

Physics Connections to Other Sciences

This section relates physics to other sciences that investigate natural phenomena. The ability to survive and acceleration may not appear to be similar, yet there is an indisputable connection between the two. Fast-moving animals can escape their predators while slow-moving animals find it difficult to reach the same level of survival as they cannot escape their predators so easily. From the smallest level of molecular motion to the most massive form of movement that occurs during earthquakes and weather changes, rapid changes can be understood using the knowledge of physics concepts. You might want to use the first set of examples to draw students into a discussion of how physics connects to other sciences. Students can explore the remaining set of connections by explaining these connections in their *Active Physics* logs.

Highlighting key points on posters will help students to retain information. Working together in a group leads to a sharing of responsibilities and students benefit from each other's perspective. Assigning tasks will encourage all students to participate. You should also ask students to include connections they may have made on their own while studying other branches of science. Finally, to gauge how much students have benefited from such an interdisciplinary approach, consider giving them a short quiz on what they have learned in *Physics Connections to Other Sciences*.



Physics

Connections to Other Sciences



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

Velocity and Acceleration

Biology An animal's ability to accelerate, and the velocity it is able to achieve, determine its means of survival. Slower-moving animals such as turtles must rely upon defensive mechanisms to survive, while faster-moving animals such as cheetahs or rabbits either become predators or use their speed and ability to evade predators.

Chemistry Atoms and molecules are in constant motion, and gas molecules are constantly accelerating by changing speed and direction as a result of collisions.

Earth Science Changes in Earth systems are due to movement. Earthquakes, weather patterns, and landform erosion require movement with some velocity. When land rapidly accelerates during an earthquake, tremendous damage may occur.



Kinetic Energy

Biology The energy of food atoms that have been consumed are used up by exercise, which is kinetic energy.

Chemistry The temperature of a gas is determined by the average kinetic energy of its molecules.

Earth Science The kinetic energy of wind and water is responsible for the erosive power of these elements.



Potential Energy

Biology Plants store the energy of sunlight in the form of compounds like *ATP*, which participate in chemical reactions that release energy.

Chemistry *GPE* which is stored by an elevated object becomes *KE* as the object falls and becomes more tightly bound to the Earth. Molecules interacting in a chemical reaction can rearrange their atoms into new product molecules in which their atoms are more tightly bound. When this happens, the atoms that become more tightly bound experience a



decrease in their electric potential energy, and there is an increase in the *KE* of the product molecules.

Earth Science The potential energy stored within high-temperature compressed gases in lava is the source of violent volcanic explosions.

The Force of Gravity and Weight

Biology The force of gravity acts on all elements of the biosphere and determines phenomena such as the height of a tree, or the maximum size and mass an animal may attain.

Chemistry Gravitational forces on the gases in our atmosphere determine its composition, and explain why light atoms such as hydrogen and helium are not normally found in air.

Earth Science The tremendous force of gravity acting on layers deep within Earth transforms sedimentary rock into metamorphic rock.

Springs

Biology The spring-like action of muscles and tendons allows animals to move and jump.

Chemistry Chemical bonds are often modeled in terms of springs, as atoms vibrate back and forth within these bonds.

Earth Science When large glaciers cover a landmass, they often compress the ground. When the glaciers retreat, the ground may "rebound" like a spring, causing small earthquakes to occur.

Work and Conservation of Energy

Biology The work done by a bird to fly to a greater height is converted into kinetic energy as the bird swoops down, gaining speed.

Chemistry Work done compressing a gas is converted into heat which may be sufficient to provide the "activation energy" required to ignite a fuel-air mix in a diesel engine.

Earth Science A boulder launched by an explosive volcano starts with a fixed amount of kinetic energy, which is converted into gravitational potential energy as it rises and then back to kinetic energy as it falls to Earth.