

## Section 3

# Using Material Resources

**Key Concept** A variety of natural resources are used to make common objects.

### What You Will Learn

- Natural resources come from the atmosphere, from Earth's crust, from Earth's oceans, and from living things.
- Both environmental and economic factors must be considered when determining the cost of using natural resources.

### Why It Matters

Learning about the natural origins of common objects will help you use material resources wisely.

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Where do you get things you need, such as food and clothing? You may say they come from a store. But where does the store get the things it sells? All of the objects that you need to live come from Earth itself.

## Resources from Earth

Earth's resources can be divided into energy resources and material resources. Energy resources are natural resources that humans use to generate energy. **Material resources** are natural resources that humans use to make objects or that are consumed as food and drink. These resources come from Earth's atmosphere, crust, and oceans and from the organisms that live on Earth.

### Resources from the Atmosphere

Perhaps the most valuable resource in the atmosphere is the oxygen required for plant and animal life. Oxygen is also used to burn rocket fuel, as shown in **Figure 1**. Other valuable chemicals are found in Earth's air. Nitrogen from the atmosphere is used as a fertilizer for agricultural plant growth. Argon is an atmospheric gas that is used inside light bulbs. Argon keeps the glowing filament in the light bulb from burning up.



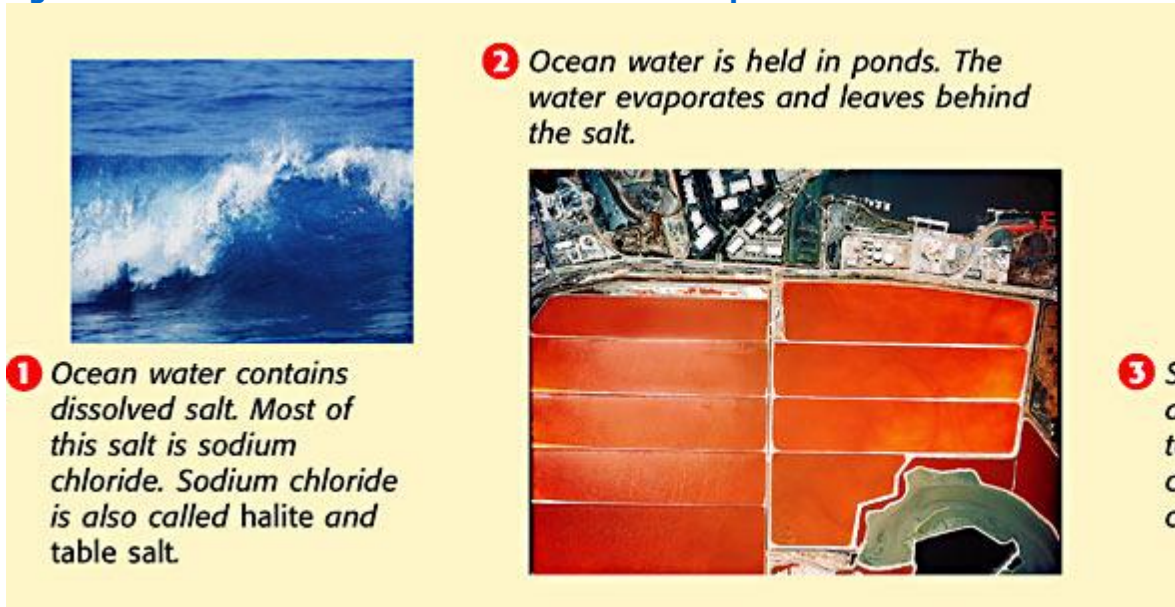
**Figure 1** Liquid oxygen from the atmosphere is used to burn fuel in the space shuttle.

### **Rock and Mineral Resources**

Minerals ranging from common sand to rare elements such as gold and platinum are used to make objects that we use daily. Earth materials are used for construction and other industrial purposes. Iron is used to make steel that serves as the framework for large buildings. Aluminum provides food and beverage packaging but is used in larger quantities to build airplanes. Copper wiring allows electricity to be distributed

efficiently. Gold is used in small quantities in computers and other electronic products. Platinum serves an essential environmental role in catalytic converters that reduce car exhaust emissions. Salt can be harvested from sea water, as shown in **Figure 2**. In addition to its use on food, salt serves as a source of chlorine for water treatment and for other industrial processes.

**Figure 2 A Mineral Resource: Salt from Solar Evaporation**



**1** Ocean water contains dissolved salt. Most of this salt is sodium chloride. Sodium chloride is also called halite and table salt.

**2** Ocean water is held in ponds. The water evaporates and leaves behind the salt.

**3** Salt is harvested from the ponds.

### **Petroleum**

A liquid mixture of complex hydrocarbons that is found in Earth's crust is called **petroleum**. You may think of petroleum as a resource that is used to provide gasoline and other fuels. But petroleum is also the raw material for other products. Some compounds in petroleum are the source of products such as waxes, tar, and asphalt. Petroleum is also the raw material for the manufacture of various types of polymers.

Polymers—sometimes called *plastics*—are made from chemicals that are separated out of petroleum. Polymers are used to make materials such as clothing and pipes for plumbing. **Figure 3** shows some of the many products that are made of polymers from petroleum.



**Figure 3** This bicyclist is using a helmet, a watch, a bicycle, gloves, and clothing that are made partly or entirely from petroleum.

**Standards Check** How is petroleum used as a material resource?

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**Figure 4 Meeting Human Needs with Natural Resources**

Some objects, such as sweaters, can be made from a single natural resource. A sweater can be made from wool or cotton or synthetic fiber.



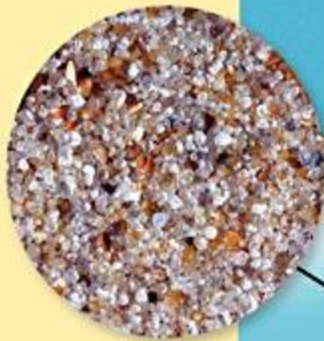
Wool comes from sheep.



Cotton comes from plants.

Other objects, such as houses, are made from a combination of different natural resources.

Wood comes from trees.



Glass is made from sand.



Cement is made from limestone.





## Resources from Living Things

Many material resources that we use are provided by living things, such as trees in the forest. Resources from living things can be combined with resources from Earth to make products we need. Some of these products are shown in **Figure 4**.

### Plant Resources

Plants store energy as sugars and starches in seeds, nuts, fruits, and roots. Humans harvest and eat plants to get this stored energy. Modern agriculture produces many kinds of plants that provide us with food and drink. Humans also grow food for domesticated animals.

Some plants, such as cotton, produce fibers that can be woven into cloth or braided into ropes or baskets. Trees supply fruit and nut crops, as well as wood for lumber, paper, and fuel. The sap of some trees may be used to make products ranging from rubber, shown in **Figure 5**, to maple syrup. Edible oils are produced from many plants.



**Figure 5** Rubber trees are tapped to collect the sap from which rubber is made. Rubber can be used to make tires, although some tires now contain synthetic rubber made from petroleum.

**Standards Check** Name some common objects that are made from plant resources.

**Animal Resources**

In some parts of the world, animals provide transportation for humans and cargo. Animals help farmers till soil for planting crops. Animals also provide meat, leather, and dairy and egg products. Fibers for clothing are supplied by animals such as sheep, goats, and llamas. And animal wastes are a source of crop fertilizers and cooking fuel for some societies.

## The Costs of Material Resources

The cost of using natural resources is related to the cost of extracting them from rock, water, or the atmosphere. Other costs include those for waste management, processing, packaging, transport, and marketing. Plant and animal resources may have additional costs related to planting, feeding, fertilization, irrigation, and pest control. And the effect of resource use on the environment is a different kind of cost.

## Economic Costs

The basic requirement for commercial products is that the total cost of making a product must be less than the price that a buyer is willing to pay for it.

Steps in the manufacture of paper are shown in **Figure 6**. Paper is made mainly from wood pulp. Highpurity clays and other ingredients are sometimes added. At each step in the paper making process, there are costs for human labor and safety, for the materials used, and for the energy needed. All of these costs will be added together to determine how much the manufacturer will charge for the finished paper. If a material resource becomes too expensive to obtain, then a cheaper resource must be used instead.

## Figure 6 The Production of Paper Recycling





### Environmental Costs

The cost of acquiring objects is sometimes more than what is reflected in the price of the object at the store. The price of paper at the store includes the economic costs of making the paper. But does the price take into account the environmental cost of the paper production? Harvesting trees for paper may destroy old-growth forests or at least disrupt local habitats. The

manufacturing process may pollute a nearby river or the atmosphere.

If a paper manufacturer installs pollution-control devices in the paper factory, that cost will be added to the monetary cost of making the paper. The price of the paper in the store will increase to reflect the increased cost of manufacturing. Some communities pass laws that require environmental protection procedures. These laws might require reduced emission of pollutants, reclamation of mined land, or the replanting of harvested trees.

**Standards Check** What are some of the environmental costs of using material resources?



### Using Resources Wisely

Reusing and recycling, as shown in **Figure 7**, help reduce the demand for some new resources. But the use of many material resources will continue to increase as the world's population increases. The economic cost of resources is sometimes reduced by improved manufacturing efficiency and by the use of new technologies. The environmental cost of using resources can also be reduced. Resources can be obtained more carefully. Land and habitats that have been damaged by mining and by the harvesting of resources can be restored. In some cases, lowering the environmental costs of using resources costs money. Communities must decide how to balance these factors as they use resources.



**Figure 7** These cubes are made of used metal products that have been compacted and are being sent to a recycling plant.

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## Section Summary

- Resources from Earth include gases from the atmosphere and rocks, minerals, and petroleum from Earth's crust.
- Living things provide humans with materials, such as food, clothing, and shelter.
- Using natural resources involves both economic and environmental costs.
- Reducing the environmental cost of using resources sometimes involves increasing the economic cost.

## Chapter Summary

### The Big Idea

Material resources differ in amounts, distribution,

usefulness, and the time required for their formation.

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## Section 1 Natural Resources

**Key Concept** Different energy and material resources can be classified as renewable or nonrenewable.

- Earth's resources can be classified as renewable or nonrenewable.
- Resources can be conserved by reducing the amount of resources we use and by reusing or recycling them.



Petroleum is a nonrenewable energy and material resource.

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## Section 2 Rock and Mineral Resources

**Key Concept** Minerals and ores are important sources of materials that are used to make common objects.

- Minerals are naturally formed, crystalline solids that form in a variety of environments.
- Ore is mined to remove rocks and minerals from Earth so that the rocks and minerals can be used to make a variety of objects.



Open-pit mines are one way that ore is removed from Earth.

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Rubber is one of the common objects made from plant material.

