Cartesian Divers

Objective: To apply your knowledge of buoyancy to understand and explain how Cartesian divers work.

Research

- Rene Descartes: 16th century mathematician who noticed differences in pressure affected sinking and floating.
- Cartesian diver: a small hollow cylinder partly filled with water and partly filled with air.

Experiment I

- <u>Squeeze the container:</u>
- increases pressure →
- compresses air in diver →
- water enters diver as volume of air decreases →
- divers density increases →
- causing it to lose buoyancy →
- diver sinks.

Experiment II

- Stop squeezing:
- air inside diver expands →
- water forced out of diver →
- density decreases →
- buoyancy increases →
- diver rises

Research:

- Must adjust the diver so that it barely FLOATS by adjusting the amount of water inside.
- Look to see the LEVEL of water changing INSIDE OF THE BOTTLE as pressure varies in the container.

Summation

- The volume of a gas decreases as the pressure on the gas increases. As you squeeze the bottle, the pressure is transferred from your hand to the water and from the water to the air trapped inside the diver. As the volume of air in the diver gets smaller, more water enters the diver, making it heavier, **more dense**, less buoyant, and the diver sinks to the bottom. As the pressure is released, the air inside the diver expands, making it lighter, **less dense**, increases the buoyancy, and the diver rises.

Questions

1. What causes the diver to sink when the bottle is squeezed?
2. How does the buoyancy of the diver compare to the weight of the diver when it hovers (stays in one place)?
3. What causes the diver to rise when pressure is released from the bottle?

Conclusions

1. Water goes in -> mass goes up -> density goes up -> not enough displaced water.
2. Buoyancy equals weight. Neutral buoyancy
3. Water pushed out -> air expands -> mass goes down -> density goes down -> enough water is displaced

Conclusions

4. Different divers contain larger column of air – more pressure to squeeze it, allow water inside.