

Cross-Disciplinary

Submarines

Read the following paragraphs, and complete the exercises below.

If you've ever tried to pull a capped, empty glass bottle under water you know that the bottle resists staying down. If you let go, the bottle will pop to the surface and float. Although the glass is more dense than water, the air in the bottle is much less dense than water. Together, the weight of the bottle and air is less than the weight of the water the bottle displaces.

BUOYANCY AND ARCHIMEDES

Weight exerts pressure. The larger weight of the water displaced by the bottle exerts a larger upward force than the downward force of gravity on the bottle. The pressure of the water, called buoyancy, acting on the bottle overcomes the force of gravity pulling the bottle down. More than 2,000 years ago, the Greek scientist Archimedes discovered what has come to be known as Archimedes' principle: The buoyant force on an object is equal to the weight of the fluid displaced by the object.

DIVING AND SURFACING SUBMARINES

Engineers use Archimedes' principle to control the downward and upward movements of submarines. To dive, the crew of a submarine pumps seawater into ballast tanks. The submarine now weighs more than the water it displaces, and it sinks. To raise the submarine, the crew pumps compressed air into the same ballast tanks, thus forcing the water out. The submarine now weighs less than the water it displaces, and it rises.

EXERCISES

1. Describe buoyancy.

2. Explain Archimedes' principle.

3. Describe the conditions that would allow a submarine to sink or rise under water.
