California's Next Generation Science Standards (NGSS) for K-12
Grade Eight
Integrated Course
Standards arranged by Disciplinary Core Ideas

MS-PS3 Energy

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Students who demonstrate understanding can:

MS-PS3-1. **Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.** [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]

MS-PS3-2. **Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.** [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. ▪ Develop a model to describe unobservable mechanisms. (MS-PS3-2) **Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative	**PS3.A: Definitions of Energy** ▪ Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1) ▪ A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) **PS3.C: Relationship Between Energy and Forces** ▪ When two objects interact, each one	**Scale, Proportion, and Quantity** ▪ Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-1) **Systems and System Models** ▪ Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ▪ Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)	exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)	energy and matter flows within systems. (MS-PS3-2)
Connections to other DCIs in this grade-band: **MS.PS2.A** (MS-PS3-1);		
Articulation across grade-bands: **4.PS3.B** (MS-PS3-1); **HS.PS2.B** (MS-PS3-2); **HS.PS3.A** (MS-PS3-1); **HS.PS3.B** (MS-PS3-1),(MS-PS3-2) **HS.PS3.C** (MS-PS3-2)		

Common Core State Standards Connections:

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions *(MS-PS3-1)*

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-PS3-2)*

Mathematics –

MP.2 Reason abstractly and quantitatively. (MS-PS3-1)

6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1)

6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. *(MS-PS3-1)*

7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS3-1)

8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)

8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. *(MS-PS3-1)*

8.F.A.3	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-1)