TORNADO IN A BOTTLE ACTIVITY

Activity Introduction: Present the setup to the group of students, encourage them to physically describe the situation, and help them understand the balance between the weight of the water and the air pressure below.

Ask students to suggest the best way to make the water flow into the bottom bottle. Demonstrate practically and explain theoretically the validity of their proposed approaches. A simple demonstration of the setup can be viewed here: Bottle Tornado Demo.

Afterward, explain to the group that the volunteers were essentially tasked with "cooking" up a tornado. But how exactly does one "cook" a tornado? Follow this brief explanation:

HOW TO COOK A TORNADO (5-10 minute presentation)

Ingredients (When does a tornado form?)

1. Warm, moist air near the ground (usually originating from the Gulf of Mexico).
2. Cold, dry air higher in the atmosphere (often coming from the west or Canada).
3. Wind shear—winds blowing in different directions at different altitudes.
4. A strong thunderstorm, known as a supercell, that generates powerful upward currents.

Preparation (How does a tornado form?)

1. **Conflicting Air Currents:** Warm, moist air collides with cold, dry air, causing the warm air to rise quickly.
2. **Severe Thunderstorm (Supercell) Formation:** Under the right conditions, these air currents lead to a powerful thunderstorm with intense upward air movement (updraft).
3. **Air Rotation (Mesocyclone):** Wind shear initiates a horizontal spinning motion. The supercell's updraft tilts this rotation from horizontal to vertical.
4. **Funnel Cloud Formation:** If the vertical rotation intensifies, a funnel cloud begins to form, stretching downward.
5. **Tornado Touchdown:** The funnel cloud becomes a tornado once it reaches and contacts the ground.

Activity Conclusion: Engage the group by asking if they can identify parallels between the bottle experiment and real tornado formation (highlighting how a heavier layer rests above a lighter one). Encourage participants to identify what's missing from the demonstration—currents inducing rotation.

Ask them: "How can we create these currents in the bottle?" Demonstrate by simply rotating the bottle, and watch as a mini-tornado forms.

Explain how vorticity and vertical motions are often interconnected in various natural phenomena, from the draining water in a sink to large-scale hurricanes.

Finally, allow participants to experiment further, creating their own tornadoes, while facilitating questions and discussions.