Modeling the Wind and Make a Cloud Activity Sheet

Name: Teacher Guide _____ **Date:** _____

Model The Wind!

1. Gather your materials to model the wind!
    a. Clear plastic tray with sides
    b. Thin paper
    c. Tape
    d. Water
    e. Optional: Blue food coloring
2. Tear or cut your paper into a few (3-5) thin strips.
3. Tape the strips to one end of the plastic tray. The strips should be taped to the outside but face into the tray. (The side of the tray with the paper strips represents the windward mountains.)
4. Fill your plastic tray with enough water to cover the bottom. The water represents the ocean. If you want, add a few drops of food coloring.
5. You are the wind! Model the movement of Easterly trade winds across the ocean:
    a. Blow along the bottom of the tray (toward the paper strips). You should see waves form on the surface of the water.
    b. Observe what happens to the paper strips.
    c. Record your observations and answer activity questions #1-5.

Activity Questions: Wind

1. What happened to the paper strips when you blew across the ocean?
   The paper strips should move up; wind gets pushed up by the edge of the tray, and the paper acts like an indicator of wind direction. If the papers are not moving upward, watch the direction of the waves on the water. The waves should be moving away from the student and toward the paper strips, but if the students blow down too much, the papers may also move down.
2. Why did the paper strips move **up** when you blew **across** the ocean?
   When the wind from students blowing reaches the edge of the tray, the wind gets pushed up by the edge of the tray. The paper acts like an indicator of wind direction.
3. How does this model of wind blowing across the plastic tray relate to trade winds blowing across the ocean toward the mountains of Hawai‘i?
   This model is really similar to what happens in real life. As the trade winds contact the windward mountains, air is forced upward.
4. What do you think happens to the wind as it rises up the mountains?
   (*Hint: do you think it gets warmer or colder.)*
   Rising air cools because of colder temperatures in the upper atmosphere.

Part B: Make a Cloud

Adult supervision required for part B!

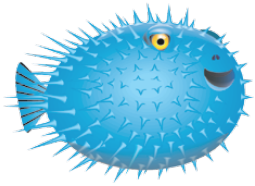
1. Gather your materials to make a cloud (Clear jar with a lid, hot water, Ice cubes, matches or incense stick and a lighter).
2. With supervision from an adult, cover the bottom of the jar with a thin layer of hot water. Swirl the water around so it touches the sides as much as possible.
3. Attach the lid to the jar and place ice cubes on top.
    a. Observe what happens inside the jar. Do you see a cloud forming?
    Students might be able to see a small cloud at this point, but there is not a lot of condensation nuclei (like dust or other small particles) for a cloud to form visibly.
4. Remove the lid and place the ice cubes to the side. With supervision from an adult, light a match and let the smoke go into the jar. Drop the match into the water to put it out and quickly attach the lid.
(Note: If you are using incense, let the smoke from the incense go into the bottle and then attach the lid.)
5. Place the ice cubes back on top of the jar.
    a. Observe what happens inside the bottle. Do you see a cloud forming?
    The cloud should be much more visible now!

6. Take off the lid and watch the cloud escape!

Activity Questions: Clouds

1. When air cools, the water in it also cools. This can cause the water to change from a gas to a liquid. This process is called condensation.
    a. Where in this experiment did you see condensation?
    The cloud is a visualization of the condensation of tiny water droplets on dust and match smoke. Students may also see condensation on the outside of the container holding their ice cubes!
    b. Where do you see condensation in real life? On cold mornings, even in Hawai‘i, we see condensation on grass, plants, cars, etc. We also see condensation on the outside of cold drinks. Students may not realize that the water condensating on the outside of drinks comes from the surrounding air!
2. Water needs something to collect on in order for a cloud to form. In the sky, water collects on microscopic pieces of dust, pollen, and salts. Scientists call these tiny cloud-collecting particles condensation nuclei.
    a. What did you use as condensation nuclei in this experiment?
    The smoke from the match. There was also probably some small amount of dust in the air that acted as nuclei for water to condense on.
    b. What did the condensation nuclei do in this experiment?
    The condensation nuclei provided a physical place for water to attach to.
3. What happens when the water drops in a cloud become very large?
(*Hint: precipitation!)*
    When water drops become very large, they fall from the sky as precipitation—as rain, snow, or hail.
4. How is this experiment similar to how clouds form in the sky?
    When warm, moist air is cooled rapidly (like in this experiment when we took warm water and added ice above to cool it), water condenses on small particles (like in this experiment when we added smoke to provide lots of small particles).

Culminating Activity Questions



1. Your experiments showed that (circle the best answer):
   a. air moves _____ **up / down** _____ when it blows towards the mountain
   b. water from wet air will _____ **disappear / condense / evaporate** _____ when it cools

2. Use these findings from question #1 as evidence to write an explanation of why clouds form when wind pushes air up a mountain.
   As the trade winds contact the windward mountains, air is forced upward.

   Rising air cools because of colder temperatures in the upper atmosphere.

   As the air cools, water vapor in the air condenses on small particles called condensation nuclei to form clouds, water droplets, and rain.

3. Why do clouds and rain form more often on the windward sides of the Hawaiian Islands than the leeward sides?
   Most of the rain in Hawai'i is caused by winds interacting with the mountains.

   The normal trade wind direction is East-Northeast.

   So, the average rainfall for the East facing sides of the islands is higher than for the West facing sides.

4. Why are the windward sides of the Hawaiian Islands more green in color than the leeward sides? (*Hint: think about the effect of rain on plant growth.*)
   Plants capture rain and use it to grow. Plants on the windward sides of Hawaiian islands tend to get plenty of rain.

   However, once the water is released from the air, there is less water to fall on the other side of the mountain, or leeward side.

5. The difference in rain and plant growth between the windward and leeward sides of the Hawaiian Islands is similar to the differences along mountain ranges across the world. Use the information you have learned in this activity to explain why a mountain range might have a lush forest on its windward side and a desert on its leeward side.
   This explanation is similar to #4 above. The question is designed to help students transfer knowledge from this activity, and their experiences at home in Hawai'i, to other locations.

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