Oakwood City School District Physical Science Standards

One goal of science education is to help students become scientifically literate citizens able to use science as a way of knowing about the natural and material world. All students should have sufficient understanding of scientific knowledge and scientific processes to enable them to distinguish what is science from what is not science and to make informed decisions about career choices, health maintenance, quality of life, community and other decisions that impact both themselves and others.

Physical science is a high school level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires three units of science. Each course should include inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

Physical science introduces students to key concepts and theories that provide a foundation for further study in other sciences and advanced science disciplines. Physical science comprises the systematic study of the physical world as it relates to fundamental concepts about matter, energy and motion. A unified understanding of phenomena in physical, living, Earth and space systems is the culmination of all previously learned concepts related to chemistry, physics, and Earth and space science, along with historical perspective and mathematical reasoning.

Physical Science Standards

Study of Matter

A. Properties of matter
   a. Identify and classify different types of matter including pure substance and mixtures.
   b. Examine the pH scale and properties of acids and bases.
   c. Explore the properties of matter.
   d. Calculate densities for a variety of objects both regular and irregular shaped.

B. Atoms
   a. Describe the location, charge, and relative size of a proton, neutron, and electron.
   b. Use information from the periodic table to calculate numbers of protons, neutrons and electrons for an element.
   c. Model electrons utilizing the Bohr model.
   d. Explain the importance of valence electrons.
   e. Differentiate between cations and anions.
   f. Define isotope and provide an example.

C. Periodic trends of the elements
   a. Using the periodic table and/or electron dot diagrams, identify the ionic charge of elements in groups 1, 2, 17, and 18.
   b. Explain why elements are grouped into families.
   c. Identify metals, nonmetals, metalloids, alkali metals, alkaline earth metals, halogens and noble gasses based on their positions on the periodic table.

D. Bonding and compounds
   a. Describe how ionic and covalent bonds are formed in terms of valence electrons.
   b. Given elements and their locations on the periodic table, predict if they will form ionic or covalent compounds.
   c. Given two elements, predict the chemical formula and name of an ionic compound.
   d. Name binary covalent molecules and binary ionic compounds when given formulas.
   e. Determine the formulas for covalent molecules and binary ionic compounds when given their names.

E. Reactions of matter
   a. Balance a chemical equation when provided the formulas of reactants and products.

b. Identify reaction types of synthesis, decomposition, single replacement, double replacement, combustion and acid-base.

F. Nuclear Energy
   a. Describe alpha, beta and gamma radiation.
   b. Compare and contrast nuclear fission and nuclear fusion.
   c. Identify applications of radioisotopes.

Energy and Waves

A. Conservation of energy
   a. Calculate potential energy given an object's mass and its height above a reference point.
   b. Calculate the kinetic energy of a moving object given the mass and velocity.
   c. Explain how the gravitational potential energy of an object varies based on the position of the reference point.
   d. Use the principle of conservation of energy to solve for an unknown quantity in a problem.

B. Transfer and transformation of energy (including work)
   a. Calculate the amount of work done by a force applied to an object.
   b. Calculate the amount of work transferred into or out of a system using changes in energy.
   c. Explain the relationship between kinetic energy, potential energy and work.

C. Waves
   a. Investigate radiant energy transmission, absorption, and reflection with a variety of materials (e.g., opaque, transparent, rough, smooth).
   b. Investigate how changes in the observed frequency and wavelength of a wave occur as a result of the movement between the observer and wave source; doppler effect.
   c. Examine how frequencies, wavelengths, and energies are arranged to construct the electromagnetic spectrum.

D. Thermal energy
   a. Differentiate between a thermal insulator and a thermal conductor.
   b. Provide examples of thermal energy.
   c. Analyze types of heat transfer through objects of various materials.
   d. Identify the various phase changes and classify them as endothermic or exothermic.

E. Electricity
   a. Differentiate how electrons move in an insulator vs. a conductor.
   b. Compare the flow of electrons in a circuit to the flow of electrical energy.
   c. Analyze a circuit or schematic, to determine if it is a series or parallel circuit.
   d. Define and measure current, voltage and resistance.
   e. Explain conceptually how batteries generate electric current.

Forces and Motion

A. Motion
   a. Identify examples of data that are vector quantities and examples of data that are scalar quantities.
   b. Determine the displacement of an object in one dimension, as measured from a frame of reference.
   c. Describe how an object can have a distance that is not the same as the displacement.
   d. Distinguish average velocity from instantaneous velocity.
   e. Calculate the velocity of an object by measuring the time to travel different distances and determine if the object moves with constant or changing velocity.
   f. Calculate the acceleration of an object from its change in speed during a given time interval.
   g. On a velocity vs. time graph, identify when an object is showing no motion, constant velocity and constant acceleration.
   h. Given a position vs. time graph, velocity vs. time graph, or acceleration vs. time graph identify the other corresponding values
   i. Calculate the final velocity of an object from the measured acceleration.
   j. Determine speed and acceleration of objects through experimentation.
   k. Determine the speed of two moving objects using their position vs. time graphs.

B. Forces
   a. Solve problems determining the acceleration of an object from a force diagram.
   b. Identify the forces acting on various objects and draw force diagrams for the objects.
   c. Use a force diagram to predict the motion of an object.
   d. Calculate the weight of an object from its mass.
   e. Identify the relationship between gravitational field strength and the magnitude of the force on an object placed in the field.
   f. Compare the weight of objects on Earth to the predicted weights on other planets in our Solar System using the planets' gravitational field strength.

C. Dynamics
   a. Explain and predict changes in motion.
   b. Explain net force and its effect on acceleration.
   c. Provide an example of an object in equilibrium and determine the forces that are acting on the object.

The Universe

A. Stars
    a. Explain how stars form.
    b. Describe the stages of our sun and compare them to those of more and less massive stars.
    c. Explain how stars can end up as white dwarfs, neutron stars and black holes. Compare the sizes of these end products.
    d. Explain fusion reactions in stars and how they are different from chemical reactions.
    e. Describe how the plasma phase differs from the other phases of matter.