BOTTLED-UP BUOYANCY

M3-2 PHYSICS

QUESTION & PURPOSE

- If you change the buoyancy of a submarine, does it affect how an object dives or surfaces?
- The purpose of this project is to see how submarines dive and surface by changing their buoyancy in the water.

ABSTRACT

- In my project, you create a soda bottle and fill it up with different types of liquids and different amounts of liquid. What I am trying to test is: If you change the buoyancy of a submarine, does it affect how an object dives or surfaces. According to Archimedes' principle, buoyancy depends on the amount of liquid displaced by an object . My hypothesis is: If the amount of liquid increases and the amount of air in an object decreases, then the buoyancy of an object will increase, because there will be more of an upward force. My independent variables are the amount of air and liquid in a bottle, and the type of liquid used. My dependent variable is the buoyancy of the submarine, and my constants are the size of the bottle(submarine), testing area, and temperature of the water.

HYPOTHESIS

- My hypothesis is: If the amount of liquid increases and the amount of air in an object decreases, then the buoyancy of an object will increase, because there will be more liquid displaced by the submarine.

MATERIALS

- 2-liter soda bottle, (1)Water bottle, standard size, approximately 500-700 mL, (1)Razor blade or knife Drill with a 3/32-inch drill bit, Scissors, Pen or Needle-nose pliers, 2 Large paper clips, Metric liquid measuring cup, Permanent marker, Chopsticks, Stiff ruler, 3 Rubber bands, Waterproof sealant (such as silicone), Bathtub (or pool) filled with water, Lab notebook, Vinegar and Syrup

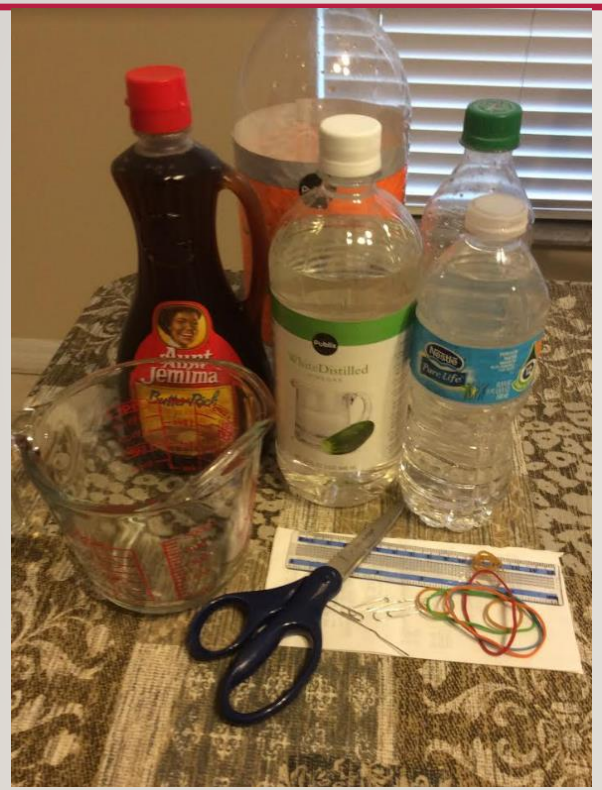
PROCEDURE

- Fill up submarine with certain amount of water
- Submerge bottle in water
- Let go of bottle
- Repeat for different amounts of water and different liquids

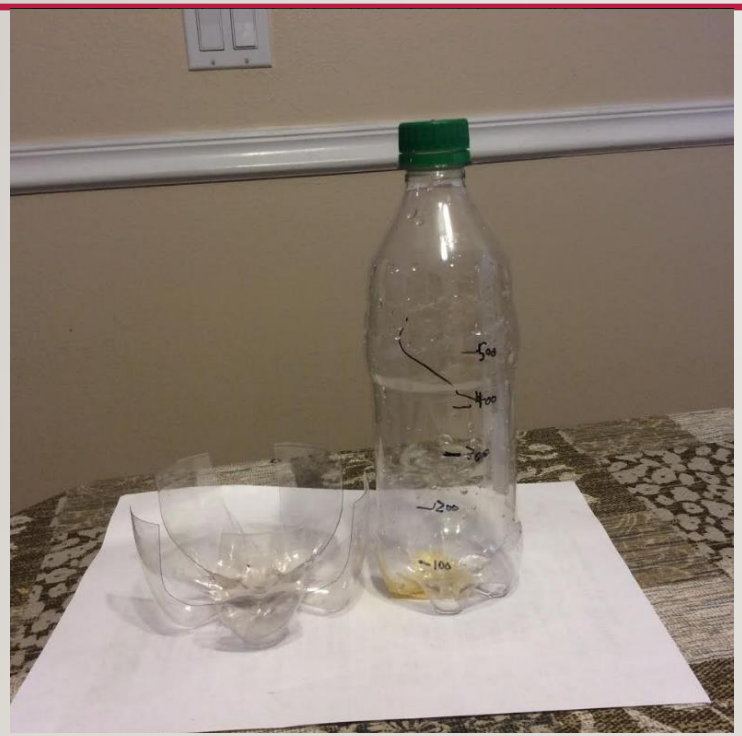
VARIABLES

- Independent variables are the amount of air and liquid in a bottle, and the type of liquid used.
- Dependent variable is the buoyancy of the submarine. The percentage of liquid displaced by the submarine indicates how strong the buoyant force is.
- Constants are the size of the bottle(submarine), testing area, temperature of the water.

PICTURES

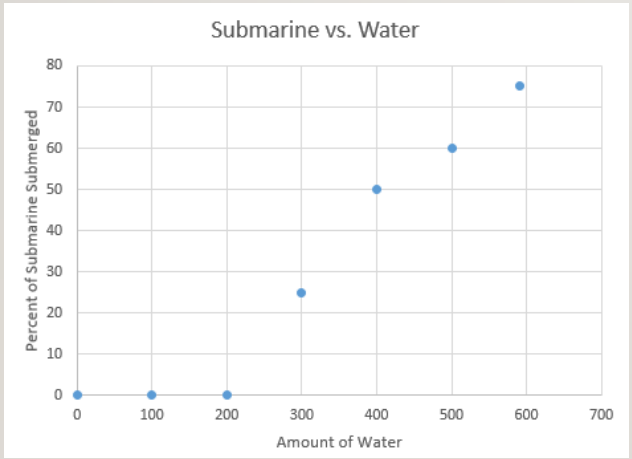


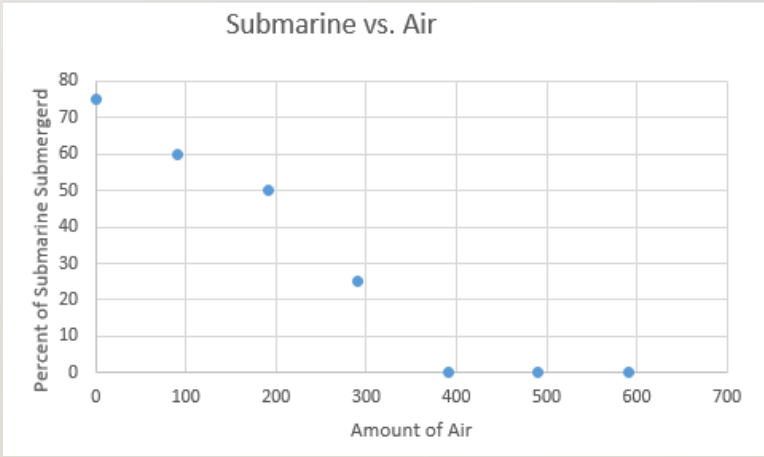
MORE PICTURES



RESULTS

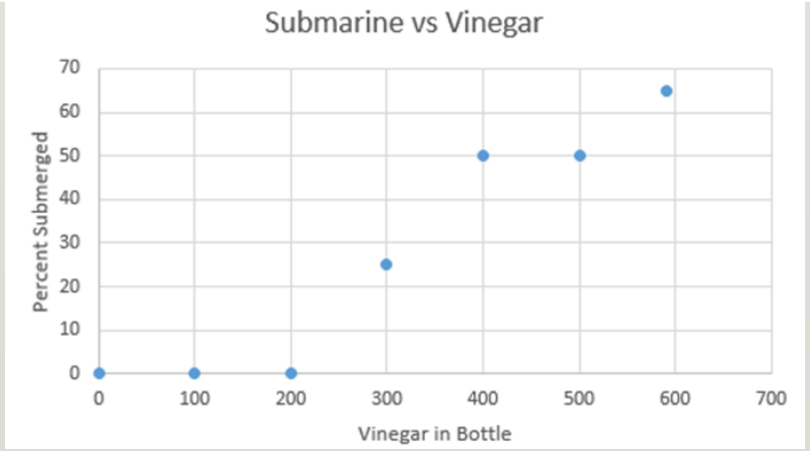
Amount of Water(mL)	Amount of air (mL)	% of Submarine Submerged	Submarine: Sinks, Rises, Stays Level
0	591	0	Rises(Neutral Buoyancy)
100	491	0	Rises (Neutral Buoyancy
200	391	0	Rises(Neutral Buoyancy)
300	291	25	Rises(Positive Buoyancy)
400	191	50	Rises(Positive Buoyancy)
500	91	60	Rises(Positive Buoyancy)
591	0	75	Rises(Positive Buoyancy)





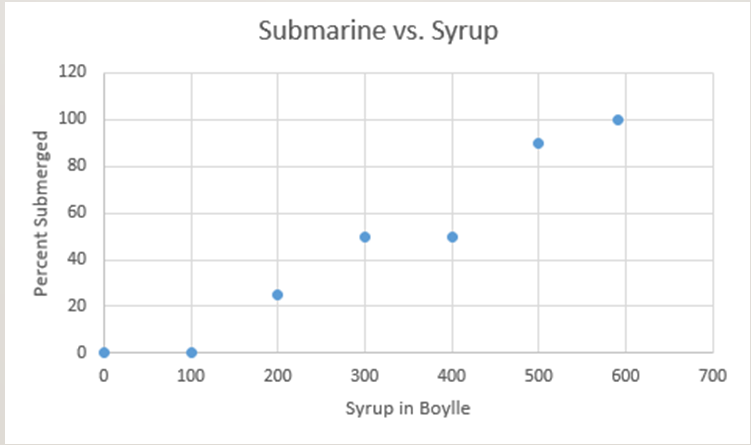
MORE RESULTS

Amount of Vinegar(mL)	Amount of air (mL)	% of Submarine Submerged	Submarine: Sinks, Rises, Stays Level
0	591	0	Rises(Neutral Buoyancy)
100	491	0	Rises (Neutral Buoyancy)
200	391	0	Rises(Neutral Buoyancy)
300	291	25	Rises(Positive Buoyancy)
400	191	50	Rises(Positive Buoyancy)
500	91	50	Rises(Positive Buoyancy)
591	0	65	Rises(Positive Buoyancy)



MORE RESULTS

Amount of Syrup (mL)	Amount of Air(mL)	% of Submarine Submerged	Submarine: Sinks, Rises, Stays Level
0	591	0	Rises(Neutral Buoyancy)
100	491	0	Rises (Neutral Buoyancy)
200	391	25	Rises(Positive Buoyancy)
300	291	50	Rises(Positive Buoyancy)
400	191	50	Rises(Positive Buoyancy)
500	91	90	Rises(Positive Buoyancy)
591	0	100	Sinks(Buoyant Force is maximum)



CONCLUSION

- My hypothesis was right because the objects started to sink with more liquid and less air, creating a more buoyant force. When an object has more liquid and less air, more liquid is displaced upon it, creating a stronger, more buoyant force. The object submerges more. When an object has less liquid and more air, less liquid is displaced by it creating a weaker, less buoyant force. The object is less submerged and floats freely.

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