Science, Grade 8

Subject: Science
Grade: 08
Expectations: 49
Breakouts: 181

(a) Introduction.

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 Statements

(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;

        (i) ask questions based on observations or information from text, phenomena, models, or investigations

        (ii) 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;

        (i) use scientific practices to plan descriptive investigations

        (ii) use scientific practices to conduct descriptive investigations

        (iii) use scientific practices to plan comparative investigations

        (iv) use scientific practices to conduct comparative investigations

        (v) use scientific practices to plan experimental investigations

        (vi) use scientific practices to conduct experimental investigations

        (vii) 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;

(i) use appropriate safety equipment during laboratory investigations as outlined in Texas Education Agency-approved safety standards

(ii) use appropriate safety equipment during classroom investigations as outlined in Texas Education Agency-approved safety standards

(iii) use appropriate safety equipment during field investigations as outlined in Texas Education Agency-approved safety standards

(iv) use appropriate safety practices during laboratory investigations as outlined in Texas Education Agency-approved safety standards

(v) use appropriate safety practices during classroom investigations as outlined in Texas Education Agency-approved safety standards

(vi) use appropriate safety practices during 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;

(i) use appropriate tools

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

(i) collect quantitative data using the International System of Units (SI) as evidence

(ii) collect qualitative data as evidence

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

(i) construct appropriate tables using repeated trials and means to organize data

(ii) construct appropriate graphs to organize data

(iii) construct appropriate maps to organize data

(iv) construct appropriate 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

(i) develop models to represent phenomena, systems, processes, or solutions to engineering problems

(ii) use models to represent phenomena, systems, processes, or solutions to engineering problems

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

(i) 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;

(i) identify advantages of models

(ii) identify limitations of models

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

(i) 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

(i) use mathematical calculations to assess quantitative relationships in data

(D) evaluate experimental and engineering designs.

(i) evaluate experimental designs

(ii) evaluate 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;

(i) develop explanations supported by data and consistent with scientific ideas

(ii) develop explanations supported by data and consistent with scientific principles

(iii) develop explanations supported by data and consistent with scientific theories

(iv) develop explanations supported by models and consistent with scientific ideas

(v) develop explanations supported by models and consistent with scientific principles

(vi) develop explanations supported by models and consistent with scientific theories

(vii) propose solutions supported by data and consistent with scientific ideas

(viii) propose solutions supported by data and consistent with scientific principles

(ix) propose solutions supported by data and consistent with scientific theories

(x) propose solutions supported by models and consistent with scientific ideas

(xi) propose solutions supported by models and consistent with scientific principles

(xii) propose solutions supported by models and consistent with scientific theories

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

(i) communicate explanations individually in a variety of settings

(ii) communicate explanations individually in a variety of formats

(iii) communicate explanations collaboratively in a variety of settings

(iv) communicate explanations collaboratively in a variety of formats

(v) communicate solutions individually in a variety of settings

(vi) communicate solutions individually in a variety of formats

(vii) communicate solutions collaboratively in a variety of settings

(viii) communicate solutions collaboratively in a variety of formats

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

(i) engage respectfully in scientific argumentation using applied scientific explanations

(ii) engage respectfully in scientific argumentation using 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;

(i) relate the impact of past research on scientific thought, including the process of science as related to the content

(ii) relate the impact of past research on scientific thought, including cost-benefit analysis as related to the content

(iii) relate the impact of past research on scientific thought, including contributions of diverse scientists as related to the content

(iv) relate the impact of past research on society, including the process of science as related to the content

(v) relate the impact of past research on society, including cost-benefit analysis as related to the content

(vi) relate the impact of past research on society, including contributions of diverse scientists as related to the content

(vii) relate the impact of current research on scientific thought, including the process of science as related to the content

(viii) relate the impact of current research on scientific thought, including cost-benefit analysis as related to the content

(ix) relate the impact of current research on scientific thought, including contributions of diverse scientists as related to the content

(x) relate the impact of current research on society, including the process of science as related to the content

(xi) relate the impact of current research on society, including cost-benefit analysis as related to the content

(xii) relate the impact of current research on society, including 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

(i) make informed decisions by evaluating evidence from multiple appropriate sources to assess the credibility

(ii) make informed decisions by evaluating evidence from multiple appropriate sources to assess the accuracy

(iii) make informed decisions by evaluating evidence from multiple appropriate sources to assess the cost-effectiveness

(iv) make informed decisions by evaluating evidence from multiple appropriate sources to assess the methods used

(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.

(i) research STEM careers

(ii) explore resources 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;

(i) identify patterns to understand scientific phenomena or to design solutions

(ii) identify patterns to connect scientific phenomena or to design solutions

(iii) apply patterns to understand scientific phenomena or to design solutions

(iv) apply patterns to connect scientific phenomena or to design solutions

(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;

(i) identify cause-and-effect relationships to explain scientific phenomena or analyze problems

(ii) 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;

(i) 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;

(i) examine the parts of a system

(ii) model the parts of a system

(iii) examine [the parts of a system's] interdependence in the function of the system

(iv) model [the parts of a system's] 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;

(i) analyze how energy flows through systems

(ii) analyze how matter cycles through systems

(iii) analyze how energy [is] conserved through a variety of systems

(iv) analyze how matter [is] conserved through a variety of systems

(v) explain how energy flows through systems

(vi) explain how matter cycles through systems

(vii) explain how energy [is] conserved through a variety of systems

(viii) explain how matter [is] conserved through a variety of systems

(F) analyze and explain the complementary relationship between the structure and function of objects, organisms, and systems; and

(i) analyze the complementary relationship between the structure and function of objects

(ii) analyze the complementary relationship between the structure and function of organisms

(iii) analyze the complementary relationship between the structure and function of systems

(iv) explain the complementary relationship between the structure and function of objects

(v) explain the complementary relationship between the structure and function of organisms

(vi) explain the complementary relationship between the structure and function of systems

(G) analyze and explain how factors or conditions impact stability and change in objects, organisms, and systems.

(i) analyze how factors or conditions impact stability in objects

(ii) analyze how factors or conditions impact stability in organisms

(iii) analyze how factors or conditions impact stability in systems

(iv) explain how factors or conditions impact stability in objects

(v) explain how factors or conditions impact stability in organisms

(vi) explain how factors or conditions impact stability in systems

(vii) analyze how factors or conditions impact change in objects

(viii) analyze how factors or conditions impact change in organisms

(ix) analyze how factors or conditions impact change in systems

(x) explain how factors or conditions impact change in objects

(xi) explain how factors or conditions impact change in organisms

(xii) explain how factors or conditions impact change in 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;

(i) 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;

(i) 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;

(i) describe the properties of cohesion in water

(ii) describe the properties of adhesion in water

(iii) describe the properties of surface tension in water

(iv) relate [cohesion] to observable phenomena

(v) relate [adhesion] to observable phenomena

(vi) relate [surface tension] to observable phenomena

(D) compare and contrast the properties of acids and bases, including pH relative to water; and

(i) compare and contrast the properties of acids and bases, including pH relative to water

(E) investigate how mass is conserved in chemical reactions and relate conservation of mass to the rearrangement of atoms using chemical equations, including photosynthesis.

(i) investigate how mass is conserved in chemical reactions

(ii) 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

(i) calculate 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

(ii) 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

(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.

(i) investigate how Newton's three laws of motion act simultaneously within systems

(ii) describe how Newton's three laws of motion act simultaneously within systems

(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

(i) compare the characteristics of amplitude, frequency, and wavelength in transverse waves, including the electromagnetic spectrum

(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.

(i) explain the use of electromagnetic waves in applications

(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;

(i) describe the life cycle of stars

(ii) compare stars using the Hertzsprung-Russell diagram

(iii) 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

(i) categorize galaxies as spiral

(ii) categorize galaxies as elliptical

(iii) categorize galaxies as irregular

(iv) locate Earth's solar system within the Milky Way galaxy

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

(i) research scientific data used as evidence to develop scientific theories that describe the origin of the universe

(ii) 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;

(i) describe how energy from the Sun influence[s] weather

(ii) describe how energy from the Sun influence[s] climate

(iii) describe how energy from the hydrosphere influence[s] weather

(iv) describe how energy from the hydrosphere influence[s] climate

(v) describe how energy from the atmosphere influence[s] weather

(vi) describe how energy from the atmosphere influence[s] climate

(vii) describe how energy from the Sun interacts[s with] weather

(viii) describe how energy from the Sun interact[s with] climate

(ix) describe how energy from the hydrosphere interacts[s with] weather

(x) describe how energy from the hydrosphere interact[s with] climate

(xi) describe how energy from the atmosphere interact[s with] weather

(xii) describe how energy from the atmosphere interact[s with] climate

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

(i) identify global patterns of atmospheric movement

(ii) identify how [global patterns of atmospheric movement] influence local weather

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

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

(ii) describe the interactions between ocean currents and air masses that produce tropical cyclones, including 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;

(i) use scientific evidence to describe how natural events, including volcanic eruptions influence climate

(ii) use scientific evidence to describe how natural events, including meteor impacts influence climate

(iii) use scientific evidence to describe how natural events, including abrupt changes in ocean currents influence climate

(iv) use scientific evidence to describe how natural events, including 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

(i) use scientific evidence to describe how human activities, including the release of greenhouse gases, can influence climate

(ii) use scientific evidence to describe how human activities, including deforestation, can influence climate

(iii) use scientific evidence to describe how human activities, including urbanization, can influence climate

(C) describe the carbon cycle.

(i) 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;

(i) explain how disruptions 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

(i) describe how primary ecological succession affect[s] populations after ecosystems are disrupted by natural events or human activity

(ii) describe how primary ecological succession affect[s] species diversity after ecosystems are disrupted by natural events or human activity

(iii) describe how secondary ecological succession affect[s] populations after ecosystems are disrupted by natural events or human activity

(iv) describe how secondary ecological succession affect[s] species diversity after ecosystems are disrupted by natural events or human activity

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

(i) describe how biodiversity contributes to the stability of an ecosystem

(ii) describe how biodiversity contributes to the sustainability of an ecosystem

(iii) describe how biodiversity contributes to 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;

(i) identify the function of the cell membrane in plant or animal cells

(ii) identify the function of the cell wall in plant or animal cells

(iii) identify the function of the nucleus in plant or animal cells

(iv) identify the function of the ribosomes in plant or animal cells

(v) identify the function of the cytoplasm in plant or animal cells

(vi) identify the function of the mitochondria in plant or animal cells

(vii) identify the function of the chloroplasts in plant or animal cells

(viii) identify the function of the vacuoles in plant or animal cells

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

(i) describe the function of genes within chromosomes in determining inherited traits of offspring

(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.

(i) describe how variations of traits within a population lead to structural adaptations that influence the likelihood of survival of a species over generations

(ii) describe how variations of traits within a population lead to behavioral adaptations that influence the likelihood of survival of a species over generations

(iii) describe how variations of traits within a population lead to physiological adaptations that influence the likelihood of survival of a species over generations

(iv) describe how variations of traits within a population lead to structural adaptations that influence the likelihood of reproductive success of a species over generations

(v) describe how variations of traits within a population lead to behavioral adaptations that influence the likelihood of reproductive success of a species over generations

(vi) describe how variations of traits within a population lead to physiological adaptations that influence the likelihood of reproductive success of a species over generations