Tennessee Science

Physical World Concepts

Matter and Its Interactions PWC.PS1

1. Using the Bohr model of an atom, describe the following features and components of an atom: protons, neutrons, electrons, mass, number and types of particles, structure, and organization. PWC.PS1.1
2. Use the kinetic molecular theory to explain how molecular motion is related to internal energy, temperature, heat, phase change, and expansion and contraction. PWC.PS1.2
3. Use data collected from a calorimeter to construct a phase diagram to explain both the constant temperature and linearly changing segments of a graph. PWC.PS1.3
4. Describe three forms of radioactivity in terms of changes in atomic number and mass number in order to write balanced equations for the three forms of radioactive decay. PWC.PS1.4
5. Create a model that illustrates the difference between nuclear fission and nuclear fusion in terms of transmutation. PWC.PS1.5
6. Through experimental data collections, investigate the concept of half-life. PWC.PS1.6

Motion and Stability: Forces and Interactions PWC.PS2

1. Investigate, measure, calculate, and analyze the relationship among position, displacement, velocity, acceleration, and time. PWC.PS2.1
2. Explore characteristics of rectilinear motion and create distance-time graphs and velocity-time graphs. PWC.PS2.2
3. Explain how Newton’s first law applies to objects at rest and objects moving at a constant velocity. PWC.PS2.3
4. Using Newton’s second law, analyze the relationship among the net force acting on a body, the mass of the body, and the resulting acceleration through mathematical and graphical methods. PWC.PS2.4
5. Apply Newton’s third law to identify the interacting forces between two bodies. PWC.PS2.5
6. Understand that the two-dimensional movement of an object can be explained as a combination of its horizontal and vertical components of motion. PWC.PS2.6

7 **Analyze the general relationship between net force, acceleration, and motion for an object undergoing uniform circular motion.** PWC.PS2.7

8 **Describe the nature and magnitude of frictional forces.** PWC.PS2.8

9 **Quantify interactions between objects to show that the total momentum is conserved in both elastic collisions and inelastic collisions.** PWC.PS2.9

10 **Determine the impulse required to produce a change in momentum.** PWC.PS2.10

11 **Using the law of universal gravitation, predict how gravitational force will change when the distance between two masses changes or the mass of one object changes.** PWC.PS2.11

12 **Distinguish between mass and weight using SI units.** PWC.PS2.12

13 **Represent the force conditions that exist for a system in equilibrium.** PWC.PS2.13

14 **Through the use of force diagrams, explain why objects float or sink in terms of force and density.** PWC.PS2.14

15 **Experimentally investigate the buoyant force exerted on floating and submerged objects.** PWC.PS2.15

16 **Demonstrate the effects of Bernoulli's principle on fluid motion.** PWC.PS2.16

Energy PWC.PS3

1 **Investigate the definitions of force, work, power, kinetic energy, and potential energy.** PWC.PS3.1

2 **Analyze the characteristics of energy and conservation of energy including friction, gravitational potential energy, and kinetic energy.** PWC.PS3.2

3 **Compare and contrast the following ways in which energy is stored in a system: mechanical, electrical, chemical, and nuclear.** PWC.PS3.3

4 **Describe various ways in which energy is transferred from one system to another (mechanical contact, thermal conduction, and electromagnetic radiation).** PWC.PS3.4

5 **Demonstrate how or explain that energy is conserved in an isolated system even if transformations occur within the system (i.e., chemical to electrical, electrical to mechanical).** PWC.PS3.5

6 **Calculate quantitative relationships associated with the conservation of energy.** PWC.PS3.6

7 **Describe various ways in which matter and energy interact.** PWC.PS3.7

8 **Mathematically quantify the relationship among electrical potential, current, and resistance in an ohmic system.** PWC.PS3.8

9 **Relate the first law of thermodynamics as an application of the law of conservation of energy.** PWC.PS3.9

10 **Analyze the relationship between energy transfer and disorder in the universe (second law of thermodynamics).** PWC.PS3.10

Waves and Their Applications in Technologies for Information Transfer PWC.PS4

1 **Build a model of a wave that describes the following characteristics of longitudinal waves and transverse waves: wavelength, frequency, period, amplitude, and velocity.** PWC.PS4.1

2 **Quantify the relationship among the frequency, wavelength, and the speed of a wave.** PWC.PS4.2

3 **Compare and contrast the properties and the applications of mechanical and electromagnetic waves.** PWC.PS4.3

4 **Explain the relationship between the wavelength of light absorbed or released by an atom or molecule and the transfer of a discrete amount of energy.** PWC.PS4.4

5 **Experimentally explore the additive and subtractive properties associated with color formation.** PWC.PS4.5

6 **Using real world application, explain the principle of the Doppler Effect.** PWC.PS4.6

7 **Investigate reflection, refraction, diffraction, and interference of waves.** PWC.PS4.7

8 **Explain what function sound resonance has in practical form.** PWC.PS4.8

9 **Analyze the application of polarization.** PWC.PS4.9