Environmental Science Institute

The University of Texas at Austin

Science in the Movies: The Science Behind Stunts & Special Effects

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§112.2. Science, Kindergarten.

(a) Introduction.

(3) Science is a way of learning about the world.

(4) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(b) Knowledge and skills.

(1) Scientific processes. The student participates in investigations following safety procedures. The student is expected to:

(A) Demonstrate safe practices

(2) Scientific processes. The student develops abilities necessary to do scientific inquiry in the field and the classroom. The student is expected to:

(A) Ask questions about objects and events;

(C) Gather information using equipment and tools;

(D) Construct reasonable explanations using information; and

(E) Communicate findings.

(3) Scientific processes. The student knows that information and critical thinking are used in making decisions. The student is expected to:

(A) Make decisions using information;

(C) Explain a problem in his/her own words and propose a solution.

(5) Science concepts. The student knows that objects and events have properties and patterns. The student is expected to:

(A) Describe properties of objects;

(6) Science concepts. The student knows that systems have parts. The student is expected to:

(D) Identify parts that, when separated from the whole, may result in the part or the whole not working, such as cars without wheels; and

(E) Manipulate parts of objects such as toys, vehicles, or construction sets that, when put together, can do things they cannot do by themselves.

(7) Science concepts. The student knows that many types of change occur. The student is expected to:

(A) Observe, describe, and record changes in size, mass, color, position, quantity, time, temperature, sound, and movement;

(B) Identify that heat causes change, such as ice melting and compare objects according to temperature;

(8) Science concepts. The student knows the difference between living organisms and nonliving objects. The student is expected to:

(A) Identify a particular organism or object as living or nonliving; and

(B) Group organisms and objects as living or nonliving.

(9) Science concepts. The student knows that living organisms have basic needs. The student is expected to:

(A) Identify basic needs of living organisms;

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§112.3. Science, Grade 1.

(a) Introduction.

(2) Students observe that heat causes change.

Students identify parts that can be put together with other parts to do new things.

(3) Science is a way of learning about the world

(4) A system is a collection of cycles…

(5) Investigations are used to learn about the world…

(b) Knowledge and skills.

(1) Scientific processes. The student conducts investigations following safety procedures. The student is expected to:

(A) Demonstrate safe practices during investigations;

(2) Scientific processes. The student develops abilities necessary to do scientific inquiry in the field and the classroom. The student is expected to:

(A) ask questions about objects and events;

(B) plan and conduct descriptive investigations;

(C) gather information using equipment and tools to extend the senses;

(D) construct reasonable explanations and draw conclusions; and

(E) communicate explanations about investigations.

(3) Scientific processes. The student knows that information and critical thinking are used in making decisions. The student is expected to:

(A) make decisions using information;

(B) discuss and justify the merits of decisions; and

(C) explain a problem in his/her own words and identify a task and solution related to the problem.

(4) Scientific processes. The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured. The student is expected to:

(A) collect information using tools

(5) Science concepts. The student knows that organisms, objects, and events have properties and patterns. The student is expected to:

(A) sort objects and events based on properties and patterns; and

(6) Science concepts. The student knows that systems have parts and are composed of organisms and objects. The student is expected to:

(C) manipulate objects such as toys, vehicles, or construction sets so that the parts are separated from the whole which may result in the part or the whole not working; and

(D) identify parts that, when put together, can do things they cannot do by themselves, such as a working camera with film, a car moving with a motor, and an airplane flying with fuel.

(7) Science concepts. The student knows that many types of change occur. The student is expected to:

(A) observe, measure, and record changes in size, mass, color, position, quantity, sound, and movement;

(B) identify and test ways that heat may cause change such as when ice melts;

(8) Science concepts. The student distinguishes between living organisms and nonliving objects. The student is expected to:

(B) compare living organisms and nonliving objects.

(9) Science concepts. The student knows that living organisms have basic needs. The student is expected to:

(A) identify characteristics of living organisms that allow their basic needs to be met; and

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§112.4. Science, Grade 2.

(a) Introduction.

(1) In Grade 2, the study of science includes planning and conducting investigations to help students develop the skills of making measurements

using standard and non-standard units, using common tools such as rulers and clocks to collect information, classifying and sequencing objects and events, and identifying patterns. Students also use computers and information technology tools to support their investigations.

(2) As students learn science skills, they identify components and processes of the world including the water cycle and the use of resources. They observe melting and evaporation, weathering, and the pushing and pulling of objects as examples of change. Students distinguish between living organisms and nonliving objects.

(3) Science is a way of learning about the world.

(4) A system is a collection of cycles....

(5) Investigations are used to learn about the world...

(b) Knowledge and skills.

(1) Scientific processes.

(3) Scientific processes. The student knows that information and critical thinking are used in making decisions. The student is expected to:

(A) make decisions using information;

(C) explain a problem in his/her own words and identify a task and solution related to the problem.

(4) Scientific processes. The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured. The student is expected to:

(A) collect information using tools including rulers, meter sticks, measuring cups, clocks, hand lenses, computers, thermometers, and balances; and

(B) measure and compare organisms and objects and parts of organisms and objects, using standard and non-standard units.

(5) Science concepts. The student knows that organisms, objects, and events have properties and patterns. The student is expected to:

(A) classify and sequence organisms, objects, and events based on properties and patterns; and

(6) Science concepts. The student knows that systems have parts and are composed of organisms and objects. The student is expected to:

(A) manipulate, predict, and identify parts that, when separated from the whole, may result in the part or the whole not working, such as flashlights without batteries and plants without leaves;

(B) manipulate, predict, and identify parts that, when put together, can do things they cannot do by themselves, such as a guitar and guitar strings;

(7) Science concepts. The student knows that many types of change occur. The student is expected to:

(A) observe, measure, record, analyze, predict, and illustrate changes in size, mass, temperature, color, position, quantity, sound, and movement;

(B) identify, predict, and test uses of heat to cause change such as melting and evaporation;

(C) demonstrate a change in the motion of an object by giving the object a push or a pull; and

(8) Science concepts. The student distinguishes between living organisms and nonliving objects.

(9) Science concepts. The student knows that living organisms have basic needs.

(10) Science concepts. The student knows that the world includes gases of the atmosphere.

§112.5. Science, Grade 3.

(a) Introduction.

(1) In Grade 3, the study of science includes planning and implementing investigations to develop the skills of collecting information using tools such as a microscope, making inferences, communicating conclusions, and making informed decisions. Students also use computers and information technology tools to support scientific investigations.

(2) As students learn science skills, they identify the importance of components of the world including rocks, soils, water, and atmospheric gases. They observe the direction and position of objects as they are pushed and pulled, and movement of the Earth's surface as examples of change caused by a force. Students investigate magnetism and gravity. In addition, students explore organisms' needs, habitats, and competition with other organisms within their ecosystem.

(3) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models.

(4) A system is a collection of cycles…

(5) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work.

(b) Knowledge and skills.

(1) Scientific processes. The student conducts investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific inquiry methods during investigations. The student is expected to:

(A) plan and implement descriptive investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect information by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions; and

(3) Scientific processes. The student knows that information, critical thinking, and scientific problem solving are used in making decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on information related to promotional materials for products and services;

(E) connect Grade 3 science concepts with the history of science and contributions of scientists.

(4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

(A) collect and analyze information using tools including calculators, microscopes, cameras, safety goggles, sound recorders, clocks, computers, thermometers, hand lenses, meter sticks, rulers, balances, magnets, and compasses; and

(5) Science concepts. The student knows that systems exist in the world. The student is expected to:

(A) observe and identify systems such as a sprouted seed and a wooden toy car; and

(B) observe a system and describe the role of various parts such as a yo-yo and string.

(6) Science concepts. The student knows that forces cause change. The student is expected to:

(A) measure and record changes in the position and direction of the motion of an object to which a force such as a push or pull has been applied; and

(7) Science concepts. The student knows that matter has physical properties. The student is expected to:

(A) gather information including temperature, magnetism, hardness, and mass using appropriate tools to identify physical properties of matter; and

(B) identify matter as liquids, solids, and gases.

(8) Science concepts. The student knows that living organisms need air.

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§112.6. Science, Grade 4.

(a) Introduction.

(1) In Grade 4, the study of science includes planning and implementing investigations using scientific methods, analyzing information, making informed decisions, and using tools such as compasses to collect information. Students also use computers and information technology tools to support scientific investigations.

(2) As students learn science skills, they identify components and processes of the world including physical properties of matter and observe the addition or reduction of heat as an example of what can cause changes in states of matter.

(3) Students learn the roles of living and nonliving components of systems.

(4) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models.

(5) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(6) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(b) Knowledge and skills.

(1) Scientific processes. The student conducts investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific inquiry methods during investigations. The student is expected to:

(A) plan and implement descriptive investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect information by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions; and

(E) construct graphs, tables, maps, and charts to organize, examine, and evaluate information.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on information related to promotional materials for products and services;

(C) represent the world using models and identify their limitations;

(D) evaluate the impact of research on scientific thought, society, and the environment; and

(E) connect Grade 4 science concepts with the history of science and contributions of scientists.

(4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

(A) collect and analyze information using tools including calculators, safety goggles, microscopes, cameras, sound recorders,

computers, hand lenses, rulers, thermometers, meter sticks, timing devices, balances, and compasses; and

(B) demonstrate that repeated investigations may increase the reliability of results.

(5) Science concepts. The student knows that complex systems may not work if some parts are removed. The student is expected to:

(A) identify and describe the roles of some organisms in living systems such as plants in a schoolyard, and parts in nonliving systems such as a light bulb in a circuit; and

(B) predict and draw conclusions about what happens when part of a system is removed.

(7) Science concepts. The student knows that matter has physical properties. The student is expected to:

(A) observe and record changes in the states of matter caused by the addition or reduction of heat; and

(B) conduct tests, compare data, and draw conclusions about physical properties of matter including states of matter, conduction, density, and buoyancy.

§112.7. Science, Grade 5.

(a) Introduction.

(1) In Grade 5, the study of science includes planning and implementing investigations using scientific methods, analyzing information, making informed decisions, and using tools such as nets and cameras to collect and record information. Students also use computers and information technology tools to support scientific investigations.

(2) Students learn about magnetism, physical states of matter, and conductivity as properties that are used to classify matter. In addition, students learn that light, heat, and electricity are all forms of energy.

(4) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models,.

(5) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components

and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(6) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(b) Knowledge and skills.

(1) Scientific processes. The student conducts investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific methods during investigations. The student is expected to:

(A) plan and implement descriptive and experimental investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect information by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions; and

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on information related to promotional materials for products and services;

(E) connect Grade 5 science concepts with the history of science and contributions of scientists.

(4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

(A) collect and analyze information using tools including calculators, microscopes, cameras, sound recorders, computers, hand lenses, rulers, thermometers, compasses, balances, hot plates, meter sticks, timing devices, magnets, collecting nets, and safety goggles; and

(5) Science concepts. The student knows that a system is a collection of cycles, structures, and processes that interact. The student is expected to:

(A) describe some cycles, structures, and processes that are found in a system; and

(B) describe some interactions that occur in a system.

(7) Science concepts. The student knows that matter has physical properties. The student is expected to:

(A) classify matter based on its physical properties including magnetism, physical state, and the ability to conduct or insulate heat, electricity, and sound;

(B) demonstrate that some mixtures maintain the physical properties of their ingredients;

(C) identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving sugar in water; and

(D) observe and measure characteristic properties of substances that remain constant such as boiling points and melting points.

(8) Science concepts. The student knows that energy occurs in many forms. The student is expected to:

(A) differentiate among forms of energy including light, heat, electrical, and solar energy;

(B) identify and demonstrate everyday examples of how light is reflected, such as from tinted windows, and refracted, such as in cameras, telescopes, and eyeglasses;

(C) demonstrate that electricity can flow in a circuit and can produce heat, light, sound, and magnetic effects; and

(D) verify that vibrating an object can produce sound.

§112.21. Implementation of Texas Essential Knowledge and Skills for Science, Middle School.

§112.22. Science, Grade 6.

(a) Introduction.

(1) In Grade 6, the study of science includes conducting investigations using scientific methods, analyzing data, making informed decisions, and using tools such as beakers, test tubes, and spring scales to collect, analyze, and record information. Students also use computers and information technology tools to support scientific investigations.

(3) Students classify substances by their chemical properties.

(4) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models.

(5) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(6) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(b) Knowledge and skills.

(1) Scientific processes. The student conducts investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific inquiry methods during investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect data by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions; and

(E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on data related to promotional materials for products and services;

(C) represent the world using models and identify their limitations;

(D) evaluate the impact of research on scientific thought, society, and the environment; and

(E) connect Grade 6 science concepts with the history of science and contributions of scientists.

(4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

(A) collect, analyze, and record information using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, timing devices, hot plates, test tubes, safety goggles, spring scales, magnets, balances, microscopes, telescopes, thermometers, calculators, field equipment, compasses, computers, and computer probes; and

(B) identify patterns in collected information using percent, average, range, and frequency.

(5) Scientific concepts. The student knows that systems may combine with other systems to form a larger system. The student is expected to:

(A) identify and describe a system that results from the combination of two or more systems such as in the solar system; and

(B) describe how the properties of a system are different from the properties of its parts.

(6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:

(A) identify and describe the changes in position, direction of motion, and speed of an object when acted upon by force;

(B) demonstrate that changes in motion can be measured and graphically represented; and

(7) Science concepts. The student knows that substances have physical and chemical properties. The student is expected to:

(A) demonstrate that new substances can be made when two or more substances are chemically combined and compare the properties of the new substances to the original substances; and

(B) classify substances by their physical and chemical properties.

(8) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:

(A) define matter and energy;

(9) Science concepts. The student knows that obtaining, transforming, and distributing energy affects the environment. The student is expected to:

(A) identify energy transformations occurring during the production of energy for human use such as electrical energy to heat energy or heat energy to electrical energy;

§112.23. Science, Grade 7.

(a) Introduction.

(1) In Grade 7, the study of science includes conducting investigations using scientific methods, critical-thinking, problem-solving, and using tools such as weather instruments and calculators to collect and analyze information to explain a phenomenon. Students also use computers and information technology tools to support scientific investigations.

(2) As students learn science skills, they identify gravity and phases of the moon as components of the solar system and explore the effects of events such as hurricanes on the Earth. Students use pulleys and levers to understand the relationship between force and motion. In addition, students study chemical and physical properties of substances by examining the tarnishing of metal or burning of wood as examples of chemical processes, and by identifying physical properties used to place elements on the periodic table.

(3) Students learn about kinetic and potential energy.

(4) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.

(5) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(6) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(b) Knowledge and skills.

(1) Scientific processes. The student conducts investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific inquiry methods during investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect data by observing and measuring;

(C) organize, analyze, make inferences, and predict trends from direct and indirect evidence;

(D) communicate valid conclusions; and

(E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on data related to promotional materials for products and services;

(C) represent the world using models and identify their limitations;

(D) evaluate the impact of research on scientific thought, society, and the environment; and

(F) connect Grade 7 science concepts with the history of science and contributions of scientists.

(4) Scientific processes. The student knows how to use tools and methods to conduct science inquiry. The student is expected to:

(A) collect, analyze, and record information to explain a phenomenon using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, timing devices, magnets, and compasses; and

(B) collect and analyze information to recognize patterns such as rates of change.

(5) Science concepts. The student knows that an equilibrium of a system may change. The student is expected to:

(A) describe how systems may reach an equilibrium such as when a volcano erupts; and

(6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:

(A) demonstrate basic relationships between force and motion using machines including pulleys and levers;

(B) demonstrate that an object will remain at rest or move at a constant speed and in a straight line if it is not being subjected to an unbalanced force; and

(7) Science concepts. The student knows that substances have physical and chemical properties. The student is expected to:

(A) identify and demonstrate everyday examples of chemical phenomena such as rusting and tarnishing of metals and burning of wood;

(B) describe physical properties of

(C) recognize that compounds are composed of elements.

(8) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:

(A) illustrate examples of potential and kinetic energy in everyday life

§112.24. Science, Grade 8.

(a) Introduction.

(1) In Grade 8, the study of science includes planning and conducting investigations using scientific methods, analyzing data, critical-thinking, scientific problem-solving, and using tools such as telescopes to collect and analyze information. Students also use computers and information technology tools to support scientific investigations.

(2) As students learn science skills, they identify the roles of both human activities and natural events in altering Earth systems. Students learn that stars and galaxies are part of the universe, identify light years as a way to describe distance, and learn about scientific theories of the origin of the universe. Cycles within Earth systems are studied as students learn about lunar cycles and the rock cycle.

(3) Students demonstrate that exothermic and endothermic chemical reactions indicate that energy is lost or gained during a chemical reaction. Interactions in matter and energy are explored in solar, weather, and ocean systems. Students identify the origin of waves and investigate their ability to travel through different media.

(5) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.

(6) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(7) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(b) Knowledge and skills.

(1) Scientific processes. The student conducts investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific inquiry methods during investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect data by observing and measuring;

(C) organize, analyze, evaluate, make inferences, and predict trends from direct and indirect evidence;

(D) communicate valid conclusions; and

(E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on data related to promotional materials for products and services;

(C) represent the world using models and identify their limitations;

(D) evaluate the impact of research on scientific thought, society, and the environment; and

(E) connect Grade 8 science concepts with the history of science and contributions of scientists.

(4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

(A) collect, record, and analyze information using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, water test kits, and timing devices; and

(B) extrapolate from collected information to make predictions.

(5) Scientific processes. The student knows that relationships exist between science and technology. The student is expected to:

(A) identify a design problem and propose a solution;

(7) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:

(A) demonstrate how unbalanced forces cause changes in the speed or direction of an object's motion; and

(B) recognize that waves are generated and can travel through different media.

(8) Science concepts. The student knows that matter is composed of atoms. The student is expected to:

(A) describe the structure and parts of an atom; and

(B) identify the properties of an atom including mass and electrical charge.

(9) Science concepts. The student knows that substances have chemical and physical properties. The student is expected to:

(A) demonstrate that substances may react chemically to form new substances;

(C) recognize the importance of formulas and equations to express what happens in a chemical reaction; and

(D) identify that physical and chemical properties influence the development and application of everyday materials such as cooking surfaces, insulation, adhesives, and plastics.

(10) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:

(A) illustrate interactions between matter and energy including specific heat;

(C) identify and demonstrate that loss or gain of heat energy occurs during exothermic and endothermic chemical reactions.

§112.42. Integrated Physics and Chemistry.

(b) Introduction.

(1) In Integrated Physics and Chemistry, students conduct investigations, use scientific methods during investigations, and make informed decisions using critical-thinking and scientific problem-solving. This course integrates the disciplines of physics and chemistry in the following topics: motion, waves, energy transformations, properties of matter, changes in matter, and solution chemistry.

(2) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.

(3) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(4) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(c) Knowledge and skills.

(1) Scientific processes. The student, for at least 40% of instructional time, conducts investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific methods during investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(B) collect data and make measurements with precision;

(C) organize, analyze, evaluate, make inferences, and predict trends from data; and

(D) communicate valid conclusions.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on data related to promotional materials for products and services;

(C) evaluate the impact of research on scientific thought, society, and the environment;

(D) describe connections between physics and chemistry, and future careers; and

(4) Science concepts. The student knows concepts of force and motion evident in everyday life. The student is expected to:

(A) calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines;

(B) investigate and describe applications of Newton's laws such as in vehicle restraints, sports activities, geological processes, and satellite orbits;

(C) analyze the effects caused by changing force or distance in machines as demonstrated in household devices, the human body, and vehicles; and

(D) investigate and demonstrate mechanical advantage and efficiency of various machines such as levers, motors, wheels and axles, pulleys, and ramps.

(5) Science concepts. The student knows the effects of waves on everyday life. The student is expected to:

(A) demonstrate wave types and their characteristics through a variety of activities such as modeling with ropes and coils;

(6) Science concepts. The student knows the impact of energy transformations in everyday life. The student is expected to:

(A) describe the law of conservation of energy;

(B) investigate and demonstrate the movement of heat through solids, liquids, and gases by convection, conduction, and radiation;

(E) measure the thermal and electrical conductivity of various materials and explain results;

(F) investigate and compare series and parallel circuits;

(7) Science concepts. The student knows relationships exist between properties of matter and its components. The student is expected to:

(A) investigate and identify properties of fluids including density, viscosity, and buoyancy;

(E) classify samples of matter from everyday life as being elements, compounds, or mixtures.

(8) Science concepts. The student knows that changes in matter affect everyday life. The student is expected to:

(A) distinguish between physical and chemical changes in matter such as oxidation, changes in states

(B) analyze energy changes that accompany chemical reactions such as those occurring in heat packs, cold packs, and glow sticks to classify them as endergonic or exergonic reactions;

(C) investigate and identify the law of conservation of mass;

(9) Science concepts. The student knows how solution chemistry is a part of everyday life. The student is expected to:

(E) demonstrate how factors such as particle size, influence the rate of dissolving.

§112.45. Chemistry.

(a) General requirements. Students shall be awarded one credit for successful completion of this course. Suggested prerequisites: one unit of high school science, Algebra I, and completion of or concurrent enrollment in a second year of math. This course is recommended for students in Grades 10, 11, or 12.

(b) Introduction.

(1) In Chemistry, students conduct investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of topics that include: characteristics of matter; energy transformations during physical and chemical changes; atomic structure; periodic table of elements; behavior of gases; bonding; nuclear fusion and nuclear fission; oxidation-reduction reactions; chemical equations; solutes; properties of solutions; acids and bases; and chemical reactions. Students will investigate how chemistry is an integral part of our daily lives.

(2) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.

(3) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(4) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(c) Knowledge and skills.

(1) Scientific processes. The student, for at least 40% of instructional time, conducts investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during investigations; and

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific methods during investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(B) collect data and make measurements with precision;

(C) express and manipulate chemical quantities using scientific conventions and mathematical procedures such as dimensional analysis, scientific notation, and significant figures;

(D) organize, analyze, evaluate, make inferences, and predict trends from data; and

(E) communicate valid conclusions.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(D) describe the connection between chemistry and future careers; and

(E) research and describe the history of chemistry and contributions of scientists.

(4) Science concepts. The student knows the characteristics of matter. The student is expected to:

(A) differentiate between physical and chemical properties of matter;

(B) analyze examples of solids, liquids, and gases to determine their compressibility, structure, motion of particles, shape, and volume;

(5) Science concepts. The student knows that energy transformations occur during physical or chemical changes in matter. The student is expected to:

(A) identify changes in matter, determine the nature of the change, and examine the forms of energy involved;

(B) identify and measure energy transformations and exchanges involved in chemical reactions; and

(C) measure the effects of the gain or loss of heat energy on the properties of solids, liquids, and gases.

(7) Science concepts. The student knows the variables that influence the behavior of gases. The student is expected to:

(A) describe interrelationships among temperature, particle number, pressure, and volume of gases contained within a closed system; and

(B) illustrate the data obtained from investigations with gases in a closed system and determine if the data are consistent with the Universal Gas Law.

(9) Science concepts. The student knows the processes, effects, and significance of nuclear fission and nuclear fusion. The student is expected to:

(11) Science concepts. The student knows that balanced chemical equations are used to interpret and describe the interactions of matter. The student is expected to:

(B) demonstrate the use of symbols, formulas, and equations in describing interactions of matter such as chemical and nuclear reactions; and

(12) Science concepts. The student knows the factors that influence the solubility of solutes in a solvent. The student is expected to:

(A) demonstrate and explain effects of temperature and the nature of solid solutes on the solubility of solids;

(15) Science concepts. The student knows factors involved in chemical reactions. The student is expected to:

(A) verify the law of conservation of energy by evaluating the energy exchange that occurs as a consequence of a chemical reaction; and

§112.47. Physics.

(b) Introduction.

(1) In Physics, students conduct investigations, use scientific methods 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; force; thermodynamics; characteristics and behavior of waves; and quantum physics.

(2) Science is a way of learning about the world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models.

(3) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(4) Investigations are used to learn about the world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the world.

(c) Knowledge and skills.

(1) Scientific processes. The student, for at least 40% of instructional time, conducts investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific methods during investigations. The student is expected to:

(A) plan and implement experimental procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(B) make quantitative observations and measurements with precision;

(C) organize, analyze, evaluate, make inferences, and predict trends from data;

(D) communicate valid conclusions;

(E) graph data to observe and identify relationships between variables; and

(F) read scales on scientific instruments with precision.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) express laws symbolically and employ mathematical procedures including vector addition and right-triangle geometry to solve physical problems;

(D) describe the connection between physics and future careers; and

(E) research and describe the history of physics and contributions of scientists.

(4) Science concepts. The student knows the laws governing motion. The student is expected to:

(B) analyze examples of uniform and accelerated motion including linear, projectile, and circular;

(C) demonstrate the effects of forces on the motion of objects;

(E) identify and describe motion relative to different frames of reference.

(5) Science concepts. The student knows that changes occur within a physical system and recognizes that energy and momentum are conserved. The student is expected to:

(A) interpret evidence for the work-energy theorem;

(B) observe and describe examples of kinetic and potential energy and their transformations;

(D) demonstrate the conservation of energy and momentum.

(6) Science concepts. The student knows forces in nature. The student is expected to:

(A) identify the influence of mass and distance on gravitational forces;

(C) identify and analyze the influences of charge and distance on electric forces;

(D) demonstrate the relationship between electricity and magnetism;

(E) design and analyze electric circuits; and

(F) identify examples of electrical and magnetic forces in everyday life.

(7) Science concepts. The student knows the laws of thermodynamics. The student is expected to:

(8) Science concepts. The student knows the characteristics and behavior of waves.