Group #1: Conserving Resources

SCIENCE Online

Research Visit the Glencoe Science Web site at **tx.science.glencoe.com** for information about the hypothesis that rising levels of carbon dioxide in the atmosphere cause global warming. In your Science Journal, write one fact that supports the hypothesis and one fact that does not.

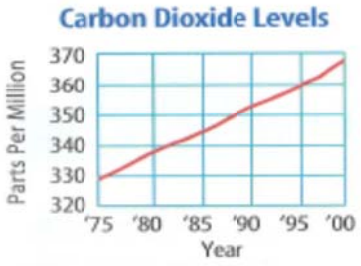


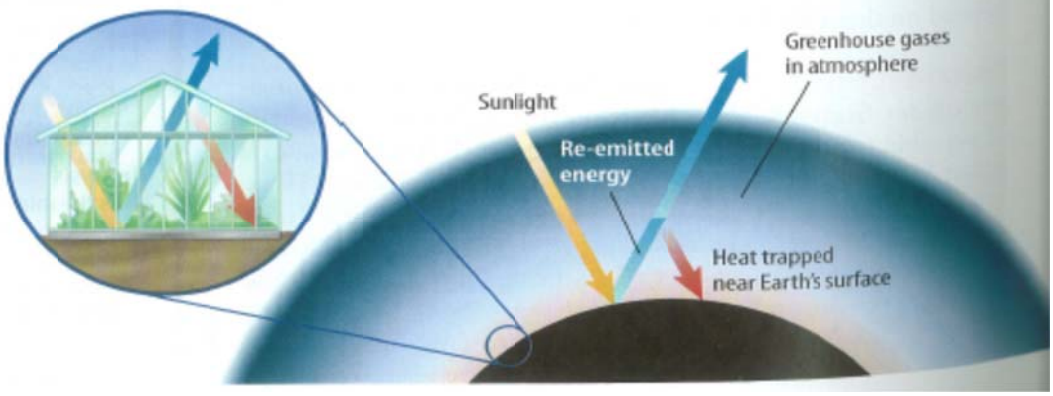
Figure 13
The moment you step inside a greenhouse, you feel the results of the greenhouse effect. Heat is trapped by the glass walls. In a similar way, atmospheric greenhouse gases trap heat close to Earth's surface.

Greenhouse Effect

Energy from the Sun travels through the atmosphere to Earth's surface. Some of this energy normally is re-emitted back into space. The rest is trapped by certain atmospheric gases, as shown in **Figure 13.** This heat-trapping feature of the atmosphere is the **greenhouse effect.** Without it, temperatures on Earth probably would be too cold to support life.

Atmospheric gases that trap heat are called greenhouse gases. One of the most important greenhouse gases is carbon dioxide (CO_2). CO_2 is a normal part of the atmosphere. It is also a by-product that forms when fossil fuels are burned. Over the past century, more fossil fuels have been burned than ever before, which is increasing the percentage of CO_2 in the atmosphere. The atmosphere might be trapping more of the Sun's heat, making Earth warmer. A rise in Earth's average temperature, possibly caused by an increase in greenhouse gases, is known as global warming.

Global Warming Temperature data collected from 1900 through 2000 indicate that Earth's temperature increased by about 0.6°C over that 100-year period. Most of this temperature increase occurred between the years 1910 and 1945 and between the years 1976 to 2000. No one is certain whether this increase in temperature was caused by human activities or is a natural part of Earth's weather cycle. For example, the output of energy from the Sun varies by small amounts. These variations in solar output might cause climate to change. Volcanic eruptions also can affect global termperatures, although they usually cause temperatures to decrease for several years after the eruption. Global warming might cause rainfall patterns to change and could affect the rate of plant growth.



Group #2: Structure and Movement

Immovable Joints Refer to **Figure 5** as you learn about different types of joints. Joints are broadly classified as immovable or movable. An immovable joint allows little or no movement. The joints of the bones in your skull and pelvis are classified as immovable joints.

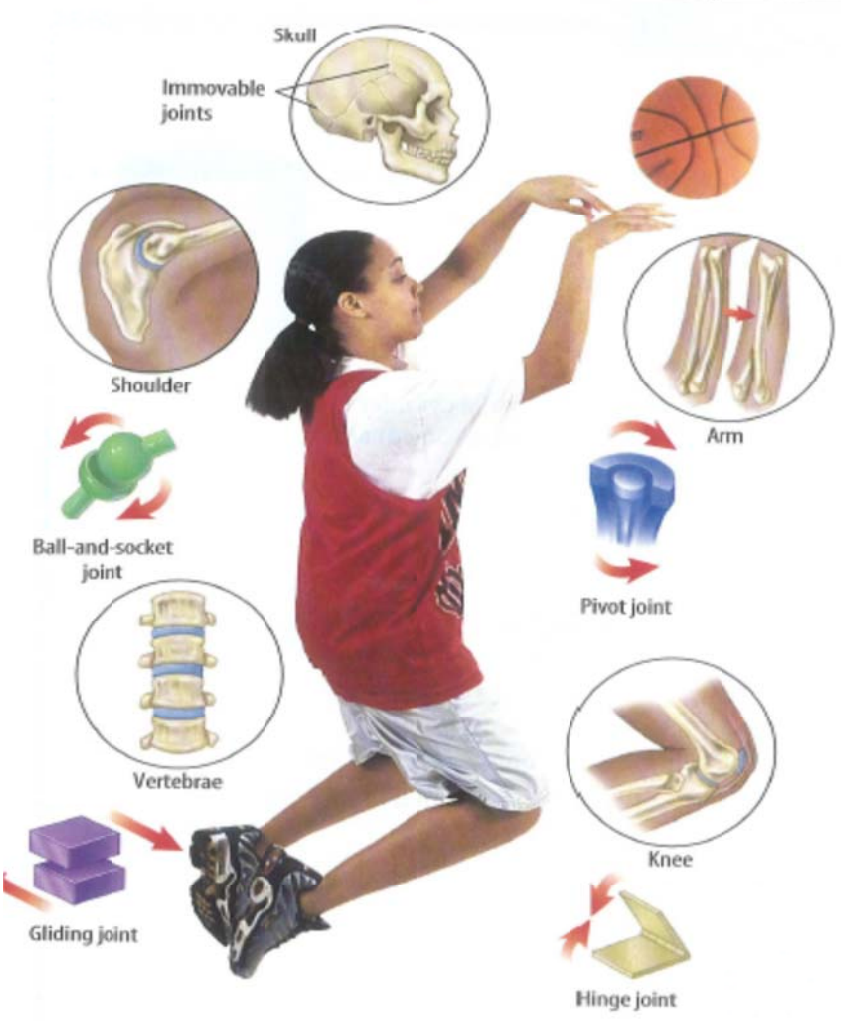
Movable Joints All movements, including somersaulting and working the controls of a video game, require movable joints. A movable joint allows the body to make a wide range of motions. There are several types of movable joints—pivot, ball and socket, hinge, and gliding. In a pivot joint, one bone rotates in a ring of another bone that does not move. Turning your head is an example of a pivot movement.

A ball-and-socket joint consists of a bone with a rounded end that fits into a cuplike cavity on another bone. A ball-and-socket joint provides a wider range of motion than a pivot joint does. That's why your legs and arms can swing in almost any direction.

A third type of joint is a hinge joint. This joint has a back-and-forth movement like hinges on a door. Elbows, knees, and fingers have hinge joints. Hinge joints have a smaller range of motion than the ball-and-socket joint. They are not dislocated as easily, or pulled apart, as a ball-and-socket joint can be.

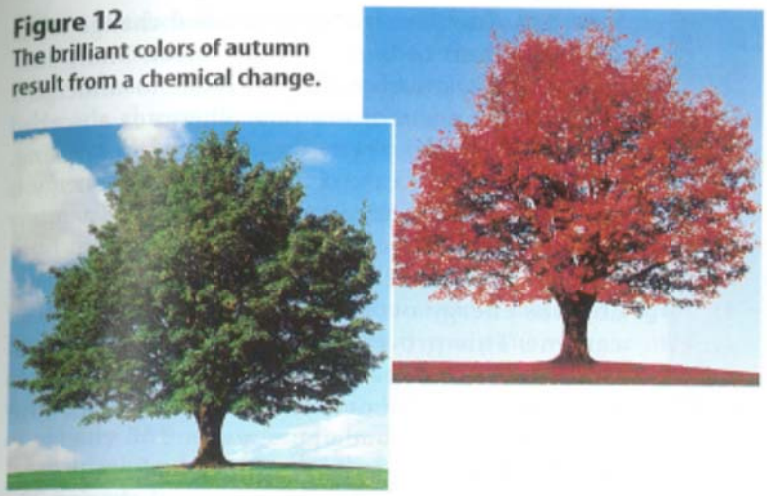
A fourth type of joint is a gliding joint in which one part of a bone slides over another bone. Gliding joints also move in a back-and-forth motion and are found in your wrists and ankles and between vertebrae. Gliding joints are used the most in your body. You can't write a word, use a joy stick, or take a step without using a gliding joint.

Figure 5
When a basketball player shoots a ball, several types of joints are in action. *What other activities use several types of joints?*



Group #3: Physical and Chemical Changes

Figure 12
The brilliant colors of autumn result from a chemical change.



Signs of Chemical Changes

Physical changes are relatively easy to identify. If only the form of a substance changes, you have observed a physical change. How can you tell whether a change is a chemical change? If you think you are unfamiliar with chemical changes, think again.

Life Science INTEGRATION

You have witnessed a spectacular change if you have seen the leaves of trees change colors in autumn, but you are not seeing a chemical change. Chemicals called pigments give tree leaves their color. In **Figure 12,** the pigment that is responsible for the green color you see during the summer is chlorophyll (KLOHR uh fihl). Two other pigments result in the colors you see in the red tree. Throughout the spring and summer, chlorophyll is present in much greater amounts than these other pigments, so you see leaves as green. In autumn, however, changes in temperature and rainfall amounts cause trees to stop producing chlorophyll. The chlorophyll that is already present undergoes a chemical change in which it loses its green color. Without chlorophyll, the red and yellow pigments, which are always present, can be seen.

Color Perhaps you have found that a half-eaten apple turns brown. The reason is that a chemical change occurs when food spoils. Maybe you have toasted a marshmallow or a slice of bread and watched them turn black. In each case, the color of the food changes as it is cooked because a chemical change occurs.

SCIENCE Online

Research Visit the Glencoe Science Web site at **tx.science.glencoe.com** for more information about how to recognize chemical changes. Choose one example not mentioned in the chapter and present it to the class as a poster or in an oral report.

TRY AT HOME Mini LAB

Comparing Changes

Procedure

1. Separate a piece of **fine steel wool** into two halves.
2. Dip one half in **tap water.**
3. Place each piece of steel wool on a separate **paper plate** and let them sit overnight.

Analysis

1. Did you observe any changes in the steel wool? If so, describe them.
2. If you observed changes, were they physical or chemical? How do you know?

Group #4: Temperature

The Celsius Scale Another temperature scale that is used more widely throughout the world is the Celsius (SEL see us) scale. On the Celsius temperature scale, the freezing point of water is given the temperature 0°C and the boiling point is given the temperature 100°C. Because there are only 100 Celsius degrees between the boiling and freezing points of water, a temperature change of one Celsius degree is bigger than a change of one Fahrenheit degree.

Heat

On a warm, sunny day when you tilt your head back, you can feel the warmth of the Sun on your face. On a chilly day, putting your cold hands near an open fire warms them up. In both cases, you could feel heat from the Sun and from the fire making you warmer. What is heat?

Look at **Figure 14.** Suppose you pick up a tall glass of iced tea. If you hold the glass for a while, the drink warms up. Your hand is at a higher temperature than the tea, so the atoms and molecules in your hand have a higher kinetic energy than the ones in the iced tea. Kinetic energy from the moving atoms and molecules in your hand is transferred by collisions to the atoms and molecules in the tea.

A transfer of energy from one object to another due to a difference in temperature is called **heat.** Heat flows from warmer objects to cooler ones. In the example just given, heat flows out of your hand and into the glass of iced tea. As you hold the glass, the temperature of the tea increases and the temperature of your skin touching the glass decreases. Heat will stop flowing from your hand to the glass of tea when the temperatures of your hand and the glass are the same.

Figure 14
Heat flows from your hand to the glass of iced tea, making your hand feel cold. *Why do people wear gloves in cold weather?*

Heat and Temperature

How much does the temperature of something increase when heat is transferred to it? It depends on two things. One is the amount of material in the object. The other is the kinds of atoms the material is made of. For example, compared to other materials, water is an unusual substance in that it must absorb a large amount of heat before its temperature rises by one degree. Water often is used as a coolant. The purpose of the water in a car's radiator is to carry a large amount of heat away from the engine and keep the engine from being damaged by overheating, as shown in **Figure 15.**

Figure 15
This car's engine overheated because its cooling system didn't carry enough heat from the engine.

Group #5: Motion, Forces, and Simple Machines

TRY AT HOME

Mini LAB

Determining Weights in Newtons

Procedure:

1. Stand on a **bathroom scale** and measure your weight.
2. Hold a **large book,** stand on the scale, and measure the combined weight of you and the book.
3. Repeat step #2 using a **chair, heavy coat,** and a **fourth object** of your choice.

Analysis

1. Subtract your weight from each of the combined weights to calculate the weight of each object in pounds.
2. Multiply the weight of each object in pounds by 4.4 to calculate its weight in newtons.
3. Calculate your own weight in newtons.

Newton's Laws of Motion

In 1665, a deadly plague spread across Europe. People who lived in crowded cities were most affected. Sir Isaac Newton was in college at the time. The school closed down because the disease was spreading rapidly. Newton, who was 23 years old, returned to his house in the country to wait for the plague to end. During this time, he discovered many things about nature, including how gravity works. One of his great discoveries was how forces cause motion. He realized he could explain the motion of objects using a set of rules, which in time came to be called Newton's laws of motion.

Newton's First Law

When you give a book on a table a push, it slides and comes to a stop. After you throw or hit a baseball and it hits the ground, it soon rolls to a stop. In fact, it seems that anytime you set something in motion, it stops moving after awhile. You might conclude that to keep an object moving, a net force must be exerted on the object at all times.

Newton and a few others before him realized that an object could be moving even if no net force was acting on it. According to Newton's first law of motion, an object will not change its motion unless a force acts on it. Therefore, an object that is not moving, like a book sitting on a table, remains at rest until something pushes or pulls it.

What if an object is already moving, like a football you've just thrown to someone? Newton's first law says the motion of the football won't change unless a force is exerted on it. This means that after the ball is in motion, a force has to be applied to make it speed up, slow down, or change direction. In other words, a moving object, like the ball in **Figure 8,** moves in a straight line with constant speed unless a force acts on it.

Figure 8
After the ball has been hit, it will move along the ground in a straight line, until it is acted on by another force.

Group #6: Interactions of Life

Symbiotic Relationships

Not all relationships among organisms involve food. Many organisms live together and share resources in other ways. Any close relationship between species is called **symbiosis.**

Figure 15
Many examples of symbiotic relationships exist in nature.

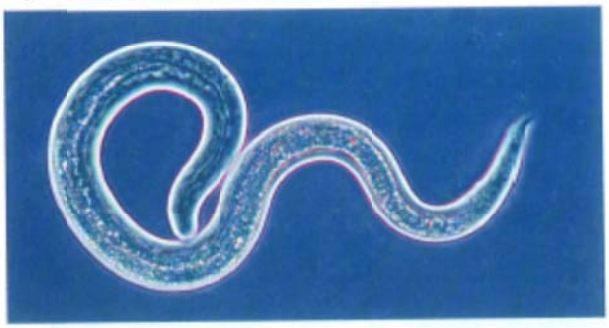
A Lichens are a result of mutualism.

Mutualism You may have noticed crusty lichens growing on fences, trees, or rocks. Lichens, like those shown in **Figure 15A,** are made up of an alga or a cyanobacterium that lives within the tissues of a fungus. Through photosynthesis, the cyanobacterium or alga supplies energy to itself and the fungus. The fungus provides a protected space in which the cyanobacterium or alga can live. Both organisms benefit from this association. A symbiotic relationship in which both species benefit is called **mutualism** (MYEW chuh wuh lih zum).

B Clown fish and sea anemones have a commensal relationship.

Commensalism If you've ever visited a marine aquarium, you might have seen the ocean organisms shown in **Figure 15B.** The creature with gently waving, tubelike tentacles is a sea anemone. The tentacles contain a mild poison. Anemones use their tentacles to capture shrimp, fish, and other small animals to eat. The striped clown fish can swim among the tentacles without being harmed. The anemone's tentacles protect the clown fish from predators. In this relationship, the clown fish benefits but the sea anemone is not helped or hurt. A symbiotic relationship in which one organism benefits and the other is not affected is called **commensalism** (kuh MEN suh lih zum).

Magnification: 128×



C Some roundworms are parasites that rob nutrients from their hosts.

Parasitism Pet cats or dogs sometimes have to be treated for worms. Roundworms, like the one shown in **Figure 15C,** are common in puppies. This roundworm attaches itself to the inside of the puppy's intestine and feeds on nutrients in the puppy's blood. The puppy may have abdominal pain, bloating, and diarrhea. If the infection is severe, the puppy might die. A symbiotic relationship in which one organism benefits but the other is harmed is called **parasitism** (PER uh suh tih zum).