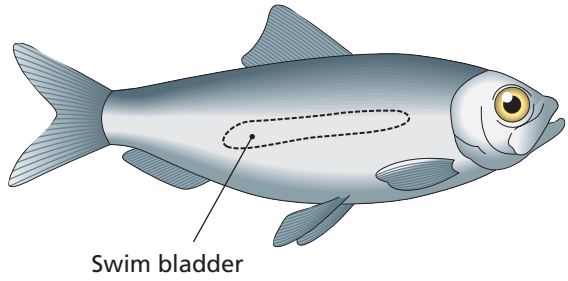
8 Submerged

Moving about while SUBMERGED is more difficult than floating.

If you are more dense ('heavier') than water you sink. If you are less dense ('lighter') you float. But what if you want to move about under water?



▲ **(Picture 1) A fish can remain still in the water because it has an air-filled bag (called a swim bladder) that is used to counteract its weight and make the fish just about the same density as water.**

Sea creatures

The sea is full of creatures that can move about in the water. Some, such as sharks, are actually heavier than water and, if they stop moving about, they sink to the bottom. But most fish have an air-filled bag inside them (Picture 1). This helps to make them about the same density as the water around them. However, they cannot change the amount of air in this bag. If they want to go up or down in the water, they have to keep swimming, just as we do.

The nautilus can float or sink in water by changing its density (Picture 2). This creature has many chambers inside its shell. To rise in the water, it fills its chambers with air; to sink, it fills the chambers with water.

▲ **(Picture 2) Ancient sea creatures like the ammonites and modern creatures like the nautilus, can increase and reduce their buoyancy by filling chambers in their shells with either air or water.**

How submarines work

Submarines rise and fall in the water using the principle of the nautilus (Picture 3). They have two hulls, and the space between the inner and outer hull can be filled with either water or air. If it is filled with water, the submarine becomes denser than water and sinks. If the water is pumped out, the submarine becomes lighter than water and rises.

A model diving straw shows how this works (Picture 4).

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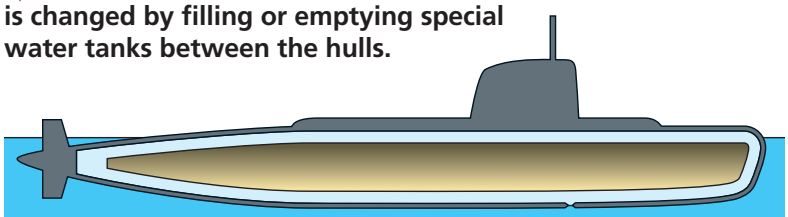
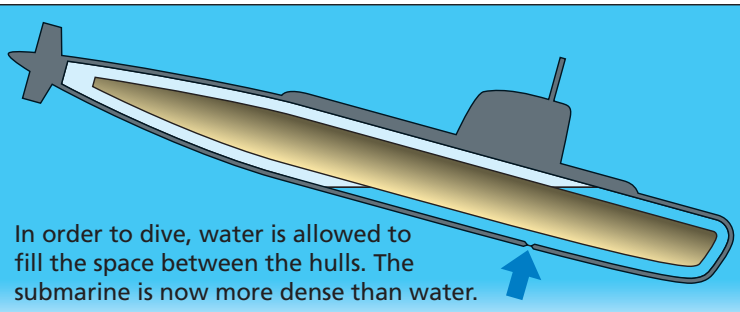
▼ **(Picture 3) The depth of a submarine is changed by filling or emptying special water tanks between the hulls.**

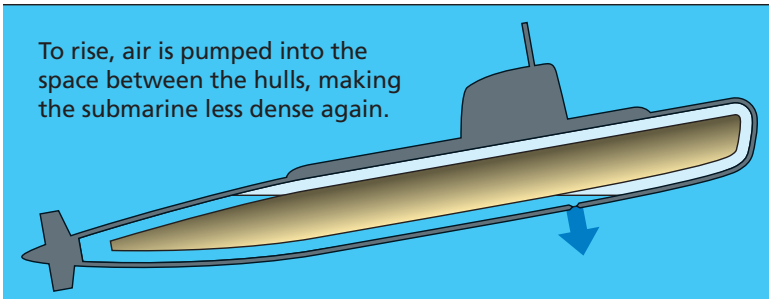


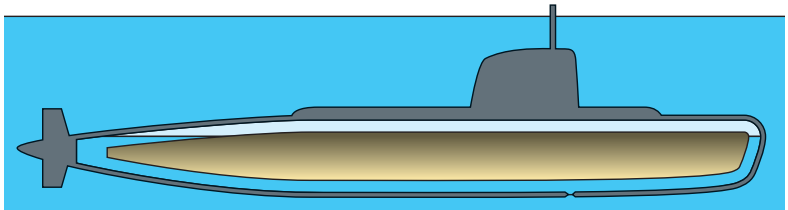
When a submarine is on the surface, the space between the hulls is full of air. Air is less dense than water and so this keeps the submarine afloat.



In order to dive, water is allowed to fill the space between the hulls. The submarine is now more dense than water.

To rise, air is pumped into the space between the hulls, making the submarine less dense again.





By adjusting the amount of water and air in the hulls the submarine can be made the same density as the water around it. It will then neither sink nor float.

Summary

- To stay submerged in water, but not sink, an object needs to have the same density as water.
- You can change the depth of a submerged object by changing the amount of water or air in the object.

▲ **(Picture 4) You can make a straw diving bell that will rise and fall in a plastic bottle. To adjust the straw's buoyancy, plug the top with Plasticine or Blu-tack. Place the straw in a bowl of water and add or remove Plasticine on the bottom of the straw, until the straw just floats upright, with the top on the surface of the water.**

Next, completely fill a plastic bottle with water, add the straw vertically, so that air is kept inside it, and screw on the bottle cap. When you squeeze the bottle, the water is squashed and some of the water goes up the inside of the straw, making it heavier. As a result, it sinks. Releasing the bottle causes the straw to rise.