Conservation of Elastic Potential Energy

(6) Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:

(A) investigate and calculate quantities using the work-energy theorem in various situations;
(B) investigate examples of kinetic and potential energy and their transformations;
(C) calculate the mechanical energy of, power generated within, impulse applied to, and momentum of a physical system;
(D) demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension; and
(E) explain everyday examples that illustrate the four laws of thermodynamics and the processes of thermal energy transfer.

Conservation of Momentum

(6) Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:

(A) investigate and calculate quantities using the work-energy theorem in various situations;
(B) investigate examples of kinetic and potential energy and their transformations;
(C) calculate the mechanical energy of, power generated within, impulse applied to, and momentum of a physical system;
(D) demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension; and
(E) explain everyday examples that illustrate the four laws of thermodynamics and the processes of thermal energy transfer.

Hooke's Law

(4) Science concepts. The student knows and applies the laws governing motion in a variety of situations. The student is expected to:

(A) generate and interpret graphs and charts describing different types of motion, including investigations using real-time technology such as motion detectors or photogates;
(B) describe and analyze motion in one dimension using equations and graphical vector addition with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, frames of reference, and acceleration;
(C) analyze and describe accelerated motion in two dimensions, including using equations, graphical vector addition, and projectile and circular examples; and
(D) calculate the effect of forces on objects, including the law of inertia, the relationship between force and acceleration, and the nature of force pairs between objects using methods, including free-body force diagrams.

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Torque

(6) Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:

(A) investigate and calculate quantities using the work-energy theorem in various situations;
(B) investigate examples of kinetic and potential energy and their transformations;
(C) calculate the mechanical energy of, power generated within, impulse applied to, and momentum of a physical system;
(D) demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension; and
(E) explain everyday examples that illustrate the four laws of thermodynamics and the processes of thermal energy transfer.

Waves and Sound

(7) Science concepts. The student knows the characteristics and behavior of waves. The student is expected to:

(A) examine and describe oscillatory motion and wave propagation in various types of media;
(B) investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationship between wavespeed, frequency, and wavelength;
(C) compare characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and characteristics and behaviors of longitudinal waves, including sound waves;
(D) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, and the Doppler effect; and
(E) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens.

Mechanical Waves

(7) Science concepts. The student knows the characteristics and behavior of waves. The student is expected to:

(A) examine and describe oscillatory motion and wave propagation in various types of media;
(B) investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationship between wavespeed, frequency, and wavelength;
(C) compare characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and characteristics and behaviors of longitudinal waves, including sound waves;
(D) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, and the Doppler effect; and
(E) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens.

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Friction

(4) Science concepts. The student knows and applies the laws governing motion in a variety of situations. The student is expected to:

(A) generate and interpret graphs and charts describing different types of motion, including investigations using real-time technology such as motion detectors or photogates;
(B) describe and analyze motion in one dimension using equations and graphical vector addition with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, frames of reference, and acceleration;
(C) analyze and describe accelerated motion in two dimensions, including using equations, graphical vector addition, and projectile and circular examples; and
(D) calculate the effect of forces on objects, including the law of inertia, the relationship between force and acceleration, and the nature of force pairs between objects using methods, including free-body force diagrams.

Uniform Circular Motion

(4) Science concepts. The student knows and applies the laws governing motion in a variety of situations. The student is expected to:

(A) generate and interpret graphs and charts describing different types of motion, including investigations using real-time technology such as motion detectors or photogates;
(B) describe and analyze motion in one dimension using equations and graphical vector addition with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, frames of reference, and acceleration;
(C) analyze and describe accelerated motion in two dimensions, including using equations, graphical vector addition, and projectile and circular examples; and
(D) calculate the effect of forces on objects, including the law of inertia, the relationship between force and acceleration, and the nature of force pairs between objects using methods, including free-body force diagrams.

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Free Fall: Measuring g

(5) Science concepts. The student knows the nature of forces in the physical world. The student is expected to:

(A) describe the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces;
(B) describe and calculate how the magnitude of the gravitational force between two objects depends on their masses and the distance between their centers;
(C) describe and calculate how the magnitude of the electric force between two objects depends on their charges and the distance between their centers;
(D) identify and describe examples of electric and magnetic forces and fields in everyday life such as generators, motors, and transformers;
(E) characterize materials as conductors or insulators based on their electric properties; and
(F) investigate and calculate current through, potential difference across, resistance of, and power used by electric circuit elements connected in both series and parallel combinations.

Newton's Laws

(4) Science concepts. The student knows and applies the laws governing motion in a variety of situations. The student is expected to:

(A) generate and interpret graphs and charts describing different types of motion, including investigations using real-time technology such as motion detectors or photogates;
(B) describe and analyze motion in one dimension using equations and graphical vector addition with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, frames of reference, and acceleration;
(C) analyze and describe accelerated motion in two dimensions, including using equations, graphical vector addition, and projectile and circular examples; and
(D) calculate the effect of forces on objects, including the law of inertia, the relationship between force and acceleration, and the nature of force pairs between objects using methods, including free-body force diagrams.

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