Physical Science

The Physical Science standards continue to build on skills of systematic investigation with a clear focus on variables and repeated trials. Validating conclusions using evidence and data becomes increasingly important at this level. Students will plan and conduct research involving both classroom experimentation and literature reviews from written and electronic resources. Research methods and skills highlight practical problems and questions. Students will share their work, using written reports and other presentations.

The Physical Science standards stress an in-depth understanding of the nature and structure of matter and the characteristics of energy. The standards place considerable emphasis on the technological application of physical science principles. Major areas covered by the standards include the organization and use of the periodic table; physical and chemical changes; nuclear reactions; temperature and heat; sound; light; electricity and magnetism; and work, force, and motion.

The Physical Science standards continue to focus on student growth in understanding the nature of science. This scientific view defines the idea that explanations of nature are developed and tested using observation, experimentation, models, evidence, and systematic processes. The nature of science includes the concepts that scientific explanations are based on logical thinking; are subject to rules of evidence; are consistent with observational, inferential, and experimental evidence; are open to rational critique; and are subject to refinement and change with the addition of new scientific evidence. The nature of science includes the concept that science can provide explanations about nature, can predict potential consequences of actions, but cannot be used to answer all questions.

PS.1 The student will plan and conduct investigations in which

a) chemicals and equipment are used safely;
b) length, mass, volume, density, temperature, weight, and force are accurately measured and reported using metric units (SI—International System of Units);
c) conversions are made among metric units, applying appropriate prefixes;
d) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data;
e) numbers are expressed in scientific notation where appropriate;
f) research skills are utilized using a variety of resources;
g) independent and dependent variables, constants, controls, and repeated trials are identified;
h) data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;
i) data tables for descriptive statistics showing specific measures of central tendency, the range of the data set, and the number of repeated trials are constructed and interpreted;
j) frequency distributions, scattergrams, line plots, and histograms are constructed and interpreted;
k) valid conclusions are made after analyzing data;
l) research methods are used to investigate practical problems and questions;
m) experimental results are presented in appropriate written form; and
n) an understanding of the nature of science is developed and reinforced.

PS.2 The student will investigate and understand the basic nature of matter. Key concepts include
a) the particle theory of matter;
b) elements, compounds, mixtures, acids, bases, and salts;
c) solids, liquids, and gases;
d) characteristics of types of matter based on physical and chemical properties;
e) physical properties (shape, density, solubility, odor, melting point, boiling point, color); and
f) chemical properties (acidity, basicity, combustibility, reactivity).

PS.3 The student will investigate and understand the modern and historical models of atomic structure. Key concepts include
a) the contributions of Dalton, Thomson, Rutherford, and Bohr in understanding the atom; and
b) the modern model of atomic structure.

PS.4 The student will investigate and understand the organization and use of the periodic table of elements to obtain information. Key concepts include
a) symbols, atomic number, atomic mass, chemical families (groups), and periods;
b) classification of elements as metals, metalloids, and nonmetals; and
c) simple compounds (formulas and the nature of bonding).

PS.5 The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts include
a) physical changes;
b) nuclear reactions (products of fusion and fission and the effect of these products on humans and the environment); and
c) chemical changes (types of reactions, reactants, and products; and balanced equations).

PS.6 The student will investigate and understand states and forms of energy and how energy is transferred and transformed. Key concepts include
a) potential and kinetic energy;
b) mechanical, chemical, and electrical energy; and
c) heat, light, and sound.

PS.7 The student will investigate and understand temperature scales, heat, and heat transfer. Key concepts include
a) Celsius and Kelvin temperature scales and absolute zero;
b) phase change, freezing point, melting point, boiling point, vaporization, and condensation;
c) conduction, convection, and radiation; and
d) applications of heat transfer (heat engines, thermostats, refrigeration, and heat pumps).

PS.8 The student will investigate and understand characteristics of sound and technological applications of sound waves. Key concepts include
a) wavelength, frequency, speed, and amplitude;
b) resonance;
c) the nature of mechanical waves; and
d) technological applications of sound.

PS.9 The student will investigate and understand the nature and technological applications of light. Key concepts include
a) the wave behavior of light (reflection, refraction, diffraction, and interference);
b) images formed by lenses and mirrors; and
c) the electromagnetic spectrum.

PS.10 The student will investigate and understand scientific principles and technological applications of work, force, and motion. Key concepts include

a) speed, velocity, and acceleration;
b) Newton's laws of motion;
c) work, force, mechanical advantage, efficiency, and power; and
d) applications (simple machines, compound machines, powered vehicles, rockets, and restraining devices).

PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include

a) static electricity, current electricity, and circuits;
b) magnetic fields and electromagnets; and
c) motors and generators.