Missouri Science

Physical Sciences: Grades 9-12

Adopted 2016

Physical Sciences

1 Matter and Its Interactions PS1

A Structure and Properties of Matter PS1.A

1 Use the organization of the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. 9-12.PS1.A-1

2 Construct and revise an explanation for the products of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. 9-12.PS1.A-2

3 Plan and conduct an investigation to gather evidence to compare physical and chemical properties of substances such as melting point, boiling point, vapor pressure, surface tension, and chemical reactivity to infer the relative strength of attractive forces between particles. 9-12.PS1.A-3

4 Apply the concepts of bonding and crystalline/molecular structure to explain the macroscopic properties of various categories of structural materials, i.e. metals, ionic (ceramics), and polymers. 9-12.PS1.A-4

5 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. 9-12.PS1.A-5

B Chemical reactions PS1.B

6 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. 9-12.PS1.B-6

7 Refine the design of a chemical system by specifying a change in conditions that would alter the amount of products at equilibrium. 9-12.PS1.B-7

8 Use symbolic representations and mathematical calculations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. 9-12.PS1.B-8

C Nuclear Process PS1.C

9 Use symbolic representations to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. 9-12.PS1.C-9

2 Motion and Stability: Forces and Interactions PS2

A Forces and Motion PS2.A

1. Analyze data to support and verify the concepts expressed by Newton's 2nd law of motion, as it describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. 9-12.PS2.A-1
2. Use mathematical representations to support and verify the concepts that the total momentum of a system of objects is conserved when there is no net force on the system. 9-12.PS2.A-2
3. Apply scientific principles of motion and momentum to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. 9-12.PS2.A-3

B Types of Interaction PS2.B

4. Use mathematical representations of Newton's Law of Gravitation to describe and predict the gravitational forces between objects. 9-12.PS2.B-4
5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. 9-12.PS2.B-5

3 Energy PS3

A Definitions of Energy PS3.A

1. Create a computational model to calculate the change in the energy of one component in a system when the changes in energy are known. 9-12.PS3.A-1
2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). 9-12.PS3.A-2
3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. 9-12.PS3.A-3

B Conservation of Energy and Energy Transfer PS3.B

4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). 9-12.PS3.B-4

C Relationship Between Energy and Forces PS3.C

5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. 9-12.PS3.C-5

4 Waves and Their Applications in Technologies for Information Transfer PS4

A Wave Properties PS4.A

1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. 9-12.PS4.A-1
2. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. 9-12.PS4.A-2

B Electromagnetic Radiation PS4.B

3. Communicate technical information about how electromagnetic radiation interacts with matter. 9-12.PS4.B-3
4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. 9-12.PS4.B-4