

Cartesian Diver Take Home Lab

Purpose: To determine if the pressure exerted on an object can affect its density.

Materials: 1ea. 1 or 2 liter clear, plastic soda bottle with cap. A 20 oz clear soda bottle will also work but 1 liter bottles are the best.

1ea. Plastic transfer pipet (obtain from instructor).

1ea. $1/4'' - 5/16''$ nut. Brass is best because it will not rust but other types work fine or a screw (medium to large) (Type B) or a $1/4'' - 5/16''$ nut.

Procedure: You may make either of the two types of divers described below in “Type A” or “Type B”. Type A may be the easiest to adjust so that it works properly. Hint: You may wish to test your diver in a clear glass of water before placing it into the bottle.

Type A:

Cut about half of the pipet stem off of the pipet. Slide the $1/4 - 5/16''$ nut up the pipet stem and secure with glue (hot melt glue works well).

Fill the pipet about half full of water and place the diver into a bottle of water filled to within 2 cm of the top. If it sinks, it has too much water inside.

If the diver floats, screw the lid onto the bottle and squeeze the bottle. The diver should sink. If it does not sink, there is not enough water inside the diver.

Adjust the water level inside the diver until a gentle squeeze makes the diver sink.



Type A



Type B

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Type B

Cut the stem of a pipet off to fit your screw. The screw should fit snugly and seal the pipet. Fill the pipet about half-full with water and twist the screw into the pipet. Set the pipet into a bottle of water filled to within 2 cm of the top. If the pipet sinks, it has too much water in it or the screw is too large. First try adjusting the water level by a few drops and retest.

When the diver floats, screw the cap on the bottle and squeeze the bottle. The diver should sink. If the diver does not sink, there is not enough water in the diver or the screw is too small. First try adjusting the water level in the pipet by a few drops and retest. If it is impossible to make the diver sink by squeezing the bottle then the screw is not heavy enough. Try a larger screw and retest.

Report

Write a description of your observations when you squeeze the bottle and when you release it. Does the appearance of the diver change? Does it sink/rise?

Two principles are involved in making the diver sink and rise: Boyle's Law and Density. Determine how these principles are involved and thoroughly discuss their contributions to the diver's behavior. Your report should be no more than one page. Many students can adequately develop this report in about one-half page.

Scoring

You may earn up to 12 points by completing this project. Points will be awarded as follows:

- (3 pts) Working diver
- (3 pts) Discussion of how Boyle's Law explains the operation of the diver
- (3 pts) Discussion of the role density plays in the operation of the diver
- (3 pts) Discussion of how Boyle's law and density are related to each other in the operation of the diver.