Name ______________________ Date ____________ Class ____________

Enrich

States of Matter

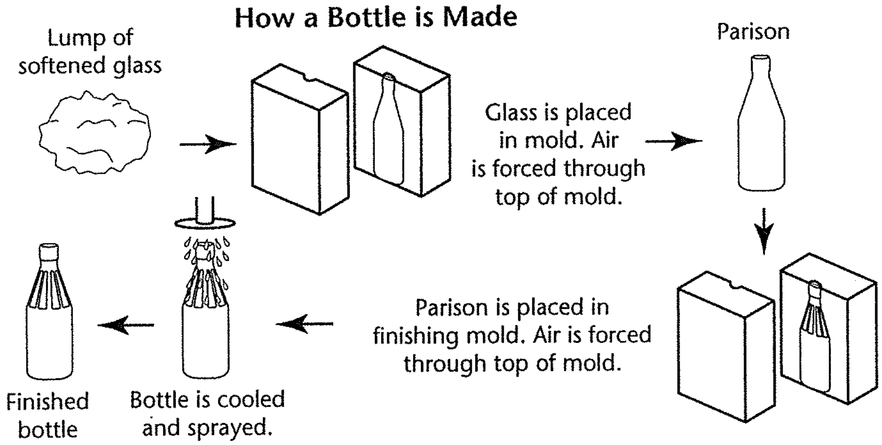
Read the passage and study the diagram below it. Then use a separate sheet of paper to answer the questions that follow the diagram.

Bottle-Making

You learned in this section that glass is an amorphous solid. This property allows it to be molded into shapes such as bottles. Bottles are usually made with an *individual section (IS) machine*, which is actually a series of automated machines that carry out each step of the bottle-making process. First, very hot, softened glass exits a furnace. Next, the softened glass is cut into lumps, or sections. Each lump of glass moves through the machine to a mold. Air is blown into the mold with great force. This forms the glass inside the mold into a hollow shape called a *parison* (PAYR uh suhn). Next, the parison is placed in a second mold called the finishing mold. Air is forced into the finishing mold to bring the bottle to its final shape. The entire molding process takes about 11 seconds.

At this point, the bottle is still very hot. After leaving the finishing mold, it travels down a conveyor belt on which it cools and hardens. At the same time, a chemical is usually sprayed on the bottle to give it a hard coating that is resistant to scratches.

How a Bottle is Made



1. Why do you think bottles are made from amorphous solids such as plastic and glass? Why aren't they made from crystalline solids?
2. What must the melting point of the mold be compared to the temperature at which glass gets soft? Why?
3. When the parison is placed in the second mold, it doesn't yet have the exact shape of a finished bottle. Is the parison's viscosity low or high? Explain.
4. Glass is sometimes called a supercooled liquid. Why do you think this is so?

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Enrich

Changes of State

Read the passage and study the diagram below it. Then use a separate sheet of paper to answer the questions that follow the diagram.

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

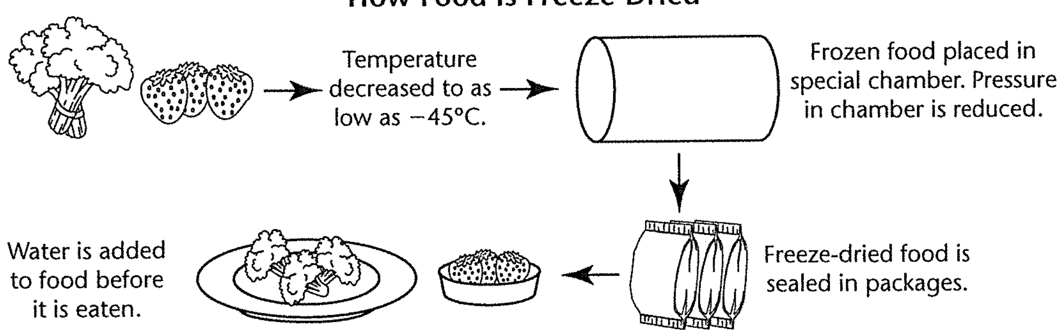
Freeze-Drying

Freeze-drying is a method of preserving food. In the first step of this process, the food is frozen, which converts the water in the food to ice. Next, the frozen food is placed into a special chamber. Most of the air in this chamber is pumped out, causing the pressure inside to decrease. At low pressure, sublimation occurs. About 98 percent of the water content of food can be removed with this method.

Freeze-dried foods are commonly eaten by campers and soldiers. One advantage of these foods is that they do not have to be refrigerated. Refrigeration slows the decay of foods by organisms such as bacteria and fungi. Because these organisms cannot reproduce without water, however, freeze-dried foods can be stored at room temperature. Freeze-dried foods are also lightweight. Removing the water from food reduces its mass by about 90 percent. In addition, freeze-dried foods are easy to prepare; they can be restored to their original composition just by adding water.

Food is not the only thing that can be freeze-dried. Florists sometimes freeze-dry flower arrangements to preserve them for up to three years. Scientists freeze-dry cells, tissues, and other samples so that they can be used in research. In addition, books and other papers that have become wet due to flooding can sometimes be saved by freeze-drying.

How Food Is Freeze-Dried



1. What two changes of state are involved in freeze-drying?
2. Suppose you have 100 kg of fresh strawberries. What would be the approximate mass of the strawberries after freeze-drying?
3. Why do you think campers and soldiers use freeze-dried food?
4. What is one advantage that freeze-dried foods have over frozen foods?
5. Is freeze-drying a physical change or a chemical change? Explain.

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Enrich

Gas Behavior

Read the passage and study the graphs below it. Then use a separate sheet of paper to answer the questions that follow the graphs.

Grasping Gas Graphs

You have examined the relationship between the temperature and volume of a gas, and between the pressure and volume of a gas. Suppose a scientist wants to determine whether the number of particles of a gas is related to its pressure. Data for this experiment can be collected by increasing the number of gas particles in a container with a constant volume and temperature, and measuring the pressure of the gas. The number of gas particles can be increased by pumping more gas into the container. Sample data from such an experiment are shown by the solid line in Figure 1. The dotted line shows how the resulting graph can be extended.

The relationship between the number of particles of a gas and its volume at a constant temperature can be determined in a similar way. Data for this experiment can be collected by increasing the number of gas particles in a cylinder that has a movable piston and measuring the effect on the volume. The graph in Figure 2 shows sample data from such an experiment.

Figure 1

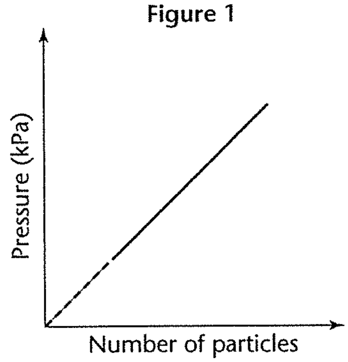
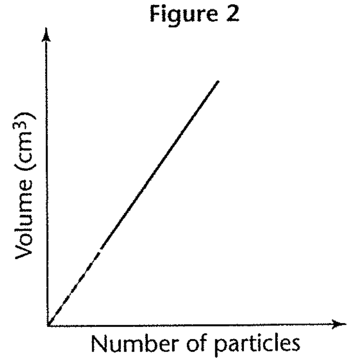


Figure 2



1. What is the manipulated variable in each graph? What is the responding variable?
2. What is the relationship between the number of gas particles and pressure? Are these two variables directly proportional or do they vary inversely?
3. What is the relationship between the number of gas particles and volume? Are these two variables directly proportional or do they vary inversely?
4. When the number of gas particles in a container with constant volume decreases, how will the pressure of the gas change?
5. When the number of gas particles at constant pressure increases, how will the volume of the gas change?