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Science, Grade 9 - 12, Physical Science, 2005

1.) Recognize periodic trends of elements, including the number of valence electrons, atomic size, and reactivity.

• Categorizing elements as metals, nonmetals, metalloids, and noble gases

• Differentiating between families and periods

• Using atomic number and mass number to identify isotopes

2.) Identify solutions in terms of components, solubility, concentration, and conductivity.

• Comparing saturated, unsaturated, and supersaturated solutions

• Comparing characteristics of electrolytes and nonelectrolytes

• Describing factors that affect solubility and rate of solution, including nature of solute and solvent, temperature, agitation, surface area, and pressure on gases

3.) Contrast the formation of ionic and covalent bonds based on the transfer or sharing of valence electrons.

• Demonstrating the formation of positive and negative monatomic ions by using electron dot diagrams

4.) Use nomenclature and chemical formulas to write balanced chemical equations.

• Explaining the law of conservation of matter

• Identifying chemical reactions as composition, decomposition, single replacement, or double replacement

• Defining the role of electrons in chemical reactions

5.) Describe physical and chemical changes in terms of endothermic and exothermic processes.

6.) Identify characteristics of gravitational, electromagnetic, and nuclear forces.

7.) Relate velocity, acceleration, and kinetic energy to mass, distance, force, and time.

• Interpreting graphic representations of velocity versus time and distance versus time

• Solving problems for velocity, acceleration, force, work, and power

• Describing action and reaction forces, inertia, acceleration, momentum, and friction in terms of Newton's three laws of motion

• Determining the resultant of collinear forces acting on a body

Example: solving problems involving the effect of a tailwind or headwind on an airplane

• Solving problems for efficiency and mechanical advantage of simple machines

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8.) Relate the law of conservation of energy to transformations of potential energy, kinetic energy, and thermal energy.

• Identifying the relationship between thermal energy and the temperature of a sample of matter

• Describing the flow of thermal energy between two samples of matter

• Explaining how thermal energy is transferred by radiation, conduction, and convection

• Relating simple formulas to the calculation of potential energy, kinetic energy, and work

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9.) Compare methods of energy transfer by mechanical and electromagnetic waves.

• Distinguishing between transverse and longitudinal mechanical waves

• Relating physical properties of sound and light to wave characteristics

Examples: loudness to amplitude, pitch to frequency, color to wavelength and frequency

10.) Explain the relationship between electricity and magnetism.

Example: using a moving charge to create a magnetic field and using a moving magnetic field to induce a current in a closed wire loop

• Differentiating between induction and conduction

• Identifying mechanical, magnetic, and chemical methods used to create an electrical charge

Examples:

- mechanical-rubbing materials together,

- magnetic-moving a closed loop of wire across a magnetic field,

- chemical-using batteries

• Describing electrical circuits in terms of Ohm's law

11.) Describe the nuclear composition of unstable isotopes and the resulting changes to their nuclear composition.

• Identifying types of nuclear emissions, including alpha particles, beta particles, and gamma radiation

• Differentiating between fission and fusion

• Identifying uses and possible negative side effects of nuclear technology

Examples:

- uses-nuclear power generation, medical applications, space travel;

- negative effects-radioactive contamination, nuclear fuel waste and waste storage

12.) Identify metric units for mass, distance, time, temperature, velocity, acceleration, density, force, energy, and power.

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