*Discovery Science Library The Basics: Physical Science Teacher’s Edition* Teacher’s Guide

Discovery Science Library

The Basics: Physical Science Teacher’s Edition *Teacher’s Guide* 2

This Physical Science Library includes the following segments: Electricity and Magnetism; Energy; Forces and Motions; Matter, Tools and Machines; and Waves, Light, and Sound.

**I. ELECTRICITY AND MAGNETISM**

**A. Electricity**

**Main Points**

• Electricity is the flow of negatively charged electrons between two or more atoms.

• For moving electrons to produce a consistent current, they must flow through a conductor. An electric current travels along a pathway called a circuit.

• People have harnessed the power of falling water to rotate the shafts of generators and produce an electric current. Electricity powers homes, industries, and offices.

**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about electricity?

• Why is electricity important to our lives?

After showing this segment, find out what students have learned:

• What is the relationship between an electric current and a circuit?

• How does falling water help produce electricity?

**B. Magnetism**

**Main Points**

• A substance in which most atoms create magnetic domains will have a magnetic force.

• Earth is a magnet with magnetic north and south poles, surrounded by a series of magnetic field lines in the surrounding space.

• Electricity and magnetism are linked. When an electric current flows through a wire, a magnetic field is produced, resulting in electromagnetism. If a magnet is moved near a coil of wire, an electric current will be generated.

**Grade Level:** K–8

**Curriculum Focus:** Physical Science \

**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about magnetism?

• Why do you think magnetism is important?

After showing this segment, find out what students have learned:

• What causes Earth’s magnetic field?

• What is unique about the relationship between electricity and magnetism?

**II. ENERGY**

**A. Kinds and Forms of Energy**

**Main Points**

• Energy exists in many forms, and can be changed from one form to another.

• Examples of different forms of energy include heat, light, electrical, chemical, mechanical, sound, and nuclear.

• Potential energy is stored, while kinetic energy has already been put to work.

**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about energy?

• How does energy affect your life?

After showing this segment, find out what students have learned:

• What are different forms of energy?

• What is the difference between potential and kinetic energy?

**B. Temperature and Heat**

**Main Points**

• Heat energy flows to colder objects.

• Temperature can be measured on the Celsius, Fahrenheit, and Kelvin scales.

• Heat is transferred from one object to another through conduction, convection, and radiation.

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Before showing this segment, ask students the following:

• What is heat?

• What is the difference between heat and temperature?

After showing this segment, find out what students have learned:

• When is the Kelvin scale used?

• What is the difference between conduction and convection? How is heat transferred through radiation?

**C. Energy Sources**

**Main Points**

• The sun is the source of most of the energy in living things.

• Burning fossil fuels creates pollution, a key reason for exploring alternative energy sources.

• Renewable energy sources include solar, wind, and geothermal energy.

Before showing this segment, ask students the following:

• Why is the sun the source of energy in most living things?

• Why does burning fossil fuels cause pollution?

After showing this segment, find out what students have learned:

• What is the difference between renewable and nonrenewable energy sources?

• What is the source of geothermal energy?

**III. FORCES AND MOTIONS**

**A. Gravity and Friction**

**Main Points**

• An object moves when a force, such as a push or a pull, is exerted on it. The factors that describe an object’s motion are its speed (the distance an object travels in a given amount of time), direction, and its acceleration (the change in speed over time).

• The force of gravity pulls objects together; it exists between any two objects that have mass. Gravity keeps planets in orbit and earthly objects firmly on the ground.

• Friction is the movement of one object against another, such as automobile tires and the road.

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**Discussion Questions**

Before showing this segment, ask students the following:

• What do you think causes objects to move?

• What do you know about gravity?

After showing this segment, find out what students have learned:

• What three factors are used to measure an object’s the motion?

• What are two common examples of friction?

**B. Laws of Motion**

**Main Points**

• Sir Isaac Newton published three laws of motion in the 17th century. The first, the law of inertia, states that a body in motion will continue to travel in a straight line at a constant speed until an outside force acts on it.

• Newton’s second law states that all objects accelerate at the same rate when free falling, or when gravity is the force acting on an object. But air resistance can affect the velocity of an object.

• Newton’s third law states that for every action, there is an equal and opposite reaction.

**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about Sir Isaac Newton?

• What effect does gravity have on motion?

After showing this segment, find out what students have learned:

• What is the relationship between acceleration and deceleration and velocity?

• Give an example in everyday life of Newton’s third law (For every action, there is an equal and opposite reaction).

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**IV. MATTER**

**A. States and Properties of Matter**

**Main Points**

• Matter is anything that has mass and takes up space; matter comprises all objects in the universe.

• Physical properties of matter include hardness and color. Chemical properties refer to what happens when one substance reacts with another.

• The three most common states of matter are solid, liquid, and gas. Matter changes from one state to another when heat or pressure is added or removed.

**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about matter?

• What are the three states of matter?

After showing this segment, find out what students have learned:

• What is the difference between a physical and chemical property of matter?

• What causes matter to change from one state to another?

**B. Characteristics of Matter**

**Main Points**

• An element is the fundamental building block of matter. Elements are organized on a chart called the periodic table.

• Atoms can combine to form compounds, which are grouped into three categories: acid, base, or salt.

• A mixture is the physical combination or one or more materials. Mixtures can be homogeneous or heterogeneous.

**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about elements?

• What do you know about compounds and mixtures?

After showing this segment, find out what students have learned: Published by Discovery Education. © 2005. All rights reserved. Discovery Science Library The Basics: Physical Science Teacher’s Edition *Teacher’s Guide* 6

• What happens when two elements form a compound?

• What is the difference between a compound and a mixture?

**C. Changes in Matter**

**Main Points**

• The chemical change, or reaction, that causes fire is called combustion.

• All chemical reactions involve energy. A chemical reaction that produces heat or light is an endothermic reaction; one that requires more energy than is produced is an exothermic reaction.

• During a nuclear reaction, the atoms of one element change into atoms of another element.

**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about chemical reactions?

• Do you know of any chemical reactions that take place in your daily life?

After showing this segment, find out what students have learned:

• What is the difference between an exothermic and an endothermic reaction?

• What happens during a nuclear reaction?

**V. TOOLS AND MACHINES**

**A. Machines**

**Main Points**

• A machine is a tool that makes work easier. It doesn’t decrease the amount of work; it allows an individual to exert less force by reducing the distance in which a force is exerted or changing its direction.

• All machines are based on the six simple machines: the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw.

• The lever allows an individual to move an object with less effort than would be needed otherwise; but a pulley can change the direction of the force applied.

**Discussion Questions**

Before showing this segment, ask students the following:

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• What do you know about machines?

• Can you name the six simple machines?

After showing this segment, find out what students have learned:

• What are the differences among the three classes of levers?

• How does a wedge work?

**B. Work and Power**

**Main Points**

• Work is the measure of the energy transferred when a force moves an object from one place to another.

• Power is a measurement of how much work is performed in a given time, or the rate at which work is done.

• Energy is the capacity to do work; all machines require energy to supply the force that will make them move.

**Discussion Questions**

Before showing this segment, ask students the following:

• Do you know the scientific definition of work?

• Do you know the scientific definition of power?

After showing this segment, find out what students have learned:

• What is the relationship between work and power?

• What is energy and why is it important?

**VI. WAVES, LIGHT, AND SOUND**

**A. Waves**

**Main Points**

• Two kinds of waves are mechanical and electromagnetic. Mechanical waves must travel through matter, and electromagnetic waves can travel through space.

• Mechanical and electromagnetic waves can be divided into two groups: longitudinal and transverse. Each kind travels differently and is measured in different ways.

• Sound waves are longitudinal waves, and electromagnetic waves are transverse waves.

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**Discussion Questions**

Before showing this segment, ask students the following:

• What do you know about waves?

• Where have you seen waves in your daily life?

After showing this segment, find out what students have learned:

• How are longitudinal waves measured?

• How are waves on the electromagnetic spectrum categorized?

**B. Light**

**Main Points**

• Light has the properties of a particle stream and a wave.

• White light is a combination of all visible wavelengths and can be divided into separate colors through a prism; colors are visible because wavelengths of light vary.

• Reflecting and refracting telescopes enable us to see objects in space.

**Discussion Questions**

Before showing this segment, ask students the following:

• What are the colors in the visible electromagnetic spectrum?

• How do you think light travels?

After showing this segment, find out what students have learned:

• Why are colors visible?

• What is the difference between reflecting and refracting telescopes?

**C. Sound**

**Main Points**

• Sound occurs when objects vibrate through a medium; air particles are compressed and relaxed as sound travels.

• Three bones in the eardrum—the hammer, anvil, and stirrup—amplify the vibrations so that humans can hear sound.

• Dolphins use sonar to find food; elephants use infrasound to communicate over long distances.

**Discussion Questions**

Before showing this segment, ask students the following:

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• What do you think sound is?

• How do you think humans hear?

After showing this segment, find out what students have learned by asking the following:

• How do dolphins use sonar to find food?

• How do elephants use infrasound to communicate?

**Support Materials**

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

• http://school.discovery.com/teachingtools/teachingtools.html

**DVD Content**

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

***How to Use the DVD***

The DVD starting screen has the following options:

***Play Video***—This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

***Video Index***—Here the video is divided into sections (see below), indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

***Standards Link***—Selecting this option displays a single screen that lists the national academic standards the video addresses.

***Teacher Resources***—This screen gives the technical support number and Web site address.

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***Video Index***

**I. ELECTRICITY AND MAGNETISM**

**Electricity**

Learn about the principles of electricity: what it is and how people have harnessed it. Observe how electricity changes life in a village in Brazil.

**Magnetism**

Find out makes materials magnetic and observe Earth’s magnetic field. Discover the unique relationship between magnetism and electricity and the inventions that have emerged from it.

**II. ENERGY**

**Kinds and Forms of Energy**

Learn about the different forms of energy: heat, solar, electrical, chemical, mechanical, sound, and nuclear. Discover the difference between potential and kinetic energy.

**Temperature and Heat**

Find out about heat and temperature and how they are related. Explore different temperature scales and how heat is transferred from one object to another.

**Energy Sources**

Discover how the sun sustains life on Earth. Learn the difference between renewable and nonrenewable energy sources. Explore the alternative energy sources of solar, wind, and geothermal energy.

**III. FORCES AND MOTIONS**

**Gravity and Friction**

Find out how motion is measured and how gravity keeps the planets in orbit. Discover why friction is important when driving in a race or on a wet road.

**Laws of Motion**

Discover how Newton’s three laws of motion changed the way people viewed the world. Learn about inertia and resistance and what causes acceleration.

**IV. MATTER**

**States and Properties of Matter**

Learn about matter and how to identify its physical and chemical properties. Find out what happens when matter changes from one state to another.

**Characteristics of Matter**

Find out the difference between an element and a compound. Learn about the categories of compounds. Observe how chemical reactions result in cave formations.

**Changes in Matter**

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Learn what causes a combustion reaction and the resulting chemical and physical changes. Observe the workings of a nuclear reaction.

**V. TOOLS AND MACHINES**

**Machines**

Explore the principles behind the six simple machines: the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw.

**Work and Power**

Discover the difference between work and power and how each is measured. Find out how energy relates to both.

**VI. WAVES, LIGHT, AND SOUND**

**Waves**

Learn the differences between mechanical and electromagnetic waves. Find out about longitudinal and transverse waves. Observe waves on the electromagnetic spectrum.

**Light**

Observe the colors in visible light and how they travel through space. Discover how reflecting and refracting telescopes work.

**Sound**

Discover the secrets of sound and how it is measured. Find out how humans hear, how dolphins use sonar, and how elephants communicate over long distances.

***Academic Standards***

This library addresses the following national standards.

***National Academy of Sciences***

http://books.nap.edu/html/nses/overview.html#content

Grades K-4: Physical Science: Properties of objects and materials; Position and motion of objects; Light, heat, electricity, and magnetism

Grades 5: Physical Science: Properties and changes of properties in matter; Motions and forces; Transfer of energy

***Mid-continent Research for Education and Learning***

http://www.mcrel.org/compendium/browse.asp

• Understands the structure and properties of matter

• Understands sources and properties of energy

• Understands forces and motion

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