the international system of measurement (i.e., metric system);
2.5k the use of grade-appropriate equipment and technology for gathering, analyzing, and reporting data; and
2.6k the use of technology to acquire, assess, analyze, interpret, and communicate information.
The beginning teacher is able to:
2.1s select and use appropriate tools, technology, materials, and equipment needed for instructional activities;
2.2s instruct and monitor students' use of materials, tools, and instruments; 2.3s make science resources accessible to all students;
2.4s recycle, reuse, and conserve laboratory resources as appropriate;
2.5s use the appropriate number of significant figures to record and report numerical data;
2.6s perform unit conversions within the international system of measurement (i.e., metric system);
2.7s perform conversions within and across measurement systems; 2.8s use techniques to calibrate measuring devices as appropriate;
2.9s organize, display, and communicate data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations);
2.10s gather, organize, display, and communicate data using appropriate technology (e.g., Internet, graphing calculators, spreadsheets); and
2.11s evaluate the validity of data and data sources.

Standard III - The science teacher understands the process of scientific inquiry and its role in science instruction

4-8 Science

Teachers of Students in Grades 4–8

The beginning teacher knows and understands:
3.1k how scientists use different types of investigation, depending on the questions they are trying to answer;
3.2k principles and procedures for designing and conducting an inquiry-based scientific investigation;
3.3k the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis);
3.4k how current knowledge and theories guide scientific investigations; 3.5k the use of technology in scientific research; and
3.6k appropriate methods of statistical analysis and measures (e.g., mean, median, mode, correlation).
The beginning teacher is able to:
3.1s design and conduct inquiry-based scientific investigations, including nonexperimental and experimental designs;
3.2s plan and implement instruction that provides opportunities for all students to engage in scientific inquiry by using various appropriate combinations of the following processes:

- ask a scientific question;

- formulate a testable hypothesis;
- select appropriate equipment and technology for gathering information related to the hypothesis;
- make observations and collect data taking accurate and precise measurements;
- organize, analyze, and evaluate data to find data trends and patterns and make inferences; and
- communicate and defend a valid conclusion about the hypothesis under investigation; 3.3s link inquiry investigations to students' prior knowledge and experience;

3.4s focus inquiry-based instruction on questions and issues that are relevant to students; 3.5s use strategies to assist students in identifying, refining, and focusing scientific ideas and questions guiding an inquiry activity;

3.6s guide students in making systematic observations and measurements;

3.7s use a variety of tools and techniques to access, gather, store, retrieve, organize, and analyze data

3.8s provide opportunities for students to use higher-order thinking skills, logical reasoning, and scientific problem solving to reach conclusions based on evidence;

3.9s develop, analyze, and evaluate different explanations for a given scientific result; 3.10s identify potential sources of error in a given inquiry-based investigation; and

3.11s develop criteria for assessing student participation in and understanding of the inquiry process.

Life Science

Teachers of Students in Grades 7–12

The beginning teacher knows and understands:

3.1k how scientists use different types of investigation, depending on the questions they are trying to answer;

3.2k principles and procedures for designing and conducting an inquiry-based scientific investigation (such as making observations; asking questions; researching and reviewing current knowledge in light of experimental evidence; using tools to gather and analyze evidence; proposing answers, explanations, and predictions; and communicating results);

3.3k the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis);

3.4k how current knowledge and theories guide scientific investigations; 3.5k the use of technology in scientific research; and

3.6k appropriate methods of statistical analysis and measures (e.g., mean, median, mode, correlation).

The beginning teacher is able to:

3.1s design and conduct inquiry-based scientific investigations, including nonexperimental and experimental designs;

3.2s plan and implement instruction that provides opportunities for all students to engage in scientific inquiry by using various appropriate combinations of the following processes:

- ask a scientific question;
- formulate a testable hypothesis;
- select appropriate equipment and technology for gathering information related to the hypothesis;

- make observations and collect data taking accurate and precise measurements;
- organize, analyze, and evaluate data to find data trends and patterns and make inferences; and
- communicate and defend a valid conclusion about the hypothesis under investigation;

3.3s link inquiry investigations to students' prior knowledge and experience;
3.4s focus inquiry-based instruction on questions and issues that are relevant to students; 3.5s use strategies to assist students in identifying, refining, and focusing scientific ideas and questions guiding an inquiry activity (i.e., an inquiry-based scientific investigation);
3.6s guide students in making systematic observations and measurements;
3.7s use a variety of tools and techniques to access, gather, store, retrieve, organize, and analyze data;

Physical Science
Teachers of Students in Grades 6–12

The beginning teacher knows and understands:
3.1k how scientists use different types of investigation, depending on the questions they are trying to answer;
3.2k principles and procedures for designing and conducting an inquiry-based scientific investigation (such as making observations; asking questions; researching and reviewing current knowledge in light of experimental evidence; using tools to gather and analyze evidence; proposing answers, explanations, and predictions; and communicating results);
3.3k the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis);
3.4k how current knowledge and theories guide scientific investigations; 3.5k the use of technology in scientific research; and
3.6k appropriate methods of statistical analysis and measures (e.g., mean, median, mode, correlation).

The beginning teacher is able to:
3.1s design and conduct inquiry-based scientific investigations, including nonexperimental and experimental designs;
3.2s plan and implement instruction that provides opportunities for all students to engage in scientific inquiry by using various appropriate combinations of the following processes:

- ask a scientific question;
- formulate a testable hypothesis;
- select appropriate equipment and technology for gathering information related to the hypothesis;
- make observations and collect data taking accurate and precise measurements;
- organize, analyze, and evaluate data to find data trends and patterns and make inferences; and
- communicate and defend a valid conclusion about the hypothesis under investigation;

3.3s link inquiry investigations to students' prior knowledge and experience;
3.4s focus inquiry-based instruction on questions and issues that are relevant to students; 3.5s use strategies to assist students in identifying, refining, and focusing scientific ideas and questions guiding an inquiry activity (i.e., an inquiry-based scientific investigation);
3.6s guide students in making systematic observations and measurements;

3.7s use a variety of tools and techniques to access, gather, store, retrieve, organize, and analyze data;
3.8s provide opportunities for students to use higher-order thinking skills, logical reasoning, and scientific problem solving to reach conclusions based on evidence;
3.9s develop, analyze, and evaluate different explanations for a given scientific result;
3.10s identify potential sources of error in a given inquiry-based investigation; and
3.12s develop criteria for assessing student participation in and understanding of the inquiry process.

Standard IV - The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.
4-8 Science
Teachers of Students in Grades 4–8
The beginning teacher knows and understands:
4.1k theories about how students develop scientific understanding; 4.2k how the developmental characteristics of students influence science learning;
4.3k the statewide curriculum as defined in the Texas Essential Knowledge and Skills (TEKS);
4.4k methods of planning and implementing an inquiry-based science program;
4.5k how students' prior knowledge and attitudes about science may affect their learning; 4.6k common student misconceptions in science and effective ways to address these misconceptions;
4.7k how to establish a collaborative scientific community among students that supports actively engaged learning;
4.8k the importance of planning activities that are inclusive and accommodate the needs of all students;
4.9k strategies that students with diverse strengths and needs can use to determine word meaning in content-related texts;
4.10k strategies that students with diverse strengths and needs can use to develop content-area vocabulary;
4.11k strategies that students with diverse strengths and needs can use to facilitate comprehension before, during, and after reading content-related texts;
4.12k the design and management of learning environments that provide the time, space, and resources needed for learning science;
4.13k the importance of ongoing assessment of student learning and one's own teaching practice in the science classroom; and
4.14k the teacher's role in the ongoing evaluation and development of science in the total school program.
The beginning teacher is able to:
4.1s use lab and field investigations to enable students to develop an understanding of science;
4.2s sequence learning activities in a way that allows students to build upon their prior knowledge and challenges them to expand their understanding of science;
4.3s model active learning and inquiry processes for students;
4.4s encourage students' self-motivation in their own learning;

4.5s display and model scientific attributes, such as curiosity, openness to new ideas, and skepticism;
4.6s design and adapt curricula and select content to meet the interests, knowledge, understanding, abilities, experiences, and needs of students;
4.7s use a variety of instructional strategies to ensure all students' reading comprehension of content-related texts, including helping students link the content of texts to their lives and connect related ideas across different texts;
4.8s teach students how to locate, retrieve, and retain content-related information from a range of texts and technologies;
4.9s teach students how to locate the meanings and pronunciations of unfamiliar content-related words using appropriate sources, such as dictionaries, thesauruses, and glossaries;
4.10s use questioning strategies to move students from concrete to more abstract understanding;
4.11s respect student diversity and encourage all students to participate fully in science learning;
4.12s manage time to provide adequate opportunity for all students to participate in investigations;
4.13s create an environment to focus and support student inquiries;
4.14s use individual, small-group, and whole-class strategies to support student learning; 4.15s foster collaboration among students; and
4.16s implement science activities to incorporate schoolwide objectives.

Life Science
Teachers of Students in Grades 7–12
The beginning teacher knows and understands:
4.1k theories about how students develop scientific understanding; 4.2k how the developmental characteristics of students influence science learning;
4.3k the statewide curriculum as defined in the Texas Essential Knowledge and Skills (TEKS); 4.4k methods of planning and implementing an inquiry-based science program;
4.5k how students' prior knowledge and attitudes about science may affect their learning; 4.6k common student misconceptions in science and effective ways to address these misconceptions;
4.7k how to establish a collaborative scientific community among students that supports actively engaged learning;
4.8k the importance of planning activities that are inclusive and accommodate the needs of all students;
4.9k strategies that students with diverse strengths and needs can use to determine word meaning in content-related texts;
4.10k strategies that students with diverse strengths and needs can use to develop content-area vocabulary;
4.11k strategies that students with diverse strengths and needs can use to facilitate comprehension before, during, and after reading content-related texts;
4.12k the design and management of learning environments that provide the time, space, and resources needed for learning science;
The beginning teacher is able to:

4.1s use lab and field investigations to enable students to develop an understanding of science;
4.2s sequence learning activities in a way that allows students to build upon their prior knowledge and challenges them to expand their understanding of science;
4.3s model active learning and inquiry processes for students; 4.4s encourage students' self-motivation in their own learning;
4.5s display and model scientific attributes, such as curiosity, openness to new ideas, and skepticism;
4.6s design and adapt curricula and select content to meet the interests, knowledge, understanding, abilities, experiences, and needs of students;
4.7s use a variety of instructional strategies to ensure all students' reading comprehension of content-related texts, including helping students link the content of texts to their lives and connect related ideas across different texts;
4.8s teach students how to locate, retrieve, and retain content-related information from a range of texts and technologies;
4.9s teach students how to locate the meanings and pronunciations of unfamiliar content-related words using appropriate sources, such as dictionaries, thesauruses, and glossaries;
4.10s use questioning strategies to move students from concrete to more abstract understanding;

Physical Science
Teachers of Students in Grades 6–12
The beginning teacher knows and understands:
4.1k theories about how students develop scientific understanding; 4.2k how the developmental characteristics of students influence science learning;
4.3k the statewide curriculum as defined in the Texas Essential Knowledge and Skills (TEKS); 4.4k methods of planning and implementing an inquiry-based science program;
4.5k how students' prior knowledge and attitudes about science may affect their learning; 4.6k common student misconceptions in science and effective ways to address these misconceptions;
4.7k how to establish a collaborative scientific community among students that supports actively engaged learning;
4.8k the importance of planning activities that are inclusive and accommodate the needs of all students;
4.9k strategies that students with diverse strengths and needs can use to determine word meaning in content-related texts;
4.10k strategies that students with diverse strengths and needs can use to develop content-area vocabulary;
4.11k strategies that students with diverse strengths and needs can use to facilitate comprehension before, during, and after reading content-related texts;
4.12k the design and management of learning environments that provide the time, space, and resources needed for learning science;
The beginning teacher is able to:
4.1s use lab and field investigations to enable students to develop an understanding of science;

4.2 s sequence learning activities in a way that allows students to build upon their prior knowledge and challenges them to expand their understanding of science;
4.3 s model active learning and inquiry processes for students; 4.4s encourage students' self-motivation in their own learning;
4.5 s display and model scientific attributes, such as curiosity, openness to new ideas, and skepticism;
4.6 s design and adapt curricula and select content to meet the interests, knowledge, understanding, abilities, experiences, and needs of students;
4.7 s use a variety of instructional strategies to ensure all students' reading comprehension of content-related texts, including helping students link the content of texts to their lives and connect related ideas across different texts;
4.8 s teach students how to locate, retrieve, and retain content-related information from a range of texts and technologies;
4.9 s teach students how to locate the meanings and pronunciations of unfamiliar content-related words using appropriate sources, such as dictionaries, thesauruses, and glossaries;
4.10 s use questioning strategies to move students from concrete to more abstract understanding;

Standard V- The science teacher knows the varied and appropriate assessments and assessment practices to monitor science learning.
4-8 Science
The beginning teacher knows and understands:
5.1 k the relationships among curriculum, assessment, and instruction;
5.2 k characteristics of various assessments, such as reliability, validity, and the absence of bias;
5.3 k the purposes, characteristics, and uses of various types of assessments in science, including formative and summative assessments;
5.4 k the importance of carefully selecting or designing formative and summative assessments for the specific decisions they are intended to inform;
5.5 k the importance of monitoring and assessing students' science understanding and skills on a regular, ongoing basis;
5.6 k ways in which assessment results inform instructional practice;
5.7 k strategies for assessing students' prior knowledge and misconceptions about science; 5.8k questioning strategies designed to elicit higher-level thinking; 5.9k the importance of sharing evaluation criteria with students; 5.10k the role of assessments as learning experiences; and
5.11k strategies for engaging students in meaningful self-assessment. The beginning teacher is able to:
5.1 s use formal and informal assessments of science performance and products (e.g., rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of the inquiry process;
5.2 s select or design a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) to monitor student understanding and progress; 5.3s design assessments that match each learning objective;
5.4 s base decisions regarding instructional content, methods, and practice on information about students' strengths and needs gathered through assessment;

5.5s select assessment instruments and methods that provide students with adequate opportunities to demonstrate their achievements;
5.6s evaluate assessment materials and procedures for reliability, validity, absence of bias, and clarity of language;
5.7s encourage use of self-assessment strategies in science;
5.8s use a variety of strategies (e.g., pre-testing, reviewing student journals, monitoring discussions, asking questions) to gain insight about students' prior knowledge and misconceptions about science;
5.9s state evaluation criteria clearly so that students can understand and derive meaning from them; and
5.10s evaluate the quality of data obtained from an assessment and determine what decisions can appropriately be made based on the data

Life Science

Teachers of Students in Grades 7–12

The beginning teacher knows and understands:
5.1k the relationships among curriculum, assessment, and instruction;
5.2k characteristics of various assessments, such as reliability, validity, and the absence of bias;
5.3k the purposes, characteristics, and uses of various types of assessments in science, including formative and summative assessments;
5.4k the importance of carefully selecting or designing formative and summative assessments for the specific decisions they are intended to inform;
5.5k the importance of monitoring and assessing students' science understanding and skills on a regular, ongoing basis;
5.6k ways in which assessment results inform instructional practice;
5.7k strategies for assessing students' prior knowledge and misconceptions about science;
5.8k questioning strategies designed to elicit higher-level thinking; 5.9k the importance of sharing evaluation criteria with students; 5.10k the role of assessments as learning experiences; and
5.11k strategies for engaging students in meaningful self-assessment. The beginning teacher is able to:
5.1s use formal and informal assessments of science performance and products (e.g., rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of the inquiry process (i.e., of inquiry based scientific investigations);
5.2s select or design a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) to monitor student understanding and progress;
5.3s design assessments that match each learning objective;
5.4s base decisions regarding instructional content, methods, and practice on information about students' strengths and needs gathered through assessment;
5.5s select assessment instruments and methods that provide students with adequate opportunities to demonstrate their achievements;
5.6s evaluate assessment materials and procedures for reliability, validity, absence of bias, and clarity of language;
5.7s encourage use of self-assessment strategies in science;

5.8s use a variety of strategies (e.g., pre-testing, reviewing student journals, monitoring discussions, asking questions) to gain insight about students' prior knowledge and misconceptions about science;

5.9s state evaluation criteria clearly so that students can understand and derive meaning from them; and

5.10s evaluate the quality of data obtained from an assessment and determine what decisions can appropriately be made based on the data.

Physical Science

Teachers of Students in Grades 6–12

The beginning teacher knows and understands:

5.1k the relationships among curriculum, assessment, and instruction;

5.2k characteristics of various assessments, such as reliability, validity, and the absence of bias;

5.3k the purposes, characteristics, and uses of various types of assessments in science, including formative and summative assessments;

5.4k the importance of carefully selecting or designing formative and summative assessments for the specific decisions they are intended to inform;

5.5k the importance of monitoring and assessing students' science understanding and skills on a regular, ongoing basis;

5.6k ways in which assessment results inform instructional practice;

5.7k strategies for assessing students' prior knowledge and misconceptions about science;

5.8k questioning strategies designed to elicit higher-level thinking; 5.9k the importance of sharing evaluation criteria with students; 5.10k the role of assessments as learning experiences; and

5.11k strategies for engaging students in meaningful self-assessment. The beginning teacher is able to:

5.1s use formal and informal assessments of science performance and products (e.g., rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of the inquiry process (i.e., of inquiry based scientific investigations);

5.2s select or design a variety of appropriate assessment instruments and/or methods (e.g., formal/informal, formative/summative) to monitor student understanding and progress;

5.3s design assessments that match each learning objective;

5.4s base decisions regarding instructional content, methods, and practice on information about students' strengths and needs gathered through assessment;

5.5s select assessment instruments and methods that provide students with adequate opportunities to demonstrate their achievements;

5.6s evaluate assessment materials and procedures for reliability, validity, absence of bias, and clarity of language;

5.7s encourage use of self-assessment strategies in science;

5.8s use a variety of strategies (e.g., pre-testing, reviewing student journals, monitoring discussions, asking questions) to gain insight about students' prior knowledge and misconceptions about science;

5.9s state evaluation criteria clearly so that students can understand and derive meaning from them; and

5.10s evaluate the quality of data obtained from an assessment and determine what decisions can appropriately be made based on the data.

Standard VI - The science teacher understands the history and nature of science.

4-8 Science

Teachers of Students in Grades 4–8

The beginning teacher knows and understands:

6.1k the limitations of the scope of science and the use and limitations of physical, mathematical, and conceptual models to describe and analyze scientific ideas about the natural world;

6.2k that science is a human endeavor influenced by societal, cultural, and personal views of the world;

6.3k that scientific ideas and explanations must be consistent with observational and experimental evidence;

6.4k how logical reasoning is used in the process of developing, evaluating, and validating scientific hypotheses and theories;

6.5k the roles that publishing and peer review play in developing and validating scientific knowledge;

6.6k principles of scientific ethics in reporting data and in experimenting with living organisms, including human subjects;

6.7k that scientific theories have predictive power;

6.8k that scientific theories are constantly being modified to conform more closely to new observational and experimental evidence about the natural world;

6.9k the historical development of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge; and

6.10k the relationship between science and technology. The beginning teacher is able to:

6.1s provide students with opportunities to examine the types of questions that science can and cannot answer;

6.2s design and conduct scientific investigations to answer questions;

6.3s analyze, review, and critique the strengths and weaknesses of scientific explanations, hypotheses, and theories using scientific evidence and information;

6.4s analyze ways in which personal or societal bias can affect the direction, support, and use of scientific research;

6.5s use key events and knowledge of individuals from throughout the history of science to illustrate scientific concepts;

6.6s design instruction that accounts for the contributions to science of individuals from a variety of cultures; and

6.7s use examples from the history of science to demonstrate the changing nature of scientific theories and knowledge.

Life Science

Teachers of Students in Grades 7–12

The beginning teacher knows and understands:

6.1k the limitations of the scope of science and the use and limitations of physical, mathematical, and conceptual models to describe and analyze scientific ideas about the natural world;

6.2k that science is a human endeavor influenced by societal, cultural, and personal views of the world;

6.3k that scientific ideas and explanations must be consistent with observational and experimental evidence;

6.4k how logical reasoning is used in the process of developing, evaluating, and validating scientific hypotheses and theories;

6.5k the roles that publishing and peer review play in developing and validating scientific knowledge;

6.6k principles of scientific ethics in reporting data and in experimenting with living organisms, including human subjects;

6.7k that scientific theories have predictive power;

6.8k that scientific theories are constantly being modified to conform more closely to new observational and experimental evidence about the natural world;

6.9k the historical development of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge; and

6.10k the relationship between science and technology. The beginning teacher is able to:

6.1s provide students with opportunities to examine the types of questions that science can and cannot answer;

6.2s design and conduct scientific investigations to answer questions;

6.3s analyze, review, and critique the strengths and weaknesses of scientific explanations, hypotheses, and theories using scientific evidence and information;

6.4s analyze ways in which personal or societal bias can affect the direction, support, and use of scientific research;

6.5s use key events and knowledge of individuals from throughout the history of science to illustrate scientific concepts;

6.6s design instruction that accounts for the contributions to science of individuals from a variety of cultures; and

6.7s use examples from the history of science to demonstrate the changing nature of scientific theories and knowledge (i.e., that scientific theories and knowledge are always subject to revision in light of new evidence).

Physical Science

Teachers of Students in Grades 6–12

The beginning teacher knows and understands:

6.1k the limitations of the scope of science and the use and limitations of physical, mathematical, and conceptual models to describe and analyze scientific ideas about the natural world;

6.2k that science is a human endeavor influenced by societal, cultural, and personal views of the world;

6.3k that scientific ideas and explanations must be consistent with observational and experimental evidence;

6.4k how logical reasoning is used in the process of developing, evaluating, and validating scientific hypotheses and theories;

6.5k the roles that publishing and peer review play in developing and validating scientific knowledge;

6.6k principles of scientific ethics in reporting data and in experimenting with living organisms, including human subjects;

6.7k that scientific theories have predictive power;

6.8 k that scientific theories are constantly being modified to conform more closely to new observational and experimental evidence about the natural world;
6.9 k the historical development of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge; and
6.10 k the relationship between science and technology. The beginning teacher is able to:
6.1 s provide students with opportunities to examine the types of questions that science can and cannot answer;
6.2 s design and conduct scientific investigations to answer questions;
6.3 s analyze, review, and critique the strengths and weaknesses of scientific explanations, hypotheses, and theories using scientific evidence and information;
6.4 s analyze ways in which personal or societal bias can affect the direction, support, and use of scientific research;
6.5 s use key events and knowledge of individuals from throughout the history of science to illustrate scientific concepts;
6.6 s design instruction that accounts for the contributions to science of individuals from a variety of cultures; and
6.7 s use examples from the history of science to demonstrate the changing nature of scientific theories and knowledge (i.e., that scientific theories and knowledge are always subject to revision in light of new evidence).

Standard VII - The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.
4-8 Science
Teachers of Students in Grades 4–8
The beginning teacher knows and understands:
7.1 k that human decisions about the use of science and technology are based on factors such as ethical standards, economics, and societal and personal needs;
7.2 k scientific concepts and principles relating to personal and societal health, including the physiological and psychological effects and risks associated with the use of substances and substance abuse;
7.3 k concepts related to changes in populations and to characteristics of human population growth;
7.4 k types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources;
7.5 k the properties of natural ecosystems and how natural and human processes can influence changes in environments;
7.6 k the principles of risk and benefit analysis and how it is used in the process of personal and societal decision making; and
7.7 k the role science can play in helping resolve personal, societal, and global challenges. The beginning teacher is able to:
7.1 s use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions;
7.2 s apply scientific principles and processes to analyze factors that influence personal choices concerning fitness and health;

7.3s analyze factors that affect the severity of disease and methods for preventing, controlling, or curing diseases and ailments;
7.4s analyze how factors such as population growth, resource use, population distribution, overconsumption, technological capacity, poverty, and societal views can influence changes in environments;
7.5s apply scientific principles and the theory of probability to analyze the advantages, disadvantages, or alternatives to a given decision or course of action; and
7.6s demonstrate how science can be used to help make informed decisions about societal and global issues.

Life Science

The beginning teacher knows and understands:

7.1k that human decisions about the use of science and technology are based on factors such as ethical standards, economics, and societal and personal needs;
7.2k scientific concepts and principles relating to personal and societal health, including the physiological and psychological effects and risks associated with the use of substances and substance abuse;
7.3k concepts related to changes in populations and to characteristics of human population growth;
7.4k types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources;
7.5k the properties of natural ecosystems and how natural and human processes can influence changes in environments;
7.6k the principles of risk and benefit analysis and how it is used in the process of personal and societal decision making; and
7.7k the role science can play in helping resolve personal, societal, and global challenges

The beginning teacher is able to:

7.1s use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions;
7.2s apply scientific principles and processes to analyze factors (e.g., diet, exercise, personal behavior) that influence personal choices concerning fitness and health;
7.3s analyze factors that affect the severity of disease and methods for preventing, controlling, or curing diseases and ailments;
7.4s analyze how factors such as population growth, resource use, population distribution, overconsumption, technological capacity, poverty, and societal views can influence changes in environments;
7.5s apply scientific principles and the theory of probability to analyze the advantages, disadvantages, or alternatives to a given decision or course of action; and
7.6s demonstrate how science can be used to help make informed decisions about societal and global issues.

Physical Science

Teachers of Students in Grades 6–12

The beginning teacher knows and understands:

7.1k that human decisions about the use of science and technology are based on factors such as ethical standards, economics, and societal and personal needs;

7.2k scientific concepts and principles relating to personal and societal health, including the physiological and psychological effects and risks associated with the use of substances and substance abuse;

7.3k concepts related to changes in populations and to characteristics of human population growth;

7.4k types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources;

7.5k the properties of natural ecosystems and how natural and human processes can influence changes in environments;

7.6k the principles of risk and benefit analysis and how it is used in the process of personal and societal decision making; and

7.7k the role science can play in helping resolve personal, societal, and global challenges.

The beginning teacher is able to:

7.1s use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions;

7.2s apply scientific principles and processes to analyze factors (e.g., diet, exercise, personal behavior) that influence personal choices concerning fitness and health;

7.3s analyze factors that affect the severity of disease and methods for preventing, controlling, or curing diseases and ailments;

7.4s analyze how factors such as population growth, resource use, population distribution, overconsumption, technological capacity, poverty, and societal views can influence changes in environments;

7.5s apply scientific principles and the theory of probability to analyze the advantages, disadvantages, or alternatives to a given decision or course of action; and

7.6s demonstrate how science can be used to help make informed decisions about societal and global issues

Standard VIII - The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in physical science.

.4-8 Science

Teachers of Students in Grades 4–8

Physical Science

The beginning teacher knows and understands:

8.5k all content specified for teachers in grades EC–4; 8.6k the relationship between force and motion;

8.7k physical and chemical properties and changes in matter; 8.8k energy and energy transformations; and

8.9k the conservation of matter and energy. The beginning teacher is able to:

8.6s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 4–8;

8.7s measure, graph, and describe changes in motion and analyze the relationship between force and motion in a variety of situations including simple machines, the flow of blood through the human body, and geologic processes;

8.8s investigate physical properties of solids, liquids, and gases; 8.9s analyze physical and chemical changes in matter;

8.10s apply properties and characteristics of waves to analyze sound, light, and other wave phenomena;
8.11s interpret the periodic table and chemical formulas and equations;
8.12s apply the law of conservation of energy to analyze a variety of phenomena (e.g., specific heat, chemical and nuclear reactions, efficiency of simple machines);
8.13s apply the law of conservation of matter to analyze a variety of phenomena (e.g., water cycle, decomposition); and
8.14s analyze the transfer of energy in a variety of situations (e.g., the production of heat, light, sound, and magnetic effects by electrical energy; the process of photosynthesis; weather processes).

Life Science

Teachers of life science are not responsible for this standard.

Physical Science

Teachers of Students in Grades 6–12

Teachers of science in grades 6–12 will have a broad knowledge of all science disciplines (i.e., physical science, life science, Earth and space science) required of teachers of grades EC–8 and a deep understanding of the concepts in the science discipline(s) they teach.

Physics

The beginning teacher knows and understands:
8.10k <u>motion and forces</u>: motion occurs when a net force is applied, and gravitation, electricity, and magnetism are universal forces;
8.11k <u>conservation of energy and increase in disorder</u>: energy is kinetic or potential, and everything becomes less orderly over time; and
8.12k <u>interactions of energy and matter</u>: waves and particles can transfer energy, and energy occurs in discrete quantities.

The beginning teacher is able to:
8.15s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 6–12;
8.16s create, analyze, and interpret graphs describing the motion of a particle;
8.17s analyze examples of uniform and accelerated motion, including linear, projectile, and circular motion;
8.18s create and analyze free-body diagrams;
8.19s apply Newton's laws to solve a variety of practical problems (e.g., properties of frictional forces, the inclined plane, motion of a pendulum);
8.20s apply the law of universal gravitation to solve a variety of problems (e.g., gravitational fields of the planets, properties of circular orbits);
8.21s apply the inverse square law to calculate electrostatic forces, fields, and potentials;
8.22s describe the source of the magnetic force and analyze the magnetic field for various current distributions;
8.23s describe the relationship between electricity and magnetism;
8.24s design and analyze series and parallel DC circuits in terms of current, resistance, voltage, and power, and describe the components and characteristics of AC circuits (e.g., impedance, resonance, r.m.s. voltage and current); 8.25s analyze the operation of electromagnets, motors, and generators;

8.26 s apply the work-energy theorem to analyze and solve a variety of practical problems (e.g., finding the speed of an object given its potential energy function, determining the work done by frictional forces);

8.27 s solve problems using the conservation of energy in a physical system (e.g., determining potential energy for conservative forces, investigating the mechanical equivalence of thermal energy);

8.28 s apply the first law of thermodynamics to investigate energy transformations in a variety of everyday situations;

8.29 s describe the concept of entropy and its relationship to the second law of thermodynamics;

8.30 s compare and contrast transverse and longitudinal waves;

8.31 s relate concepts of amplitude, frequency, velocity, and wavelength to the properties of sound and light waves (e.g., pitch, color);

8.32 s apply the properties of wave reflection, refraction, and interference to analyze and explain acoustical and optical phenomena;

8.33 s describe the electromagnetic spectrum and explain how electromagnetic waves are produced;

8.34 s interpret wave particle duality;

8.35 s describe examples and consequences of the uncertainty principle; 8.36s describe and analyze the photoelectric effect; and

8.37 s use the quantum model of the atom to describe the line spectra from gas discharge tubes.

Chemistry

The beginning teacher is able to:

8.38 s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 6–12;

8.39 s differentiate between physical and chemical properties of matter;

8.40 s describe and create models to explain the molecular structure of solids, liquids, and gases;

8.41 s use the periodic table to predict and explain the physical (e.g., metallic, nonmetallic) and chemical (e.g., electron valence) properties of an element;

8.42 s apply the gas laws (e.g., Charles law, Boyle’s law, ideal gas law) to predict gas behavior in a variety of situations;

8.43 s describe the properties of the bonds and the arrangement of atoms in molecules, ionic crystals, polymers, and metallic substances;

8.44 s compare and contrast the chemical properties of ionic and covalent compounds;

8.45s describe the physical and chemical properties of covalent compounds in terms of intermolecular forces in the bonds;

8.46 s use the physical properties of a substance (e.g., boiling point, crystal structure) to predict the kind of interaction between molecules of a given substance;

8.47 s solve problems involving moles and stoichiometry; 8.48s analyze factors that affect solubility;

8.49s determine the molarity, molality, and percent composition of aqueous solutions; 8.50s analyze and describe models to explain the structural properties of water;

8.51s describe the importance of water as a solvent in living organisms and the environment; 8.52s describe the atom in terms of protons, neutrons, and electron clouds;

8.53s analyze relationships among electron energy levels, photons, and atomic spectra; 8.54s relate electronic configuration to physical and chemical properties and reactivity;
8.55s describe the relationship between the kinetic theory and the universal gas law; 8.56s analyze and describe the effects of energy transformations that occur in phase changes; 8.57s identify and analyze the effects of energy transformations that occur in chemical reactions to enable students to make predictions about other reactions;
8.58 s analyze and describe models to explain the process(es) of radioactivity and radioactive decay;
8.59 s compare fission and fusion reactions in terms of the mass of the reactants and products and the amount of energy released in the reactions;
8.60 s use the half-life of radioactive elements to solve real-world problems (e.g., carbon dating, radioactive traces);
8.61 s evaluate the risks and benefits of the commercial uses of nuclear energy and the medical uses of radioisotopes;
8.62 s evaluate environmental issues associated with the storage, containment, and disposal of nuclear wastes;
8.63 s interpret and balance chemical and nuclear equations using number of atoms, mass, and charge;
8.64 s analyze processes occurring during redox reactions using applications from everyday life;
8.65 s determine oxidation numbers and balance redox equations in order to determine if the reaction will occur;
8.66 s describe the operating principles of an electrochemical cell and the process of electroplating metals;
8.67 s describe the effect of solution concentration on the properties and chemical reactivity of a variety of aqueous solutions;
8.68 s analyze and interpret relationships among ionic and covalent compounds, electrical conductivity, and colligative properties of water;
8.69 s illustrate the relationship between the hydronium ion concentration and the pH for various acids and bases;
8.70 s apply the principles of solution concentration and stoichiometry to analyze characteristics of a neutralization reaction;
8.71 s analyze and apply the principles of acid-base titration;
8.72 s analyze examples from the real world that illustrate the effects of acids and bases on an ecological system;
8.73 s apply the law of conservation of energy to evaluate the energy exchange that occurs during a chemical reaction;
8.74 s analyze factors (e.g., temperature, concentration) that affect the rate of a chemical reaction; and
8.75 s analyze and describe the chemical properties of a variety of household chemicals in order to predict potential for chemical reactivity.

Standard IX - The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in life science.

4-8 Science

Teachers of Students in Grades 4–8

Life Science

The beginning teacher knows and understands:

9.7k all content specified for teachers in grades EC–4; 9.8k the structure and function of living systems;

9.9k reproduction and the mechanisms of heredity;

9.10k adaptations of organisms and the theory of evolution; 9.11k regulatory mechanisms and behavior; and

9.12k the relationships between organisms and the environment. The beginning teacher is able to:

9.10s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 4–8;

9.11s analyze how structure complements function in cells, organs, organ systems, organisms, and populations;

9.12s identify human body systems and describe their functions;

9.13s distinguish between dominant and recessive traits and predict the probable outcomes of genetic combinations;

9.14s explain that every organism requires a set of instructions for specifying its traits;

9.15s describe how an inherited trait can be determined by one or by many genes and how more than one trait can be influenced by a single gene;

9.16s compare and contrast sexual and asexual reproduction;

9.17s compare traits in a population or species that enhance its survival and reproduction;

9.18s describe how populations and species change through time; 9.19s analyze responses in organisms that result from internal and external stimuli;

9.20s describe feedback mechanisms that allow organisms to maintain stable internal conditions;

9.21s identify the abiotic and biotic components of an ecosystem;

9.22s describe the interrelationships among producers, consumers, and decomposers in an ecosystem; and

9.23s analyze and describe adaptive characteristics that result in a population's or species' unique niche in an ecosystem.

Life Science

*Teachers of Students in Grades EC–4**

Life Science

The beginning teacher knows and understands:

9.1k that living systems have different structures to perform different functions; 9.2k that organisms have basic needs;

9.3k that organisms respond to internal or external stimuli;

9.4k the relationship between organisms and the environment; 9.5k the life cycles of organisms; and

9.6k how populations or species evolve through time. The beginning teacher is able to:

9.1s describe stages in the life cycle of common plants and animals; 9.2s identify characteristics (e.g., physical traits) of plants and animals;

9.3s identify adaptive characteristics and explain how adaptations influence the survival of populations or species;

9.4s describe the processes by which plants and animals reproduce and explain how hereditary information is passed from one generation to the next;
9.5s analyze the role of internal and external stimuli in the behavior of organisms; 9.6s compare and contrast inherited traits and learned characteristics;
9.7s describe ways living organisms depend on each other and their environment for basic needs;
9.8s analyze the characteristics of habitats within an ecosystem; and
9.9s identify organisms, populations, or species with similar needs and analyze how they compete with one another for resources.

Physical Science

Teachers of physical science are not responsible for this standard.

Standard X - The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in Earth and space science.

4-8 Science

Teachers of Students in Grades 4–8

Earth and Space Science

The beginning teacher knows and understands:

10.4k all content specified for teachers in grades EC–4; 10.5k the structure and function of Earth systems; 10.6k cycles in Earth systems;
10.7k the role of energy in weather and climate;
10.8k characteristics of the solar system and the universe; 10.9k the history of Earth; and
10.10k the history of the universe. The beginning teacher is able to:
10.6s apply all skills specified for teachers in grades EC–4, using content and contexts appropriate for grades 4–8;
10.7s analyze and describe characteristics of the geosphere, the hydrosphere, the atmosphere, and the biosphere;
10.8s analyze a variety of Earth cycles (e.g., rock cycle, water cycle, carbon cycle, nitrogen cycle);
10.9s analyze and describe how human activity and natural processes, both gradual and catastrophic, can alter Earth systems;
10.10s identify properties of and analyze interactions among the components of the solar system;
10.11s explain weather measurements and analyze weather processes;
10.12s analyze how the Earth's position, orientation, and surface features affect weather and climate; and
10.13s examine characteristics of the universe, such as distances, stars, and galaxies, and describe scientific theories of the origin of the universe.

Life Science

Teachers of life science are not responsible for this standard.

Physical Science
Teachers of physical science are not responsible for this standard.

Standard – XI - The science teacher knows unifying concepts and processes that are common to all sciences

4-8 Science
Teachers of Students in Grades 4–8

The beginning teacher knows and understands:

11.1 k how systems and subsystems can be used as a conceptual framework to organize and unify the common themes of science and technology;

11.2 k how patterns in observations and data which explain natural phenomena allow predictions to be made;

11.3 k how the concepts and processes listed below provide a unifying framework across the science disciplines:

- systems, order, and organization;
- evidence, models, and explanation;
- change, constancy, and measurements;
- evolution and equilibrium; and
- form and function;

11.4 k properties and patterns of systems can be described in terms of space, time, energy, and matter;

11.5 k how change and constancy occur in systems;

11.6 k the complementary nature of form and function in a given system; and

11.7 k how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

The beginning teacher is able to:

11.1 s apply the systems model to identify and analyze common themes that occur in physical science, life science, and Earth and space science;

11.2 s analyze a system (e.g., a cell, the ocean, an ideal gas) in terms of cycles, structure, and processes;

11.3 s analyze the general features of systems (e.g., input, process, output, feedback);

11.4s analyze the interactions that occur between the components of a given system or subsystem;

11.5 s analyze the interactions and interrelationships between various systems and subsystems; and

11.6 s use the systems model to analyze the concepts of constancy (e.g., conservation of mass, energy, and momentum) and change (e.g., evolution).

Life Science
Teachers of Students in Grades 7–12

The beginning teacher knows and understands:

11.1 k how systems and subsystems can be used as a conceptual framework to organize and unify the common themes of science and technology;

11.2 k how patterns in observations and data which explain natural phenomena allow predictions to be made;

11.3 k how the concepts and processes listed below provide a unifying framework across the science disciplines:

- systems, order, and organization;
- evidence, models, and explanation;
- change, constancy, and measurements;
- evolution and equilibrium; and
- form and function;

11.4 k properties and patterns of systems can be described in terms of space, time, energy, and matter;

11.5 k how change and constancy occur in systems (e.g., conservation laws, symmetry, stability, cyclic variation, rates of change);

11.6 k the complementary nature of form and function in a given system; and

11.7 k how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

The beginning teacher is able to:

11.1 s apply the systems model (e.g., interacting parts, boundaries, input, output, feedback, subsystems) to identify and analyze common themes that occur in physical science, life science, and Earth and space science;

11.2 s analyze a system (e.g., a cell, the ocean, an ideal gas) in terms of cycles, structure, and processes;

11.3 s analyze the general features of systems (e.g., input, process, output, feedback);

11.4s analyze the interactions that occur between the components of a given system or subsystem;

11.5 s analyze the interactions and interrelationships between various systems and subsystems; and

11.6 s use the systems model to analyze the concepts of constancy (e.g., conservation of mass, energy, and momentum) and change (e.g., evolution).

Physical Science

Teachers of Students in Grades 6–12

The beginning teacher knows and understands:

11.1 k how systems and subsystems can be used as a conceptual framework to organize and unify the common themes of science and technology;

11.2 k how patterns in observations and data which explain natural phenomena allow predictions to be made;

11.3 k how the concepts and processes listed below provide a unifying framework across the science disciplines:

- systems, order, and organization;
- evidence, models, and explanation;
- change, constancy, and measurements;
- evolution and equilibrium; and
- form and function;

11.4 k properties and patterns of systems can be described in terms of space, time, energy, and matter;

11.5 k how change and constancy occur in systems (e.g., conservation laws, symmetry, stability, cyclic variation, rates of change);
11.6 k the complementary nature of form and function in a given system; and
11.7 k how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).
The beginning teacher is able to:
11.1 s apply the systems model (e.g., interacting parts, boundaries, input, output, feedback, subsystems) to identify and analyze common themes that occur in physical science, life science, and Earth and space science;
11.2 s analyze a system (e.g., a cell, the ocean, an ideal gas) in terms of cycles, structure, and processes;
11.3 s analyze the general features of systems (e.g., input, process, output, feedback);
11.4s analyze the interactions that occur between the components of a given system or subsystem;
11.5 s analyze the interactions and interrelationships between various systems and subsystems; and
11.6 s use the systems model to analyze the concepts of constancy (e.g., conservation of mass, energy, and momentum) and change
(e.g., evolution).

4-8 Science Exam Framework Domains and Competencies

Domain I—Scientific Inquiry and Processes
Competency 001—The teacher understands how to manage learning activities to ensure the safety of all students.
The beginning teacher:

1. Understands safety regulations and guidelines for science facilities and science instruction.
2. Knows procedures for and sources of information regarding the appropriate handling, use, conservation, disposal, recycling, care and maintenance of chemicals, materials, specimens and equipment.
3. Knows procedures for the safe handling and ethical care and treatment of organisms and specimens.

Competency 002—The teacher understands the correct use of tools, materials, equipment and technologies.
The beginning teacher:

1. Selects and safely uses appropriate tools, technologies, materials and equipment needed for instructional activities.
2. Understands concepts of precision, accuracy and error with regard to reading and recording numerical data from a scientific instrument.
3. Understands how to gather, organize, display and communicate data in a variety of ways (e.g., construct charts, tables, graphs, maps, satellite images, diagrams, written reports, oral presentations).
4. Understands the international system of measurement (i.e., metric system) and performs unit conversions within measurement systems.

Competency 003—The teacher understands the process of scientific inquiry and the history and nature of science.
The beginning teacher:

1. Understands the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis).
2. Understands how to design, conduct and communicate the results of a variety of scientific investigations.
3. Understands the historical development of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge.
4. Understands the roles that logical reasoning, verifiable empirical evidence, prediction and peer review play in the process of generating and evaluating scientific knowledge.
5. Understands principles of scientific ethics.
6. Develops, analyzes and evaluates different explanations for a given scientific result.
7. Demonstrates an understanding of potential sources of error in inquiry-based investigation and the use of multiple trials to increase reliability.
8. Demonstrates an understanding of how to communicate and defend the results of an inquiry-based investigation.

Competency 004—The teacher understands how science impacts the daily lives of students and interacts with and influences personal and societal decisions.
The beginning teacher:

1. Understands that decisions about the use of science are based on factors such as ethical standards, economics and personal and societal needs.
2. Applies scientific principles and the theory of probability to analyze the advantages of, disadvantages of or alternatives to a given decision or course of action.
3. Applies scientific principles and processes to analyze factors that influence personal choices concerning fitness and health, including physiological and psychological effects and risks associated with the use of substances and substance abuse.
4. Understands concepts, characteristics and issues related to changes in populations and human population growth.
5. Understands the types and uses of natural resources (renewable, non-renewable) and the effects of human consumption on the renewal and depletion of resources.
6. Understands the role science can play in helping resolve personal, societal and global challenges (e.g., recycling, evaluating product claims, alternative energy sources).

Competency 005—The teacher knows and understands the unifying concepts and processes that are common to all sciences.
The beginning teacher:

1. Understands how the following concepts and processes provide a unifying explanatory framework across the science disciplines: systems, order and organization; evidence, models and explanation; change, constancy and measurements; evolution and equilibrium; and form and

function.

2. Demonstrates an understanding of how patterns in observations and data can be used to make explanations and predictions.
3. Analyzes interactions and interrelationships between systems and subsystems.
4. Applies unifying concepts to explore similarities in a variety of natural phenomena.
5. Understands how properties and patterns of systems can be described in terms of space, time, energy and matter.
6. Understands how change and constancy occur in systems.
7. Understands the complementary nature of form and function in a given system.
8. Understands how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

Domain II—Physical Science

Competency 006—The teacher understands forces and motion and their relationships. The beginning teacher:

1. Demonstrates an understanding of properties of universal forces (e.g., gravitational, electrical, magnetic).
2. Understands how to measure, graph and describe changes in motion using concepts of displacement, speed, velocity and acceleration.
3. Understands the vector nature of force.
4. Identifies the forces acting on an object and applies Newton's laws to describe the motion of an object.
5. Analyzes the relationship between force and motion in a variety of situations (e.g., simple machines, blood flow, geologic processes).

Competency 007—The teacher understands physical properties of and changes in matter. The beginning teacher:

1. Describes the physical properties of substances (e.g., density, boiling point, melting point, solubility, thermal and electrical conductivity, luster, malleability).
2. Describes the physical properties and molecular structure of solids, liquids and gases.
3. Describes the relationship between the molecular structure of materials (e.g., metals, crystals, polymers) and their physical properties.
4. Relates the physical properties of an element to its placement in the periodic table, including metals, non-metals and metalloids.
5. Distinguishes between physical and chemical changes in matter.
6. Applies knowledge of physical properties of and changes in matter to processes and situations that occur in life and earth/space science.

Competency 008—The teacher understands chemical properties of and changes in matter. The beginning teacher:

1. Describes the structure and components of the atom.
2. Distinguishes among elements, compounds, mixtures and solutions and describes their properties.
3. Relates the chemical properties of an element to its placement in the periodic table.
4. Describes chemical bonds and chemical formulas.

5. Analyzes chemical reactions and their associated chemical equations.

6. Explains the importance of a variety of chemical reactions that occur in daily life (e.g., rusting, burning of fossil fuels, photosynthesis, cell respiration, chemical batteries, digestion of food).
7. Understands applications of chemical properties of matter in physical, life and earth/space science and technology (e.g., materials science, biochemistry, transportation, medicine, telecommunications).

Competency 009—The teacher understands energy and interactions between matter and energy. The beginning teacher:

1. Describes concepts of work, power and potential and kinetic energy.
2. Understands the concept of heat energy and the difference between heat and temperature.
3. Understands the principles of electricity and magnetism and their applications (e.g., electric circuits, motors, audio speakers, nerve impulses, lightning).
4. Applies knowledge of properties of light (e.g., reflection, refraction, dispersion) to describe the function of optical systems and phenomena (e.g., camera, microscope, rainbow, eye).
5. Demonstrates an understanding of the properties, production and transmission of sound.
6. Applies knowledge of properties and characteristics of waves (e.g., wavelength, frequency, interference) to describe a variety of waves (e.g., water, electromagnetic, sound).

Competency 010—The teacher understands energy transformations and the conservation of matter and energy.
The beginning teacher:

1. Describes the processes that generate energy in the sun and other stars.
2. Applies the law of conservation of matter to analyze a variety of situations (e.g., the water cycle, food chains, decomposition, balancing chemical equations).
3. Describes sources of electrical energy and processes of energy transformation for human uses (e.g., fossil fuels, solar panels, hydroelectric plants).
4. Understands exothermic and endothermic chemical reactions and their applications (e.g., hot and cold packs, energy content of food).
5. Applies knowledge of the transfer of energy in a variety of situations (e.g., the production of heat, light, sound and magnetic effects by electrical energy; the process of photosynthesis; weather processes; food webs; food/energy pyramids).
6. Applies the law of conservation of energy to analyze a variety of physical phenomena (e.g., specific heat, nuclear reactions, efficiency of simple machines, collisions).
7. Understands applications of energy transformations and the conservation of matter and energy in life and earth/space science.

Domain III—Life Science

Competency 011—The teacher understands the structure and function of living things. The beginning teacher:

1. Describes characteristics of organisms from the major taxonomic groups, including domains and kingdoms and uses these characteristics to construct

a dichotomous key.
2. Analyzes how structure complements function in cells.

3. Analyzes how structure complements function in tissues, organs, organ systems and organisms including both plants and animals.
4. Identifies human body systems and describes their functions (e.g., digestive, circulatory).
5. Describes how organisms, including producers, consumers and decomposers obtain and use energy and matter.
6. Applies chemical principles to describe the structure and function of the basic chemical components (e.g., proteins, carbohydrates, lipids, nucleic acids) of living things and distinguishes between organic and inorganic compounds.

Competency 012—The teacher understands reproduction and the mechanisms of heredity. The beginning teacher:

1. Compares and contrasts sexual and asexual reproduction.
2. Understands the organization of hereditary material (e.g., DNA, genes, chromosomes).
3. Describes how an inherited trait can be determined by one or many genes and how more than one trait can be influenced by a single gene.
4. Distinguishes between dominant and recessive traits and predicts the probable outcomes of genetic combinations.
5. Evaluates the influence of environmental and genetic factors on the traits of an organism.
6. Describes current applications of genetic research (e.g., related to cloning, reproduction, health, industry, agriculture).

Competency 013—The teacher understands adaptations of organisms and the theory of evolution. The beginning teacher:

1. Describes similarities and differences among various types of organisms and methods of classifying organisms (e.g., presence of a nucleus determines if a cell is prokaryotic and eukaryotic).
2. Describes traits in a population or species that enhance its survival and reproductive success.
3. Describes how populations and species change through time.
4. Applies knowledge of the mechanisms and processes of biological evolution (e.g., variation, mutation, environmental factors, natural selection).
5. Describes evidence that supports the theory of evolution of life on Earth.

Competency 014—The teacher understands regulatory mechanisms and behavior. The beginning teacher:

1. Describes how organisms respond to internal and external stimuli.
2. Applies knowledge of structures and physiological processes that maintain stable internal conditions.
3. Demonstrates an understanding of feedback mechanisms that allow organisms to maintain stable internal conditions.
4. Understands how evolutionary history affects behavior.

Competency 015—The teacher understands the relationships between organisms and the environment.
The beginning teacher:

1. Understands the levels of organization within an ecosystem (organism, population, community) and identifies the abiotic and biotic components of an ecosystem.
2. Analyzes the interrelationships (food chains, food webs) among producers, consumers and decomposers in an ecosystem.
3. Identifies factors that influence the size and growth of populations in an ecosystem.
4. Analyzes adaptive characteristics that result in a population's or species' unique niche in an ecosystem.
5. Describes and analyzes energy flow through various types of ecosystems.
6. Knows how populations and species modify and affect ecosystems (e.g., succession), and how biodiversity affects the sustainability of ecosystems.

Domain IV—Earth and Space Science

Competency 016—The teacher understands the structure and function of Earth systems. The beginning teacher:

1. Understands the layers and surface features (landforms) of Earth and uses topographic maps and satellite imaging to analyze constructive and destructive processes that produce geologic change.
2. Understands the form and function of surface and subsurface water (e.g., watershed, aquifer).
3. Applies knowledge of the composition and structure of the atmosphere and its properties, including characteristics that allow life to exist.
4. Demonstrates an understanding of the interactions that occur among the biosphere, geosphere, hydrosphere and atmosphere.
5. Applies knowledge of how human activity and natural processes, both gradual and catastrophic, can alter earth and ocean systems.
6. Identifies the sources of energy (e.g., solar, geothermal, wind, hydroelectric, biofuels) in earth systems and describes mechanisms of energy transfer (e.g., conduction, convection, radiation).

Competency 017—The teacher understands cycles in Earth systems. The beginning teacher:

1. Understands the rock cycle and how rocks, minerals, fossil fuels and soils are formed.
2. Understands the water cycle and its relationship to weather processes; how the sun and the ocean interact in the water cycle.
3. Understands the nutrient (e.g., carbon, nitrogen) cycle and its relationship to earth systems.
4. Applies knowledge of how human and natural processes affect earth systems.
5. Understands the dynamic interactions that occur among the various cycles in the biosphere, geosphere, hydrosphere and atmosphere.

Competency 018—The teacher understands the role of energy in weather and climate. The beginning teacher:

1. Understands the elements of weather (e.g., humidity, wind speed, pressure, temperature) and how they are measured.
2. Compares and contrasts weather and climate.

3. Analyzes weather charts and data to make weather predictions based on local and global patterns.
4. Applies knowledge of how transfers of energy among earth systems affect weather and climate.
5. Analyzes how Earth's position, orientation and surface features affect weather and climate.

Competency 019—The teacher understands the characteristics of the solar system and the universe.

The beginning teacher:

1. Understands the properties and characteristics of celestial objects.
2. Applies knowledge of the earth-moon-sun system and the interactions among them (e.g., seasons, lunar phases, eclipses).
3. Identifies properties of the components of the solar system, including systems that allow life to exist.
4. Recognizes characteristics of stars, nebulae and galaxies and their distribution in the universe.
5. Demonstrates an understanding of scientific theories of the origin of the universe.

Competency 020—The teacher understands the history of the Earth system.

The beginning teacher:

1. Understands the scope of the geologic time scale and its relationship to geologic processes.
2. Demonstrates an understanding of theories about the earth's origin and geologic history.
3. Demonstrates an understanding of how tectonic forces have shaped landforms over time.
4. Understands the formation of fossils and the importance of the fossil record in explaining the earth's history.

Domain V—Science Learning, Instruction and Assessment

Competency 021—The teacher has theoretical and practical knowledge about teaching science and about how students learn science.

The beginning teacher:

1. Understands how the developmental characteristics, prior knowledge and experience and attitudes of students influence science learning.
2. Selects and adapts science curricula, content, instructional materials and activities to meet the interests, knowledge, understanding, abilities, experiences and needs of all students, including English-language learners.
3. Understands how to use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions.
4. Understands common misconceptions in science and effective ways to address these misconceptions.
5. Understands the rationale for the use of active learning and inquiry processes for students.
6. Understands questioning strategies designed to elicit higher-level thinking and how to use them to move students from concrete to more abstract understanding.
7. Understands the importance of planning activities that are inclusive and accommodate the needs of all students.

8. Understands how to sequence learning activities in a way that allows students to build upon their prior knowledge and challenges them to expand their understanding of science.

Competency 022—The teacher understands the process of scientific inquiry and its role in science instruction.

The beginning teacher:

1. Plans and implements instruction that provides opportunities for all students to engage in nonexperimental and experimental inquiry investigations.
2. Focuses inquiry-based instruction on questions and issues relevant to students and uses strategies to assist students with generating, refining and focusing scientific questions and hypotheses.
3. Instructs students in the safe and proper use of a variety of grade-appropriate tools, equipment, resources, technology and techniques to access, gather, store, retrieve, organize and analyze data.
4. Knows how to guide and manage students in making systematic observations and measurements.
5. Knows how to promote the use of critical-thinking skills, logical reasoning and scientific problem solving to reach conclusions based on evidence.
6. Knows how to teach students to develop, analyze and evaluate different explanations for a given scientific result.
7. Knows how to teach students to demonstrate an understanding of potential sources of error in inquiry-based investigation.
8. Knows how to teach students to demonstrate an understanding of how to communicate and defend the results of an inquiry-based investigation.

Competency 023—The teacher knows the varied and appropriate assessments and assessment practices to monitor science learning in laboratory, field and classroom settings.

The beginning teacher:

1. Understands the relationships among science curriculum, assessment and instruction and bases instruction on information gathered through assessment of students' strengths and needs.
2. Understands the importance of monitoring and assessing students' understanding of science concepts and skills on an ongoing basis.
3. Understands the importance of carefully selecting or designing formative and summative assessments for the specific decisions they are intended to inform.
4. Selects or designs and administers a variety of appropriate assessment methods (e.g., performance assessment, self-assessment, formal/informal, formative/summative) to monitor student understanding and progress.
5. Uses formal and informal assessments of student performance and products (e.g., projects, lab journals, rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of the inquiry process.
6. Understands the importance of sharing evaluation criteria and assessment results with students.

7-12 Science Exam Framework Standards, Domains, and Competencies

Standards
Standard I - The science teacher manages classroom, field and laboratory activities to ensure the safety of all students and the ethical care and treatment of organisms and specimens.
Standard II - The science teacher understands the correct use of tools, materials, equipment and technologies.
Standard III - The science teacher understands the process of scientific inquiry and its role in science instruction
Standard IV - The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.
Standard V- The science teacher knows the varied and appropriate assessments and assessment practices to monitor science learning.
Standard VI - The science teacher understands the history and nature of science.
Standard VII - The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.
Standard VIII - The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in physical science.
Standard IX - The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in life science.
Standard X - The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in Earth and space science.
Standard – XI - The science teacher knows unifying concepts and processes that are common to all sciences
Domain I—Scientific Inquiry and Processes
Competency 001—The teacher understands how to select and manage learning activities to ensure the safety of all students and the correct use and care of organisms, natural resources, materials, equipment and technologies.
The beginning teacher:

1. Uses current sources of information about laboratory safety, including safety regulations and guidelines for the use of science facilities.
2. Recognizes potential safety hazards in the laboratory and in the field and knows how to apply procedures, including basic first aid, for responding to accidents.
3. Employs safe practices in planning, implementing and managing all instructional activities and designs, and implements rules and procedures to maintain a safe learning environment.
4. Understands procedures for selecting, maintaining and safely using chemicals, tools, technologies, materials, specimens and equipment, including procedures for the recycling, reuse and conservation of laboratory resources and for the safe handling and ethical treatment of organisms.
5. Knows how to use appropriate equipment and technology (e.g., Internet, spreadsheet, calculator) for gathering, organizing, displaying and communicating data in a variety of ways (e.g., charts, tables, graphs, diagrams, maps, satellite images, written reports, oral presentations).
6. Understands how to use a variety of tools, techniques and technology to gather, organize and analyze data, how to perform calculations and how to apply appropriate methods of statistical measures and analyses.

7. Knows how to apply techniques to calibrate measuring devices and understands concepts of precision, accuracy and error with regard to reading and recording numerical data from scientific instruments (e.g., significant figures).
8. Uses the International System of Units (i.e., metric system) and performs unit conversions within and across measurement systems.

Competency 002—The teacher understands the nature of science, the process of scientific inquiry and the unifying concepts that are common to all sciences.

The beginning teacher:

1. Understands the nature of science, the relationship between science and technology, the predictive power of science and limitations to the scope of science (i.e., the types of questions that science can and cannot answer).
2. Knows the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis) and how and why scientists use different types of scientific investigations.
3. Understands principles and procedures for designing and conducting a variety of scientific investigations — with emphasis on inquiry-based investigations — and how to communicate and defend scientific results.
4. Understands how logical reasoning, verifiable observational and experimental evidence and peer review are used in the process of generating and evaluating scientific knowledge.
5. Understands how to identify potential sources of error in an investigation, evaluate the validity of scientific data and develop and analyze different explanations for a given scientific result.
6. Knows the characteristics and general features of systems; how properties and patterns of systems can be described in terms of space, time, energy and matter; and how system components and different systems interact.
7. Knows how to apply and analyze the systems model (e.g., interacting parts, boundaries, input, output, feedback, subsystems) across the science disciplines.
8. Understands how shared themes and concepts (e.g., systems, order and organization; evidence, models and explanation; change, constancy and measurements; evolution and equilibrium; form and function) provide a unifying framework in science.
9. Understands the difference between a theory and a hypothesis, how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

Competency 003—The teacher understands the history of science, how science impacts the daily lives of students and how science interacts with and influences personal and societal decisions. The beginning teacher:

1. Understands the historical development of science, key events in the history of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge.
2. Knows how to use examples from the history of science to demonstrate the changing nature of scientific theories and knowledge (i.e., that scientific theories and knowledge are always subject to revision in light of new evidence).

3. Knows that science is a human endeavor influenced by societal, cultural and personal views of the world, and knows that decisions about the use and direction of science are based on factors such as ethical standards, economics and personal and societal biases and needs.
4. Understands the application of scientific ethics to the conducting, analyzing and publishing of scientific investigations.
5. Applies scientific principles to analyze factors (e.g., diet, exercise, personal behavior) that influence personal and societal choices concerning fitness and health (e.g., physiological and psychological effects and risks associated with the use of substances and substance abuse).
6. Applies scientific principles, the theory of probability and risk/benefit analysis to analyze the advantages of, disadvantages of or alternatives to a given decision or course of action.
7. Understands the role science can play in helping resolve personal, societal and global issues (e.g., recycling, population growth, disease prevention, resource use, evaluating product claims).

Domain II—Physics
Competency 004—The teacher understands the description of motion in one and two dimensions.
The beginning teacher:

1. Generates, analyzes and interprets graphs describing the motion of a particle.
2. Applies vector concepts to displacement, velocity and acceleration to analyze and describe the motion of a particle.
3. Solves problems involving uniform and accelerated motion using scalar (e.g., speed) and vector (e.g., velocity) quantities.
4. Analyzes and solves problems involving projectile motion.
5. Analyzes and solves problems involving uniform circular and rotary motion.
6. Understands motion of fluids.
7. Understands motion in terms of frames of reference and relativity concepts.

Competency 005—The teacher understands the laws of motion.
The beginning teacher:

1. Identifies and analyzes the forces acting in a given situation and constructs a free-body diagram.
2. Solves problems involving the vector nature of force (e.g., resolving forces into components, analyzing static or dynamic equilibrium of a particle).
3. Identifies and applies Newton's laws to analyze and solve a variety of practical problems (e.g., properties of frictional forces, acceleration of a particle on an inclined plane, displacement of a mass on a spring, forces on a pendulum).

Competency 006—The teacher understands the concepts of gravitational and electromagnetic forces in nature.
The beginning teacher:

1. Applies the law of universal gravitation to solve a variety of problems (e.g., determining the gravitational fields of the planets, analyzing properties of satellite orbits).
2. Calculates electrostatic forces, fields and potentials.

3. Understands the properties of magnetic materials and the molecular theory of magnetism.
4. Identifies the source of the magnetic field and calculates the magnetic field for various simple current distributions.
5. Analyzes the magnetic force on charged particles and current-carrying conductors.
6. Understands induced electric and magnetic fields and analyzes the relationship between electricity and magnetism.
7. Understands the electromagnetic spectrum and the production of electromagnetic waves.

Competency 007—The teacher understands applications of electricity and magnetism. The beginning teacher:

1. Analyzes common examples of electrostatics (e.g., a charged balloon attached to a wall, behavior of an electroscope, charging by induction).
2. Understands electric current, resistance and resistivity, potential difference, capacitance and electromotive force in conductors and circuits.
3. Analyzes series and parallel DC circuits in terms of current, resistance, voltage and power.
4. Identifies basic components and characteristics of AC circuits.
5. Understands the operation of an electromagnet.
6. Understands the operation of electric meters, motors, generators and transformers.

Competency 008—The teacher understands the conservation of energy and momentum.

The beginning teacher:

1. Understands the concept of work.
2. Understands the relationships among work, energy and power.
3. Solves problems using the conservation of mechanical energy in a physical system (e.g., determining potential energy for conservative forces, conversion of potential to kinetic energy, analyzing the motion of a pendulum).
4. Applies the work-energy theorem to analyze and solve a variety of practical problems (e.g., finding the speed of an object given its potential energy, determining the work done by frictional forces on a decelerating car).
5. Understands linear and angular momentum.
6. Solves a variety of problems (e.g., collisions) using the conservation of linear and angular momentum.

Competency 009—The teacher understands the laws of thermodynamics. The beginning teacher:

1. Understands methods of heat transfer (i.e., convection, conduction, radiation).
2. Understands the molecular interpretation of temperature and heat.
3. Solves problems involving thermal expansion, heat capacity and the relationship between heat and other forms of energy.
4. Applies the first law of thermodynamics to analyze energy transformations in a variety of everyday situations (e.g., electric light bulb, power generating plant).
5. Understands the concept of entropy and its relationship to the second law of thermodynamics.

Competency 010—The teacher understands the characteristics and behavior of waves. The beginning teacher:

1. Understands relationships among wave characteristics such as velocity, frequency, wavelength and amplitude and relates them to properties of sound and light (e.g., pitch, color).
2. Compares and contrasts transverse and longitudinal waves.
3. Describes how various waves are propagated through different media.
4. Applies properties of reflection and refraction to analyze optical phenomena (e.g., mirrors, lenses, fiber-optic cable).
5. Applies principles of wave interference to analyze wave phenomena, including acoustical (e.g., harmonics) and optical phenomena (e.g., patterns created by thin films and diffraction gratings).
6. Identifies and interprets how wave characteristics and behaviors are used in medical, industrial and other real-world applications.

Competency 011—The teacher understands the fundamental concepts of quantum physics. The beginning teacher:

1. Interprets wave-particle duality.
2. Identifies examples and consequences of the uncertainty principle.
3. Understands the photoelectric effect.
4. Uses the quantum model of the atom to describe and analyze absorption and emission spectra (e.g., line spectra, blackbody radiation).
5. Explores real-world applications of quantum phenomena (e.g., lasers, photoelectric sensors, semiconductors, superconductivity).

Domain III—Chemistry

Competency 012—The teacher understands the characteristics of matter and atomic structure. The beginning teacher:

1. Differentiates between physical and chemical properties and changes of matter.
2. Explains the structure and properties of solids, liquids and gases.
3. Identifies and analyzes properties of substances (i.e., elements and compounds) and mixtures.
4. Models the atom in terms of protons, neutrons and electron clouds.
5. Identifies elements and isotopes by atomic number and mass number and calculates average atomic mass of an element.
6. Understands atomic orbitals and electron configurations and describes the relationship between electron energy levels and atomic structure.
7. Understands the nature and historical significance of the periodic table.
8. Applies the concept of periodicity to predict the physical properties (e.g., atomic and ionic radii) and chemical properties (e.g., electronegativity, ionization energy) of an element.

Competency 013—The teacher understands the properties of gases. The beginning teacher:

1. Understands interrelationships among temperature, number of moles, pressure and volume of gases contained within a closed system.
2. Analyzes data obtained from investigations with gases in a closed system and determines whether the data are consistent with the ideal gas law.
3. Applies the gas laws (e.g., Charles's law, Boyle's law, combined gas law) to describe and calculate gas properties in a variety of situations.

4. Applies Dalton's law of partial pressure in various situations (e.g., collecting a gas over water).
5. Understands the relationship between kinetic molecular theory and the ideal gas law.
6. Knows how to apply the ideal gas law to analyze mass relationships between reactants and products in chemical reactions involving gases.

Competency 014—The teacher understands the properties and characteristics of ionic and covalent bonds.

The beginning teacher:

1. Relates the electron configuration of an atom to its chemical reactivity.
2. Compares and contrasts characteristics of ionic and covalent bonds.
3. Applies the "octet" rule to construct Lewis structures.
4. Identifies and describes the arrangement of atoms in molecules, ionic crystals, polymers and metallic substances.
5. Understands the influence of bonding forces on the physical and chemical properties of ionic and covalent substances.
6. Identifies and describes intermolecular and intramolecular forces.
7. Uses intermolecular forces to explain the physical properties of a given substance (e.g., melting point, crystal structure).
8. Applies the concepts of electronegativity, electron affinity and oxidation state to analyze chemical bonds.
9. Evaluates energy changes in the formation and dissociation of chemical bonds.
10. Understands the relationship between chemical bonding and molecular geometry.

Competency 015—The teacher understands and interprets chemical equations and chemical reactions.

The beginning teacher:

1. Identifies elements, common ions and compounds using scientific nomenclature.
2. Uses and interprets symbols, formulas and equations in describing interactions of matter and energy in chemical reactions.
3. Understands mass relationships involving percent composition, empirical formulas and molecular formulas.
4. Interprets and balances chemical equations using conservation of mass and charge.
5. Understands mass relationships in chemical equations and solves problems using calculations involving moles, limiting reagents and reaction yield.
6. Identifies factors (e.g., temperature, pressure, concentration, catalysts) that influence the rate of a chemical reaction and describes their effects.
7. Understands principles of chemical equilibrium and solves problems involving equilibrium constants.
8. Identifies the chemical properties of a variety of common household chemicals (e.g., baking soda, bleach, ammonia) in order to predict the potential for chemical reactivity.

Competency 016—The teacher understands types and properties of solutions. The beginning teacher:

1. Analyzes factors that affect solubility (e.g., temperature, pressure, polarity of solvents and solutes) and rate of dissolution (e.g., surface area, agitation).

2. Identifies characteristics of saturated, unsaturated and supersaturated solutions.
3. Determines the molarity, molality, normality and percent composition of aqueous solutions.
4. Analyzes precipitation reactions and derives net ionic equations.
5. Understands the colligative properties of solutions (e.g., vapor pressure lowering, osmotic pressure changes, boiling-point elevation, freezing-point depression).
6. Understands the properties of electrolytes and explains the relationship between concentration and electrical conductivity.
7. Understands methods for measuring and comparing the rates of reaction in solutions of varying concentration.
8. Analyzes models to explain the structural properties of water and evaluates the significance of water as a solvent in living organisms and the environment.

Competency 017—The teacher understands energy transformations that occur in physical and chemical processes.

The beginning teacher:

1. Analyzes the energy transformations that occur in phase transitions.
2. Solves problems in calorimetry (e.g., determining the specific heat of a substance, finding the standard enthalpy of formation and reaction of substances).
3. Applies the law of conservation of energy to analyze and evaluate energy exchanges that occur in exothermic and endothermic reactions.
4. Understands thermodynamic relationships among spontaneous reactions, entropy, enthalpy, temperature and Gibbs free energy.

Competency 018—The teacher understands nuclear fission, nuclear fusion and nuclear reactions.

The beginning teacher:

1. Uses models to explain radioactivity and radioactive decay (i.e., alpha, beta, gamma).
2. Interprets and balances equations for nuclear reactions.
3. Compares and contrasts fission and fusion reactions (e.g., relative energy released in the reactions, mass distribution of products).
4. Knows how to use the half-life of radioactive elements to solve real-world problems (e.g., carbon dating, radioactive tracers).
5. Understands stable and unstable isotopes.
6. Knows various issues associated with using nuclear energy (e.g., medical, commercial, environmental).

Competency 019—The teacher understands oxidation and reduction reactions. The beginning teacher:

1. Determines the oxidation state of ions and atoms in compounds.
2. Identifies and balances oxidation and reduction reactions.
3. Uses reduction potentials to determine whether a redox reaction will occur spontaneously.
4. Explains the operation and applications of electrochemical cells.
5. Analyzes applications of oxidation and reduction reactions from everyday life (e.g., combustion, rusting, electroplating, batteries).

Competency 020—The teacher understands acids, bases and their reactions. The beginning teacher:

1. Identifies the general properties of, and relationships among, acids, bases and salts.
2. Identifies acids and bases using models of Arrhenius, Brønsted-Lowry and Lewis.
3. Differentiates between strong and weak acids and bases.
4. Applies the relationship between hydronium ion concentration and pH for acids and bases.
5. Understands and analyzes acid-base equilibria and buffers.
6. Analyzes and applies the principles of acid-base titration.
7. Analyzes neutralization reactions based on the principles of solution concentration and stoichiometry.
8. Describes the effects of acids and bases in the real world (e.g., acid precipitation, physiological buffering).

Domain IV—Cell Structure and Processes

Competency 021—The teacher understands the structure and function of biomolecules. The beginning teacher:

1. Identifies the chemical elements necessary for life and understands how those elements combine to form biologically important compounds.
2. Relates the physical and chemical properties of water and carbon to the significance of those properties in basic life processes.
3. Analyzes how a molecule's biological function is related to its shape (e.g., enzymes, tRNA, DNA, receptors, neurotransmitters, lipids).
4. Understands the importance of chemical reactions in the synthesis and degradation of biomolecules.
5. Identifies and compares the structures and functions of different types of biomolecules, including carbohydrates, lipids, proteins and nucleic acids.
6. Explains how enzymes function in synthesis and degradation of biomolecules (e.g., DNA, food).

Competency 022—The teacher understands that cells are the basic structure of living things and have specialized parts that perform specific functions.
The beginning teacher:

1. Differentiates among viruses, prokaryotic cells and eukaryotic cells (e.g., structure and function).
2. Describes the basic components of prokaryotic and eukaryotic cells (e.g., cell membrane, cell wall, ribosomes, nucleus, mitochondrion, chloroplast), and the functions and relationships of the components.
3. Identifies differences in cell structure and function in different types of organisms (e.g., differences in plant and animal cells).
4. Analyzes specialization of structure and function in different types of cells in living organisms (e.g., skin, nerve and muscle cells in animals; root, stem and leaf cells in plants).

Competency 023—The teacher understands how cells carry out life processes. The beginning teacher:

1. Analyzes how cells maintain homeostasis (e.g., the effects of concentration gradients, rate of movement and ratio of surface area to volume).
2. Understands processes by which cells transport water, nutrients and wastes

across cell membranes (e.g., osmosis, diffusion, transport systems).

3. Analyzes energy flow in the processes of photosynthesis and cellular respiration.
4. Compares and contrasts anaerobic and aerobic respiration and their products.

Competency 024—The teacher understands how specialized cells, tissues, organs, organ systems and organisms grow and develop.

The beginning teacher:

1. Understands factors (e.g., hormones, cell size) that regulate the cell cycle and the effects of unregulated cell growth (e.g., cancer).
2. Analyzes the role of cell differentiation in the development of tissues, organs, organ systems and living organisms.
3. Analyzes factors (e.g., genetics, disease, nutrition, exposure to toxic chemicals) affecting cell differentiation and the growth and development of organisms.
4. Identifies the different levels of organization in multicellular organisms and relates the parts to each other and to the whole.

Domain V—Heredity and Evolution of Life

Competency 025—The teacher understands the structures and functions of nucleic acids in the mechanisms of genetics.

The beginning teacher:

1. Relates the structure of DNA (e.g., bases, sugars, phosphates) to the nature, function and relationships of genes, chromatin and chromosomes.
2. Relates the structures of DNA and RNA to the processes of replication, transcription, translation and genetic regulation.
3. Compares and contrasts the organization and control of the genome in viruses, prokaryotic cells and eukaryotic cells.
4. Understands the types, biological significance and causes of mutations.
5. Identifies methods and applications of genetic identification and manipulation (e.g., production of recombinant DNA, cloning, PCR).
6. Analyzes human karyotypes to identify chromosomal disorders and sex.

Competency 026—The teacher understands the continuity and variations of traits from one generation to the next.

The beginning teacher:

1. Applies the laws of probability to determine genotypic and phenotypic frequencies in Mendelian inheritance (e.g., Punnett squares, pedigree charts).
2. Compares the processes of meiosis and mitosis (in plants and animals) and describes their roles in sexual and asexual reproduction.
3. Recognizes factors influencing the transmission of genes from one generation to the next (e.g., linkage, position of genes on a chromosome, crossing over, independent assortment).
4. Understands how the genotype of an organism influences the expression of traits in its phenotype (e.g., dominant and recessive traits; monogenic, polygenic and polytypic inheritance; genetic disorders).
5. Analyzes the effects of environmental factors (e.g., light, nutrition, moisture, temperature) on the expression of traits in the phenotype of an organism.

Competency 027—The teacher understands the theory of biological evolution. The beginning teacher:

1. Understands stability and change in populations (e.g., Hardy-Weinberg

equilibrium) and analyzes factors leading to genetic variation and evolution
in

populations (e.g., mutation, gene flow, genetic drift, recombination, nonrandom mating, natural selection).

2. Analyzes the effects of natural selection on adaptations and diversity in populations and species.
3. Understands the role of intraspecific and interspecific competition in evolutionary change.
4. Compares and contrasts the different effects of selection (e.g., directional, stabilizing, diversifying) on a variable characteristic.
5. Analyzes processes that contribute to speciation (e.g., natural selection, founder effect, reproductive isolation).
6. Analyzes the development of isolating mechanisms that discourage hybridization between species (e.g., species' recognition marks, behavioral displays, ecological separation, seasonal breeding).

Competency 028—The teacher understands evidence for evolutionary change during Earth's history.

The beginning teacher:

1. Analyzes how fossils, DNA sequences, anatomical similarities, physiological similarities and embryology provide evidence of both common origin and change in populations and species.
2. Understands the relationship between environmental change, mutations and adaptations of an organism over many generations.
3. Identifies major developments in the evolutionary history of life (e.g., formation of organic molecules, self-replication, backbones, vascular tissue, colonization of the land).
4. Understands theories regarding the causes of extinction of species and the pace and mode of evolutionary change (e.g., punctuated equilibrium, mass extinctions, adaptive radiation).

Domain VI—Diversity of Life

Competency 029—The teacher understands similarities and differences between living organisms and how taxonomic systems are used to organize and interpret the diversity of life.

The beginning teacher:

1. Compares and contrasts structural and physiological adaptations of plants and animals living in various aquatic and terrestrial environments (e.g., freshwater and marine; forest and plain; desert and tundra).
2. Understands the relationship between environmental changes in aquatic and terrestrial ecosystems and adaptive changes in organisms inhabiting those ecosystems.
3. Explains the uses and limitations of classification schemes.
4. Relates taxonomic classification to evolutionary history and knows how to distinguish between traits that are taxonomically useful (e.g., homologous traits) and those that are not (e.g., convergent traits).
5. Analyzes relationships among organisms to develop a model of a hierarchical classification system and knows how to classify aquatic and terrestrial organisms at several taxonomic levels (e.g., species, phylum/division, kingdom) using dichotomous keys.

6. Identifies distinguishing characteristics of domains and kingdoms, including eubacteria, archaebacteria, protists, fungi, plants and animals.

Competency 030—The teacher understands that, at all levels of nature, living systems are found within other living systems, each with its own boundaries and limits.

The beginning teacher:

1. Identifies the basic requirements (e.g., nutrients, oxygen, water, carbon dioxide) necessary for various organisms to carry out life functions.
2. Compares how various organisms obtain, transform, transport, release, eliminate and store energy and matter.
3. Analyzes characteristics, functions and relationships of systems in animals including humans (e.g., digestive, circulatory, nervous, endocrine, reproductive, integumentary, skeletal, respiratory, muscular, excretory, immune systems).
4. Analyzes characteristics, functions and relationships of systems in plants (e.g., transport, control, reproductive, nutritional, structural systems).
5. Identifies methods of reproduction, growth and development of various plants and animals.

Competency 031—The teacher understands the processes by which organisms maintain homeostasis.

The beginning teacher:

1. Explains the importance of maintaining a stable internal environment.
2. Describes the relationships among internal feedback mechanisms in maintaining homeostasis.
3. Identifies anatomical structures and physiological processes in a variety of organisms that function to maintain homeostasis in the face of changing environmental conditions.
4. Analyzes the importance of nutrition, environmental conditions and physical exercise on health in humans and other organisms.
5. Analyzes the role of viruses and microorganisms in maintaining or disrupting homeostasis in different organisms (e.g., the role of bacteria in digestion, diseases of plants and animals).

Competency 032—The teacher understands the relationship between biology and behavior. The beginning teacher:

1. Understands how the behavior of organisms, including humans, is in response to internal and external stimuli.
2. Recognizes that behavior in many animals is determined by a combination of genetic and learned factors.
3. Identifies adaptive advantages of innate and learned patterns of behavior.
4. Explains mediating factors in innate (e.g., imprinting, hormonal system) and learned (e.g., classical conditioning, play) behavior.
5. Understands concepts linking behavior and natural selection (e.g., kin selection, courtship behavior, altruism).

Domain VII—Interdependence of Life and Environmental Systems

Competency 033—The teacher understands the relationships between abiotic and biotic factors of terrestrial and aquatic ecosystems, habitats and biomes, including the flow of matter and energy. The beginning teacher:

1. Analyzes types, sources and flow of energy through different trophic levels (e.g., producers, consumers, decomposers) and between organisms and the physical environment in aquatic and terrestrial ecosystems.
2. Analyzes the flow of energy and the cycling of matter through biogeochemical cycles (e.g., carbon, water, oxygen, nitrogen, phosphorus) in aquatic and terrestrial ecosystems.
3. Understands the concept of limiting factors (e.g., light intensity, temperature, mineral availability) and the effects that they have on the productivity and complexity of different ecosystems (e.g., tropical forest versus taiga, continental shelf versus deep ocean).
4. Explains the relationship among abiotic characteristics of different biomes and the adaptations, variations, tolerances and roles of indigenous plants and animals in those biomes.

Competency 034—The teacher understands the interdependence and interactions of living things in terrestrial and aquatic ecosystems.

The beginning teacher:

1. Understands the concepts of ecosystem, biome, community, habitat and niche.
2. Analyzes interactions of organisms, including humans, in the production and consumption of energy (e.g., food chains, food webs, food pyramids) in aquatic and terrestrial ecosystems.
3. Understands interspecific interactions in aquatic and terrestrial ecosystems (e.g., predator-prey relationships, competition, parasitism, commensalism, mutualism) and how they affect ecosystem structure.
4. Identifies indigenous plants and animals, assesses their roles in an ecosystem and describes their relationships in different types of environments (e.g., fresh water, continental shelf, deep ocean, forest, desert, plains, tundra).
5. Analyzes how the introduction, removal or reintroduction of an organism may alter the food chain, affect existing populations and influence natural selection in terrestrial and aquatic ecosystems.
6. Evaluates the importance of biodiversity in an ecosystem and identifies changes that may occur if biodiversity is increased or reduced in an ecosystem.
7. Understands types and processes of ecosystem change over time in terrestrial and aquatic ecosystems (e.g., equilibrium, cyclical change, succession) and the effects of human activity on ecosystem change.
8. Explains the significance of plants in different types of terrestrial and aquatic ecosystems.

Competency 035—The teacher understands the relationship between carrying capacity and changes in populations and ecosystems.

The beginning teacher:

1. Identifies basic characteristics of populations in an ecosystem (e.g., age pyramid, density, patterns of distribution).
2. Compares concepts of population dynamics, including exponential growth, logistic (i.e., limited) growth and cycling (e.g., boom-and-bust cycles).
3. Relates carrying capacity to population dynamics, including human population growth.

4. Analyzes the impact of density-dependent and density-independent factors (e.g., geographic locales, natural events, diseases, birth and death rates) on populations.
5. Compares *r*- and *K*-selected reproductive strategies (e.g., survivorship curves).

Domain VIII—Earth's History and the Structure and Function of Earth Systems

Competency 036—The teacher understands structure and function of the geosphere. The beginning teacher:

1. Analyzes the internal structure and composition of Earth and methods used to investigate Earth's interior (e.g., seismic waves, chemical composition of rocks).
2. Classifies rocks according to how they are formed as described by the rock cycle (e.g., igneous, sedimentary, metamorphic) and identifies the economic significance of rocks and minerals.
3. Uses physical properties (e.g., density, hardness, streak, cleavage) to identify common minerals and understands processes affecting rock and mineral formation (e.g., temperature, pressure, rate of cooling).
4. Identifies different types of landforms and topographic features on the surface of Earth, including the ocean floor (e.g., faults, volcanoes, mid-ocean ridges, deltas).
5. Identifies the types, characteristics and uses of Earth's renewable and nonrenewable resources, including marine resources (e.g., ores, minerals, soil, fossil fuels).
6. Identifies sources and reservoirs for matter and energy (e.g., carbon, nitrogen, water, solar radiation, radioactive decay).
7. Analyzes the cycling and transformation of matter and energy through the geosphere (e.g., mantle convection).
8. Relates the principles of conservation of mass and energy to processes that occur in the geosphere (e.g., the melting of rock).

Competency 037—The teacher understands processes of plate tectonics, weathering, erosion and deposition that change Earth's surface.
The beginning teacher:

1. Understands how the theory of plate tectonics explains the movement and structure of Earth's crustal plates (e.g., seafloor spreading, major tectonic plates, subduction).
2. Understands evidence for plate movement (e.g., magnetic reversals, distribution of earthquakes, GPS measurements).
3. Describes the historical development of the theory of plate tectonics (e.g., Wegener's continental drift hypothesis).
4. Analyzes the effects of plate movement, including faulting, folding, mineral formation, earthquakes and volcanic activity.
5. Knows the processes (e.g., freezing/thawing, chemical reactions) and products of weathering (e.g., soils, karst features) and compares and contrasts chemical and mechanical weathering.
6. Identifies the causes (e.g., wind, water, gravity, glaciers) and effects of erosion and deposition (e.g., removal of topsoil, sedimentation).

Competency 038—The teacher understands the formation and history of Earth. The beginning teacher:

1. Knows the historical development of scientific theories relating to the origin

and development of Earth (e.g., Hutton's uniformitarianism).

2. Understands how Earth's geosphere, hydrosphere and atmosphere have changed over time and analyzes the significance of those changes (e.g., formation of oxygen in the atmosphere).
3. Understands the organization of the geologic time scale and methods of relative (e.g., superposition, fossils) and absolute (e.g., radiometric, dendrochronology) dating.
4. Identifies important events in the history of Earth (e.g., formation of major mountain chains, breakup of continents, appearance of life, appearance of multicellular organisms) and locates those events on the geologic time scale.
5. Understands relationships between physical changes during Earth's history and biological evolution (e.g., plate movement and biogeography; meteoric impacts, global temperature changes, extinctions, adaptive radiations, formation of ozone layer) and predict future effects (e.g., changing ocean temperatures).
6. Analyzes processes involved in the formation of fossils and how fossils are used to interpret the history of Earth.

Competency 039—The teacher understands structure and function of the hydrosphere. The beginning teacher:

1. Identifies the components and distribution of hydrologic systems (e.g., rivers, lakes, aquifers, oceans) and compares and contrasts the chemical composition (e.g., salinity, acidity) and physical attributes (e.g., density, turbidity) of fresh, brackish and salt water.
2. Understands the water cycle and processes by which water moves through the water cycle (e.g., infiltration, runoff, evaporation, condensation, transpiration) and quantifies the dynamics of surface and groundwater movement.
3. Identifies and uses the tools and procedures needed to collect and analyze quantitative data (e.g., pH, salinity, temperature, mineral content, nitrogen compounds, turbidity, dissolved oxygen) from hydrologic systems and describes the impact of those measured conditions on the quality of an ecosystem.
4. Knows how to use principles of fluid statics and dynamics (e.g., Archimedes' principle, turbulence, viscosity, hydrostatic pressure) to analyze hydrologic systems.
5. Identifies characteristics of a local watershed and the effects of natural events (e.g., floods, droughts) and human activities (e.g., irrigation, industrial use, municipal use) on a local watershed.
6. Analyzes patterns of ocean circulation (e.g., upwelling, surface currents) and factors that influence those patterns (e.g., winds, heating).
7. Understands the relationship between ocean depth and temperature, pressure, density and light penetration.
8. Analyzes the causes and effects of waves, tides, tidal bores and tsunamis.
9. Identifies the characteristics of different ocean zones (e.g., coastal zones, lighted zones, deep zones, estuaries, bays).

Competency 040—The teacher understands structure and function of the atmosphere. The beginning teacher:

1. Understands the composition of Earth's atmosphere.
2. Understands the range of atmospheric conditions that organisms will tolerate

(e.g., types of gases, temperature, particulate matter, moisture).

3. Identifies the layers of the atmosphere (e.g., troposphere, ionosphere, mesophere) and the characteristics of each layer.
4. Recognizes that the Sun is the ultimate source of energy for the atmosphere.
5. Understands processes of energy transfer (e.g., convection, radiation, conduction, phase changes of water) within the atmosphere and at the boundaries between the atmosphere, landmasses and oceans.
6. Knows types, characteristics and processes of formation of clouds (e.g., cumulus, stratus, cirrus) and precipitation (e.g., rain, snow, hail).
7. Knows the characteristics of air masses (e.g., temperature, moisture) and how air masses form and interact (e.g., fronts).
8. Understands the types (e.g., blizzards, hurricanes, tornadoes), characteristics and causes of severe weather.
9. Identifies the types, characteristics and distribution of climates and the factors (e.g., latitude, maritime effect, deforestation) that affect local and global climate.
10. Identifies the effects of global phenomena (e.g., jet stream, El Niño) on local weather patterns.
11. Understands weather maps and the principles, procedures and technology of weather forecasting (e.g., satellite technology, computer models).
12. Understands that climate changes over time (e.g., ice ages, carbon dioxide level) and understands the evidence for those changes.

Competency 041—The teacher understands the effects of natural events and human activity on Earth systems.

The beginning teacher:

1. Analyzes issues (e.g., economic impact, environmental effects, availability) regarding the use of Earth's resources (e.g., fossil fuels, renewable and nonrenewable resources).
2. Analyzes the effects of natural events (e.g., fires, hurricanes, volcanic eruptions) and human activity (e.g., mining, fishing, reforestation, ocean dumping, municipal development) on aquatic and terrestrial ecosystems.
3. Demonstrates an understanding of factors affecting the quality, use and conservation of water (e.g., floods, droughts, agriculture, dams).
4. Evaluates methods of land use and understands issues in land-use management (e.g., development of barrier islands).
5. Identifies the sources (e.g., burning of fossil fuels, industrial production of heavy metals, release of chlorofluorocarbons) and effects of pollution (e.g., mercury contamination of fish, acid rain, lead poisoning, ozone depletion).
6. Recognizes that Earth is composed of interacting systems and that regional changes in the environment may have global effects (e.g., weather changes due to reforestation, global warming).
7. Demonstrates an understanding of how individuals, communities and governments can conserve, protect and restore habitats and ecosystems.

Domain IX—Components and Properties of the Solar System and the Universe

Competency 042—The teacher understands the implications of Earth's placement and orientation in the solar system.

The beginning teacher:

1. Analyzes the relationship between Earth's placement in the solar system and the conditions on Earth that enable organisms to survive.
2. Demonstrates an understanding of the Sun's effects (e.g., gravitational, electromagnetic, solar wind, solar flares) on Earth.
3. Understands the effects of Earth's rotation, revolution and tilt of axis on its environment (e.g., length of day and night, seasons).
4. Identifies the effects of the Moon and Sun on tides.
5. Analyzes information about lunar phases and lunar and solar eclipses to model the Earth, Moon and Sun system.

Competency 043—The teacher understands the role of the Sun in the solar system and the characteristics of planets and other objects that orbit the Sun.
The beginning teacher:

1. Knows the approximate size, mass, motion, temperature, structure and composition of the Sun.
2. Compares and contrasts conditions essential to life on Earth (e.g., temperature, water, mass, gases) to conditions on other planets.
3. Compares and contrasts the planets in terms of orbit, mass, size, composition, rotation, atmosphere, moons and geologic activity.
4. Identifies objects other than planets that orbit the Sun (e.g., asteroids, comets) and analyzes their characteristics (e.g., mass, size, composition, trajectory, origin).
5. Relates gravitational force to the motion and interactions of objects within the solar system (e.g., Sun, planets, moons, comets, meteors).
6. Understands theories of the formation of the solar system (e.g., planets, the Moon).

Competency 044—The teacher understands composition, history and properties of the universe. The beginning teacher:

1. Describes how nuclear fusion produces energy in stars, such as the Sun.
2. Identifies different types of stars, their characteristics and motions (e.g., temperature, age, relative size, composition, magnitude and radial velocity) and understands the use of spectral analysis to determine those characteristics.
3. Describes the characteristics of the stages in the life cycle of stars using the Hertzsprung-Russell diagram.
4. Compares and contrasts characteristics of different types of galaxies.
5. Interprets data to make inferences about the formation of stars and galaxies.
6. Identifies types, characteristics and significance of other deep-space objects in the universe (e.g., pulsars, nebulae, black holes, extra-solar planets).
7. Interprets empirical data and scientific theories regarding the estimated age, origin and evolution of the universe (e.g., big bang, inflation, role of dark matter and dark energy).
8. Describes the role of supernovas on the chemical composition of the universe (e.g., origin of carbon on Earth).

Competency 045—The teacher understands the history and methods of astronomy. The beginning teacher:

1. Recognizes that all of science including current theories of the origin and evolution of the universe are based on the assumption that the fundamental

laws of nature do not change over space and time.

2. Describes the historical origins of the perceived patterns of constellations and their role in navigation.
3. Describes the historical development and significance of the law of universal gravitation and planetary motion, the big bang theory of the origin of the universe and the theory of special relativity.
4. Recognizes and explains the patterns of movement of the Sun, Moon, planets and stars in the sky.
5. Demonstrates the use of units of measurement in astronomy (e.g., light year, astronomical units).
6. Explains how various technologies (e.g., Earth- and space-based telescopes, deep-space probes, artificial satellites, human space flight) are used in advancing knowledge about the universe.
7. Understands how mathematical models, computer simulations and data collected by the space and other science programs have contributed to scientific knowledge about Earth, the solar system and the universe.

Domain X—Science Learning, Instruction and Assessment

Competency 046—The teacher understands research-based theoretical and practical knowledge about teaching science, how students learn science and the role of scientific inquiry in science instruction.

The beginning teacher:

1. Knows research-based theories about how students develop scientific understanding and how developmental characteristics, prior knowledge, experience and attitudes of students influence science learning.
2. Understands the importance of respecting student diversity by planning activities that are inclusive and selecting and adapting science curricula, content, instructional materials and activities to meet the interests, knowledge, understanding, abilities, possible career paths and experiences of all students, including English-language learners.
3. Knows how to plan and implement strategies to encourage student self-motivation and engagement in their own learning (e.g., linking inquiry-based investigations to students' prior knowledge, focusing inquiry-based instruction on issues relevant to students, developing instructional materials using situations from students' daily lives, fostering collaboration among students).
4. Knows how to use a variety of instructional strategies to ensure all students comprehend content-related texts, including how to locate, retrieve and retain information from a range of texts and technologies.
5. Understands the science teacher's role in developing the total school program by planning and implementing science instruction that incorporates schoolwide objectives and the statewide curriculum as defined in the Texas Essential Knowledge and Skills (TEKS).
6. Knows how to design and manage the learning environment (e.g., individual, small-group, whole-class settings) to focus and support student inquiries and to provide the time, space and resources for all students to participate in field, laboratory, experimental and nonexperimental scientific investigation.

7. Understands the rationale for using active learning and inquiry methods in science instruction and how to model scientific attitudes such as curiosity, openness to new ideas and skepticism.
8. Knows principles and procedures for designing and conducting an inquiry-based scientific investigation (e.g., making observations; generating questions; researching and reviewing current knowledge in light of existing evidence; choosing tools to gather and analyze evidence; proposing answers, explanations and predictions; and communicating and defending results).
9. Knows how to assist students with generating, refining, focusing and testing scientific questions and hypotheses.
10. Knows strategies for assisting students in learning to identify, refine and focus scientific ideas and questions guiding an inquiry-based scientific investigation; to develop, analyze and evaluate different explanations for a given scientific result; and to identify potential sources of error in an inquiry-based scientific investigation.
11. Understands how to implement inquiry strategies designed to promote the use of higher-level thinking skills, logical reasoning and scientific problem solving in order to move students from concrete to more abstract understanding.
12. Knows how to guide students in making systematic observations and measurements.
13. Knows how to sequence learning activities in a way that uncovers common misconceptions, allows students to build upon their prior knowledge and challenges them to expand their understanding of science.

Competency 047—The teacher knows how to monitor and assess science learning in laboratory, field and classroom settings.

The beginning teacher:

1. Knows how to use formal and informal assessments of student performance and products (e.g., projects, laboratory and field journals, rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of inquiry-based scientific investigations.
2. Understands the relationship between assessment and instruction in the science curriculum (e.g., designing assessments to match learning objectives, using assessment results to inform instructional practice).
3. Knows the importance of monitoring and assessing students' understanding of science concepts and skills on an ongoing basis by using a variety of appropriate assessment methods (e.g., performance assessment, self-assessment, peer assessment, formal/informal assessment).
4. Understands the purposes, characteristics and uses of various types of assessment in science, including formative and summative assessments, and the importance of limiting the use of an assessment to its intended purpose.
5. Understands strategies for assessing students' prior knowledge and misconceptions about science and how to use those assessments to develop effective ways to address the misconceptions.
6. Understands characteristics of assessments, such as reliability, validity and the absence of bias in order to evaluate assessment instruments and their results.

7. Understands the role of assessment as a learning experience for students and strategies for engaging students in meaningful self-assessment.
8. Recognizes the importance of selecting assessment instruments and methods that provide all students with adequate opportunities to demonstrate their achievements.
9. Recognizes the importance of clarifying teacher expectations by sharing evaluation criteria and assessment results with students.

Texas Essential Knowledge and Skills for Science

Grade 4

(1) In Kindergarten through Grade 5 Science, content is organized into recurring strands. The concepts within each grade level build on prior knowledge, prepare students for the next grade level, and establish a foundation for high school courses. In Grade 4, the following concepts will be addressed in each strand. (A) Scientific and engineering practices. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, correlative, comparative, or experimental. The method chosen should be appropriate to the grade level and question being asked. Student learning for different types of investigations includes descriptive investigations, which have no hypothesis that tentatively answers the research question and involve collecting data and recording observations without making comparisons; correlative and comparative investigations, which have a hypothesis that predicts a relationship and involve collecting data, measuring variables relevant to the hypothesis that are manipulated, and comparing results; and experimental investigations, which involve §112.A. Elementary Page 18 August 2018 Update processes similar to comparative investigations but in which a hypothesis can be tested by comparing a treatment with a control. (i) Scientific practices. Students ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. (ii) Engineering practices. Students identify problems and design solutions using appropriate tools and models. (iii) To support instruction in the science content standards, it is recommended that districts integrate scientific and engineering practices through classroom and outdoor investigations for at least 50% of instructional time. (B) Matter and energy. Students investigate matter's measurable properties, including mass, volume, states, temperature, magnetism, and relative density, to determine how it is classified, changed, and used. Students compare and contrast a variety of mixtures, including solutions, and demonstrate that matter is conserved. (C) Force, motion, and energy. Students investigate forces, including friction, gravity, and magnetism, to observe their effects on objects. They differentiate between mechanical, sound, light, thermal, and electrical energy. Students observe the cycle of energy and the parts of a system while exploring circuits that produce light and thermal energy. They will build on their understanding of circuits in Grade 5. As students explore thermal and electrical energy, they observe the behavior of different materials to identify patterns and label the materials as conductors or insulators. (D) Earth and space. Students learn about processes on Earth that create patterns of change. These processes include the water cycle, weathering, erosion, deposition, the appearance of the Moon, and seasons. Students will build on this understanding in Grade 5 when they learn about day and night, shadows, and the rotation of Earth on its axis. Finally, students identify Earth's resources and classify them as renewable or nonrenewable. (E) Organisms and environments. In this strand, students begin to understand how organisms within an ecosystem interact. Students investigate producers to learn how they make food. Students build on their understanding of food chains, from Grade 3, as they explore food webs where they describe the

flow of energy and the role of producers, consumers, and decomposers. They also use fossil evidence to describe environments of the past. Additionally, students explore plant structures and their functions. Students also differentiate between inherited and acquired traits of organisms. (2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable. (3) Scientific observations, inferences, hypotheses, and theories. Students are expected to know that: (A) observations are active acquisition of either qualitative or quantitative information from a primary source through the senses; (B) inferences are conclusions reached on the basis of observations or reasoning supported by relevant evidence; (C) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and (D) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well Elementary §112.A. April 2022 Update Page 19 of 42 established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed. (4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students distinguish between scientific decision- making practices and ethical and social decisions that involve science. (5) Recurring themes and concepts. Science consists of recurring themes and making connections between overarching concepts. Recurring themes include structure and function, systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. Models have limitations but provide a tool for understanding the ideas presented. Students analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. (6) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples. (b) Knowledge and skills. (1) Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; (B) use scientific practices to plan and conduct descriptive investigations and use engineering practices to design solutions to problems; (C) demonstrate safe practices and the use of safety equipment during classroom and field investigations as outlined in Texas Education Agency-approved safety standards; (D) use tools, including hand lenses; metric rulers; Celsius thermometers; calculators; laser pointers; mirrors; digital scales; balances; graduated cylinders; beakers; hot plates; meter sticks; magnets; notebooks; timing devices; sieves; materials for building circuits; materials to support observation of habitats of organisms such as terrariums, aquariums, and collecting nets; and materials to support digital data collection such as computers, tablets, and cameras, to observe, measure, test, and analyze information; (E) collect observations and measurements as evidence; (F) construct appropriate graphic organizers used to collect data, including tables, bar graphs, line graphs, tree maps, concept maps, Venn diagrams, flow charts or sequence maps, and input-output tables that show cause and effect; and (G) develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem. (2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to: (A) identify advantages and limitations of models such as their size, scale, properties, and materials; (B) analyze data by identifying any significant features, patterns, or sources of error; (C) use mathematical calculations to compare patterns and relationships; and (D) evaluate a design or object using criteria. §112.A. Elementary Page 20 August 2018 Update (3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: (A) develop explanations and propose solutions supported by data and models; (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and (C) listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion. (4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation for society. The student is expected to: (A) explain how scientific discoveries and innovative solutions to problems impact science and society; and (B) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers. (5) Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines. The student is expected to: (A) identify and use patterns to explain scientific phenomena or to design solutions; (B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems; (C) use scale, proportion, and quantity to describe, compare, or model different systems; (D) examine and model the parts of a system and their interdependence in the function of the system; (E) investigate how energy flows and matter cycles through systems and how matter is conserved; (F) explain the relationship between the structure and function of objects, organisms, and systems; and (G) explain how factors or conditions impact stability and change in objects, organisms, and systems. (6) Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used. The student is expected to: (A) classify and describe matter using observable physical properties, including temperature, mass, magnetism, relative density (the ability to sink or float in water), and physical state (solid, liquid, gas); (B) investigate and compare a variety of mixtures, including solutions that are composed of liquids in liquids and solids in liquids; and (C) demonstrate that matter is conserved when mixtures such as soil and water or oil and water are formed. (7) Force, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to plan and conduct descriptive investigations to explore the patterns of forces such as gravity, friction, or magnetism in contact or at a distance on an object. (8) Force, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems. The student is expected to: (A) investigate and identify the transfer of energy by objects in motion, waves in water, and sound; Elementary §112.A. April 2022 Update Page 21 of 42 (B) identify conductors and insulators of thermal and electrical energy; and (C) demonstrate and describe how electrical energy travels in a closed path that can produce light and thermal energy. (9) Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects. The student is expected to: (A) collect and analyze data to identify sequences and predict patterns of change in seasons such as change in temperature and length of daylight; and (B) collect and analyze data to identify sequences and predict patterns of change in the observable appearance of the Moon from Earth. (10) Earth and space. The student knows that there are processes on Earth that create patterns of change. The student is expected to: (A) describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process; (B) model and describe slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice; and (C) differentiate between weather and climate. (11) Earth and space. The student understands how natural resources are important and can be managed. The student is expected to: (A) identify and explain advantages and disadvantages of using Earth's renewable and nonrenewable natural resources such as wind, water, sunlight, plants, animals, coal, oil, and natural gas; (B) explain the critical role of energy resources to modern life and how conservation, disposal, and recycling of natural resources impact the environment; and (C) determine the physical properties of rocks that allow Earth's natural resources to be stored there. (12) Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments. The student is expected to: (A) investigate and explain how most producers can make their own food using sunlight, water, and carbon dioxide through the cycling of matter; (B) describe the cycling of matter and flow of energy through food webs, including the roles of the Sun, producers, consumers, and decomposers; and (C) identify and describe past environments based on fossil evidence, including common Texas fossils. (13) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments. The student is expected to: (A) explore and explain how structures and functions of plants such as waxy leaves and deep roots enable them to survive in their environment; and (B) differentiate between inherited and acquired physical traits of organisms.

Grade 5

(1) In Kindergarten through Grade 5 Science, content is organized into recurring strands. The concepts within each grade level build on prior knowledge, prepare students for the next grade level, and establish a foundation for high school courses. In Grade 5, the following concepts will be addressed in each strand. (A) Scientific and engineering practices. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, correlative, comparative, or experimental. The method chosen should be appropriate to the grade level and question being asked. Student learning for different types of investigations includes descriptive investigations, which have no hypothesis that tentatively answers the research question and involve collecting data and recording observations without making comparisons; correlative and comparative investigations, which have a hypothesis that predicts a relationship and involve collecting data, measuring variables relevant to the hypothesis that are manipulated, and comparing results; and experimental investigations, which involve processes similar to comparative investigations but in which a hypothesis can be tested by comparing a treatment with a control. (i) Scientific practices. Students ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. (ii) Engineering practices. Students identify problems and design solutions using appropriate tools and models. (iii) To support instruction in the science content standards, it is recommended that districts integrate scientific and engineering practices through classroom and outdoor investigations for at least 50% of instructional time. (B) Matter and energy. Students investigate matter expanding their understanding of properties learned in Grade 4 (mass, volume, states, temperature, magnetism,

and relative density) to include solubility and the ability to conduct or insulate both thermal and electrical energy. Students observe the combination of substances to make mixtures and develop an understanding of conservation of matter. These concepts lead to the understanding of elements and compounds. Students will build on this understanding in middle school when they learn to determine density and to identify evidence of chemical changes. (C) Force, motion, and energy. Students investigate equal and unequal forces and the effects these forces have on objects (motion and direction). Additionally, students investigate energy, including mechanical, light, thermal, electrical, and sound. They uncover cycles (e.g., movement of thermal energy), patterns (e.g., behavior of light, including reflection and refraction), and systems through their exploration. Students will build on this understanding in middle school when they begin to use calculations and measurements to study force, motion, and energy through the study of Newton's Laws of Motion. (D) Earth and space. This strand is focused on identifying recognizable patterns and processes as students learn about Earth's rotation and demonstrate the effects this movement has on Earth's surface, including day and night, shadows, and the rotation of Earth on its axis. Students continue their learning of patterns and processes on Earth while exploring weather, climate, the water cycle, the formation of sedimentary rock and fossil fuels, and the formation of landforms. Finally, students learn ways to manage natural resources to support a healthy environment. (E) Organisms and environments. This strand focuses on identifying relationships, systems, and cycles within organisms and environments. Students describe the interactions of biotic and abiotic factors in an ecosystem. Students build on their understanding of food webs from Grade 4 by predicting how ecosystem changes affect the flow of energy. Additionally, they describe how humans impact the ecosystem. Students also learn how organisms' structures help them to survive, and they distinguish between instinctual and Elementary §112.A. April 2022 Update Page 23 of 42 learned behaviors in animals. This will set the foundation for Grade 6 where students compare and contrast variations within organisms and how they impact survival. (2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable. (3) Scientific observations, inferences, hypotheses, and theories. Students are expected to know that: (A) observations are active acquisition of either qualitative or quantitative information from a primary source through the senses; (B) inferences are conclusions reached on the basis of observations or reasoning supported by relevant evidence; (C) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and (D) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed. (4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students distinguish between scientific decision-making practices and ethical and social decisions that involve science. (5) Recurring themes and concepts. Science consists of recurring themes and making connections between overarching concepts. Recurring themes include structure and function, systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. Models have limitations but provide a tool for understanding the ideas presented. Students analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(6) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples. (b) Knowledge and skills. (1) Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; (B) use scientific practices to plan and conduct descriptive and simple experimental investigations and use engineering practices to design solutions to problems; (C) demonstrate safe practices and the use of safety equipment during classroom and field investigations as outlined in Texas Education Agency-approved safety standards; (D) use tools, including calculators, microscopes, hand lenses, metric rulers, Celsius thermometers, prisms, concave and convex lenses, laser pointers, mirrors, digital scales, balances, spring scales, graduated cylinders, beakers, hot plates, meter sticks, magnets, collecting nets, notebooks, timing devices, materials for building circuits, materials to support observations of habitats or organisms such as terrariums and aquariums, and §112.A. Elementary Page 24 August 2018 Update materials to support digital data collection such as computers, tablets, and cameras to observe, measure, test, and analyze information; (E) collect observations and measurements as evidence; (F) construct appropriate graphic organizers used to collect data, including tables, bar graphs, line graphs, tree maps, concept maps, Venn diagrams, flow charts or sequence maps, and input-output tables that show cause and effect; and (G) develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem. (2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to: (A) identify advantages and limitations of models such as their size, scale, properties, and materials; (B) analyze data by identifying any significant features, patterns, or sources of error; (C) use mathematical calculations to compare patterns and relationships; and (D) evaluate experimental and engineering designs. (3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: (A) develop explanations and propose solutions supported by data and models; (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and (C) listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion. (4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation for society. The student is expected to: (A) explain how scientific discoveries and innovative solutions to problems impact science and society; and (B) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers. (5) Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections

across disciplines. The student is expected to: (A) identify and use patterns to explain scientific phenomena or to design solutions; (B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems; (C) use scale, proportion, and quantity to describe, compare, or model different systems; (D) examine and model the parts of a system and their interdependence in the function of the system; (E) investigate how energy flows and matter cycles through systems and how matter is conserved; (F) explain the relationship between the structure and function of objects, organisms, and systems; and Elementary §112.A. April 2022 Update Page 25 of 42 (G) explain how factors or conditions impact stability and change in objects, organisms, and systems. (6) Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used. The student is expected to: (A) compare and contrast matter based on measurable, testable, or observable physical properties, including mass, magnetism, relative density (sinking and floating using water as a reference point), physical state (solid, liquid, gas), volume, solubility in water, and the ability to conduct or insulate thermal energy and electric energy; (B) demonstrate and explain that some mixtures maintain physical properties of their substances such as iron filings and sand or sand and water; (C) compare the properties of substances before and after they are combined into a solution and demonstrate that matter is conserved in solutions; and (D) illustrate how matter is made up of particles that are too small to be seen such as air in a balloon. (7) Force, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to: (A) investigate and explain how equal and unequal forces acting on an object cause patterns of motion and transfer of energy; and (B) design a simple experimental investigation that tests the effect of force on an object in a system such as a car on a ramp or a balloon rocket on a string. (8) Force, motion, and energy.

The student knows that energy is everywhere and can be observed in cycles, patterns, and systems. The student is expected to: (A) investigate and describe the transformation of energy in systems such as energy in a flashlight battery that changes from chemical energy to electrical energy to light energy; (B) demonstrate that electrical energy in complete circuits can be transformed into motion, light, sound, or thermal energy and identify the requirements for a functioning electrical circuit; and (C) demonstrate and explain how light travels in a straight line and can be reflected, refracted, or absorbed. (9) Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects. The student is expected to demonstrate that Earth rotates on its axis once approximately every 24 hours and explain how that causes the day/night cycle and the appearance of the Sun moving across the sky, resulting

in changes in shadow positions and shapes. (10) Earth and space. The student knows that there are recognizable patterns and processes on Earth. The student is expected to: (A) explain how the Sun and the ocean interact in the water cycle and affect weather; (B) model and describe the processes that led to the formation of sedimentary rocks and fossil fuels; and (C) model and identify how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including deltas, canyons, and sand dunes. (11) Earth and space. The student understands how natural resources are important and can be managed. The student is expected to design and explain solutions such as conservation, recycling, or proper disposal to minimize environmental impact of the use of natural resources. (12) Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments. The student is expected to: §112.A. Elementary Page 26 August 2018 Update (A) observe and describe how a variety of organisms survive by interacting with biotic and abiotic factors in a healthy ecosystem; (B) predict how changes in the ecosystem affect the cycling of matter and flow of energy in a food web; and (C) describe a healthy ecosystem and how human activities can be beneficial or harmful to an ecosystem. (13) Organisms and environments. The student knows that organisms undergo similar life processes and have structures and behaviors that help them survive within their environments. The student is expected to: (A) analyze the structures and functions of different species to identify how organisms survive in the same environment; and

(B) explain how instinctual behavioral traits such as turtle hatchlings returning to the sea and learned behavioral traits such as orcas hunting in packs increase chances of survival.

Grade 6

(1) Grade 6 science is interdisciplinary in nature; however, much of the content focus is on (1) In Grades 6 through 8 Science, content is organized into recurring strands. The concepts within each grade level build on prior knowledge, prepare students for the next grade level, and establish a foundation for high school courses. In Grade 6, the following concepts will be addressed in each strand.

(A) Scientific and engineering practices. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, correlative, comparative, or experimental. The method chosen should be appropriate to the grade level and question being asked. Student learning for different types of investigations includes descriptive investigations, which have no hypothesis that tentatively answers the research question and involve collecting data and recording observations without making comparisons; correlative and comparative investigations, which have a hypothesis that predicts a relationship and involve collecting data, measuring variables relevant to the hypothesis that are manipulated, and comparing results; and experimental investigations, which involve processes similar to comparative investigations but in which a hypothesis can be tested by comparing a treatment with a control.

(i) Scientific practices. Students ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(ii) Engineering practices. Students identify problems and design solutions using appropriate tools and models.

(B) Matter and energy. Students build upon their knowledge of properties of solids, liquids, and gases and further explore their molecular energies. In Grade 6, students learn how elements are classified as metals, nonmetals, or metalloids based on their properties on the Periodic Table. Students have previous experience with mixtures in Grade 5. Grade 6 furthers their understanding by investigating the different types of mixtures. Subsequent grades will learn about compounds. In Grade 6, students compare the density of substances relative to fluids and identify evidence of chemical changes.

(C) Force, motion, and energy. Students investigate the relationship between force and motion using a variety of means, including calculations and measurements through the study of Newton's Third Law of Motion. Subsequent grades will study force and motion through Newton's First and Second Laws of Motion. Energy occurs as either potential or kinetic energy. Potential energy can take several forms, including gravitational, elastic, and chemical energy. Energy is conserved throughout systems by changing from one form to another and transfers through waves.

(D) Earth and space. Cycles within Sun, Earth, and Moon systems are studied as students learn about seasons and tides. Students identify that the Earth is divided into spheres and examine the processes within and organization of the geosphere. Researching the advantages and disadvantages of short- and long-term uses of resources enables informed decision making about resource management.

(E) Organisms and environments. All living organisms are made up of smaller units called cells. Ecosystems are organized into communities, populations, and organisms. Students compare and contrast variations within organisms and how they impact survival. Students examine relationships and interactions between organisms, biotic factors, and abiotic factors in an ecosystem.

(2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(3) Scientific observations, inferences, hypotheses, and theories. Students are expected to know that:

(A) observations are active acquisition of either qualitative or quantitative information from a primary source through the senses;

(B) inferences are conclusions reached on the basis of observations or reasoning supported by relevant evidence;

(C) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power

that have been tested over a wide variety of conditions are incorporated into theories; and

(D) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students distinguish between scientific decision-making practices and ethical and social decisions that involve science.

(5) Recurring themes and concepts. Science consists of recurring themes and making connections between overarching concepts. Recurring themes include structure and function, systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Models have limitations but provide a tool for understanding the ideas presented. Students analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(6) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and skills.

(1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; (D) use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators, hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, hand lenses, and lab notebooks or journals;

(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

(F) construct appropriate tables, graphs, maps, and charts using repeated trials and means to organize data;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying any significant descriptive statistical features, patterns, sources of error, or limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) relate the impact of past and current research on scientific thought and society, including the process of science, cost-benefit analysis, and contributions of diverse scientists as
related to the content;

(B) make informed decisions by evaluating evidence from multiple appropriate sources to assess the credibility, accuracy, cost-effectiveness, and methods used; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers.

(5) Recurring themes and concepts. The student understands that recurring themes and concepts

provide a framework for making connections across disciplines. The student is expected to:
(A) identify and apply patterns to understand and connect scientific phenomena or to design solutions;
(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;
(C) analyze how differences in scale, proportion, or quantity affect a system's structure or performance;
(D) examine and model the parts of a system and their interdependence in the function of the system;
(E) analyze and explain how energy flows and matter cycles through systems and how energy and matter are conserved through a variety of systems;
(F) analyze and explain the complementary relationship between the structure and function of objects, organisms, and systems; and
(G) analyze and explain how factors or conditions impact stability and change in objects, organisms, and systems.
(6) Matter and energy. The student knows that matter is made of atoms, can be classified according to its properties, and can undergo changes. The student is expected to:
(A) compare solids, liquids, and gases in terms of their structure, shape, volume, and kinetic energy of atoms and molecules;
(B) investigate the physical properties of matter to distinguish between pure substances, homogeneous mixtures (solutions), and heterogeneous mixtures;
(C) identify elements on the periodic table as metals, nonmetals, metalloids, and rare Earth elements based on their physical properties and importance to modern life;
(D) compare the density of substances relative to various fluids; and
(E) identify the formation of a new substance by using the evidence of a possible chemical change, including production of a gas, change in thermal energy, production of a precipitate, and color change.
(7) Force, motion, and energy. The student knows the nature of forces and their role in systems that experience stability or change. The student is expected to:
(A) identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces, using real-world applications;
(B) calculate the net force on an object in a horizontal or vertical direction using diagrams and determine if the forces are balanced or unbalanced; and
(C) identify simultaneous force pairs that are equal in magnitude and opposite in direction that result from the interactions between objects using Newton's Third Law of Motion.
(8) Force, motion, and energy. The student knows that the total energy in systems is conserved through energy transfers and transformations. The student is expected to:
(A) compare and contrast gravitational, elastic, and chemical potential energies with kinetic energy;
(B) describe how energy is conserved through transfers and transformations in systems such as electrical circuits, food webs, amusement park rides, or photosynthesis; and
(C) explain how energy is transferred through transverse and longitudinal waves.
(9) Earth and space. The student models the cyclical movements of the Sun, Earth, and Moon and describes their effects. The student is expected to:
(A) model and illustrate how the tilted Earth revolves around the Sun, causing changes

in seasons; and

(B) describe and predict how the positions of the Earth, Sun, and Moon cause daily, spring, and neap cycles of ocean tides due to gravitational forces.
(10) Earth and space. The student understands the rock cycle and the structure of Earth. The student is expected to:
(A) differentiate between the biosphere, hydrosphere, atmosphere, and geosphere and identify components of each system;
(B) model and describe the layers of Earth, including the inner core, outer core, mantle, and crust; and
(C) describe how metamorphic, igneous, and sedimentary rocks form and change through geologic processes in the rock cycle.
(11) Earth and space. The student understands how resources are managed. The student is expected to:
(A) research and describe why resource management is important in reducing global energy, poverty, malnutrition, and air and water pollution, and
(B) explain how conservation, increased efficiency, and technology can help manage air, water, soil, and energy resources.
(12) Organisms and environments. The student knows that interdependence occurs between living systems and the environment. The student is expected to:
(A) investigate how organisms and populations in an ecosystem depend on and may compete for biotic factors such as food and abiotic factors such as availability of light and water, range of temperatures, or soil composition;
(B) describe and give examples of predatory, competitive, and symbiotic relationships between organisms, including mutualism, parasitism, and commensalism; and
(C) describe the hierarchical organization of organism, population, and community within an ecosystem.
(13) Organisms and environments. The student knows that organisms have an organizational structure and variations can influence survival of populations. The student is expected to:
(A) describe the historical development of cell theory and explain how organisms are composed of one or more cells, which come from pre-existing cells and are the basic unit of structure and function;
(B) identify and compare the basic characteristics of organisms, including prokaryotic and eukaryotic, unicellular and multicellular, and autotrophic and heterotrophic; and
(C) describe how variations within a population can be an advantage or disadvantage to the survival of a population as environments change.

Grade 7
(1) In Grades 6 through 8 Science, content is organized into recurring strands. The concepts within each grade level build on prior knowledge, prepare students for the next grade level, and establish a foundation for high school courses. In Grade 7, the following concepts will be addressed in each strand.
(A) Scientific and engineering practices. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, correlative, comparative, or experimental. The method chosen should be appropriate to the grade level and question being asked. Student learning for different

types of investigations includes descriptive investigations, which have no hypothesis that
tentatively

answers the research question and involve collecting data and recording observations without making comparisons; correlative and comparative investigations, which have a hypothesis that predicts a relationship and involve collecting data, measuring variables relevant to the hypothesis that are manipulated, and comparing results; and experimental investigations, which involve processes similar to comparative investigations but in which a hypothesis can be tested by comparing a treatment with a control.

(i) Scientific practices. Students ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(ii) Engineering practices. Students identify problems and design solutions using appropriate tools and models.

(B) Matter and energy. Students have prior experience with elements in Grade 6 and develop an understanding that compounds are also pure substances in Grade 7. Students investigate the differences between elements and compounds through observations, descriptions of physical properties, and chemical reactions. Students build upon their understanding of solutions by exploring aqueous solutions.

(C) Force, motion, and energy. Students measure, calculate, graph, and investigate how forces impact linear motion. Students build upon their understanding of the laws of motions by exploring Newton's First Law of Motion. Temperature is a measure of the average kinetic energy of molecules. Thermal energy is transferred by conduction, convection, or radiation in order to reach thermal equilibrium.

(D) Earth and space. Students explore characteristics and organization of objects and the role of gravity within our solar system. Earth has a specific set of characteristics that allows life to exist. Students further their understanding of the geosphere by illustrating how Earth's features change over time through tectonic movement. Students investigate how humans depend on and affect the hydrosphere.

(E) Organisms and environments. Students further their understanding of organisms as systems made up of cells organized into tissues, tissues into organs, and organs into organ systems by identifying the main functions of the organs within the human body. During both sexual and asexual reproduction, traits are passed on to the next generation. Students understand how traits in populations can change through the processes of natural and artificial selection. Students analyze how energy flows through trophic levels and how biodiversity impacts an ecosystem's sustainability. Students gain an understanding of the taxonomic classifications of organisms and how characteristics determine their classification.

(2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(3) Scientific observations, inferences, hypotheses, and theories. Students are expected to know that:

(A) observations are active acquisition of either qualitative or quantitative information from a primary source through the senses;

(B) inferences are conclusions reached on the basis of observations or reasoning supported by relevant evidence;

(C) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(D) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students distinguish between scientific decision-making practices and ethical and social decisions that involve science.

(5) Recurring themes and concepts. Science consists of recurring themes and making connections between overarching concepts. Recurring themes include structure and function, systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Models have limitations but provide a tool for understanding the ideas presented. Students analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(6) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and skills.

(1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators, hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, hand lenses, and lab notebooks or journals;

(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

(F) construct appropriate tables, graphs, maps, and charts using repeated trials and means to organize data;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;
(B) analyze data by identifying any significant descriptive statistical features, patterns, sources of error, or limitations;
(C) use mathematical calculations to assess quantitative relationships in data; and
(D) evaluate experimental and engineering designs.
(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:
(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;
(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and
(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.
(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:
(A) relate the impact of past and current research on scientific thought and society, including the process of science, cost-benefit analysis, and contributions of diverse scientists as related to the content;
(B) make informed decisions by evaluating evidence from multiple appropriate sources to assess the credibility, accuracy, cost-effectiveness, and methods used; and
(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers.
(5) Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines. The student is expected to:
(A) identify and apply patterns to understand and connect scientific phenomena or to design solutions;
(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;
(C) analyze how differences in scale, proportion, or quantity affect a system's structure or performance;
(D) examine and model the parts of a system and their interdependence in the function of the system;
(E) analyze and explain how energy flows and matter cycles through systems and how energy and matter are conserved through a variety of systems;
(F) analyze and explain the complementary relationship between structure and function of objects, organisms, and systems; and
(G) analyze and explain how factors or conditions impact stability and change in objects, organisms, and systems.
(6) Matter and energy. The student distinguishes between elements and compounds, classifies changes in matter, and understands the properties of solutions. The student is expected to:
(A) compare and contrast elements and compounds in terms of atoms and molecules, chemical symbols, and chemical formulas;

(B) use the periodic table to identify the atoms and the number of each kind within a chemical formula;
(C) distinguish between physical and chemical changes in matter;
(D) describe aqueous solutions in terms of solute and solvent, concentration, and dilution; and
(E) investigate and model how temperature, surface area, and agitation affect the rate of dissolution of solid solutes in aqueous solutions.
(7) Force, motion, and energy. The student describes the cause-and-effect relationship between force and motion. The student is expected to:
(A) calculate average speed using distance and time measurements from investigations;
(B) distinguish between speed and velocity in linear motion in terms of distance, displacement, and direction;
(C) measure, record, and interpret an object's motion using distance-time graphs; and
(D) analyze the effect of balanced and unbalanced forces on the state of motion of an object using Newton's First Law of Motion.
(8) Force, motion, and energy. The student understands the behavior of thermal energy as it flows into and out of systems. The student is expected to:
(A) investigate methods of thermal energy transfer into and out of systems, including conduction, convection, and radiation;
(B) investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium; and
(C) explain the relationship between temperature and the kinetic energy of the particles within a substance.
(9) Earth and space. The student understands the patterns of movement, organization, and characteristics of components of our solar system. The student is expected to:
(A) describe the physical properties, locations, and movements of the Sun, planets, moons, meteors, asteroids, comets, Kuiper belt, and Oort cloud;
(B) describe how gravity governs motion within Earth's solar system; and
(C) analyze the characteristics of Earth that allow life to exist such as the proximity of the Sun, presence of water, and composition of the atmosphere.
(10) Earth and space. The student understands the causes and effects of plate tectonics. The student is expected to:
(A) describe the evidence that supports that Earth has changed over time, including fossil evidence, plate tectonics, and superposition; and
(B) describe how plate tectonics causes ocean basin formation, earthquakes, mountain building, and volcanic eruptions, including supervolcanoes and hot spots.
(11) Earth and space. The student understands how human activity can impact the hydrosphere. The student is expected to:
(A) analyze the beneficial and harmful influences of human activity on groundwater and surface water in a watershed; and
(B) describe human dependence and influence on ocean systems and explain how human activities impact these systems.
(12) Organisms and environments. The student understands that ecosystems are dependent upon the cycling of matter and the flow of energy. The student is expected to:
(A) diagram the flow of energy within trophic levels and describe how the available energy

decreases in successive trophic levels in energy pyramids; and
(B) describe how ecosystems are sustained by the continuous flow of energy and the recycling of matter and nutrients within the biosphere.
(13) Organisms and environments. The student knows how systems are organized and function to support the health of an organism and how traits are inherited. The student is expected to:
(A) identify and model the main functions of the systems of the human organism, including the circulatory, respiratory, skeletal, muscular, digestive, urinary, reproductive, integumentary, nervous, immune, and endocrine systems;
(B) describe the hierarchical organization of cells, tissues, organs, and organ systems within plants and animals;
(C) compare the results of asexual and sexual reproduction of plants and animals in relation to the diversity of offspring and the changes in the population over time; and
(D) describe and give examples of how natural and artificial selection change the occurrence of traits in a population over generations.
(14) Organisms and environments. The student knows how the taxonomic system is used to describe
relationships between organisms. The student is expected to:
(A) describe the taxonomic system that categorizes organisms based on similarities and differences shared among groups; and
(B) describe the characteristics of the recognized kingdoms and their importance in ecosystems such as bacteria aiding digestion or fungi decomposing organic matter.

Grade 8
(1) In Grades 6 through 8 Science, content is organized into recurring strands. The concepts within each grade level build on prior knowledge, prepare students for the next grade level, and establish a foundation for high school courses. In Grade 8, the following concepts will be addressed in each strand.
(A) Scientific and engineering practices. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, correlative, comparative, or experimental. The method chosen should be appropriate to the grade level and question being asked. Student learning for different types of investigations includes descriptive investigations, which have no hypothesis that tentatively answers the research question and involve collecting data and recording observations without making comparisons; correlative and comparative investigations, which have a hypothesis that predicts a relationship and involve collecting data, measuring variables relevant to the hypothesis that are manipulated, and comparing results; and experimental investigations, which involve processes similar to comparative investigations but in which a hypothesis can be tested by comparing a treatment with a control.
(i) Scientific practices. Students ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.
(ii) Engineering practices. Students identify problems and design solutions using appropriate tools and models.
(B) Matter and energy. Students make connections between elements, compounds, and mixtures that were introduced in prior grade levels. Students examine the properties of water, acids, and bases. In addition, students understand the basic concept of conservation of mass using chemical equations.

(C) Force, motion, and energy. Students are introduced to Newton's Second Law of Motion and investigate how all three laws of motion act simultaneously within systems. Students understand that waves transfer energy and further explore the characteristics and applications of waves.
(D) Earth and space. Students learn that stars and galaxies are part of the universe. In addition, students use data to research scientific theories of the origin of the universe. Students learn how interactions in solar, weather, and ocean systems create changes in weather patterns and climate. In addition, students understand that climate can be impacted by natural events and human activities.
(E) Organisms and environments. Students identify the function of organelles. Traits are contained in genetic material that is found on genes within a chromosome from the parent. These traits influence the success of a species over time. Students explore how organisms and their populations respond to environmental changes, including those caused by human activities.
(2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.
(3) Scientific observations, inferences, hypotheses, and theories. Students are expected to know that:
(A) observations are active acquisition of either qualitative or quantitative information from a primary source through the senses;
(B) inferences are conclusions reached on the basis of observations or reasoning supported by relevant evidence;
(C) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power
that have been tested over a wide variety of conditions are incorporated into theories; and
(D) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.
(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students distinguish between scientific decision-making practices and ethical and social decisions that involve science.
(5) Recurring themes and concepts. Science consists of recurring themes and making connections between overarching concepts. Recurring themes include structure and function, systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Models have limitations but provide a tool for understanding the ideas presented. Students analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
(6) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.
(b) Knowledge and skills.

(1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators,
hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, weather maps, hand lenses, and lab notebooks or journals;

(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

(F) construct appropriate tables, graphs, maps, and charts using repeated trials and means to organize data;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying any significant descriptive statistical features, patterns, sources of error, or limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) relate the impact of past and current research on scientific thought and society, including the process of science, cost-benefit analysis, and contributions of diverse scientists as related to the content;

(B) make informed decisions by evaluating evidence from multiple appropriate sources to

assess the credibility, accuracy, cost-effectiveness, and methods used; and
(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers.
(5) Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines. The student is expected to:
(A) identify and apply patterns to understand and connect scientific phenomena or to design solutions;
(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;
(C) analyze how differences in scale, proportion, or quantity affect a system's structure or performance;
(D) examine and model the parts of a system and their interdependence in the function of the system;
(E) analyze and explain how energy flows and matter cycles through systems and how energy and matter are conserved through a variety of systems;
(F) analyze and explain the complementary relationship between the structure and function of objects, organisms, and systems; and
(G) analyze and explain how factors or conditions impact stability and change in objects, organisms, and systems.
(6) Matter and energy. The student understands that matter can be classified according to its properties and matter is conserved in chemical changes that occur within closed systems. The student is expected to:
(A) explain by modeling how matter is classified as elements, compounds, homogeneous mixtures, or heterogeneous mixtures;
(B) use the periodic table to identify the atoms involved in chemical reactions;
(C) describe the properties of cohesion, adhesion, and surface tension in water and relate to observable phenomena such as the formation of droplets, transport in plants, and insects walking on water;
(D) compare and contrast the properties of acids and bases, including pH relative to water; and
(E) investigate how mass is conserved in chemical reactions and relate conservation of mass to the rearrangement of atoms using chemical equations, including photosynthesis.
(7) Force, motion, and energy. The student understands the relationship between force and motion within systems. The student is expected to:
(A) calculate and analyze how the acceleration of an object is dependent upon the net force acting on the object and the mass of the object using Newton's Second Law of Motion;
and
(B) investigate and describe how Newton's three laws of motion act simultaneously within systems such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.
(8) Force, motion, and energy. The student knows how energy is transferred through waves. The student is expected to:
(A) compare the characteristics of amplitude, frequency, and wavelength in transverse waves, including the electromagnetic spectrum; and

(B) explain the use of electromagnetic waves in applications such as radiation therapy, wireless technologies, fiber optics, microwaves, ultraviolet sterilization, astronomical observations, and X-rays.

(9) Earth and space. The student describes the characteristics of the universe and the relative scale of its components. The student is expected to:

(A) describe the life cycle of stars and compare and classify stars using the Hertzsprung-Russell diagram;

(B) categorize galaxies as spiral, elliptical, and irregular and locate Earth's solar system within the Milky Way galaxy; and

(C) research and analyze scientific data used as evidence to develop scientific theories that describe the origin of the universe.

(10) Earth and space. The student knows that interactions between Earth, ocean, and weather systems impact climate. The student is expected to:

(A) describe how energy from the Sun, hydrosphere, and atmosphere interact and influence weather and climate;

(B) identify global patterns of atmospheric movement and how they influence local weather; and

(C) describe the interactions between ocean currents and air masses that produce tropical cyclones, including typhoons and hurricanes.

(11) Earth and space. The student knows that natural events and human activity can impact global climate. The student is expected to:

(A) use scientific evidence to describe how natural events, including volcanic eruptions, meteor impacts, abrupt changes in ocean currents, and the release and absorption of greenhouse gases influence climate;

(B) use scientific evidence to describe how human activities, including the release of greenhouse gases, deforestation, and urbanization, can influence climate; and

(C) describe the carbon cycle.

(12) Organisms and environments. The student understands stability and change in populations and ecosystems. The student is expected to:

(A) explain how disruptions such as population changes, natural disasters, and human intervention impact the transfer of energy in food webs in ecosystems;

(B) describe how primary and secondary ecological succession affect populations and species diversity after ecosystems are disrupted by natural events or human activity; and

(C) describe how biodiversity contributes to the stability and sustainability of an ecosystem and the health of the organisms within the ecosystem.

(13) Organisms and environments. The student knows how cell functions support the health of an organism and how adaptation and variation relate to survival. The student is expected to:

(A) identify the function of the cell membrane, cell wall, nucleus, ribosomes, cytoplasm, mitochondria, chloroplasts, and vacuoles in plant or animal cells;

(B) describe the function of genes within chromosomes in determining inherited traits of offspring; and

(C) describe how variations of traits within a population lead to structural, behavioral, and physiological adaptations that influence the likelihood of survival and reproductive success of a species over generations.

Chemistry

(1) Chemistry. In Chemistry, students conduct laboratory and field investigations, use scientific practices during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of topics that include characteristics of matter, use of the Periodic Table, development of atomic theory, chemical bonding, chemical stoichiometry, gas laws, solution chemistry, acid-base chemistry, thermochemistry, and nuclear chemistry. Students investigate how chemistry is an integral part of our daily lives. By the end of Grade 12, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving. (2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable. (3) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and (B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed. (4) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations includes descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified. (A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. (B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models. (5) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information). (6) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. (7) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills. (1) Scientific and engineering practices. The student, for at least 40%

of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; (B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems; (C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; (D) use appropriate tools such as Safety Data Sheets (SDS), scientific or graphing calculators, computers and probes, electronic balances, an adequate supply of consumable chemicals, and sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, and burettes; (E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence; (F) organize quantitative and qualitative data using oral or written lab reports, labeled drawings, particle diagrams, charts, tables, graphs, journals, summaries, or technologybased reports; (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and (H) distinguish between scientific hypotheses, theories, and laws. (2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to: (A) identify advantages and limitations of models such as their size, scale, properties, and materials; (B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations; (C) use mathematical calculations to assess quantitative relationships in data; and (D) evaluate experimental and engineering designs. (3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: (A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories; (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and (C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. (4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to: (A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student; (B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and (C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers. (5) Science concepts. The student understands the development of the Periodic Table and applies its predictive power. The student is expected to: (A) explain the development of the Periodic Table over time using evidence such as chemical and physical properties; High School §112.C. November 2021 Update Page 39 of 70 (B) predict the properties of elements in chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals, based on valence electrons patterns using the Periodic Table; and (C) analyze and interpret elemental data, including atomic radius, atomic mass, electronegativity, ionization energy, and reactivity to identify periodic trends. (6) Science concepts. The student understands the development of atomic theory and applies it to realworld phenomena. The student is expected to: (A) construct models using Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, Bohr's nuclear atom, and Heisenberg's Uncertainty Principle to show the development of modern atomic theory over time; (B) describe the structure of atoms and ions, including the masses, electrical charges, and locations of protons and neutrons in the nucleus and electrons in the electron cloud; (C) investigate the mathematical relationship between energy, frequency, and wavelength of light using the electromagnetic spectrum and relate it to the quantization of energy in the emission spectrum; (D) calculate average atomic mass of an element using isotopic composition; and (E) construct models to express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis dot structures. (7) Science concepts. The student knows how atoms form ionic, covalent, and metallic bonds. The student is expected to: (A) construct an argument to support how periodic trends such as electronegativity can predict bonding between elements; (B) name and write the chemical formulas for ionic and covalent compounds using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules; (C) classify and draw electron dot structures for molecules with linear, bent, trigonal planar, trigonal pyramidal, and tetrahedral molecular geometries as explained by Valence Shell Electron Pair Repulsion (VSEPR) theory; and (D) analyze the properties of ionic, covalent, and metallic substances in terms of intramolecular and intermolecular forces. (8) Science concepts. The student understands how matter is accounted for in chemical substances. The student is expected to: (A) define mole and apply the concept of molar mass to convert between moles and grams; (B) calculate the number of atoms or molecules in a sample of material using Avogadro's number; (C) calculate percent composition of compounds; and (D) differentiate between empirical and molecular formulas. (9) Science concepts. The student understands how matter is accounted for in chemical reactions. The student is expected to: (A) interpret, write, and balance chemical equations, including synthesis, decomposition, single replacement, double replacement, and combustion reactions using the law of conservation of mass;

(B) differentiate among acid-base reactions, precipitation reactions, and oxidation-reduction reactions; (C) perform stoichiometric calculations, including determination of mass relationships, gas volume relationships, and percent yield; and (D) describe the concept of limiting reactants in a balanced chemical equation. (10) Science concepts. The student understands the principles of the kinetic molecular theory and ideal gas behavior. The student is expected to: (A) describe the postulates of the kinetic molecular theory; (B) describe and calculate the relationships among volume, pressure, number of moles, and temperature for an ideal gas; and (C) define and apply Dalton's law of partial pressure. (11) Science concepts. The student understands and can apply the factors that influence the behavior of solutions. The student is expected to: (A) describe the unique role of water in solutions in terms of polarity; (B) distinguish among types of solutions, including electrolytes and nonelectrolytes and unsaturated, saturated, and supersaturated solutions; (C) investigate how solid and gas solubilities are influenced by temperature using solubility curves and how rates of dissolution are influenced by temperature, agitation, and surface area; (D) investigate the general rules regarding solubility and predict the solubility of the products of a double replacement reaction; (E) calculate the concentration of solutions in units of molarity; and (F) calculate the dilutions of solutions using molarity. (12) Science concepts. The student understands and applies various rules regarding acids and bases. The student is expected to: (A) name and write the chemical formulas for acids and bases using IUPAC nomenclature rules; (B) define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions; (C) differentiate between strong and weak acids and bases; (D) predict products in acid-base reactions that form water; and (E) define pH and calculate the pH of a solution using the hydrogen ion concentration. (13) Science concepts. The student understands the energy changes that occur in chemical reactions. The student is expected to: (A) explain everyday examples that illustrate the four laws of thermodynamics; (B) investigate the process of heat transfer using calorimetry; (C) classify processes as exothermic or endothermic and represent energy changes that occur in chemical reactions using thermochemical equations or graphical analysis; and (D) perform calculations involving heat, mass, temperature change, and specific heat. (14) Science concepts. The student understands the basic processes of nuclear chemistry. The student is expected to: (A) describe the characteristics of alpha, beta, and gamma radioactive decay processes in terms of balanced nuclear equations; (B) compare fission and fusion reactions; and (C) give examples of applications of nuclear phenomena such as nuclear stability, radiation therapy, diagnostic imaging, solar cells, and nuclear power.

Biology

(1) Biology. Students in Biology focus on patterns, processes, and relationships of living organisms through four main concepts: biological structures, functions, and processes; mechanisms of genetics; biological evolution; and interdependence within environmental systems. By the end of Grade 12, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving. (2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable. (3) Scientific hypotheses and theories. Students are expected to know that: (A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and (B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed. (4) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified. (A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. (B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models. (5) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information). (6) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter.

Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. (7) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples. (c) Knowledge and skills. (1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; (B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems; (C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; (D) use appropriate tools such as microscopes, slides, Petri dishes, laboratory glassware, metric rulers, digital balances, pipets, filter paper, micropipettes, gel electrophoresis and polymerase chain reaction (PCR) apparatuses, microcentrifuges, water baths, incubators, thermometers, hot plates, data collection probes, test tube holders, lab notebooks or journals, hand lenses, and models, diagrams, or samples of biological specimens or structures; (E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence; (F) organize quantitative and qualitative data using scatter plots, line graphs, bar graphs, charts, data tables, digital tools, diagrams, scientific drawings, and student-prepared models; (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and (H) distinguish among scientific hypotheses, theories, and laws. (2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to: (A) identify advantages and limitations of models such as their size, scale, properties, and materials; (B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations; (C) use mathematical calculations to assess quantitative relationships in data; and (D) evaluate experimental and engineering designs. (3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: (A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories; (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and (C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. (4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to: (A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student; (B) relate the impact of past and current research on scientific thought and society, including research methodology, cost- benefit analysis, and contributions of diverse scientists as related to the content; and (C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers. (5) Science concepts--biological structures, functions, and processes. The student knows that biological structures at multiple levels of organization perform specific functions and processes that affect life. The student is expected to: (A) relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell; (B) compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity; (C) investigate homeostasis through the cellular transport of molecules; and

(D) compare the structures of viruses to cells and explain how viruses spread and cause disease. (6) Science concepts--biological structures, functions, and processes. The student knows how an organism grows and the importance of cell differentiation. The student is expected to: (A) explain the importance of the cell cycle to the growth of organisms, including an overview of the stages of the cell cycle and deoxyribonucleic acid (DNA) replication models; (B) explain the process of cell specialization through cell differentiation, including the role of environmental factors; and (C) relate disruptions of the cell cycle to how they lead to the development of diseases such as cancer.

(7) Science concepts--mechanisms of genetics. The student knows the role of nucleic acids in gene expression. The student is expected to: (A) identify components of DNA, explain how the nucleotide sequence specifies some traits of an organism, and examine scientific explanations for the origin of DNA; (B) describe the significance of gene expression and explain the process of protein synthesis using models of DNA and ribonucleic acid (RNA); (C) identify and illustrate changes in DNA and evaluate the significance of these changes; and (D) discuss the importance of molecular technologies such as polymerase chain reaction (PCR), gel electrophoresis, and genetic engineering that are applicable in current research and engineering practices. (8) Science concepts-- mechanisms of genetics. The student knows the role of nucleic acids and the principles of inheritance and variation of traits in Mendelian and non-Mendelian genetics. The student is expected to: (A) analyze the significance of chromosome reduction, independent assortment, and crossingover during meiosis in increasing diversity in populations of organisms that reproduce sexually; and (B) predict possible outcomes of various genetic combinations using monohybrid and dihybrid crosses, including non-Mendelian traits of incomplete dominance, codominance, sex- linked traits, and multiple alleles. (9) Science concepts--biological evolution. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple lines of evidence. The student is expected to: (A) analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental; and (B) examine scientific explanations for varying rates of change such as gradualism, abrupt appearance, and stasis in the fossil record. (10) Science concepts--biological evolution. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple mechanisms. The student is expected to: (A) analyze and evaluate how natural selection produces change in populations and not in individuals;

(B) analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success; (C) analyze and evaluate how natural selection may lead to speciation; and (D) analyze evolutionary mechanisms other than natural selection, including genetic drift, gene flow, mutation, and genetic recombination, and their effect on the gene pool of a population. (11) Science concepts--biological structures, functions, and processes. The student knows the significance of matter cycling, energy flow, and enzymes in living organisms. The student is expected to: (A) explain how matter is conserved and energy is transferred during photosynthesis and cellular respiration using models, including the chemical equations for these processes; and (B) investigate and explain the role of enzymes in facilitating cellular processes. (12) Science concepts--biological structures, functions, and processes. The student knows that multicellular organisms are composed of multiple systems that interact to perform complex functions. The student is expected to: (A) analyze the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals; and (B) explain how the interactions that occur among systems that perform functions of transport, reproduction, and response in plants are facilitated by their structures. (13) Science concepts--interdependence within environmental systems. The student knows that interactions at various levels of organization occur within an ecosystem to maintain stability. The student is expected to: (A) investigate and evaluate how ecological relationships, including predation, parasitism, commensalism, mutualism, and competition, influence ecosystem stability; (B) analyze how ecosystem stability is affected by disruptions to the cycling of matter and flow of energy through trophic levels using models; (C) explain the significance of the carbon and nitrogen cycles to ecosystem stability and analyze the consequences of disrupting these cycles; and (D) explain how environmental change, including change due to human activity, affects biodiversity and analyze how changes in biodiversity impact ecosystem stability.

Integrated Physics and Chemistry

(1) Integrated Physics and Chemistry. In Integrated Physics and Chemistry, students conduct laboratory and field investigations, use engineering practices, use scientific practices during investigation, and make informed decisions using critical thinking and scientific problem solving. This course integrates the disciplines of physics and chemistry in the following topics: force, motion, energy, and matter. By the end of Grade 12, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving. (2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable. (3) Scientific hypotheses and theories. Students are expected to know that: (A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and (B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed. (4) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified. (A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. (B) Engineering practices. Students should be able to identify

problems and design solutions using appropriate tools and models. (5) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information). (6) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. (7) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples. (c) Knowledge and skills. (1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; (B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems; (C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; (D) use appropriate tools such as data-collecting probes, software applications, the internet, standard laboratory glassware, metric rulers, meter sticks, spring scales, multimeters, Gauss meters, wires, batteries, light bulbs, switches, magnets, electronic balances, mass sets, Celsius thermometers, hot plates, an adequate supply of consumable chemicals, lab notebooks or journals, timing devices, models, and diagrams; (E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence; (F) organize quantitative and qualitative data using labeled drawings and diagrams, graphic organizers, charts, tables, and graphs; (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and (H) distinguish between scientific hypotheses, theories, and laws. (2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to: (A) identify advantages and limitations of models such as their size, scale, properties, and materials; (B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations; (C) use mathematical calculations to assess quantitative relationships in data; and (D) evaluate experimental and engineering designs. (3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: (A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories; (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and (C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. (4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to: (A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student; (B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and (C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers. (5) Science concepts. The student knows the relationship between force and motion in everyday life. The student is expected to: (A) investigate, analyze, and model motion in terms of position, velocity, acceleration, and time using tables, graphs, and mathematical relationships; (B) analyze data to explain the relationship between mass and acceleration in terms of the net force on an object in one dimension using force diagrams, tables, and graphs; (C) apply the concepts of momentum and impulse to design, evaluate, and refine a device to minimize the net force on objects during collisions such as those that occur during vehicular accidents, sports activities, or the dropping of personal electronic devices; (D) describe the nature of the four fundamental forces: gravitation; electromagnetic; the strong and weak nuclear forces, including fission and fusion; and mass-energy equivalency; and (E) construct and communicate an explanation based on evidence for how changes in mass, charge, and distance affect the strength of gravitational and electrical forces between two objects. (6) Science concepts. The student knows the impact of energy transfer and energy conservation in everyday life. The student is expected to: (A) design and construct series and parallel circuits that model real-world circuits such as inhome wiring, automobile wiring, and simple electrical devices to evaluate the transfer of electrical energy;

(B) design, evaluate, and refine a device that generates electrical energy through the interaction of electric charges and magnetic fields; (C) plan and conduct an investigation to provide evidence that energy is conserved within a closed system; (D) investigate and demonstrate the movement of thermal energy through solids, liquids, and gases by convection, conduction, and radiation such as weather, living, and mechanical systems; (E) plan and conduct an investigation to evaluate the transfer of energy or information through different materials by different types of waves such as wireless signals, ultraviolet radiation, and microwaves; (F) construct and communicate an evidence- based explanation for how wave interference, reflection, and refraction are used in technology such as medicine, communication, and scientific research; and (G) evaluate evidence from multiple sources to critique the advantages and disadvantages of various renewable and nonrenewable energy sources and their impact on society and the environment. (7) Science concepts. The student knows that relationships exist between the structure and properties of matter. The student is expected to: (A) model basic atomic structure and relate an element's atomic structure to its bonding, reactivity, and placement on the Periodic Table; (B) use patterns within the Periodic Table to predict the relative physical and chemical properties of elements; (C) explain how physical and chemical properties of substances are related to their usage in everyday life such as in sunscreen, cookware, industrial applications, and fuels; (D) explain how electrons can transition from a high energy level to a low energy state, emitting photons at different frequencies for different energy transitions; (E) explain how atomic energy levels and emission spectra present evidence for the wave particle duality; and (F) plan and conduct an investigation to provide evidence that the rate of reaction or dissolving is affected by multiple factors such as particle size, stirring, temperature, and concentration. (8) Science concepts. The student knows that changes in matter affect everyday life. The student is expected to: (A) investigate how changes in properties are indicative of chemical reactions such as hydrochloric acid with a metal, oxidation of metal, combustion, and neutralizing an acid with a base; (B) develop and use models to balance chemical equations and support the claim that atoms, and therefore mass, are conserved during a chemical reaction; (C) research and communicate the uses, advantages, and disadvantages of nuclear reactions in current technologies; and (D) construct and communicate an evidence-based explanation of the environmental impact of the end-products of chemical reactions such as those that may result in degradation of water, soil, air quality, and global climate change.

Physics

(1) Physics. In Physics, students conduct laboratory and field investigations, use scientific practices during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of topics that include: laws of motion, changes within physical systems and conservation of energy and momentum, forces, characteristics and behavior of waves, and electricity and magnetism. Students will apply conceptual knowledge and collaborative skills to experimental design, implementation, and interpretation. By the end of Grade 12, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving. (2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable. (3) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and (B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed. (4) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified. (A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models. (B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models. (5) Science and social ethics.

Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information). (6) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment. (7) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples. (c) Knowledge and skills. (1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: (A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations; (B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations, and use engineering practices to design solutions to problems; (C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; (D) use appropriate tools such as balances, ballistic carts or equivalent, batteries, computers, constant velocity cars, convex lenses, copper wire, discharge tubes with power supply (H, He, Ne, Ar), data acquisition probes and software, dynamics and force demonstration equipment, electrostatic generators, electrostatic kits, friction blocks, graph paper, graphing technology, hand-held visual spectroscopes, inclined planes, iron filings, lab masses, laser pointers, magnets, magnetic compasses, metric rulers, motion detectors, multimeters (current, voltage, resistance), optics bench, optics kit, photogates, plane mirrors, prisms, protractors, pulleys, resistors, rope or string, scientific calculators, stopwatches, springs, spring scales, switches, tuning forks, wave generators, or other equipment and materials that will produce the same results; (E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence; (F) organize quantitative and qualitative data using bar charts, line graphs, scatter plots, data tables, labeled diagrams, and conceptual mathematical relationships; (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and (H) distinguish among scientific hypotheses, theories, and laws. (2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to: (A) identify advantages and limitations of models such as their size, scale, properties, and materials; (B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations; (C) use mathematical calculations to assess quantitative relationships in data; and (D) evaluate experimental and engineering designs. (3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: (A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories; (B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and (C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. (4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to: (A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student; High School §112.C. November 2021 Update Page 47 of 70 (B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and (C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers. (5) Science concepts. The student knows and applies the laws governing motion in a variety of situations. The student is expected to: (A) analyze different types of motion by generating and interpreting position versus time, velocity versus time, and acceleration versus time using hand graphing and real-time technology such as motion detectors, photogates, or digital applications; (B) define scalar and vector quantities related to one- and two-dimensional motion and combine vectors using both graphical vector addition and the Pythagorean theorem; (C) describe and analyze motion in one dimension using equations with the concepts of distance, displacement, speed, velocity, frames of reference, and acceleration; (D) describe and analyze acceleration in uniform circular and horizontal projectile motion in two dimensions using equations; (E) explain and apply the concepts of equilibrium and inertia as represented by Newton's first law of motion using relevant real-world examples such as rockets, satellites, and automobile safety devices; (F) calculate the effect of forces on objects, including tension, friction, normal, gravity, centripetal, and applied forces, using free body diagrams and the relationship between force and acceleration as represented by Newton's second law of motion; (G) illustrate and analyze the simultaneous forces between two objects as represented in Newton's third law of motion using free body diagrams and in an experimental design scenario; and (H) describe and calculate, using scientific notation, how the magnitude of force between two objects depends on their masses and the distance between their centers, and predict the effects on objects in linear and orbiting systems using Newton's law of universal gravitation. (6) Science concepts. The student knows the nature of forces in the physical world. The student is expected to: (A) use scientific notation and predict how the magnitude of the electric force between two objects depends on their charges and the distance between their centers using Coulomb's law; (B) identify and describe examples of electric and magnetic forces and fields in everyday life such as generators, motors, and transformers; (C) investigate and describe conservation of charge during the processes of induction, conduction, and polarization using different materials such as electroscopes, balloons, rods, fur, silk, and Van de Graaf generators; (D) analyze, design, and construct series and parallel circuits using schematics and materials such as switches, wires, resistors, lightbulbs, batteries, voltmeters, and ammeters; and (E) calculate current through, potential difference across, resistance of, and power used by electric circuit elements connected in both series and parallel circuits using Ohm's law. (7) Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to: (A) calculate and explain work and power in one dimension and identify when work is and is not being done by or on a system; (B) investigate and calculate mechanical, kinetic, and potential energy of a system; (C) apply the concept of conservation of energy using the work-energy theorem, energy diagrams, and energy transformation equations, including transformations between kinetic, potential, and thermal energy; (D) calculate and describe the impulse and momentum of objects in physical systems such as automobile safety features, athletics, and rockets; and (E) analyze the conservation of momentum qualitatively in inelastic and elastic collisions in one dimension using models, diagrams, and simulations. (8) Science concepts. The student knows the characteristics and behavior of waves. The student is expected to: (A) examine and describe simple harmonic motion such as masses on springs and pendulums and wave energy propagation in various types of media such as surface waves on a body of water and pulses in ropes; (B) compare the characteristics of transverse and longitudinal waves, including electromagnetic and sound waves; (C) investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationships between wave speed, frequency, and wavelength; (D) investigate behaviors of waves, including reflection, refraction, diffraction, interference, standing wave, the Doppler effect and polarization and superposition; and (E) compare the different applications of the electromagnetic spectrum, including radio telescopes, microwaves, and x-rays; (F) investigate the emission spectra produced by various atoms and explain the relationship to the electromagnetic spectrum; and (G) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens. (9) Science concepts. The student knows examples of quantum phenomena and their applications. The student is expected to: (A) describe the photoelectric effect and emission spectra produced by various atoms and how both are explained by the photon model for light; (B) investigate Malus's Law and describe examples of applications of wave polarization, including 3-D movie glasses and LCD computer screens; (C) compare and explain how superposition of quantum states is related to the wave-particle duality nature of light; and (D) give examples of applications of quantum phenomena, including the Heisenberg uncertainty principle, quantum computing, and cybersecurity.

ELPS-TELPAS Proficiency Level Descriptors

Grades K-12 Listening

Beginning English learners (ELs) have little or no ability to understand spoken English used in academic and social settings.
These students: • struggle to understand simple conversations and simple discussions even when the topics are familiar and the speaker uses linguistic supports (e.g., visuals, slower speech and other verbal cues, gestures) • struggle to identify and distinguish individual words and phrases during social and instructional interactions that have not been intentionally modified for ELs • may not seek clarification in English when failing to comprehend the English they hear; frequently remain silent, watching others for cues

Intermediate ELs have the ability to understand simple, high-frequency spoken English used in routine academic and social settings.
These students: • usually understand simple or routine directions, as well as short, simple conversations and short, simple discussions on familiar topics; when topics are unfamiliar, require extensive linguistic supports and adaptations (e.g., visuals, slower speech and other verbal cues, simplified language, gestures, preteaching to preview or build topic-related vocabulary) • often identify and distinguish key words and phrases necessary to understand the general meaning (gist) during social and basic instructional interactions that have not been intentionally modified for ELs • have the ability to seek clarification in English when failing to comprehend the English they hear by requiring/requesting the speaker to repeat, slow down, or rephrase speech

Advanced ELs have the ability to understand, with second language acquisition support, grade-appropriate spoken English used in academic and social settings.
These students: • usually understand longer, more elaborated directions, conversations, and discussions on familiar and some unfamiliar topics, but sometimes need processing time and sometimes depend on visuals, verbal cues, and gestures to support understanding • understand most main points, most important details, and some implicit information during social and basic instructional interactions that have not been intentionally modified for ELs • occasionally require/request the speaker to repeat, slow down, or rephrase to clarify the meaning of the English they hear

Advanced high ELs have the ability to understand, with minimal second language acquisition support, grade appropriate spoken English used in academic and social settings.
These students: • understand longer, elaborated directions, conversations, and discussions on familiar and unfamiliar topics with only occasional need for processing time and with little dependence on visuals, verbal cues, and gestures; some exceptions when complex academic or highly specialized language is used • understand main points, important details, and implicit information at a level nearly comparable to native English-speaking peers during social and instructional interactions • rarely require/request the speaker to repeat, slow down, or rephrase to clarify the meaning of the English they hear

Grade K-12 Speaking

Beginning English learners (ELs) have little or no ability to speak English in academic and social settings.
These students: • mainly speak using single words and short phrases consisting of recently practiced, memorized, or highly familiar material to get immediate needs met; may be hesitant to speak and often give up in their attempts to communicate • speak using a very limited bank of high- frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts • lack the knowledge of English grammar necessary to connect ideas and speak in sentences; can sometimes produce sentences using recently practiced, memorized, or highly familiar material • exhibit second language acquisition errors that may hinder overall communication, particularly when trying to convey information beyond memorized, practiced, or highly familiar material • typically use pronunciation that significantly inhibits communication

Intermediate ELs have the ability to speak in a simple manner using English commonly heard in routine academic and social settings.
These students: • are able to express simple, original messages, speak using sentences, and participate in short conversations and classroom interactions; may hesitate frequently and for long periods to think about how to communicate desired meaning • speak simply using basic vocabulary needed in everyday social interactions and routine academic contexts; rarely have vocabulary to speak in detail • exhibit an emerging awareness of English grammar and speak using mostly simple sentence structures and simple tenses; are most comfortable speaking in present tense • exhibit second language acquisition errors that may hinder overall communication when trying to use complex or less familiar English • use pronunciation that can usually be understood by people accustomed to interacting with ELs

Advanced ELs have the ability to speak using grade-appropriate English, with second language acquisition support, in academic and social settings.
These students: • are able to participate comfortably in most conversations and academic discussions on familiar topics, with some pauses to restate, repeat, or search for words and phrases to clarify meaning • discuss familiar academic topics using content-based terms and common abstract vocabulary; can usually speak in some detail on familiar topics • have a grasp of basic grammar features, including a basic ability to narrate and describe in present, past, and future tenses; have an emerging ability to use complex sentences and complex grammar features • make errors that interfere somewhat with communication when using complex grammar structures, long

sentences, and less familiar words and expressions • may mispronounce words, but use pronunciation that can usually be understood by people not accustomed to interacting with ELs

Advanced high ELs have the ability to speak using grade appropriate English, with minimal second language acquisition support, in academic and social settings.

These students: • are able to participate in extended discussions on a variety of social and grade-appropriate academic topics with only occasional disruptions, hesitations, or pauses • communicate effectively using abstract and content-based vocabulary during classroom instructional tasks, with some exceptions when low-frequency or academically demanding vocabulary is needed; use many of the same idioms and colloquialisms as their native English-speaking peers • can use English grammar structures and complex sentences to narrate and describe at a level nearly comparable to native English-speaking peers • make few second language acquisition errors that interfere with overall communication • may mispronounce words, but rarely use pronunciation that interferes with overall communication

Texas Teaching Standards (TAC 19.2. Chapter 149.AA. Rule §149.1001)

(a) Purpose. The standards identified in this section are performance standards to be used to inform the training, appraisal, and professional development of teachers.

(b) Standards.

(1) Standard 1--Instructional Planning and Delivery. Teachers demonstrate their understanding of instructional planning and delivery by providing standards-based, data-driven, differentiated instruction that engages students, makes appropriate use of technology, and makes learning relevant for today's learners.

(A) Teachers design clear, well organized, sequential lessons that build on students' prior knowledge.

(i) Teachers develop lessons that build coherently toward objectives based on course content, curriculum scope and sequence, and expected student outcomes.

(ii) Teachers effectively communicate goals, expectations, and objectives to help all students reach high levels of achievement.

(iii) Teachers connect students' prior understanding and real-world experiences to new content and contexts, maximizing learning opportunities.

(B) Teachers design developmentally appropriate, standards-driven lessons that reflect evidence- based best practices.

(i) Teachers plan instruction that is developmentally appropriate, is standards driven, and motivates students to learn.

(ii) Teachers use a range of instructional strategies, appropriate to the content area, to make subject matter accessible to all students.

(iii) Teachers use and adapt resources, technologies, and standards-aligned instructional materials to promote student success in meeting learning goals.

(C) Teachers design lessons to meet the needs of diverse learners, adapting methods when appropriate.

(i) Teachers differentiate instruction, aligning methods and techniques to diverse student needs, including acceleration, remediation, and implementation of individual education plans.

(ii) Teachers plan student groupings, including pairings and individualized and small-group instruction, to facilitate student learning.
(iii) Teachers integrate the use of oral, written, graphic, kinesthetic, and/or tactile methods to teach key concepts.
(D) Teachers communicate clearly and accurately and engage students in a manner that encourages students' persistence and best efforts.
(i) Teachers ensure that the learning environment features a high degree of student engagement by facilitating discussion and student-centered activities as well as leading direct instruction.
(ii) Teachers validate each student's comments and questions, utilizing them to advance learning for all students.
(iii) Teachers encourage all students to overcome obstacles and remain persistent in the face of challenges, providing them with support in achieving their goals.
(E) Teachers promote complex, higher-order thinking, leading class discussions and activities that provide opportunities for deeper learning.
(i) Teachers set high expectations and create challenging learning experiences for students, encouraging them to apply disciplinary and cross-disciplinary knowledge to real-world problems.
(ii) Teachers provide opportunities for students to engage in individual and collaborative critical thinking and problem solving.
(iii) Teachers incorporate technology that allows students to interact with the curriculum in more significant and effective ways, helping them reach mastery.
(F) Teachers consistently check for understanding, give immediate feedback, and make lesson adjustments as necessary.
(i) Teachers monitor and assess student progress to ensure that their lessons meet students' needs.
(ii) Teachers provide immediate feedback to students in order to reinforce their learning and ensure that they understand key concepts.
(iii) Teachers adjust content delivery in response to student progress through the use of developmentally appropriate strategies that maximize student engagement.
(2) Standard 2--Knowledge of Students and Student Learning. Teachers work to ensure high levels of learning, social-emotional development, and achievement outcomes for all students, taking into consideration each student's educational and developmental backgrounds and focusing on each student's needs.
(A) Teachers demonstrate the belief that all students have the potential to achieve at high levels and support all students in their pursuit of social-emotional learning and academic success.
(i) Teachers purposefully utilize learners' individual strengths as a basis for academic and social-emotional growth.
(ii) Teachers create a community of learners in an inclusive environment that views differences in learning and background as educational assets.
(iii) Teachers accept responsibility for the growth of all of their students, persisting in their efforts to ensure high levels of growth on the part of each learner.
(B) Teachers acquire, analyze, and use background information (familial, cultural, educational, linguistic, and developmental characteristics) to engage students in learning.
(i) Teachers connect learning, content, and expectations to students' prior knowledge, life experiences, and interests in meaningful contexts.
(ii) Teachers understand the unique qualities of students with exceptional needs, including disabilities and giftedness, and know how to effectively address these needs through instructional strategies and resources.

(iii) Teachers understand the role of language and culture in learning and know how to modify their practices to support language acquisition so that language is comprehensible and instruction is fully accessible.
(C) Teachers facilitate each student's learning by employing evidence-based practices and concepts related to learning and social-emotional development.
(i) Teachers understand how learning occurs and how learners develop, construct meaning, and acquire knowledge and skills.
(ii) Teachers identify readiness for learning and understand how development in one area may affect students' performance in other areas.
(iii) Teachers apply evidence-based strategies to address individual student learning needs and differences, adjust their instruction, and support the learning needs of each student.
(3) Standard 3--Content Knowledge and Expertise. Teachers exhibit a comprehensive understanding of their content, discipline, and related pedagogy as demonstrated through the quality of the design and execution of lessons and their ability to match objectives and activities to relevant state standards.
(A) Teachers understand the major concepts, key themes, multiple perspectives, assumptions, processes of inquiry, structure, and real-world applications of their grade-level and subject-area content.
(i) Teachers have expertise in how their content vertically and horizontally aligns with the grade-level/subject-area continuum, leading to an integrated curriculum across grade levels and content areas.
(ii) Teachers identify gaps in students' knowledge of subject matter and communicate with their leaders and colleagues to ensure that these gaps are adequately addressed across grade levels and subject areas.
(iii) Teachers keep current with developments, new content, new approaches, and changing methods of instructional delivery within their discipline.
(B) Teachers design and execute quality lessons that are consistent with the concepts of their specific discipline, are aligned to state standards, and demonstrate their content expertise.
(i) Teachers organize curriculum to facilitate student understanding of the subject matter.
(ii) Teachers understand, actively anticipate, and adapt instruction to address common misunderstandings and preconceptions.
(iii) Teachers promote literacy and the academic language within the discipline and make discipline-specific language accessible to all learners.
(C) Teachers demonstrate content-specific pedagogy that meets the needs of diverse learners, utilizing engaging instructional materials to connect prior content knowledge to new learning.
(i) Teachers teach both the key content knowledge and the key skills of the discipline.
(ii) Teachers make appropriate and authentic connections across disciplines, subjects, and students' real-world experiences.
(4) Standard 4--Learning Environment. Teachers interact with students in respectful ways at all times, maintaining a physically and emotionally safe, supportive learning environment that is characterized by efficient and effective routines, clear expectations for student behavior, and organization that maximizes student learning.
(A) Teachers create a mutually respectful, collaborative, and safe community of learners by using knowledge of students' development and backgrounds.
(i) Teachers embrace students' backgrounds and experiences as an asset in their

learning environment.

(ii) Teachers maintain and facilitate respectful, supportive, positive, and productive interactions with and among students.
(iii) Teachers establish and sustain learning environments that are developmentally appropriate and respond to students' needs, strengths, and personal experiences.
(B) Teachers organize their classrooms in a safe and accessible manner that maximizes learning.
(i) Teachers arrange the physical environment to maximize student learning and to ensure that all students have access to resources.
(ii) Teachers create a physical classroom set-up that is flexible and accommodates the different learning needs of students.
(C) Teachers establish, implement, and communicate consistent routines for effective classroom management, including clear expectations for student behavior.
(i) Teachers implement behavior management systems to maintain an environment where all students can learn effectively.
(ii) Teachers maintain a strong culture of individual and group accountability for class expectations.
(iii) Teachers cultivate student ownership in developing classroom culture and norms.
(D) Teachers lead and maintain classrooms where students are actively engaged in learning as indicated by their level of motivation and on-task behavior.
(i) Teachers maintain a culture that is based on high expectations for student performance and encourages students to be self-motivated, taking responsibility for their own learning.
(ii) Teachers maximize instructional time, including managing transitions.
(iii) Teachers manage and facilitate groupings in order to maximize student collaboration, participation, and achievement.
(iv) Teachers communicate regularly, clearly, and appropriately with parents and families about student progress, providing detailed and constructive feedback and partnering with families in furthering their students' achievement goals.
(5) Standard 5--Data-Driven Practice. Teachers use formal and informal methods to assess student growth aligned to instructional goals and course objectives and regularly review and analyze multiple sources of data to measure student progress and adjust instructional strategies and content delivery as needed.
(A) Teachers implement both formal and informal methods of measuring student progress.
(i) Teachers gauge student progress and ensure student mastery of content knowledge and skills by providing assessments aligned to instructional objectives and outcomes that are accurate measures of student learning.
(ii) Teachers vary methods of assessing learning to accommodate students' learning needs, linguistic differences, and/or varying levels of background knowledge.
(B) Teachers set individual and group learning goals for students by using preliminary data and communicate these goals with students and families to ensure mutual understanding of expectations.
(i) Teachers develop learning plans and set academic as well as social-emotional learning goals for each student in response to previous outcomes from formal and informal assessments.
(ii) Teachers involve all students in self-assessment, goal setting, and monitoring progress.
(iii) Teachers communicate with students and families regularly about the importance of collecting data and monitoring progress of student outcomes, sharing timely and comprehensible feedback so they understand students' goals and progress.
(C) Teachers regularly collect, review, and analyze data to monitor student progress.

(i) Teachers analyze and review data in a timely, thorough, accurate, and appropriate manner, both individually and with colleagues, to monitor student learning.
(ii) Teachers combine results from different measures to develop a holistic picture of students' strengths and learning needs.
(D) Teachers utilize the data they collect and analyze to inform their instructional strategies and adjust short- and long-term plans accordingly.
(i) Teachers design instruction, change strategies, and differentiate their teaching practices to improve student learning based on assessment outcomes.
(ii) Teachers regularly compare their curriculum scope and sequence with student data to ensure they are on track and make adjustments as needed.
(6) Standard 6--Professional Practices and Responsibilities. Teachers consistently hold themselves to a high standard for individual development, pursue leadership opportunities, collaborate with other educational professionals, communicate regularly with stakeholders, maintain professional relationships, comply with all campus and school district policies, and conduct themselves ethically and with integrity.
(A) Teachers reflect on their teaching practice to improve their instructional effectiveness and engage in continuous professional learning to gain knowledge and skills and refine professional judgment.
(i) Teachers reflect on their own strengths and professional learning needs, using this information to develop action plans for improvement.
(ii) Teachers establish and strive to achieve professional goals to strengthen their instructional effectiveness and better meet students' needs.
(iii) Teachers engage in relevant, targeted professional learning opportunities that align with their professional growth goals and their students' academic and social-emotional needs.
(B) Teachers collaborate with their colleagues, are self-aware in their interpersonal interactions, and are open to constructive feedback from peers and administrators.
(i) Teachers seek out feedback from supervisors, coaches, and peers and take advantage of opportunities for job-embedded professional development.
(ii) Teachers actively participate in professional learning communities organized to improve instructional practices and student learning.
(C) Teachers seek out opportunities to lead students, other educators, and community members within and beyond their classrooms.
(i) Teachers clearly communicate the mission, vision, and goals of the school to students, colleagues, parents and families, and other community members.
(ii) Teachers seek to lead other adults on campus through professional learning communities, grade- or subject-level team leadership, committee membership, or other opportunities.
(D) Teachers model ethical and respectful behavior and demonstrate integrity in all situations.
(i) Teachers adhere to the educators' code of ethics in §247.2 of this title (relating to Code of Ethics and Standard Practices for Texas Educators), including following policies and procedures at their specific school placement(s).
(ii) Teachers communicate consistently, clearly, and respectfully with all members of the campus community, including students, parents and families, colleagues, administrators, and staff.
(iii) Teachers serve as advocates for their students, focusing attention on students' needs and concerns and maintaining thorough and accurate student records.
Statutory Authority: The provisions of this §149.1001 issued under the Texas Education Code, §21.351.

Source: The provisions of this §149.1001 adopted to be effective June 30, 2014, 39 TexReg 4955.

Technology Standards

In this course, we will focus on Standards I – VII of Technology Standards from the Texas State Board for Educator Certification, 2016.

Standard I. All teachers use and promote creative thinking and innovative processes to construct knowledge, generate new ideas, and create products.

Standard II. All teachers collaborate and communicate both locally and globally using digital tools and resources to reinforce and promote learning.

Standard III. All teachers acquire, analyze, and manage content from digital resources. Standard IV. All teachers make informed decisions by applying critical-thinking and problem- solving skills.

Standard V. All teachers practice and promote safe, responsible, legal, and ethical behavior while using technology tools and resources.

Standard VI. All teachers demonstrate a thorough understanding of technology concepts, systems, and operations.

Standard VII. All teachers know how to plan, organize, deliver, and evaluate instruction for all students that incorporates the effective use of current technology for teaching and integrating the Technology Applications Texas Essential Knowledge and Skills (TEKS) into the curriculum.

Standard X. The digital art/animation teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital art/animation, in addition to the content described in Technology Applications Standards I–VII.

Standard XII. The digital communications teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in digital communications, in addition to the content described in Technology Applications Standards I–VII.

Standard XIII. The Web design teacher has the knowledge and skills needed to teach the creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts strands of the Technology Applications Texas Essential Knowledge and Skills (TEKS) in Web design, in addition to the content described in Technology Applications Standards I–VII

Technology Standards Complete List

Grade 4

(1) Technology includes data communication, data processing, and the devices used for these tasks locally and across networks. Learning to apply these technologies motivates students to develop critical-thinking skills, higher-order thinking, and innovative problem solving. Technology applications incorporates the study of digital tools, devices, communication, and programming to empower students to apply current and emerging technologies in their careers, their education, and beyond.

(2) The technology applications Texas Essential Knowledge and Skills (TEKS) consist of five strands that prepare students to be literate in technology applications by Grade 8: computational thinking; creativity and innovation; data literacy, management, and representation; digital citizenship; and practical technology concepts. Communication and collaboration skills are embedded across the strands.

(A) Computational thinking. Students break down the problem-solving process into four steps: decomposition, pattern recognition, abstraction, and algorithms.

(B) Creativity and innovation. Students use innovative design processes to develop solutions to problems. Students plan a solution, create the solution, test the solution, iterate, and debug the solution as needed, and implement a completely new and innovative product.

(C) Data literacy, management, and representation. Students collect, organize, manage, analyze, and publish various types of data for an audience.

(D) Digital citizenship. Students practice the ethical and effective application of technology and develop an understanding of cybersecurity and the impact of a digital footprint to become safe, productive, and respectful digital citizens.

(E) Practical technology concepts. Students build their knowledge of software applications and hardware focusing on keyboarding and use of applications and tools. Students also build their knowledge and use of technology systems, including integrating the use of multiple applications.

(3) The technology applications TEKS can be integrated into all content areas and can support stand-alone courses. Districts have the flexibility of offering technology applications in a variety of settings, including through a stand-alone course or by integrating the technology applications standards in the essential knowledge and skills for one or more courses or subject areas.

(4) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Computational thinking--foundations. The student explores the core concepts of computational thinking, a set of problem-solving processes that involve decomposition, pattern recognition, abstraction, and algorithms. The student is expected to:

(A) decompose story problems into smaller, manageable subproblems and discuss and document various solutions to the problems;

(B) identify patterns in story problems and make predictions based on the pattern;

(C) communicate design plans and solutions using a variety of options; and

(D) debug algorithms (set of procedures) by identifying and removing errors.

(2) Computational thinking--applications. The student applies the fundamentals of computer science. The student is expected to:

(A) use variables within a program to modify data; and

(B) use a design process to create programs that include sequences, loops, and conditionals to express ideas or address a problem.

(3) Creativity and innovation--innovative design process. The student takes an active role in learning by using a design process to solve authentic problems for a local or global audience, using a variety of technologies. The student is expected to:

(A) explain the importance of and demonstrate personal skills and behaviors, including problem solving and questioning, effective communication, following directions, mental agility, and metacognition, that are needed to implement a design process successfully; and

(B) apply an appropriate design process that includes components to improve processes and refine original products for authentic problems.

(4) Creativity and innovation--emerging technologies. The student demonstrates an understanding that technology is dynamic and impacts different communities. The student is expected to identify examples of emerging technologies.

(5) Data literacy, management, and representation--collect data. The student uses digital strategies to collect and identify data. The student is expected to:

(A) classify numerical and non-numerical data; and

(B) identify and collect data by using various search strategies, including two or more keywords within specific parameters.

(6) Data literacy, management, and representation--organize, manage, and analyze data. The student uses data to answer questions. The student is expected to use digital tools to transform and make inferences about data to answer a question.

(7) Data literacy, management, and representation--communicate and publish results. The student communicates data through the use of digital tools to inform an audience. The student is expected to use digital tools to communicate results of an inquiry to inform an intended audience.

(8) Digital citizenship--social interactions. The student understands different styles of digital communication and that a student's actions online can have a long-term impact. The student is expected to:

(A) describe how information retained online creates a permanent digital footprint;

(B) describe appropriate digital etiquette for various forms of digital communication such as text, email, and online chat; and

(C) demonstrate appropriate digital etiquette for various forms of digital collaboration such as shared documents, video conferencing, and other platforms.

(9) Digital citizenship--ethics and laws. The student recognizes and practices responsible, legal, and ethical behavior while using digital tools and resources. The student is expected to:

(A) demonstrate adherence to local acceptable use policy (AUP) and explain the importance of responsible and ethical technology use;

(B) describe the rights and responsibilities of a creator, define copyright law, and explain how copyright law applies to creative work; and

(C) create citations for digital forms of media with assistance.

(10) Digital citizenship--privacy, safety, and security. The student practices safe, legal, and ethical digital behaviors to become a socially responsible digital citizen. The student is expected to:

(A) demonstrate account safety, including creating a strong password and logging off devices, and explain the importance of these practices;

(B) identify and discuss types of data collection tools such as cookies, pop-ups, smart devices, and unsecured networks and explain why it is important to maintain digital privacy; and

(C) discuss and explain how to respond to cyberbullying, including advocating for self and others.

(11) Practical technology concepts--processes. The student engages with technology systems, concepts, and operations. The student is expected to:

(A) evaluate and choose applications for relevance to an assigned task; and

(B) perform software application functions such as outline options, bulleting, and numbering lists, and perform editing functions such as finding and replacing.

(12) Practical technology concepts--skills and tools. The student selects appropriate methods or techniques for an assigned task and identifies and solves simple hardware and software problems using common troubleshooting strategies. The student is expected to:

(A) communicate an understanding of terminology related to virtual systems such as video conferencing, augmented reality, and virtual reality environments;

(B) evaluate where and how to save, including the use of appropriate naming conventions and effective file management strategies and folder structures;

(C) demonstrate proper touch keyboarding techniques with speed and accuracy and ergonomic strategies such as correct hand and body positions;

(D) identify and practice using cross-curricular symbols or other input device shortcuts on a keyboard; and

(E) use troubleshooting strategies to solve minor technical problems with hardware and software such as restarting software or rebooting hardware.

Grade 5

1) Technology includes data communication, data processing, and the devices used for these tasks locally and across networks. Learning to apply these technologies motivates students to develop critical-thinking skills, higher-order thinking, and innovative problem solving. Technology applications incorporates the study of digital tools, devices, communication, and programming to empower students to apply current and emerging technologies in their careers, their education, and beyond.

(2) The technology applications Texas Essential Knowledge and Skills (TEKS) consist of five strands that prepare students to be literate in technology applications by Grade 8: computational thinking; creativity and innovation; data literacy, management, and representation; digital citizenship; and practical technology concepts. Communication and collaboration skills are embedded across the strands.

(A) Computational thinking. Students break down the problem-solving process into four steps: decomposition, pattern recognition, abstraction, and algorithms.

(B) Creativity and innovation. Students use innovative design processes to develop solutions to problems. Students plan a solution, create the solution, test the solution, iterate, and debug the solution as needed, and implement a completely new and innovative product.

(C) Data literacy, management, and representation. Students collect, organize, manage, analyze, and publish various types of data for an audience.

(D) Digital citizenship. Students practice the ethical and effective application of technology and develop an understanding of cybersecurity and the impact of a digital footprint to become safe, productive, and respectful digital citizens.

(E) Practical technology concepts. Students build their knowledge of software applications and hardware focusing on keyboarding and use of applications and tools. Students also build their knowledge and use of technology systems, including integrating the use of multiple applications.

(3) The technology applications TEKS can be integrated into all content areas and can support stand-alone courses. Districts have the flexibility of offering technology applications in a variety of settings, including through a stand-alone course or by

integrating the technology applications standards in the essential knowledge and skills for one or more courses or subject areas.

(4) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Computational thinking--foundations. The student explores the core concepts of computational thinking, a set of problem-solving processes that involve decomposition, pattern recognition, abstraction, and algorithms. The student is expected to:

(A) decompose a real-world problem into smaller, manageable subproblems using graphic organizers such as learning maps, concept maps, or other representations of data;

(B) identify patterns in real-world problems and make predictions based on the pattern;

(C) design and create an outline collaboratively that documents a problem, possible solutions, and an expected timeline for the development of a coded solution; and

(D) compare multiple algorithms for the same task and determine which algorithm is the most appropriate for that task.

(2) Computational thinking--applications. The student applies the fundamentals of computer science. The student is expected to:

(A) use variables within a program to store and modify data;

(B) use a design process to create block-based programs that include sequences, loops, conditionals, and events to solve an everyday problem; and

(C) analyze a code and how the code may be reused to develop new or improved programs.

(3) Creativity and innovation--innovative design process. The student takes an active role in learning by using a design process to solve authentic problems for a local or global audience, using a variety of technologies. The student is expected to:

(A) explain the importance of and demonstrate personal skills and behaviors, including persistence, effective communication, following directions, mental agility, metacognition, problem solving and questioning, that are needed to implement a design process successfully; and

(B) apply an appropriate design process that includes components to generate multiple solutions for an authentic problem and develop original products.

(4) Creativity and innovation--emerging technologies. The student demonstrates an understanding that technology is dynamic and impacts different communities. The student is expected to predict how emerging technologies may impact different communities.

(5) Data literacy, management, and representation--collect data. The student uses digital strategies to collect and identify data. The student is expected to:

(A) identify and collect quantitative and qualitative data with digital tools; and

(B) identify keyword(s), Boolean operators, and limiters within provided search strategies.

(6) Data literacy, management, and representation--organize, manage, and analyze data. The student uses data to answer questions. The student is expected to use digital tools to analyze and transform data and make inferences to answer questions.

(7) Data literacy, management, and representation--communicate and publish results. The student communicates data through the use of digital tools to inform an audience. The student is expected to use digital tools to communicate and display data using appropriate visualization to inform an intended audience.

(8) Digital citizenship--social interactions. The student understands different styles of digital communication and that a student's actions online can have a long-term impact. The student is expected to:

(A) identify the components of a digital footprint such as online activity, game use, or social media platforms;

(B) describe appropriate digital etiquette for addressing different audiences such as peers, teachers, and other adults; and

(C) apply appropriate digital etiquette for collaborating with different audiences such as peers, teachers, and other adults.

(9) Digital citizenship--ethics and laws. The student recognizes and practices responsible, legal, and ethical behavior while using digital tools and resources. The student is expected to:

(A) demonstrate adherence to local acceptable use policy (AUP) and explain the importance of responsible and ethical technology use;

(B) describe the purpose of copyright law and the possible consequences for inappropriate use of digital content; and

(C) create citations for digital forms of media with assistance.

(10) Digital citizenship--privacy, safety, and security. The student practices safe, legal, and ethical digital behaviors to become a socially responsible digital citizen. The student is expected to:

(A) discuss cybersecurity strategies such as using a secured internet connection to protect digital information;

(B) discuss how data collection technology is used to track online navigation and identify strategies to maintain digital privacy and security; and

(C) discuss and identify how interactions can escalate online and explain ways to stand up to cyberbullying, including advocating for self and others.

(11) Practical technology concepts--processes. The student engages with technology systems, concepts, and operations. The student is expected to:

(A) identify file types for text, graphics, and multimedia files; and

(B) perform software application functions, including inserting or deleting text and images and formatting tools or options.

(12) Practical technology concepts--skills and tools. The student selects appropriate methods or techniques for an assigned task and identifies and solves simple hardware and software problems using common troubleshooting strategies. The student is expected to:

(A) describe and evaluate operating systems, learning management systems, virtual systems, and network systems such as internet, intranet, wireless network, and short- range wireless technology;

(B) organize files using appropriate naming conventions and folder structures;

(C) demonstrate proper touch keyboarding techniques with increasing speed and accuracy and ergonomic strategies such as correct hand and body positions;

(D) demonstrate keyboard or other input device shortcuts with fluency; and

(E) use help sources to research application features and solve software issues.

Grade 6

(1) The technology applications curriculum has six strands based on the National Educational Technology Standards for Students (NETS•S) and performance indicators developed by the International Society for Technology in Education (ISTE): creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts.

(2) Through the study of technology applications, students make informed decisions by understanding current and emerging technologies, including technology systems, appropriate digital tools, and personal learning networks. As competent researchers and responsible digital citizens, students use creative and computational thinking to solve problems while developing career and college readiness skills.

(3) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Creativity and innovation. The student uses creative thinking and innovative processes to construct knowledge, generate new ideas, and create products. The student is expected to:

(A) identify, create, and use files in various formats such as text, raster and vector graphics, video, and audio files;

(B) create original works as a means of personal or group expression;

(C) explore complex systems or issues using models, simulations, and new technologies to make predictions, modify input, and review results; and

(D) discuss trends and possible outcomes.

(2) Communication and collaboration. The student collaborates and communicates both locally and globally to reinforce and promote learning. The student is expected to:

(A) participate in personal learning networks to collaborate with peers, experts, or others using digital tools such as blogs, wikis, audio/video communication, or other emerging technologies;

(B) communicate effectively with multiple audiences using a variety of media and formats; and

(C) read and discuss examples of technical writing.

(3) Research and information fluency. The student acquires, analyzes, and manages content from digital resources. The student is expected to:

(A) create a research plan to guide inquiry;

(B) discuss and use various search strategies, including keyword(s) and Boolean operators;

(C) select and evaluate various types of digital resources for accuracy and validity; and

(D) process data and communicate results.

(4) Critical thinking, problem solving, and decision making. The student makes informed decisions by applying critical-thinking and problem-solving skills. The student is expected to:

(A) identify and define relevant problems and significant questions for investigation;

(B) plan and manage activities to develop a solution, design a computer program, or complete a project;

(C) collect and analyze data to identify solutions and make informed decisions;

(D) use multiple processes and diverse perspectives to explore alternative solutions;

(E) make informed decisions and support reasoning; and

(F) transfer current knowledge to the learning of newly encountered technologies.

(5) Digital citizenship. The student practices safe, responsible, legal, and ethical behavior while using technology tools and resources. The student is expected to:

(A) understand copyright principles, including current laws, fair use guidelines, creative commons, open source, and public domain;

(B) practice ethical acquisition of information and standard methods for citing sources;

(C) practice safe and appropriate online behavior, personal security guidelines, digital identity, digital etiquette, and acceptable use of technology; and

(D) understand the negative impact of inappropriate technology use, including online bullying and harassment, hacking, intentional virus setting, invasion of privacy, and piracy such as software, music, video, and other media.

(6) Technology operations and concepts. The student demonstrates a thorough understanding of technology concepts, systems, and operations. The student is expected to:

(A) define and use current technology terminology appropriately;

(B) select technology tools based on licensing, application, and support;
(C) identify, understand, and use operating systems;

(3) (D) understand and use software applications, including selecting and using software for a defined task;

(4) (E) identify, understand, and use hardware systems;

(5) (F) understand troubleshooting techniques such as restarting systems, checking power issues, resolving software compatibility, verifying network connectivity, connecting to remote resources, and modifying display properties;

(6) (G) demonstrate effective file management strategies such as file naming conventions, location, backup, hierarchy, folder structure, file conversion, tags, labels, and emerging digital organizational strategies;

(7) (H) discuss how changes in technology throughout history have impacted various areas of study;

(8) (I) discuss the relevance of technology as it applies to college and career readiness, life-long learning, and daily living;

(9) (J) use a variety of local and remote input sources;

(10) (K) use keyboarding techniques and ergonomic strategies while building speed and accuracy;

(11) (L) create and edit files with productivity tools, including:

(12) (i) a word processing document using digital typography standards such as page layout, font formatting, paragraph formatting, and list attributes;

(13) (ii) a spreadsheet workbook using basic computational and graphic components such as basic formulas and functions, data types, and chart generation;

(14) (iii) a database by manipulating components such as entering and searching for relevant data; and

(15) (iv) a digital publication using relevant publication standards;

(16) (M) plan and create non-linear media projects using graphic design principles; and

(17) (N) integrate two or more technology tools to create a new digital product

Grade 7

(1) The technology applications curriculum has six strands based on the National Educational Technology Standards for Students (NETS•S) and performance indicators developed by the International Society for Technology in Education (ISTE): creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts.

(2) Through the study of technology applications, students make informed decisions by understanding current and emerging technologies, including technology systems, appropriate digital tools, and personal learning networks. As competent researchers and responsible digital citizens, students use creative and computational thinking to solve problems while developing career and college readiness skills.

(3) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Creativity and innovation. The student uses creative thinking and innovative processes to construct knowledge, generate new ideas, and create products. The student is expected to:

(A) identify, create, and use files in various formats such as text, raster and vector graphics, video, and audio files;

(B) create and present original works as a means of personal or group expression;

(C) explore complex systems or issues using models, simulations, and new technologies to make predictions, modify input, and review results; and

(D) discuss trends and make predictions.

(2) Communication and collaboration. The student collaborates and communicates both locally and globally to reinforce and promote learning. The student is expected to:

(A) create personal learning networks to collaborate and publish with peers, experts, or others using digital tools such as blogs, wikis, audio/video communication, or other emerging technologies;

(B) communicate effectively with multiple audiences using a variety of media and formats; and

(C) create products using technical writing strategies.

(3) Research and information fluency. The student acquires, analyzes, and manages content from digital resources. The student is expected to:

(A) create a research plan to guide inquiry;

(B) use and evaluate various search strategies, including keyword(s) and Boolean operators;

(C) select and evaluate various types of digital resources for accuracy and validity; and

(D) process data and communicate results.

(4) Critical thinking, problem solving, and decision making. The student makes informed decisions by applying critical-thinking and problem-solving skills. The student is expected to:

(A) identify and define relevant problems and significant questions for investigation;

(B) plan and manage activities to develop a solution, design a computer program, or complete a project;

(C) collect and analyze data to identify solutions and make informed decisions;

(D) use multiple processes and diverse perspectives to explore alternative solutions;

(E) make informed decisions and support reasoning; and

(F) transfer current knowledge to the learning of newly encountered technologies.

(5) Digital citizenship. The student practices safe, responsible, legal, and

ethical behavior while using technology tools and resources. The student is expected to:

(A) understand and practice copyright principles, including current laws, fair use guidelines, creative commons, open source, and public domain;

(B) practice ethical acquisition of information and standard methods for citing sources;

(C) practice and explain safe and appropriate online behavior, personal security guidelines, digital identity, digital etiquette, and acceptable use of technology; and

(D) understand the negative impact of inappropriate technology use, including online bullying and harassment, hacking, intentional virus setting, invasion of privacy, and piracy such as software, music, video, and other media.

(6) Technology operations and concepts. The student demonstrates a thorough understanding of technology concepts, systems, and operations. The student is expected to:

(A) define and use current technology terminology appropriately;

(B) select and apply technology tools based on licensing, application, and support;

(C) identify, understand, and use operating systems;

(D) understand and use software applications, including selecting and using software for a defined task;

(E) identify, understand, and use hardware systems;

(F) understand troubleshooting techniques such as restarting systems, checking power issues, resolving software compatibility, verifying network connectivity, connecting to remote resources, and modifying display properties;

(G) implement effective file management strategies such as file naming conventions, location, backup, hierarchy, folder structure, file conversion, tags, labels, and emerging digital organizational strategies;

(H) explain how changes in technology throughout history have impacted various areas of study;

(I) explain the relevance of technology as it applies to college and career readiness, life-long learning, and daily living;

(J) use a variety of local and remote input sources;

(K) use keyboarding techniques and ergonomic strategies while building speed and accuracy;

(L) create and edit files with productivity tools, including:

(i) a word processing document using digital typography standards such as page layout, font formatting, paragraph formatting, and list attributes;

(ii) a spreadsheet workbook using advanced computational and graphic components such as complex formulas, basic functions, data types, and chart generation;

(iii) a database by manipulating components such as defining fields, entering data, and designing layouts appropriate for reporting; and

(iv) a digital publication using relevant publication standards;

(M) plan and create non-linear media projects using graphic design principles; and
(N) integrate two or more technology tools to create a new digital product

Grade 8

(1) The technology applications curriculum has six strands based on the National Educational Technology Standards for Students (NETS•S) and performance indicators developed by the International Society for Technology in Education (ISTE): creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts.

(2) Through the study of technology applications, students make informed decisions by understanding current and emerging technologies, including technology systems, appropriate digital tools, and personal learning networks. As competent researchers and responsible digital citizens, students use creative and computational thinking to solve problems while developing career and college readiness skills.

(3) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Creativity and innovation. The student uses creative thinking and innovative processes to construct knowledge, generate new ideas, and create products. The student is expected to:

(A) identify, create, and use files in various formats, including text, raster and vector graphics, video, and audio files;

(B) create, present, and publish original works as a means of personal or group expression;

(C) explore complex systems or issues using models, simulations, and new technologies to develop hypotheses, modify input, and analyze results; and

(D) analyze trends and forecast possibilities.

(2) Communication and collaboration. The student collaborates and communicates both locally and globally to reinforce and promote learning. The student is expected to:

(A) create and manage personal learning networks to collaborate and publish with peers, experts, or others using digital tools such as blogs, wikis, audio/video communication, or other emerging technologies;

(B) communicate effectively with multiple audiences using a variety of media and formats; and

(C) create and publish products using technical writing strategies.

(3) Research and information fluency. The student acquires, analyzes, and manages content from digital resources. The student is expected to:

(A) create a research plan to guide inquiry;

(B) plan, use, and evaluate various search strategies, including keyword(s) and Boolean operators;

(C) select and evaluate various types of digital resources for accuracy and validity; and

(D) process data and communicate results.

(4) Critical thinking, problem solving, and decision making. The student makes informed decisions by applying critical-thinking and problem-solving skills. The student is expected to:

(A) identify and define relevant problems and significant questions for investigation;

(B) plan and manage activities to develop a solution, design a computer program, or complete a project;

(C) collect and analyze data to identify solutions and make informed decisions;

(D) use multiple processes and diverse perspectives to explore alternative solutions;

(E) make informed decisions and support reasoning; and

(F) transfer current knowledge to the learning of newly encountered technologies.

(5) Digital citizenship. The student practices safe, responsible, legal, and ethical behavior while using technology tools and resources. The student is expected to:

(A) understand, explain, and practice copyright principles, including current laws, fair use guidelines, creative commons, open source, and public domain;

(B) practice and explain ethical acquisition of information and standard methods for cit ing sources;

(C) practice and explain safe and appropriate online behavior, personal security guidelines, digital identity, digital etiquette, and acceptable use of technology; and

(D) understand and explain the negative impact of inappropriate technology use, including online bullying and harassment, hacking, intentional virus setting, invasion of privacy, and piracy such as software, music, video, and other media.

(6) Technology operations and concepts. The student demonstrates a thorough understanding of technology concepts, systems, and operations. The student is expected to:

(A) define and use current technology terminology appropriately;

(B) evaluate and select technology tools based on licensing, application, and support;

(C) identify, understand, and use operating systems;

(D) understand and use software applications, including selecting and using software for a defined task;

(E) identify, understand, and use hardware systems;

(F) apply troubleshooting techniques, including restarting systems, checking power issues, resolving software compatibility, verifying network connectivity, connecting to remote resources, and modifying display properties;

(G) implement effective file management strategies such as file naming conventions, location, backup, hierarchy, folder structure, file conversion, tags, labels, and emerging digital organizational strategies;

(H) evaluate how changes in technology throughout history have impacted various areas of study;

(I) evaluate the relevance of technology as it applies to college and career readiness, life-long learning, and daily living;

(J) use a variety of local and remote input sources;

(K) use keyboarding techniques and ergonomic strategies while building speed and accuracy;

(L) create and edit files with productivity tools, including:

(i) a word processing document using digital typography standards such as page layout, font formatting, paragraph formatting, mail merge, and list attributes;

(ii) a spreadsheet workbook using advanced computational and graphic components such as complex formulas, advanced functions, data types, and chart generation;

(iii) a database by manipulating components, including defining fields, entering data, and designing layouts appropriate for reporting; and

(iv) a digital publication using relevant publication standards and graphic design principles;

(M) plan and create non-linear media projects using graphic design principles; and

(N) integrate two or more technology tools to create a new digital product

Pedagogy and Professional Responsibilities Standards, Grades 4-8

(a) Grades 4-8 pedagogy and professional responsibilities (PPR) standards. The PPR standards identified in this section are targeted for classroom teachers of students in Grades 4-8. The standards address the discipline that deals with the theory and practice of teaching to inform skill-based training and development. The standards inform proper teaching techniques, strategies, teacher actions, teacher judgements, and decisions by taking into consideration theories of learning, understandings of students and their needs, and the backgrounds and interests of individual students. The standards are also aligned with the Commissioner's Teacher Standards in 19 TAC Chapter 149 of this title (relating to Commissioner's Rules Concerning Educator Standards).

(b) Instructional Planning and Delivery. Grades 4-8 classroom teachers demonstrate understanding of instructional planning and delivery by providing standards-based, data-driven, differentiated instruction that engages students and makes learning relevant for today's learners. Grades 4-8 classroom teachers must:

(1) develop lessons that build coherently toward objectives based on course content, curriculum scope and sequence, and expected student outcomes;

(2) effectively communicate goals, expectations, and objectives to help all students reach high levels of achievement;

(3) connect students' prior understanding and real-world experiences to new content and contexts, maximizing learning opportunities;

(4) plan instruction that is developmentally appropriate, is standards driven, and motivates students to learn;

(5) use a range of instructional strategies, appropriate to the content area, to make subject matter accessible to all students;

(6) differentiate instruction, aligning methods and techniques to diverse student needs, including acceleration, remediation, and implementation of individual education plans;

(7) ensure that the learning environment features a high degree of student engagement by facilitating discussion and student-centered activities as well as leading direct instruction;

(8) set high expectations and create challenging learning experiences for students, encouraging them to apply disciplinary and cross-disciplinary knowledge to real-world problems;

(9) provide opportunities for students to engage in individual and collaborative critical thinking and problem solving;

(10) monitor and assess students' progress to ensure that their lessons meet students' needs;

(11) provide immediate feedback to students in order to reinforce their learning and ensure that they understand key concepts; and

(12) adjust content delivery in response to student progress through the use of developmentally appropriate strategies that maximize student engagement.

(c) Knowledge of Student and Student Learning. Grades 4-8 classroom teachers work to ensure high levels of learning and achievement outcomes for all students, taking into consideration each student's educational and developmental backgrounds and focusing on each student's needs. Grades 4-8 classroom teachers must:

(1) create a community of learners in an inclusive environment that views differences in learning and background as educational assets;

(2) connect learning, content, and expectations to students' prior knowledge, life experiences, and interests in meaningful contexts;

(3) understand the unique qualities of students with exceptional needs, including disabilities and giftedness, and know how to effectively address these needs through instructional strategies and resources;

(4) understand the role of language and culture in learning and know how to modify their practice to support language acquisition so that language is comprehensible and instruction is fully accessible; and

(5) understand how learning occurs and how learners develop, construct meaning, and acquire knowledge and skills.

(d) Content Knowledge and Expertise. Grades 4-8 classroom teachers exhibit an understanding of content and related pedagogy as demonstrated through the quality of the design and execution of lessons and the ability to match objectives and activities to relevant state standards. Grades 4-8 classroom teachers must:

(1) keep current with developments, new content, new approaches, and changing methods of instructional delivery within their discipline;

(2) organize curriculum to facilitate student understanding of the subject matter;

(3) understand, actively anticipate, and adapt instruction to address common misunderstandings and preconceptions;

(4) promote literacy and the academic language within the discipline and make discipline-specific language accessible to all learners; and

(5) teach both the key content knowledge and the key skills of the discipline.

(e) Learning Environment. Grades 4-8 classroom teachers interact with students in respectful ways at all times, maintaining a physically and emotionally safe, supportive learning environment that is characterized by efficient and effective routines, clear expectations for student behavior, and organization that maximizes student learning. Grades 4-8 classroom teachers must:

(1) embrace students' backgrounds and experiences as an asset in their learning;

(2) maintain and facilitate respectful, supportive, positive, and productive interactions with and among students;

(3) implement behavior management systems to maintain an environment where all students can learn effectively;

(4) maintain a culture that is based on high expectations for student performance and encourages students to be self-motivated, taking responsibility for their own learning;

(5) maximize instructional time, including managing transitions; and

(6) communicate regularly, clearly, and appropriately with parents and families about student progress, providing detailed and constructive feedback and partnering with families in furthering their students' achievement goals.

(f) Data-Driven Practices. Grades 4-8 classroom teachers use formal and informal methods to assess student growth aligned to instructional goals and course objectives and regularly review and analyze multiple sources of data to measure student progress and adjust instructional strategies and content delivery as needed. Grades 4-8 classroom teachers must:

(1) gauge student progress and ensure mastery of content knowledge and skills by providing assessments aligned to instructional objectives and outcomes that are accurate measures of student learning;

(2) analyze and review data in a timely, thorough, accurate, and appropriate manner, both individually and with colleagues, to monitor student learning; and

(3) design instruction, change strategies, and differentiate their teaching practices to improve student learning based on assessment outcomes.

(g) Professional Practices and Responsibilities. Grades 4-8 classroom teachers consistently hold themselves to a high standard for individual development, collaborate with other educational professionals, communicate regularly with stakeholders, maintain professional relationships, comply with all campus and school district policies, and conduct themselves ethically and with integrity. Grades 4-8 classroom teachers must:

(1) reflect on their own strengths and professional learning needs, using this information to develop action plans for improvement;

(2) seek out feedback from supervisor, coaches, and peers and take advantage of opportunities for job-embedded professional development;

(3) adhere to the educators' code of ethics in §247.2 of this title (relating to Code of Ethics and Standard Practices for Texas Educators), including following policies and procedures at their specific school placement(s); and

(4) communicate consistently, clearly, and respectfully with all members of the campus community, administrators, and staff.

Pedagogy and Professional Responsibilities Standards, Grades 7-12

(a) Grades 7-12 pedagogy and professional responsibilities (PPR) standards. The PPR standards identified in this section are targeted for classroom teachers of students in Grades 7-12. The standards address the discipline that deals with the theory and practice of teaching to inform skill-based training and development. The standards inform proper teaching techniques, strategies, teacher actions, teacher judgements, and decisions by taking into consideration theories of learning, understandings of students and their needs, and the backgrounds and interests of individual students. The standards are also aligned with the Commissioner's Teacher Standards in 19 TAC Chapter 149 of this title (relating to Commissioner's Rules Concerning Educator Standards).

(b) Instructional Planning and Delivery. Grades 7-12 classroom teachers demonstrate understanding of instructional planning and delivery by providing standards-based, data-driven, differentiated instruction that engages students and makes learning relevant for today's learners. Grades 7-12 classroom teachers must:

(1) develop lessons that build coherently toward objectives based on course content, curriculum scope and sequence, and expected student outcomes;

(2) effectively communicate goals, expectations, and objectives to help all students reach high levels of achievement;

(3) connect students' prior understanding and real-world experiences to new content and contexts, maximizing learning opportunities;

(4) plan instruction that is developmentally appropriate, is standards driven, and motivates students to learn;

(5) use a range of instructional strategies, appropriate to the content area, to make subject matter accessible to all students;

(6) differentiate instruction, aligning methods and techniques to diverse student needs, including acceleration, remediation, and implementation of individual education plans;

(7) ensure that the learning environment features a high degree of student engagement by facilitating discussion and student-centered activities as well as leading direct instruction;

(8) set high expectations and create challenging learning experiences for students, encouraging them to apply disciplinary and cross-disciplinary knowledge to real-world problems;

(9) provide opportunities for students to engage in individual and collaborative critical thinking and problem solving;

(10) monitor and assess students' progress to ensure that their lessons meet students' needs;

(11) provide immediate feedback to students in order to reinforce their learning and ensure that they understand key concepts; and

(12) adjust content delivery in response to student progress through the use of developmentally appropriate strategies that maximize student engagement.

(c) Knowledge of Student and Student Learning. Grades 7-12 classroom teachers work to ensure high levels of learning and achievement outcomes for all students, taking into consideration each student's educational and developmental backgrounds and focusing on each student's needs. Grades 7-12 classroom teachers must:

(1) create a community of learners in an inclusive environment that views differences in learning and background as educational assets;

(2) accept responsibility for the growth of all of their students, persisting in their efforts to ensure high levels of growth on the part of each learner;

(3) connect learning, content, and expectations to students' prior knowledge, life experiences, and interests in meaningful contexts;

(4) understand the unique qualities of students with exceptional needs, including disabilities and giftedness, and know how to effectively address these needs through instructional strategies and resources;

(5) understand the role of language and culture in learning and know how to modify their practice to support language acquisition so that language is comprehensible and instruction is fully accessible; and

(6) understand how learning occurs and how learners develop, construct meaning, and acquire knowledge and skills.

(d) Content Knowledge and Expertise. Grades 7-12 classroom teachers exhibit an understanding of content and related pedagogy as demonstrated through the quality of the design and execution of lessons and the ability to match objectives and activities to relevant state standards. Grades 7-12 classroom teachers must:

(1) keep current with developments, new content, new approaches, and changing methods of instructional delivery within their discipline;

(2) organize curriculum to facilitate student understanding of the subject matter;

(3) understand, actively anticipate, and adapt instruction to address common misunderstandings and preconceptions;

(4) promote literacy and the academic language within the discipline and make discipline-specific language accessible to all learners; and

(5) teach both the key content knowledge and the key skills of the discipline.

(e) Learning Environment. Grades 7-12 classroom teachers interact with students in respectful ways at all times, maintaining a physically and emotionally safe, supportive learning environment that is characterized by efficient and effective routines, clear expectations for student behavior, and organization that maximizes student learning. Grades 7-12 classroom teachers must:

(1) embrace students' backgrounds and experiences as an asset in their learning;

(2) maintain and facilitate respectful, supportive, positive, and productive interactions with and among students;

(3) implement behavior management systems to maintain an environment where all students can learn effectively;

(4) maintain a culture that is based on high expectations for student performance and encourages students to be self-motivated, taking responsibility for their own learning;

(5) maximize instructional time, including managing transitions; and
(6) communicate regularly, clearly, and appropriately with parents and families about student progress, providing detailed and constructive feedback and partnering with families in furthering their students' achievement goals.

(f) Data-Driven Practices. Grades 7-12 classroom teachers use formal and informal methods to assess student growth aligned to instructional goals and course objectives and regularly review and analyze multiple sources of data to measure student progress and adjust instructional strategies and content delivery as needed. Grades 7-12 classroom teachers must:

(1) gauge student progress and ensure mastery of content knowledge and skills by providing assessments aligned to instructional objectives and outcomes that are accurate measures of student learning;
(2) analyze and review data in a timely, thorough, accurate, and appropriate manner, both individually and with colleagues, to monitor student learning; and
(3) design instruction, change strategies, and differentiate their teaching practices to improve student learning based on assessment outcomes.

(g) Professional Practices and Responsibilities. Grades 7-12 classroom teachers consistently hold themselves to a high standard for individual development, collaborate with other educational professionals, communicate regularly with stakeholders, maintain professional relationships, comply with all campus and school district policies, and conduct themselves ethically and with integrity. Grades 7-12 classroom teachers must:

(1) reflect on their own strengths and professional learning needs, using this information to develop action plans for improvement;
(2) seek out feedback from supervisor, coaches, and peers and take advantage of opportunities for job-embedded professional development;
(3) adhere to the educators' code of ethics in §247.2 of this title (relating to Code of Ethics and Standard Practices for Texas Educators), including following policies and procedures at their specific school placement(s);
(4) communicate consistently, clearly, and respectfully with all members of the campus community, administrators, and staff; and
(5) serve as advocates for their students, focusing attention on students' needs and concerns and maintaining thorough and accurate student records.

Appendix B: Learning experiences at WCOE

Clinical experiences at the WCOE, including both initial clinical experiences (e.g., classroom observations) and clinical teaching, are an essential part of the professional preparation program. Clinical experiences vary across many WCOE undergraduate programs and are designed and implemented through collaboration with school district and community partners. WCOE teacher candidates gain essential knowledge, skills, and dispositions through observations and teaching opportunities in a wide variety of diverse settings (e.g., urban/rural, SES, special needs, race/ethnicity). WCOE believes in gradual release of responsibilities and exposes and evaluates teacher candidates throughout the program so as to provide them with the best learning experience. Below are the assessments that are used across courses and programs to effectively monitor teacher candidates’ progress.

Dispositions

Candidates in the teacher education program are evaluated on their dispositions towards the 10 In TASC standards three times (beginning, middle, end) during their program in Educational Psychology, Professional Methods Block A, and Clinical Teaching in the following areas:

- Candidates respect learners' differing strengths and needs and are committed to using this information to further each learner's development.
- Candidates believe that all learners can achieve at high levels and persist in helping each learner reach his/her full potential.
- Candidates are committed to working with learners, colleagues, families, and communities to establish positive and supportive learning environments.
- Candidates realize that content knowledge is not a fixed body of facts but is complex, culturally situated, and ever evolving. He or she keeps abreast of new ideas and understandings in the field.
- Candidates value flexible learning environments that encourage learner exploration, discovery, and expression across content areas.
- Candidates are committed to using multiple types of assessment processes to support, verify, and document learning.
- Candidates respect learners' diverse strengths and needs and are committed to using this information to plan effective instruction.
- Candidates are committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.
- Candidates take responsibility for student learning and use ongoing analysis and reflection to improve planning and practice.
- Candidates actively share responsibility for shaping and supporting the mission of his/her school as one of advocacy for learners and accountability for their success.

Candidates are evaluated by faculty in those courses at a developing, beginning, and mastery level of competency as determined by the academic committee on program quality. The evaluation is based upon evidence gathered through classroom participation, assignments, observed field experiences and unit planning.

Gradual Release of Responsibility

Data Literacy Assignment

Teacher candidates are expected to demonstrate the ability to interpret standardized test data and make instructional decisions based on the test data from students. At the conclusion of the Classroom Assessment/Assessment in PE, students will develop an understanding of assessment practices that enable them to accurately read and interpret testing data. In addition, teacher candidates will apply concepts learned in the course to explain what the data means and what, if any, interventions should be implemented for targeting specific groups of students. By identifying weak areas of conceptual understanding of their students, teacher candidates can create appropriate instructional strategies that lead to greater student success.

Lesson Planning

Teacher candidates must demonstrate the ability to plan, assess, and implement instruction.
This begins in the Foundational block where the teacher candidates create and write lessons for effective teaching. Teacher candidates are required to develop lesson plans. The specific format can be adapted, but should always include the objectives (TEKS), procedures, materials/resources, and

assessment. Student engagement is a key element in a good lesson with a goal of student learning/success is the ultimate goal.
Candidates must form an assessment strategy to determine the extent to which students are able to master learning of objectives. Candidates also describes the instructional delivery method addressing the following step-by-step procedures:

1. Questions and concerns listed in the directions given to you by your instructor
2. Setting purposes ("Today we will be…I want you to…because you will…")
3. Method(s) for engaging students in the lesson
4. Any questions asked during the lesson should be in bold
5. Higher order thinking reflected in questions
6. Instructional Strategies: Modeling, Discussion, "Hands-on", Inquiry, etc.
7. Grouping: when and how
8. Instruction that addresses learners' needs (ELLs, Special Education, 504, Gifted, Struggling Learner)
9. Closure

After teaching the lesson, candidates are then required to reflect on the lesson delivery, appropriateness of instructional strategies, impact for future planning, and opportunities for collaboration with mentor teacher. The skills acquired during lesson planning provides the foundation and are also built upon for unit planning and other key assessments.

Unit Plan

Teacher candidate's ability to demonstrate the ability to plan, assess, and implement instruction continues in the professional block with the Unit plan assessment. The unit plan assessment is a modified form of Midwestern Impact on Student Learning (MISL) that requires teacher candidates to plan a unit of teaching. Candidates are required to determine a set of multiple learning objectives aligned to state content standards Texas Essential Knowledge and Skills (TEKS) appropriate to the lesson(s) the candidate is preparing. This key assignment should be submitted in TK20.

Co-Teaching

WCOE adopts a co-teaching model for the candidates during their clinical experiences. These strategies include the following:

- One Teach, One Observe — One teacher has primary instructional responsibility while the other gathers specific observational information on students or the (instructing) teacher. The key to this strategy is to have a focus for the observation.
- One Teach, One Assist — One teacher has primary instructional responsibility while the other teacher assists students with their work, monitors behaviors, or corrects assignments.
- Station Teaching — The co-teaching pair divide the instructional content into parts and the students into groups. Groups spend a designated amount of time at each station. Of-ten an independent station will be used.
- Parallel Teaching — Each teacher instructs half of the students. The two teachers are addressing the same instructional material and present the lesson using the same teaching strategy. The greatest benefit is the reduction of student to teacher ratio.
- Supplemental Teaching — This strategy allows one teacher to work with students at their expected grade level, while the co-teacher works with those students who need the information and/or materials extended or remediated.

- Alternative/Differentiated Teaching — Alternative teaching strategies provide two different approaches to teaching the same information. The learning outcome is the same for all students, however the instructional methodology is different.
- Team Teaching — Well-planned, team-taught lessons, exhibit an invisible flow of instruction with no prescribed division of authority. Using a team-teaching strategy, both teachers are actively involved in the lesson. From a student's perspective, there is no clearly defined leader, as both teachers share the instruction, are free to interject in-formation, and available to assist students and answer questions. (Adapted from Cook & Friend (1995))

Midwestern Impact on Student Learning [MISL]

Successful completion and submission of a MISL portfolio is required during the first six weeks of clinical teaching. Teachers candidates are required to plan, implement, and assess student learning within a unit of study. The Midwestern Impact on Student Learning (MISL) measures content knowledge, pedagogical knowledge, and effect on student learning in the following areas/domains: Learning Environments; Individual Development and Diversity; Collaboration; Planning Process and Content; Assessment; Strategies and Methods; Reflection; Professional Development; and Communication.

Each of the 10 areas is scored with one of 4 ratings: Exemplary 4, Competent 3, Needs Improvement 2, and Unsatisfactory 1. An overall score of 20 (meets expectations) is required for successful completion of student teaching for all teacher candidates.

The MISL is a record of candidates' ability to carefully consider all contextual factors that influence instruction and to then use those factors to plan and design a unit of instruction, including an assessment plan that can demonstrate changes in student knowledge, skills, or dispositions resulting from instruction. The MISL includes both reflexive (description of instructional decision making during the unit) and reflective components that encourage candidates to plan instruction strategically and to approach teaching in a purposeful, thoughtful, and methodical manner.

Appendix B: Required assignment/standard alignment matrix

Assignment	**Course Objectives - (CO #)**	**WCOE Standard (WCOE #)**
Technology Assignment	CO #10	WCOE #4
Vertical Alignment Assignment	CO #1	WCOE #1,4,5, EC6C #1,2,3,4,5,6 Applicable Teks/Tech Standards
Lab Safety Assignment	CO #8	WCOE #5, 7 Applicable Teks/Tech Standards
Lesson Plan and Reflection	CO #2,3,4,5,7,8	WCOE #1,2,4,5,6,7,8,10 Applicable Teks/Tech Standards TT #1-6, PPR-All
Classroom Observation	CO #2,6,7,8,9	WCOE #1,2,3,4,5,6,7,8,10 TT #1-6, PPR-All
Science Presentation	CO #6, 10	WCOE #8,
Reflection Assignment	CO #1,9	WCOE #1,2,3,7,8,9,10

Assignment	**Course Objectives - (CO #)**	**WCOE Standard (WCOE #)**
Article Analysis Assignment	CO #2,3,4,5,7,8	WCOE #1,2,3,7,8,9,10
Unit Plan	CO #1,2,3	WCOE #1,2,3,4,5,7,8,10
Field Experience	CO #1,2,3,4,6,9,10	WCOE #1,2,3,4,5,6,7,8,9,10 Applicable Teks/Tech Standards
In Class Activities: class discussion, lecture, guided reading, guest speakers, case study, peer practice, experiential learning, exploration, and role playing	CO #1,2,3,4,5,6,7,8,9,10	WCOE #1,2,3,4,5,6,7,8,9,10 Applicable Teks/Tech Standards