Meteorology for Makenna: Cloud in a Jar!

Materials Needed

- A clear glass jar with a lid (a large mason jar is perfect)
- About 1/3 cup of hot water (Warm to the touch, not boiling. Adult supervision needed.)
- A few ice cubes
- Aerosol spray (hairspray or air freshener works well)
- A dark piece of paper or cardboard (optional, to see the cloud better)
- Pictures of different cloud types (especially cumulus clouds) OR a window to look outside

Learning Objectives (20 Minutes)

- **Hands-On Goal:** Makenna will create a cloud in a jar to demonstrate the process of condensation.
- **Application Goal:** Makenna will explain that clouds form when warm, moist air cools and water vapor condenses onto particles.
- **Identification Goal:** Makenna will identify a cumulus cloud outside or in a picture and describe it as "puffy" or "like cotton."

Lesson Activities

1. **Introduction: The Secret Recipe for Clouds (3 minutes)**

   Start by asking Makenna, "If you were to make a cloud, what ingredients do you think you would need?" Listen to her ideas. Then, explain: "Real meteorologists know the three secret 'ingredients' for a cloud: **1. Warm, moist air**, **2. Cooling**, and **3. Something for the water to stick to**, like dust or pollen. Today, you're going to be a meteorologist and use this recipe to build your very own cloud in this jar!"

2. **Experiment: Make a Cloud in a Jar (10 minutes)**

   - **Step 1 (Add Warm, Moist Air):** Have an adult carefully pour the hot water into the jar. Swirl it around to warm the sides of the jar. This creates our warm, moist air as some of the water turns into invisible water vapor.
   - **Step 2 (Add Cooling):** Turn the lid upside down and place it on top of the jar. Place three or four ice cubes on top of the lid. Ask Makenna, "What do you notice happening on the inside of the jar near the cold lid?" (She might see some condensation). Explain that the ice is making the air at the top of the jar cold.
   - **Step 3 (Add Particles):** This is the magic step! Quickly lift the lid and give a very short (1-second) spray of hairspray into the jar. Immediately put the lid with the ice back on top. The hairspray provides the "particles" for the water to stick to.
   - **Step 4 (Observe):** Watch closely! A cloud will begin to form inside the jar. It will look like a swirling mist. You can hold the dark paper behind the jar to see it more clearly. Ask, "What do you see? Describe your cloud!" After a minute, remove the lid and watch the cloud escape into the room.

3. **Connection: From the Jar to the Sky (5 minutes)**

Explain the connection: "The same thing that happened in our jar happens in the sky! The sun warms the ground and water (**warm, moist air**), that air rises and gets colder (**cooling**), and the water vapor condenses onto tiny dust particles in the air to form real clouds."

Show Makenna the pictures of clouds or look out the window. "Let's be cloud detectives. Can you find a 'puffy,' 'cotton-ball' cloud? That's a **Cumulus** cloud. It's formed just like our cloud in the jar, by warm air rising."

4. **Wrap-Up: Meteorologist's Report (2 minutes)**

   Ask Makenna to be the meteorologist and give a "weather report." Ask her, "In your own words, how did we make a cloud today?" Listen for her to mention warm water, ice/cold, and the spray.

Assessment

- **Formative (During the lesson):** Observe Makenna's participation and listen to her predictions and observations during the experiment. Can she explain why each step (water, ice, spray) is important?
- **Summative (End of lesson):** Ask Makenna to point to a cumulus cloud (in a picture or outside) and explain in one sentence why it looks puffy (because it's formed by rising warm air, like in our jar).

Differentiation & Extension

- **For Support:** If the concept is tricky, focus on the "magic" of the experiment first. Use a simple analogy: "It's like seeing your breath on a cold day. Your warm breath (moist air) hits the cold air and makes a tiny cloud!"
- **For a Challenge:** Introduce other cloud types. "Flat, gray clouds are called **Stratus** clouds, and they form in layers, not puffy piles. Wispy clouds high in the sky are called **Cirrus** clouds, and they're made of ice crystals!" Ask her to predict what kind of weather each cloud might bring.

Curriculum Connection

- This lesson aligns with elementary science standards related to Earth Science, specifically the water cycle (evaporation, condensation) and weather patterns (cloud formation). It provides a concrete, hands-on model for the abstract concept of condensation. (e.g., NGSS 3-ESS2-1)