

### DCI: Energy

#### HS.PS3.A: Definitions of Energy

Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1), (HS-PS3-2)

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At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.

(HS-PS3-2), (HS-PS3-3)

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These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)

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#### HS.PS3.B: Conservation of Energy and Energy Transfer

Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1)

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#### HS.PS3.B: Conservation of Energy and Energy Transfer

The availability of energy limits what can occur in any system. (HS-PS3-1)

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Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4)

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#### HS.PS3.C: Relationship Between Energy and Forces

When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5)

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#### HS.PS3.D: Energy in Chemical Processes and Everyday Life

Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3), (HS-PS3-4)

### **HS.ETS1.A: Defining and Delimiting Engineering Problems**

Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-PS3-3)

