Water as a Weight Lifter

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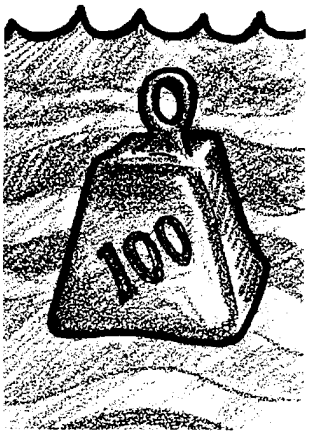
Key Concepts

1. Water exerts an upward force we call buoyancy upon floating or immersed objects.
2. Objects are more buoyant in saltwater (because it is more dense) than in freshwater.



Background

As land-dwelling animals, we humans are anchored to the earth. In many ways, we lead a two dimensional life; we travel back and forth across the earth's surface easily but really cannot travel vertically without help. Fish on the other hand, travel readily in all three dimensions. Tidepool animals find themselves at the crossroads of these two life styles; perhaps they live in two and a half dimensions. When the tide is in, and tidepool organisms are in the water, these organisms can move in three dimensions. When the tide is out, they are fixed to the surface.

As the tides bring saltwater into the tidepools, many tidepool organisms change shape. The saltwater buoys their bodies, helping to support the animals. The buoyant effect of water helps tidepool plants and animals save energy; the water holds them up, relatively free of energy cost. Also, because the saltwater exerts an upward force upon floating or immersed objects (including plants and animals), the objects seem lighter.

Materials

For the class:

- stones (about 5-10 pounds)
- plastic grocery bag with handles
- bucket, large plastic bowl or pan
- container for pouring water, such as a one gallon milk container
- water
- salt, 1 cup

Teaching Hints

"Water as a Weight Lifter" provides your students with a chance to experience the force of buoyancy as they compare lifting a bag of stones in air with lifting the same bag underwater. The upward force exerted by the saltwater upon floating or immersed objects makes the objects seem lighter.

Procedure:

1. Put the stones into the plastic bag.

2. Have each child lift the bag by the handle to feel how heavy it is.

3. Put the bag of stones into the bucket, bowl, or pan.

4. Pour water into the container (at least enough to raise the water level to the top of the stones). Be careful not to get water into the bag.

5. Have each child lift the bag of stones off of the bottom of the container but not out of the water. Ask:

   "When was the bag the easiest to lift?"

   (If they have trouble distinguishing between the two conditions, have them feel any changes as they lift the bag off of the bottom and then out of the water. When the bag leaves the water, it will feel heavier. You may wish to relate this change to experiences some students may have had lifting another person in a swimming pool or to the differences they may have felt in their own "weights" upon getting out of a swimming pool.)

"Why do you think it feels lighter?"

6. Ask students how they think the water in a tidepool affects seaweed or animals. What adaptations do the plants and animals in a tidepool have to "hold on" in their buoyant habitat at high tide?

Key Words

adaptation - an alteration or adjustment, often hereditary, by which a species or individual improves its condition in relationship to its environment.

float - to remain suspended within or on the surface of a fluid without sinking

saltwater - water with high concentrations of dissolved salts

Extensions

1. Use a spring scale, such as those carried by people who fish, to show the weight difference of the bag of stones or other object in water and in air. Clip the spring to the bag and have a student place a mark at the balance point. Then lower the bag, still attached to the spring scale, into the water. Place a second mark at the new balance point. The difference in the two points is a measure of the buoyancy of the water.

2. Have students predict what would happen if salt was added to the water in which the bag of stones is floating. Try it!