| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
| **Disciplinary Core Idea** | **Conceptual Understanding** | **Content Standard** | **Breakout** | **Citations** | **Comments** |
| PHS.1 Nature of Matter | To actively develop scientific investigation, reasoning, and logic skills, this standard develops basic ideas about the characteristics and structure of matter. Matter is anything that has mass and occupies space. All matter is made up of small particles called atoms. Matter can exist as a solid, liquid, gas, or plasma. | PHS.1 Students will demonstrate an understanding of the nature of matter. | PHS.1.1 Use contextual evidence to describe particle theory of matter. Examine the particle properties of solids, liquids, and gases. | Chapter 6: Heat<br>6.1 Kinetic Theory of Matter<br>Page 118 | |
| | | | PHS.1.2 Use scientific research to generate models to compare physical and chemical properties of elements, compounds, and mixtures. | This topic is not covered in the text. | |
| | | | PHS.1.3 Conduct an investigation to determine the identity of unknown substances | This topic is not covered in the text. | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| | | | by comparing properties to known substances. | | |
| | | | PHS.1.4 Design and conduct investigations to explore techniques in measurements of mass, volume, length, and temperature. | Chapter 2: Describing Motion<br>2.3 Mass – A measure of Inertia<br>Page 25 | 2.3 Mass – A measure of Inertia (Describe and distinguish between mass and weight +density) |
| | | | PHS.1.5 Design and conduct an investigation using graphical analysis (e.g., line graph) to determine the density of liquids and/or solids. | This topic is not covered in the text. | |
| | | | PHS.1.6 Use mathematical and computational analysis to solve density problems. Manipulate the<br>density formula to determine density, volume, or mass or use dimensional analysis to solve problems. | This topic is not covered in the text. | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| PHS.2 Atomic Theory | Many scientists have contributed to our understanding of atomic structure. The atom is the basic building block of matter and consists of subatomic particles (proton, neutron, electron, and quark) that differ in their location, charge, and relative mass. | PHS.2 Students will demonstrate an understanding of both modern and historical theories of atomic structure. | PHS.2.1 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. | Chapter 9: Atoms and the Periodic Table<br>9.5 – The Quantum Hypothesis<br>Pages 226-227 | 9.5 – The Quantum Hypothesis (how the quantum nature of energy led to Bohr's planetary model of the atom) |
| PHS.3 Periodic Table | The organization of the periodic table allows scientists to obtain information and develop an understanding of concepts of atomic interactions. Developing scientific investigations increases logical reasoning and | PHS.3 Students will analyze the organization of the periodic table of elements to predict atomic interactions. | PHS.3.1 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. | Chapter 9: Atoms and the Periodic Table<br>9.1 – The Elements<br>Page 213<br><br>9.2 Protons and Neutrons<br>Pages 214-216<br><br>9.3 The Periodic Table<br>Pages 217-223 | 9.1 – The Elements (Recognize the elements of the periodic table + atomic symbol + elemental formula)<br><br>9.2 Protons and Neutrons |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| | deduction skills to present the nature of science in the context of key scientific concepts. | | | | (structure of the atomic nucleus + atomic number + calculation of atomic mass of an element)<br><br>9.3 The Periodic Table (The way the table is organized) |
| | | | PHS.3.2 Using the periodic table and scientific methods, investigate the formation of compounds through ionic and covalent bonding. | Chapter 11: Investigating Matter<br>11.4 Physical and Chemical Changes<br>Pages 272–274<br><br>Chapter 12: Chemical Bonds and Mixtures<br>12.2 The Ionic Bond<br>Pages 291–297<br><br>12.3 The Covalent Bond | 11.4 Physical and Chemical Changes (Relates chemical bond to chemical change) |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| | | | | Pages 298–300<br><br>12.4 Polar Covalent Bonds<br>Pages 301–302 | 12.4 Polar Covalent Bonds (Differentiate ionic, polar covalent, and nonpolar covalent chemical bonds) |
| | | | PHS.3.3 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). | Chapter 11: Investigating Matter<br>11.7 Naming Compounds<br>Page 279<br><br>Think and Explain (Synthesis)<br>11.7 Naming Compounds<br>Page 286<br><br>Readiness Assurance Test (RAT)<br>Q 10<br>Page 288 | 11.2 The Submicroscopic View of Matter (molecule as a fundamental unit of matter)<br><br>11.6 Elements to Compounds (Contrast compounds with the elements from which they are created+ |

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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
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| | | | | | chemical formula)<br><br>11.7 Naming Compounds (Guidelines used to name compounds) |
| | | | PHS.3.4 Use naming conventions to name common acids and common compounds used in classroom labs (e.g., sodium bicarbonate (baking soda), $NaHCO_3$; hydrochloric acid, HCl; sulfuric acid, $H_2SO_4$ ; acetic acid (vinegar), $HC_2H_3O_2$; and nitric acid, $HNO_3$). | Chapter 11: Investigating Matter<br>11.7 Naming Compounds<br>Page 279 | |
| | | | PHS.3.5 Use mathematical and computational analysis to determine the atomic mass of binary compounds. | This topic is not covered in the text. | |
| PHS.4 The Law of Conservation | The law of conservation of matter and energy | PHS.4 Students will analyze changes in matter and the | PHS.4.1 Design and conduct experiments to investigate | Chapter 11: Investigating Matter | |

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| of Matter and Energy | states that matter and energy<br>can be transformed in different ways, but the total amount of mass and energy will be conserved. These concepts should be investigated and further developed in the classroom. | relationship of these changes to the<br>law of conservation of matter and energy. | physical and chemical changes of various<br>household products (e.g., rusting, sour milk, crushing, grinding, tearing, boiling, and freezing) and reactions of common chemicals that produce color changes or gases. | 11.4 Physical and Chemical Properties<br>Pages 272-274<br><br>11.5 Determining Physical and Chemical Changes<br>Pages 275-276 | |
| | | | PHS.4.2 Design and conduct investigations to produce evidence that mass is conserved in chemical<br>reactions (e.g., vinegar and baking soda in a Ziploc© bag). | This topic is not covered in the text. | |
| | | | PHS.4.3 Apply the concept of conservation of matter to balancing simple chemical equations. | Chapter 13: Chemical Reactions<br>13.1 Chemical Equations<br>Pages 327-328 | 13.1 Chemical Equations<br>(Identify if a chemical equation is balanced or not balanced) |

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| | | | | | |
| | | | PHS.4.4 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. | Chapter 13: Chemical Reactions<br>13.1 Chemical Equations<br>Pages 327-328 | |
| | | | PHS.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. | Chapter 10: The Atomic Nucleus and Radioactivity<br>10.1 Radioactivity<br>Page 242<br><br>10.2 The Strong Nuclear Force<br>Page 243<br><br>10.3 Half Life and Transmutation<br>Pages 243-244 | 10.1 Radioactivity (Three forms of radioactivity)<br><br>10.2 The Strong Nuclear Force (Holding nucleons in the nucleus)<br><br>10.3 Half Life and Transmutation (how radioactive elements can be |

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| **Disciplinary Core Idea** | **Conceptual Understanding** | **Content Standard** | **Breakout** | **Citations** | **Comments** |
| | | | | 10.3 Half Life and Transmutation<br>Pages 243-244<br><br>10.3 Half Life and Transmutation<br>Pages 245-249<br><br>10.4 Nuclear Fission<br>Pages 250–254<br><br>10.5 Mass-Energy Equivalence<br>Pages 250–254 | identified by the half-life)<br><br>10.5 Mass-Energy Equivalence (Nuclear fusion) |
| | | | PHS.4.6 Analyze and debate the advantages and disadvantages of nuclear reactions as energy sources. | Chapter 10: The Atomic Nucleus and Radioactivity<br>Think and Explain (Synthesis)<br>Q 84, 87<br>Page 263<br><br>Think and Discuss (Evaluation)<br>Q 92, 95 | *Think and Explain/ Think and Discuss (Evaluation)/ has some questions on radiation-<br>Page 264 |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
|---|---|---|---|---|---|
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
| **Disciplinary Core Idea** | **Conceptual Understanding** | **Content Standard** | **Breakout** | **Citations** | **Comments** |
| | | | | Page 264 | |
| PHS.5 Newton's Laws of Motion | Kinematics (contact forces) describe the motion of objects using words, diagrams, numbers, graphs, and equations. The goal of any study of kinematics is to develop scientific models to describe and explain the motion of real-world objects. Newton's laws of motion are an example of a tool that can aid in the explanation of motion. | PHS.5 Students will analyze the scientific principles of motion, force, and work. | PHS.5.1 Research the scientific contributions of Newton, and use models to communicate Newton's principles. | Chapter 3: Newton's Law of Motion<br>3.1 Newton's First Law of Motion<br>Page 44<br><br>3.2 Newton's Second Law of Motion<br>Pages 45-48<br><br>3.4 Newton's Third Law of Motion<br>Pages 51-52<br><br>3.6 Summary of Newton's Three Laws<br>Pages 55-56 | |
| | | | PHS.5.2 Design and conduct an investigation to study the motion of an object using properties such as displacement, time of motion, velocity, and acceleration. | Chapter 2: Describing Motion<br>Acceleration<br>Page 31<br><br>Chapter 3: Newton's Law of Motion | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
| **Disciplinary Core Idea** | **Conceptual Understanding** | **Content Standard** | **Breakout** | **Citations** | **Comments** |
| | | | | 3.3 Forces and Interactions<br>Page 49<br><br>3.5 Vectors<br>Page 54 | |
| | | | PHS.5.3 Collect, organize, and interpret graphical data using correct metric units to determine the average speed of an object. | Chapter 2: Describing Motion<br>2.8 Speed and Velocity<br>Page 30 | |
| | | | PHS.5.4 Use mathematical and computational analyses to show the relationships among force, mass, and acceleration (i.e., Newton's second law). | Chapter 3: Newton's Law of Motion<br>3.2 Newton's Second Law of Motion<br>Pages 45-48 | |
| | | | PHS.5.5 Design and construct an investigation using probe systems and/or online simulations to observe relationships between force, mass, and acceleration (F=ma). | Partial alignment<br><br>Chapter 3: Newton's Law of Motion<br>Think and Do (Hands-On Application)<br>Q 36<br>Page 61 | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
|---|---|---|---|---|---|
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| | | | PHS.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). | Chapter 4: Momentum and Energy<br>4.1 Momentum<br>Page 69<br><br>4.4 Conservation of Momentum<br>Page 73 | |
| | | | PHS.5.7 Use mathematical and computational representations to create graphs and formulas that describe the relationships between force, work, and energy (i.e., W=Fd, KE=½ mv2 , PE=mgh, W=KE). | Chapter 4: Momentum and Energy<br>4.5 Energy<br>Page 74- 75<br><br>4.6 Power<br>Page 76<br><br>4.9 The Work-Energy Theorem<br>Page 79 | |
| | | | PHS.5.8 Research the efficiency of everyday machines, and debate ways to improve their economic | Chapter 4: Momentum and Energy<br>4.11 Machines<br>Page 81 | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
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| | | | impact on society (e.g., electrical appliances, transportation vehicles). | | |
| PHS.6 Waves | Waves are everywhere in nature. Understanding of the physical world is not complete until we understand the nature, properties, and behaviors of waves. Students have experienced transverse and horizontal waves in their everyday lives. The exploration of waves in greater depth will allow students to conceptualize these waves. The goal is to develop various models of waves and apply those | PHS.6 Students will explore the characteristics of waves. | PHS.6.1 Use models to analyze and describe examples of mechanical waves' properties (e.g., wavelength, frequency, speed, amplitude, rarefaction, and compression). | Chapter 8: Waves- Sound and Light<br>8.1 Vibrations and Waves<br>Page 178<br><br>8.4 The Nature of Sound<br>Page 181 | 8.1 Vibrations and Waves (Distinguish among amplitude, wavelength, frequency, and period)<br><br>8.4 The Nature of Sound (Compressions and rarefactions in a sound wave) |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
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| | models to understanding wave interactions. | | | | |
| | | | PHS.6.2 Analyze examples and evidence of transverse and longitudinal waves found in nature (e.g., earthquakes, ocean waves, and sound waves). | Chapter 8: Waves- Sound and Light<br>8.3 Transverse and Longitudinal and Waves<br>Page 180 | |
| | | | PHS.6.3 Generate wave models to explore energy transference. | Chapter 8: Waves- Sound and Light<br>8.2 Wave Motion<br>Page 179 | 8.2 Wave Motion (how energy is carried in waves) |
| | | | PHS.6.4 Enrichment: Use an engineering design process to design and build a musical instrument to demonstrate the influence of resonance on music.* | Chapter 8: Waves- Sound and Light<br>Think and Do (Hands-On Application)<br>Q 42<br>Page 203 | |
| | | | PHS.6.5 Design and conduct experiments to investigate technological applications of sound (e.g., medical uses, music, acoustics, Doppler | Chapter 8: Waves- Sound and Light<br>8.13 The Doppler Effect<br>Pages 196-197<br><br>8.7 Reflection | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
| **Disciplinary Core Idea** | **Conceptual Understanding** | **Content Standard** | **Breakout** | **Citations** | **Comments** |
| | | | effects, and influences of mathematical theory on music). | Page 184 | |
| | | | PHS.6.6 Research real-world applications to create models or visible representations of the electromagnetic spectrum, including visible light, infrared radiation, and ultraviolet radiation. | Chapter 8: Waves- Sound and Light<br>8.6 The Nature of Light<br>Page 183<br><br>8.8 Transparent and Opaque Materials<br>Pages 185-186 | |
| | | | PHS.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.* | This topic is not covered in the text. | |
| | | | PHS.6.8 Enrichment: Debate the particle/wave behavior of light. | Chapter 8: Waves- Sound and Light<br>8.14 The Wave-Particle Duality<br>Page 198 | |
| PHS.7 Energy | Concepts about different energy forms | PHS.7 Students will examine different forms | PHS.7.1 Using digital resources, explore forms of energy (e.g., | Chapter 4: Momentum and Energy | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
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| | and energy transformations continue to be expanded and explored in greater depth, leading to the development of more mathematical applications. Focus should be on students actively developing scientific investigations, reasoning, and logic skills. | of energy and energy transformations. | potential and kinetic energy, mechanical, chemical, electrical, thermal, radiant, and nuclear energy). | 4.10 Conservation of Energy<br>Page 80<br><br>4.7 Potential Energy<br>Page 77<br><br>4.8 Kinetic Energy<br>Page 78 | |
| | | | PHS.7.2 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). | Chapter 4: Momentum and Energy<br>Think and Do (Hands-On Application)<br>Q 37<br>Page 86 | |
| | | | PHS.7.3 Using mathematical and computational analysis, | Chapter 4: Momentum and Energy | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
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| | | | calculate potential and kinetic energy based on given data. Use equations such as PE=mgh and KE=½ mv2. | 4.9 The Work-Energy Theorem<br>Page 79 | |
| | | | PHS.7.4 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). | Chapter 4: Momentum and Energy<br>4.10 Conservation of Energy<br>Page 80<br><br>Think and Do (Hands-On Application)<br>Q 37<br>Page 86 | |
| PHS.8 Thermal Energy | Thermal energy is transferred in the form of heat. Heat is always transferred from an area of high heat to low heat. More complex concepts and terminology related to phase changes are developed, including | PHS.8 Students will demonstrate an understanding of temperature scales, heat, and thermal energy transfer. | PHS.8.1 Compare and contrast temperature scales by converting between Celsius, Fahrenheit, and Kelvin. | Chapter 6: Heat<br>6.2 Temperature<br>Page 119<br><br>6.3 Absolute Zero<br>Page 120 | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
|---|---|---|---|---|---|
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
| **Disciplinary Core Idea** | **Conceptual Understanding** | **Content Standard** | **Breakout** | **Citations** | **Comments** |
| | the distinction between heat and temperature. | | | | |
| | | | PHS.8.2 Apply particle theory to phase change and analyze freezing point, melting point, boiling point, vaporization, and condensation of different substances. | Chapter 11: Investigating Matter<br>11.3 Phase Change<br>Page 271 | |
| | | | PHS.8.3 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). | Chapter 6: Heat<br>6.4 Heat<br>Page 121<br><br>6.5 The Laws of Thermodynamics<br>Pages 122-124<br><br>6.6 Specific Heat Capacity<br>Pages 125-126<br><br>6.7 Thermal Expansion<br>Page 128<br><br>6.8 Heat Transfer: Conduction<br>Page 129 | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
|---|---|---|---|---|---|
| **Book: Conceptual Integrated Science, ©2020** | | | | | |
| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
| **Disciplinary Core Idea** | **Conceptual Understanding** | **Content Standard** | **Breakout** | **Citations** | **Comments** |
| | | | | 6.9 Heat Transfer: Convection<br>Page 130<br><br>6.10 Heat Transfer: Radiation<br>Page 131 | |
| | | | PHS.8.4 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.* | This topic is not covered in the text. | |
| PHS.9 Electricity | Electrical energy (both battery and circuit energy) is transformed into other forms of energy. Charged particles and | PHS.9 Students will explore basic principles of magnetism and electricity (e.g., static electricity, current electricity, and circuits). | PHS.9.1 Use digital resources and online simulations to investigate the basic principles of electricity, including static electricity, current electricity, and circuits. | Chapter 7: Electricity and Magnetism<br>7.7 Electric Current<br>Pages 151-152<br><br>7.8 Electrical Resistance | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
|---|---|---|---|---|---|
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
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| | magnetic fields are similar because they both store energy. Magnetic fields exert forces on moving charged particles. Students investigate practical uses of these concepts and develop a working understanding of the basic concepts of magnetism and electricity. | | Use digital resources (e.g., online simulations) to build a model showing the relationship between magnetic fields and electric currents. | Page 153<br><br>7.9 Ohm's law<br>Pages 154-155<br><br>7.10 Electric Circuits<br>Page 156<br><br>7.15: Electromagnetic induction<br>Page 164 | |
| | | | PHS.9.2 Distinguish between magnets, motors, and generators, and evaluate modern industrial uses of each. | Chapter 7: Electricity and Magnetism<br>7.12 The Magnetic Force<br>Page 158<br><br>7.13 Magnetic Fields<br>Page 159-161<br><br>7.14 Magnetic Forces on Moving Charges<br>Pages 162-163 | |

| 2018 Mississippi College- and Career-Readiness Standards for Science | | | | | |
|---|---|---|---|---|---|
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| **Physical Science Standards**<br>**Total Standards: 9** | | | | | |
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| | | | PHS.9.3 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.* | This topic is not covered in the text. | |
| | | | PHS.9.4 Use an engineering design process to construct and test conductors, semiconductors, and insulators using various materials to optimize efficiency.* | This topic is not covered in the text. | |