

# Physical Science: Grades 9-12

## Matter and Its Interactions HS-PS1

- 1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. HS-PS1.1

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- 2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS1.2

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- 3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. HS-PS1.3

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- 4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. HS-PS1.4

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- 5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. HS-PS1.5

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- 6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.\* HS-PS1.6

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- 7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-PS1.7

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- 8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. HS-PS1.8

## Motion and Stability: Forces and Interactions HS-PS2

- 1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. HS-PS2.1

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- 2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. HS-PS2.2

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- 3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.\* HS-PS2.3

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**4** Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects. [HS-PS2.4](#)

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**5** Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. [HS-PS2.5](#)

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**6** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. [HS-PS2.6](#)

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## Energy [HS-PS3](#)

**1** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. [HS-PS3.1](#)

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**2** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). [HS-PS3.2](#)

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**3** Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.\* [HS-PS3.3](#)

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**4** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). [HS-PS3.4](#)

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**5** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. [HS-PS3.5](#)

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## Waves and Their Applications in Technologies for Information Transfer [HS-PS4](#)

**1** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. [HS-PS4.1](#)

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**2** Evaluate questions about the advantages of using a digital transmission and storage of information. [HS-PS4.2](#)

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**3** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. [HS-PS4.3](#)

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**4** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. [HS-PS4.4](#)

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**5 Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.\*** HS-PS4.5