The Cartesian Diver Experiment

You will conduct a lab to create a Cartesian Diver. On the next page you will find the directions for the experiment. After you have completed the experiment, you will need to answer the discussion questions below. Please follow your teacher's instructions for submitting your work.

Discussion

1. How did your observations compare with what you thought would happen?
2. What do you think would happen if you repeated this experiment with a larger pen top? …a smaller pen top? Explain your reasoning.
3. What do you think would happen if you repeated this experiment with a smaller blob of clay or gum, so that the pen top floated higher up in the water initially?
4. When operating underwater, a submarine allows water to come into special tanks. Later, the submarine will pump the water out of the tanks. What is the purpose of doing this? What happens to the submarine and why? (This is how a submarine is able to go down and up in the ocean. Letting water into the tanks reduces the buoyant force on the submarine, so it sinks. Pumping water out of the tanks increases the buoyant force on the submarine, so it rises.)
5. What other situations can you think of in which buoyancy makes a significant difference? How does it affect your everyday life? (examples: swimming, scuba diving, submarines, pontoons on bridges, boats, airplanes …)
6. Did you attach a ruler to the bottle? If so, what did you have to do to make the diver go to a specific level without overshooting? How easy or difficult was it to keep the diver at that level for a period of time?
7. What other objects could be made into divers? Repeat the activity using one or more of these objects. (This could include a medicine dropper, an inverted test tube, etc.)
8. Instead of water, use other common but safe liquids to see if the diver behaves differently. (This could include vinegar, rubbing alcohol, cooking oil, shampoo, etc.)
9. What are the similarities between scuba diving and a Cartesian diver? What are the differences? You can check out this website for more details: http://www.seed.slb.com/labcontent.aspx?id=12030&terms=scuba+diving
10. If you had to conduct this experiment again, what would you do differently? Why?

Use a pen cap and some modeling clay or silly putty. Stick the end of the pen cap through a pea-sized ball of the clay or putty. You will have to experiment with how much material to put at the end of the pen cap to get it to just barely float. Carefully place the pen cap in the plastic bottle so that there is an air bubble trapped inside the pen cap. Fill the bottle to the top, screw the cap tightly onto the bottle, and squeeze the outside. If your pen cap doesn't sink, take it out and put a little more material on the end of the cap. When you have it right, you will be able to send your "diver" to the bottom with just a small squeeze of the bottle. Experiment with your diver. Can you squeeze the bottle just enough to keep the diver suspended in the middle of the bottle?

If you cannot get these materials, here is another way you can do it:
Cause a ketchup packet to float or sink on command! For this experiment you will need: • 1 ketchup or soy sauce packet from a restaurant or a Milky Way mini candy individually sealed • water • a 1 or 2 liter clear plastic bottle Place the ketchup or sauce packet, or the candy, in a bowl or cup of water to see if it will float. For this experiment you will need a packet that just barely floats. Take a packet that barely floats and put it in the clear plastic bottle (you may need to fold it in half lengthwise to get in through the opening). Fill the bottle to the brim with water and screw the cap on tight. Squeeze the sides of the bottle. What happens? The packet or candy has a small bubble of air trapped in it. When you squeeze the outside of the bottle, you increase the pressure inside the bottle. This will compress the air inside the packet, which changes the overall density of the packet. When the air is compressed enough, the density of the packet will be greater than the density of the water in the bottle, and the packet will sink. When you release the pressure on the outside of the bottle, the air in the packet will expand, increasing the buoyancy of the packet, and the packet will rise to the top. If you are using a clear soy

sauce packet, you may even be able to see the size of the air bubble change as you squeeze on the bottle.