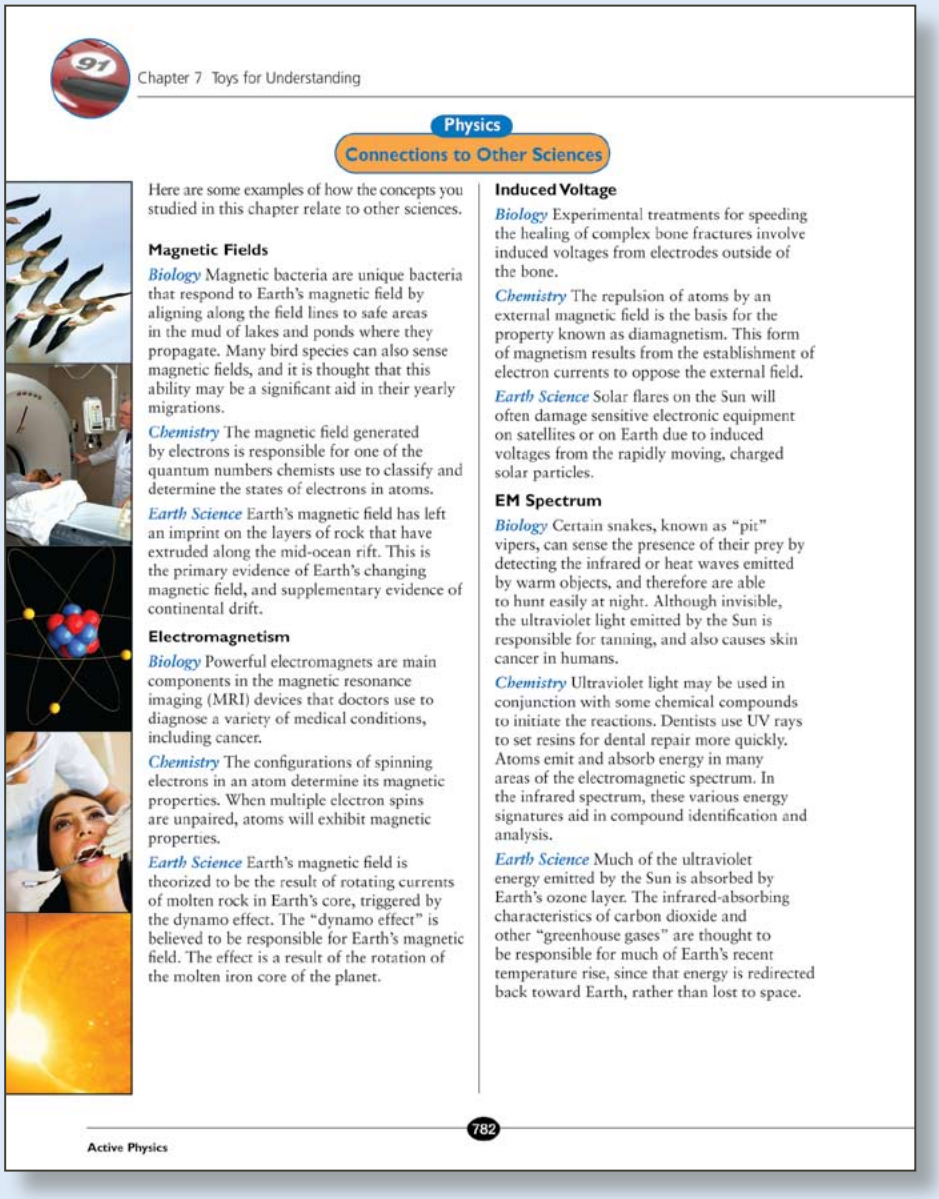
Physics Connections to Other Sciences

This section describes interdisciplinary interactions between sciences through different examples. Each description provides an insight to the interconnectedness between the physics concepts presented in this chapter and the scientific disciplines of biology, chemistry, and Earth Science.

While discussing how physics concepts relate to other sciences, encourage students to draw analogies with science connections with which they are familiar. The discussion should give students the idea of how scientists develop new insights from interdisciplinary connections. Emphasize the growing interdisciplinary approach to science and the need for scientists to understand the fundamentals of electricity, magnetism, and electromagnetism. Encourage appreciation for physics in relation to the broader framework of science by describing the increase in demand for scientists with interdisciplinary backgrounds; for example, geophysics, biochemistry, and biophysics.



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Physics

Connections to Other Sciences

Here are some examples of how the concepts you studied in this chapter relate to other sciences.

Magnetic Fields

Biology Magnetic bacteria are unique bacteria that respond to Earth's magnetic field by aligning along the field lines to safe areas in the mud of lakes and ponds where they propagate. Many bird species can also sense magnetic fields, and it is thought that this ability may be a significant aid in their yearly migrations.

Chemistry The magnetic field generated by electrons is responsible for one of the quantum numbers chemists use to classify and determine the states of electrons in atoms.

Earth Science Earth's magnetic field has left an imprint on the layers of rock that have extruded along the mid-ocean rift. This is the primary evidence of Earth's changing magnetic field, and supplementary evidence of continental drift.

Electromagnetism

Biology Powerful electromagnets are main components in the magnetic resonance imaging (MRI) devices that doctors use to diagnose a variety of medical conditions, including cancer.

Chemistry The configurations of spinning electrons in an atom determine its magnetic properties. When multiple electron spins are unpaired, atoms will exhibit magnetic properties.

Earth Science Earth's magnetic field is theorized to be the result of rotating currents of molten rock in Earth's core, triggered by the dynamo effect. The "dynamo effect" is believed to be responsible for Earth's magnetic field. The effect is a result of the rotation of the molten iron core of the planet.

Induced Voltage

Biology Experimental treatments for speeding the healing of complex bone fractures involve induced voltages from electrodes outside of the bone.

Chemistry The repulsion of atoms by an external magnetic field is the basis for the property known as diamagnetism. This form of magnetism results from the establishment of electron currents to oppose the external field.

Earth Science Solar flares on the Sun will often damage sensitive electronic equipment on satellites or on Earth due to induced voltages from the rapidly moving, charged solar particles.

EM Spectrum

Biology Certain snakes, known as "pit" vipers, can sense the presence of their prey by detecting the infrared or heat waves emitted by warm objects, and therefore are able to hunt easily at night. Although invisible, the ultraviolet light emitted by the Sun is responsible for tanning, and also causes skin cancer in humans.

Chemistry Ultraviolet light may be used in conjunction with some chemical compounds to initiate the reactions. Dentists use UV rays to set resins for dental repair more quickly. Atoms emit and absorb energy in many areas of the electromagnetic spectrum. In the infrared spectrum, these various energy signatures aid in compound identification and analysis.

Earth Science Much of the ultraviolet energy emitted by the Sun is absorbed by Earth's ozone layer. The infrared-absorbing characteristics of carbon dioxide and other "greenhouse gases" are thought to be responsible for much of Earth's recent temperature rise, since that energy is redirected back toward Earth, rather than lost to space.

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