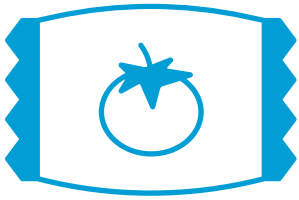


ACTIVITY 4: SAUCE PACKET CARTESIAN DIVER



The purpose of this activity is for students to create a Cartesian diver using a water bottle and a ketchup packet to understand the relationship between pressure, volume, and density. They will observe how changes in pressure affect the movement of the "diver" (condiment packet) inside the water bottle.

Materials:

- Empty plastic disposable water bottle
- Unopened ketchup, hot sauce or other small condiment packet
- Water
- Scissors
- Optional: Food coloring & waterproof markers

Inform students that they will be making something called a Cartesian Diver to visualize the relationship between pressure, volume, and density. Like a scuba diver needs to go between different depths of the water, the Cartesian Diver will do something similar.

First, demonstrate to students how to prepare a Cartesian Diver by filling an empty water bottle with water to about 80% full. If you want to make the diver more visible, add a drop of food coloring or draw a small face on the condiment packet using waterproof markers. Insert the packet into the bottle, top off the water, and tighten the cap.

Note: if your condiment packet doesn't float, select another packet that does.

Next, have students make their own Cartesian Divers according to the same procedure that you just showed them. They can do this in pairs, or if you have enough supplies, everyone can make their own. Encourage them to make a prediction about what will happen to the sauce packet when the bottle undergoes more or less pressure.

Then, after students have made their Cartesian Divers, instruct them to gently squeeze the bottles and observe what happens. Have them release the bottle and observe what happens. Challenge them to see if they can get the condiment packet to hold exactly in the middle of the water bottle.

Last, have students make a particle diagram of the diver and water bottle before and after the squeeze/release. Have them discuss their results, reflecting on their predictions, and making connections to their particle diagrams to explain how the pressure, volume, and density of the condiment packets change in the system. Facilitate a whole-class discussion to debrief what happened in the Cartesian Diver and to get them to think about the questions:

- Explain why the ketchup packet changes its position inside the water bottle when you squeeze it.
- How would the diver be affected if you used a different amount of water inside the bottle?