8th Grade Physical Science Learning Targets

Matter and Its Interactions

1. Analyze patterns within the periodic table to construct models that illustrate the structure, composition, and characteristics of atoms, molecules, and ionic compounds.

a) I can identify the charge, relative mass, and significance of protons, neutrons, and electrons in an atom.

b) I can analyze the location of an element on the periodic table to determine the number of protons, neutrons, and electrons, and valence electrons in an atom.

c) I can classify elements as metals, nonmetals, or metalloids.

d) I can predict which elements on the periodic table will form either ionic or covalent bonds.

e) I can create a Lewis structure to demonstrate the role of valence electrons in the formation of covalent and ionic bonds.

f) I can differentiate among atoms, molecules and ionic compounds.

g) I can evaluate the chemical and physical properties of families of the periodic table.

2. Plan and carry out investigations to generate evidence supporting the claim that one pure substance can be distinguished from another based on characteristic properties.

a) I can investigate characteristic properties, and use evidence and reasoning to identify a substance.

b) I can interpret a phase change graph and evaluate the melting point and boiling point of various unknown substances to make predictions about its identity.

c) I can recognize a pure substance as a substance that cannot be separated physically.

d) I can distinguish between an element and a compound.

e) I can perform an investigation to separate a compound chemically.

f) I can evaluate characteristic properties of various pure substances, including density, melting point, boiling point, and solubility.

g) I can construct graphs to illustrate characteristic properties (ex. mass v. volume).

h) investigate the solubility of various solutes - solubility as a characteristic property that varies with temperature.

i) I can analyze and interpret data on characteristic properties of substances (e.g., odor, density, solubility, flammability, melting point, boiling point) before and after the substances combine to determine if a chemical reaction has occurred.

3. Construct explanations based on evidence from investigations to differentiate between pure substances and mixtures.

a) I can classify mixtures as homogeneous or heterogeneous.

b) I can compare and contrast the three types of mixtures: solutions, colloids and suspensions.

c) I can identify the parts of a solution: solute and solvent.

d) I can utilize a variety of physical means to separate a mixture into its component parts

e) I can investigate various physical properties (such as particle size, texture, distribution) to categorize unknown substances according to mixture type.

f) I can collect and analyze information to illustrate how synthetic materials (e.g., medicine, food additives, alternative fuels, and plastics) are derived from natural resources and how they impact society.

4. Design and conduct an experiment to determine changes in particle motion, temperature, and state of a pure substance when thermal energy is added to or removed from a system.

a) I can interpret a phase change graph (temperature v. time) and explain how the transfer of energy to a substance affects its kinetic and potential energy.

b) I can distinguish between heat and temperature.

c) I can apply concepts of the transfer of thermal energy that takes place when two substances with different temperatures come in contact with one another.

d) I can compare the Celsius (SI), Kelvin (SI), and Fahrenheit temperature scales and determine the temperature for melting and boiling points of water, room temperature, body temperature, and absolute zero for each scale.

e) I can model the three states of matter (particles and their arrangement and motion), compare their densities and amount of energy, and classify their shape and volume.

f) I can investigate, describe and give examples of boiling, melting, freezing, condensation, evaporation, sublimation and deposition, and classify each as endothermic or exothermic.

5. Create a model, diagram, or digital simulation to describe conservation of mass in a chemical reaction and explain the resulting differences between products and reactants.

a) I can distinguish between an atom and a molecule.

b) I can predict how an atom of that element will interact with an atom of another element (e.g., what types of bond(s) will it form?).

c) I can construct a model to illustrate how an atom of the element bonds with other atoms of other elements (using Lewis dot structures).

d) I can determine the number of atoms in a molecule or an ionic compound.

e) I can determine the number of molecules in a chemical formula.

f) I can determine and compare the total number of atoms in the reactants of a chemical reaction to the total number of atoms in the products.

g) I can compare and contrast the properties of the reactants and products.

h) I can compare what happens to substances (and their atoms) in a chemical reaction to what happens to substances (and their atoms) in a physical change.

i) I can explain why a chemical equation must be balanced, and why this must be done using coefficients, not subscripts.

j) I can balance a chemical equation using coefficients.

k) I can investigate chemical reactions and draw conclusions about the properties of the reactants and the products. (ex: electrolysis of water, ionic vs. covalent bond lab)

l) I can construct an explanation based on evidence to describe the properties of ionic and covalent compounds.

m) I can use evidence from the Conservation of Mass lab (Alka-Seltzer) to support the claim that chemical equations must be balanced.

n) I can design, construct, and test a device that either releases or absorbs thermal energy by chemical reactions .

Motion and Stability: Forces and Interactions

6. Use Newton's first law to demonstrate and explain that an object is either at rest or moves at a constant velocity unless acted upon by a net force (e.g., model car on a table remaining at rest until pushed).

a) I can design and carry out investigations to determine the effects of various conditions on forces by manipulating one variable at a time. (e.g., weight and friction, stretching distance and elastic force, mass and weight…)

b) I can describe harmful and helpful examples of friction.

c) I can analyze a physical scenario and determine the forces acting upon the object and make predictions about the object's motion.

d) I can determine the net force acting on an object and evaluate whether they are balanced or unbalanced.

e) I can define inertia and state Newton's first law.

f) I can distinguish between the concepts of mass and weight.

g) I can relate an object's mass to its inertia.

h) I can explain how an object can be in motion with NO forces acting on it.

i) I can apply Newton's first law to the importance of wearing a seat belt.

7. Use Newton's second law to demonstrate and explain how changes in an object's motion depend on the sum of the external forces on the object and the mass of the object.

a) I can distinguish between speed, velocity, and acceleration (including definitions, formulas, and units).

b) I can solve for speed, velocity, and acceleration when given appropriate information.

c) I can use dimensional analysis to solve for time or distance in a speed problem.

d) I can calculate the acceleration of an object.

e) I can calculate the magnitude of an individual force and resulting net forces.

f) I can interpret a distance or position v. time graph.

g) I can create a distance or position v. time graph and use it to analyze the motion of an object.

h) I can interpret a speed or velocity v. time graph.

i) I can create a speed or velocity v. time graph and use it to analyze the motion of an object.

j) I can utilize Newton's second law equation to algebraically solve for an unknown quantity - acceleration, net force, or mass.

k) I can identify the forces acting upon an object and relate the net force of an object to the acceleration of the object.

l) I can plan and carry out investigations to evaluate how various factors affect the strength of electric and magnetic forces.

m) I can construct an argument from evidence explaining that fields exist between objects exerting forces on each other even when the objects are not in contact.

n) I can draw and interpret a model of the forces acting on an object in various situations (e.g. free fall, terminal velocity…).

8. Use Newton's third law to design a model to demonstrate and explain the resulting motion of two colliding objects.

a) I can identify action-reaction force pairs for any physical situation.

b) I can compare the magnitudes of action-reaction force pairs and describe the effect (and the non-effect) of action-reaction force pairs on the two interacting objects.

Energy

9. Use models to construct an explanation of how a system of objects may contain varying types and amounts of potential energy.

a) I can differentiate types of potential energy such as gravitational and elastic potential energy.

b) I can determine the relative amounts of potential energy stored in the system based on the arrangement of objects.

10. Apply the law of conservation of energy to develop arguments supporting the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

a) I can create and analyze graphical displays of data to illustrate the relationships of kinetic energy to the mass and speed of an object.

b) I can analyze data from investigations to determine factors that affect the amount of kinetic energy.

c) I can construct and interpret a graph to demonstrate the relationship between kinetic energy and mass.

d) I can construct and interpret a graph to demonstrate the relationship between kinetic energy and speed.

Waves and Their Applications in Technologies for Information Transfer

11. Create and manipulate a simple model for waves.

a) I can describe waves both qualitatively and quantitatively.

b) I can predict and describe how the amplitude, frequency and wavelength of a wave is related to the energy in a wave.

c) I can analyze and interpret data to illustrate an electromagnetic spectrum.

d) I can develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.

e) I can integrate qualitative information to explain that common communication devices use electromagnetic waves to encode and transmit information.