

Grade 8

Physical Science

Grade 8 Physical Science is designed to help students apply physical science concepts to daily life, including electricity, thermal energy transfer, and the acceleration of objects such as a car. It also provides students with the skills and content knowledge necessary to be successful in high school chemistry, physics, and physical science courses. Physical Science requires comprehensive learning and the use of reading, writing, and mathematics skills.

This course focuses on four disciplinary core ideas from the physical sciences domain. In “Matter and Its Interactions,” students study the structure and function of matter and their effects on chemical reactions. In the second core idea, “Motion and Stability: Forces and Interactions,” students explore different forces and various types of interactions. They also engage in predicting and developing explanations for changes in motion. The “Energy” core idea involves the conservation of energy, energy transformations, and applications of energy to everyday life. In the final core idea, “Waves and Their Applications in Technologies for Information Transfer,” students examine the relationships between wave properties, types of signals, and their interactions with different instruments.

Embedded in the content standards are the disciplinary core ideas of the Engineering, Technology, and Applications of Science (ETS) domain, which require students to use design strategies in conjunction with knowledge and understanding of science and technology to solve practical problems. Engineering standards are denoted with a gear icon ⚙️. Through guided participation in the engineering design process, students design and test a device that can release or absorb thermal energy by chemical reactions and design, construct, and modify an electromagnet.

Each content standard completes the stem “*Students will...*”

Matter and Its Interactions		
Structure and Properties	1. Plan and carry out investigations to support the claim that pure substances can be described and defined by their properties, including solubility, electrical conductivity, and density.	Structure and Function
	2. Develop and manipulate models to explain changes in particle motion, temperature, and state of a pure substance when thermal energy is added to or removed from a system.	Energy and Matter

Chemical Reactions	3. Justify a claim, based on evidence from investigations, that pure substances differ from mixtures, including solutions.	Structure and Function
	4. Obtain and communicate information from the periodic table, including atomic number, number of electrons and neutrons, average atomic mass, groups, and periods, to illustrate the structure and composition of atoms of different elements. a. Analyze and interpret data to differentiate among elements based on their properties and classify the elements as metals, nonmetals, or metalloids.	Patterns
	5. Obtain, evaluate, and communicate information from the periodic table to make predictions about the reactivity of the main group elements. a. Use valence electron configuration to model ionic and covalent bonds.	Structure and Function
	6. Observe and analyze data regarding characteristic properties of substances before and after they are combined to determine whether a chemical reaction has occurred. <i>Examples: color change, temperature change, production of a gas, formation of a precipitate</i>	Stability and Change
	7. Analyze data from an investigation to determine whether thermal energy is released or absorbed in a chemical reaction. a. ⚙️ Design and test a device that can release or absorb thermal energy by chemical reactions. 8. Engage in an argument from evidence to support the claim that matter is conserved in a chemical reaction. a. Use a model to verify that atoms of reactants are conserved as products in a chemical reaction. <i>Examples: simulations, atomic and molecular drawings, or equations to compare atoms in the reactants and products</i>	Energy and Matter

Motion and Stability: Forces and Interactions

Forces and Motion

9. Use data from an investigation to identify factors that affect acceleration.
Examples: velocity vs. time graphs, data tables, diagrams
10. Develop and use models to illustrate how individual external forces affect the motion of objects.
Examples: frictional forces, gravitational force, applied forces
11. Use models to demonstrate each of Newton's laws of motion and explain the effect of net force on objects.
Examples: A model car on a table remains at rest until pushed, and a marble rolls across the floor until friction causes it to stop (first law of inertia); a bicycle rider's leg muscles apply force to the mass of the bicycle, causing the bicycle to move, and greater acceleration results when pedaling harder creates a greater net force (second law); a ball hitting the ground applies downward action force and the ground applies an upward reaction force, causing the ball to bounce (third law).
 - a. Use mathematical representations to explain how the sum of external forces on an object and the object's mass affect its acceleration.
Examples: data tables, graphs, diagrams
12. Use a model to identify factors affecting the strength of noncontact forces, including magnetic, gravitational, and electrical forces, and demonstrate that fields exist even though the objects are not in contact.
 - a.  Design and construct an electromagnet and modify the design to change its strength.

Cause and Effect

Energy

Types of Energy

13. Analyze graphical displays of data to describe the relationship of mass and velocity of an object to its kinetic energy (KE).
Examples: mass vs. KE graph, velocity vs. KE graph, data table

Scale, Proportion, and Quantity

	14. Use models to construct an explanation of how a system of objects may contain varying amounts of potential energy, including gravitational, elastic, and chemical.	Systems and System Models
Conservation of Energy	15. Use models to construct an explanation of how energy is transformed but still conserved. <i>Example: kinetic energy to potential energy</i> 16. Develop and use a model to construct an explanation of how electrical energy is transferred and transformed. <i>Example: In a circuit, there is an energy source (battery) that has chemical potential energy. Chemical energy is transformed into electrical energy (current), transferred through the wires, and transformed again into light and heat in the light bulb. Add a resistor and analyze its effect on current.</i>	
Waves and Their Applications in Technologies for Information Transfer		
Wave Properties	17. Use models of mechanical and electromagnetic waves to qualitatively describe the relationships among wave properties, including amplitude, wavelength, and frequency. <i>Example: Use a model to show that frequency and wavelength are inversely proportional.</i> a. Use models to compare and contrast light and sound wave behaviors, including reflection, refraction, diffraction, and speed, as waves propagate and interact with matter.	Scale, Proportion, and Quantity
Information Transfer	18. Construct an argument from evidence that digital and analog signals encode and transmit information differently.	