

Topic: Energy

Days: 25

Subject(s): Science

Grade(s): 9th

3.4.10.B - Essential

Analyze energy sources and transfers of heat.

- Determine the efficiency of chemical systems by applying mathematical formulas.
- Use knowledge of chemical reactions to generate an electrical current.
- Evaluate energy changes in chemical reactions.
- Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion).
- Explain resistance, current and electro-motive force (Ohm's Law).

S11.C.2.2.2 - Important

Explain the practical use of alternative sources of energy (i.e., wind, solar, and biomass) to address environmental problems (e.g., air quality, erosion, resource depletion).

S11.C.2.1.1 - Important

Compare or analyze different types of waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, x-rays, microwaves) as it relates to their properties, energy levels, and motion.

S11.C.2.1.3 - Important

Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration system, rocket propulsion, heat pump).

S11.C.2.1.4 - Important

Use Ohm's Law to explain resistance, current and electro-motive forces.

S11.C.3.1.4 - Compact

Describe electricity and magnetism as two aspects of a single electromagnetic force.

Topic: Forces and Motion

Days: 50

Subject(s): Science

Grade(s): 9th

3.1.10.E - Important

Describe patterns of change in nature, physical and man made systems.

- Describe how fundamental science and technology concepts are used to solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, feedback systems).
- Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously).
- Describe the effects of error in measurements.
- Describe changes to matter caused by heat, cold, light or chemicals using a rate function.

3.4.10.A - Essential

Explain concepts about the structure and properties of matter.

- Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable.
- Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table.
- Predict the behavior of gases through the use of Boyle's, Charles' or the ideal gas law, in everyday situations.
- Describe phases of matter according to the Kinetic Molecular Theory.
- Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).
- Recognize formulas for simple inorganic compounds.
- Describe various types of chemical reactions by applying the laws of conservation of mass and energy.
- Apply knowledge of mixtures to appropriate separation techniques.
- Understand that carbon can form several types of compounds.

3.4.10.C - Essential

Distinguish among the principles of force and motion.

- Identify the relationship of electricity and magnetism as two aspects of a single electromagnetic force.
- Identify elements of simple machines in compound machines.
- Explain fluid power systems through the design and construction of appropriate models.
- Describe sound effects (e.g., Doppler effect, amplitude, frequency, reflection, refraction, absorption, sonar, seismic).
- Describe light effects (e.g., Doppler effect, dispersion, absorption, emission spectra, polarization, interference).
- Describe and measure the motion of sound, light and other objects.
- Know Newton's laws of motion (including inertia, action and reaction) and gravity and apply them to solve problems related to forces and mass.
- Determine the efficiency of mechanical systems by applying mathematical formulas.

S11.C.3.1.1 - Essential

Explain common phenomena (e.g., motion of bowling ball, a rock in a landslide, an astronaut during a space walk, a car hitting a patch of ice on the road) using an understanding of conservation of momentum.

S11.C.3.1.2 - Essential

Design or evaluate simple technological or natural systems that incorporate the principles of force and motion (e.g., simple and compound machines).

S11.C.3.1.3 - Essential

Explain that acceleration is the rate at which the velocity of an object is changing.

S11.C.3.1.5 - Essential

Calculate the mechanical advantage of moving an object using a simple machine.

S11.C.3.1.6 - Essential

Identify elements of simple machines in compound machines.

Topic: Introduction to Chemistry

Days: 74

Subject(s): Science

Grade(s): 9th

3.1.10.C - Compact

Apply patterns as repeated processes or recurring elements in science and technology.

- Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.
- Examine and describe stationary physical patterns.
- Examine and describe physical patterns in motion.

3.4.10.A - Essential

Explain concepts about the structure and properties of matter.

- Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable.
- Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table.
- Predict the behavior of gases through the use of Boyle's, Charles' or the ideal gas law, in everyday situations.
- Describe phases of matter according to the Kinetic Molecular Theory.
- Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).
- Recognize formulas for simple inorganic compounds.
- Describe various types of chemical reactions by applying the laws of conservation of mass and energy.
- Apply knowledge of mixtures to appropriate separation techniques.
- Understand that carbon can form several types of compounds.

S11.C.1.1.1 - Essential

Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., proton, neutrons, electrons).

S11.C.1.1.2 - Important

Explain the relationship between the physical properties of a substance and its molecular or atomic structure.

S11.C.1.1.3 - Essential

Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).

S11.C.1.1.4 - Compact

Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.

Topic: The Nature of Science

Days: 20

Subject(s): Science

Grade(s): 9th

3.1.10.A - Important

Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.

- Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).
- Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.
- Explain the concept of system redesign and apply it to improve technological systems.
- Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.
- Analyze and describe the effectiveness of systems to solve specific problems.

3.2.10.A - Important

Apply knowledge and understanding about the nature of scientific and technological knowledge.

- Compare and contrast scientific theories and beliefs.
- Know that science uses both direct and indirect observation means to study the world and the universe.
- Integrate new information into existing theories and explain implied results.

3.2.10.B - Essential

Apply process knowledge and organize scientific and technological phenomena in varied ways.

- Describe materials using precise quantitative and qualitative skills based on observations.
- Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.
- Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.

3.2.10.C - Essential

Apply the elements of scientific inquiry to solve problems.

- Generate questions about objects, organisms and/or events that can be answered through scientific investigations.
- Evaluate the appropriateness of questions.
- Design an investigation with adequate control and limited variables to investigate a question.
- Conduct a multiple step experiment.
- Organize experimental information using a variety of analytic methods.
- Judge the significance of experimental information in answering the question.
- Suggest additional steps that might be done experimentally.

3.2.10.D - Important

Identify and apply the technological design process to solve problems.

- Examine the problem, rank all necessary information and all questions that must be answered.
- Propose and analyze a solution.
- Implement the solution.
- Evaluate the solution, test, redesign and improve as necessary.
- Communicate the process and evaluate and present the impacts of the solution.

S11.A.1.1.1 - Essential

Compare and contrast scientific theories, scientific laws, and beliefs (e.g., the law of gravity, how light travels, formation of moons, stages of ecological succession).

S11.A.2.1.1 - Important

Use evidence, observations, or a variety of scales (e.g., time, mass, distance, volume, temperature) to describe relationships.

S11.A.3.1.3 - Important

Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).