Mississippi Science

High School: Physical Science

Adopted 2018

High School - Physical Science

1. **Nature of Matter** PHS.1

   1A. Students will demonstrate an understanding of the nature of matter. PHS.1A

      1. Use contextual evidence to describe particle theory of matter. Examine the particle properties of solids, liquids, and gases. PHS.1A.1
      2. Use scientific research to generate models to compare physical and chemical properties of elements, compounds, and mixtures. PHS.1A.2
      3. Conduct an investigation to determine the identity of unknown substances by comparing properties to known substances. PHS.1A.3
      4. Design and conduct investigations to explore techniques in measurements of mass, volume, length, and temperature. PHS.1A.4
      5. Design and conduct an investigation using graphical analysis (e.g., line graph) to determine the density of liquids and/or solids. PHS.1A.5
      6. Use mathematical and computational analysis to solve density problems. Manipulate the density formula to determine density, volume, or mass or use dimensional analysis to solve problems. PHS.1A.6

2. **Atomic Theory** PHS.2

   2A. Students will demonstrate an understanding of both modern and historical theories of atomic structure. PHS.2A

      1. Research and develop models (e.g., 3-D models, online simulations, or ball and stick) to investigate both modern and historical theories of atomic structure. Compare models and contributions of Dalton, Thomson, Rutherford, Bohr, and of modern atomic theory. PHS.2A.1

3. Periodic Table PHS.3

3A. Students will analyze the organization of the periodic table of elements to predict atomic interactions. PHS.3A

1. Use contextual evidence to determine the organization of the periodic table, including metals, metalloids, and nonmetals; symbols; atomic number; atomic mass; chemical families/groups; and periods/series. PHS.3A.1
2. Using the periodic table and scientific methods, investigate the formation of compounds through ionic and covalent bonding. PHS.3A.2
3. Using naming conventions for binary compounds, write the compound name from the formula, and write balanced formulas from the name (e.g., carbon dioxide - CO₂, sodium chloride - NaCl, iron III oxide- Fe2O3, and calcium bromide - CaBr₂). PHS.3A.3
4. Use naming conventions to name common acids and common compounds used in classroom labs (e.g., sodium bicarbonate (baking soda), NaHCO3; hydrochloric acid, HCl; sulfuric acid, H2SO4 ; acetic acid (vinegar), HC2H3O2; and nitric acid, HNO3). PHS.3A.4
5. Use mathematical and computational analysis to determine the atomic mass of binary compounds. PHS.3A.5

4. The Law of Conservation of Matter and Energy PHS.4

4A. Students will analyze changes in matter and the relationship of these changes to the law of conservation of matter and energy. PHS.4A

1. Design and conduct experiments to investigate physical and chemical changes of various household products (e.g., rusting, sour milk, crushing, grinding, tearing, boiling, and freezing) and reactions of common chemicals that produce color changes or gases. PHS.4A.1
2. Design and conduct investigations to produce evidence that mass is conserved in chemical reactions (e.g., vinegar and baking soda in a Ziploc© bag). PHS.4A.2
3. Apply the concept of conservation of matter to balancing simple chemical equations. PHS.4A.3
4. Use mathematical and computational analysis to examine evidence that mass is conserved in chemical reactions using simple stoichiometry problems (1:1 mole ratio) or atomic masses to demonstrate the conservation of mass with a balanced equation. PHS.4A.4
5. Research nuclear reactions and their uses in the modern world, exploring concepts such as fusion, fission, stars as reactors, nuclear energy, and chain reactions. PHS.4A.5
6. Analyze and debate the advantages and disadvantages of nuclear reactions as energy sources. PHS.4A.6

5. Newton's Laws of Motion PHS.5

5A. Students will analyze the scientific principles of motion, force, and work. PHS.5A

1. Research the scientific contributions of Newton, and use models to communicate Newton's principles. PHS.5A.1
2. Design and conduct an investigation to study the motion of an object using properties such as displacement, time of motion, velocity, and acceleration. PHS.5A.2
3. Collect, organize, and interpret graphical data using correct metric units to determine the average speed of an object. PHS.5A.3
4. Use mathematical and computational analyses to show the relationships among force, mass, and acceleration (i.e., Newton's second law). PHS.5A.4
5. Design and construct an investigation using probe systems and/or online simulations to observe relationships between force, mass, and acceleration (F=ma). PHS.5A.5
6. Use an engineering design process and mathematical analysis to design and construct models to demonstrate the law of conservation of momentum (e.g., roller coasters, bicycle helmets, bumper systems). PHS.5A.6
7. Use mathematical and computational representations to create graphs and formulas that describe the relationships between force, work, and energy (i.e., $W=Fd$, $KE=\frac{1}{2}mv^2$, $PE=mgh$, $W=KE$). PHS.5A.7
8. Research the efficiency of everyday machines, and debate ways to improve their economic impact on society (e.g., electrical appliances, transportation vehicles). PHS.5A.8

6. Waves PHS.6

6A. Students will explore the characteristics of waves. PHS.6A

1. Use models to analyze and describe examples of mechanical waves' properties (e.g., wavelength, frequency, speed, amplitude, rarefaction, and compression). PHS.6A.1
2. Analyze examples and evidence of transverse and longitudinal waves found in nature (e.g., earthquakes, ocean waves, and sound waves). PHS.6A.2
3. Generate wave models to explore energy transference. PHS.6A.3
4. Enrichment: Use an engineering design process to design and build a musical instrument to demonstrate the influence of resonance on music. PHS.6A.4
5. Design and conduct experiments to investigate technological applications of sound (e.g., medical uses, music, acoustics, Doppler effects, and influences of mathematical theory on music). PHS.6A.5
6. Research real-world applications to create models or visible representations of the electromagnetic spectrum, including visible light, infrared radiation, and ultraviolet radiation. PHS.6A.6
7. Enrichment: Use an engineering design process to design and construct an apparatus that forms images to project on a screen or magnify images using lenses and/or mirrors. PHS.6A.7
8. Enrichment: Debate the particle/wave behavior of light. PHS.6A.8

7. Energy PHS.7

7A. Students will examine different forms of energy and energy transformations. PHS.7A

1. Using digital resources, explore forms of energy (e.g., potential and kinetic energy, mechanical, chemical, electrical, thermal, radiant, and nuclear energy). PHS.7A.1
2. Use scientific investigations to explore the transformation of energy from one type to another (e.g., potential to kinetic energy, and mechanical, chemical, electrical, thermal, radiant, and nuclear energy interactions). PHS.7A.2
3. Using mathematical and computational analysis, calculate potential and kinetic energy based on given data. Use equations such as PE=mgh and KE=½ mv^2. PHS.7A.3
4. Conduct investigations to provide evidence of the conservation of energy as energy is converted from one form of energy to another (e.g., wind to electric, chemical to thermal, mechanical to thermal, and potential to kinetic). PHS.7A.4

8. Thermal Energy PHS.8

8A. Students will demonstrate an understanding of temperature scales, heat, and thermal energy transfer. PHS.8A

1. Compare and contrast temperature scales by converting between Celsius, Fahrenheit, and Kelvin. PHS.8A.1
2. Apply particle theory to phase change and analyze freezing point, melting point, boiling point, vaporization, and condensation of different substances. PHS.8A.2
3. Relate thermal energy transfer to real world applications of conduction (e.g., quenching metals), convection (e.g., movement of air masses/weather/plate tectonics), and radiation (e.g., electromagnetic). PHS.8A.3
4. Enrichment: Use an engineering design process to construct a simulation of heat energy transfer between systems. Calculate the calories/joules of energy generated by burning food products. Communicate conclusions based on evidence from the simulation. PHS.8A.4

9. Electricity PHS.9

9A. Students will explore basic principles of magnetism and electricity (e.g., static electricity, current electricity, and circuits). PHS.9A

1. Use digital resources and online simulations to investigate the basic principles of electricity, including static electricity, current electricity, and circuits. Use digital resources (e.g., online simulations) to build a model showing the relationship between magnetic fields and electric currents. PHS.9A.1
2. Distinguish between magnets, motors, and generators, and evaluate modern industrial uses of each. PHS.9A.2
3. Enrichment: Use an engineering design process to construct a working electric motor to perform a task. Communicate the design process and comparisons of task performance efficiencies. PHS.9A.3
4. Use an engineering design process to construct and test conductors, semiconductors, and insulators using various materials to optimize efficiency. PHS.9A.4