Disney Youth Education Series

Disney's World of Physics: Energy and Waves

National Standards

Understands basic concepts about the structure and properties of matter

Grades 3–5

- Knows that objects can be classified according to their properties.

Understands energy types, sources, and conversions, and their relationship to heat and light

Grades 3–5

- Knows the organization of a simple electrical circuit

Grades 6–8

- Knows that energy is the property of many substances
- Understand that energy cannot be created or destroyed only changed from one form to another

Grades 9–12

- Knows that although the total energy of the universe remains constant, matter tends to become steadily less ordered as various energy transfers occur, and the energy tends to spread out uniformly

Understands motion and the principles that explain it

Grades 3–5

- Knows that the pitch of a sound depends on the frequency of the vibration producing it
- Knows that light can be reflected, refracted, or absorbed

Grades 6–8

- Knows that vibrations move at different speed in different materials, have different wavelengths, and set up wave–like disturbances that spread away from the source
- Knows ways in which light interacts with matter
- Knows that only a narrow range of wavelengths of electromagnetic radiation can be seen by the human eye: differences of wavelength within that range of visible light are perceived as differences in color

Grades 9–12

- Knows that waves have energy and can transfer energy when they interact with matter
- Knows that range of the electromagnetic spectrum; electromagnetic waves result when a charged object is accelerated or decelerated, and the energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength

Knows that kinds of forces that exist between objects and within atoms

Grades 3–5

- Knows that electrically charged material pulls on all other materials and can attract or repel other charged materials.
- Knows that magnets attract and repel each other and attract certain kinds of other materials

Grades 6–8

- Knows that just as electric currents can produce magnetic forces, magnets can cause electric currents.

Grades 9–12

- Knows that materials that contain equal proportions of positive and negative charges are electrically neutral, but a very small excess or deficit of negative charges in a material produces noticeable electric forces
- Knows that magnetic forces are very closely related to electric forces and can be thought of as different aspects of a single magnetic force; the interplay of these forces is the basis for electric motors, generators, radio, television, and many other technologies

Understands the nature of scientific knowledge

Grades 3–5

- Knows that although the same scientific investigation may give slightly different results when it is carried out by different persons, or at different times or places, the general evidence collected from the investigations should be replicable by others

Grades 6–8

- Knows that all scientific ideas are tentative and subject to change and improvement in principle, but for most core ideas in science, there is much experimental and observational confirmation

Understands the nature of scientific inquiry

Grades 3–5

- Plans and conducts simple investigations
- Uses simple tools to gather scientific data and extended senses
- Knows that good scientific explanations are based on evidence and scientific knowledge

Grades 6–8

- Knows that there is no fixed procedure called "the scientific method," but that investigations involve systematic observations, carefully collected, relevant evidence, logical reasoning, and some imagination in developing hypotheses and explanations
- Designs and conducts a scientific investigation
- Uses appropriate tools and techniques to gather, analyze, and interpret scientific data
- Establishes relationships based on evidence and logical argument

Grades 9 –12

- Understands the use of hypotheses in science
- Uses technology and mathematics to perform accurate scientific investigations and communications
- Knows that scientists conduct investigations for a variety or reasons

Understands the sources and properties of energy

Grades 3–5

- Knows the organization of a simple electrical circuit
- Knows that light can be reflected, refracted, or absorbed
- Knows that the pitch of a sound depends on the frequency of the vibration producing it

Grades 6–8

- Knows that energy is a property of many substances
- Knows how the Sun acts as a major source of energy for changes on the Earth's surface
- Knows that electrical circuits provide a means of transferring electrical energy to produce heat, light, sound, and chemical changes
- Knows that most chemical and nuclear reactions involve a transfer of energy
- Knows that vibrations move at different speeds in different materials, have different wavelengths, and set up wave–like disturbances that spread away from the source
- Knows ways in which light interacts with matter
- Knows that only a narrow range of wavelengths of electromagnetic radiation can be seen by the human eye; differences of wavelength within that range of visible light are perceived as differences in color

Grades 9–12

- Knows that waves have energy and can transfer energy when they interact with matter
- Knows the range of the electromagnetic spectrum

Understands forces and motion

Grades 3–5

- Knows that magnets attract and repel each other and attract certain kinds of other materials (e.g., iron, steel)
- Knows that electrically charged material pulls on all other materials and can attract or repel other charged materials.

Grades 6–8

- Knows that just as electric currents can produced magnetic forces, magnets can cause electric currents.

Grades 9–12

- Knows that magnetic forces are very closely related to electric forces and can be thought of as different aspects of a single electromagnetic force (moving electric charges produce magnetic forces and moving magnets produce electric forces); the interplay of theses forces is the basis for electric motors, generators, radio, television, and many other modern technologies.