

# Humidity in the Atmosphere

## **PA STEELS Standards:**

3.3.6-8.J Collect data to provide evidence for how the motion and complex interactions of air masses result in changes in weather conditions.

3.4.6-8.E Collect, analyze, and interpret environmental data to describe a local environment.

## **Grade Level:**

Grades 6-8

## **Background:**

Water in the atmosphere is obtained from many different surfaces on Earth. In this lab, we will plan and carry out an investigation to determine where the water in the air comes from by measuring the humidity in the air over samples of different Earth surfaces.

## **Guiding Questions:**

1. How is atmospheric moisture (relative humidity) measured?
2. How do different Earth surfaces generate different amounts of humidity into the atmosphere?

## **Objectives:**

- Students will conduct an investigation using a model to gather data to serve as evidence to support a claim about where water in the air originates.
- Students will understand that water can go into the air (increasing its humidity) from many different types of surfaces with water in or on them.
- Students will understand that when individual water molecules on the surface of a liquid gain enough motion energy (kinetic energy), they leave the liquid to become a gas; this process is known as evaporation.

## **Vocabulary:**

- Hygrometer (Humidity Probe)
- Relative Humidity
- Evaporation
- Water Vapor

## **Materials:** on

- Humidity in the Atmosphere Lab [Worksheet](#)
  - Lab Worksheet [KEY](#)
- 18 Hygrometers
- Hot Plate (1)
- Hot Mitts (1)
- Medium [Beaker](#) filled halfway with water (1)
- 6 Empty Ziploc containers (for closed environment)
- 6 small cups with lids (for earth materials)
- 5 100-watt incandescent bulb and clamp lamps; you do not use a light for the control group container
- ½ cup of each Earth material

- Wet Sand - Beach (add a little bit of water to one of the dry sand containers)
  - Should be the consistency of sand on the beach near the water.
- Dry Sand - Desert
- \*Crushed Ice - Snow Covered Ground
- \*Sod or Small Potted Plant - Lawn
- Rocks - Puddle on Sidewalk (add a little bit of water to this container to create a “puddle”)

\* Implies teachers will need to supply material.

### **Duration:**

2 - 45-60 minute class periods.

- The first class period will be used to introduce humidity in the atmosphere and how hygrometers are used as well as testing different areas throughout the school and outside.
- The second period will be used to test humidity in the atmosphere through models of different Earth surfaces.

### **Set Up:**

#### **- Day 1:**

- Gather a hot plate, beaker with water and hot mitts.
  - Have this water heating up for the pre-lab demonstration.
  - Velcro a hygrometer to the end of a meter stick

#### **- Day 2:**

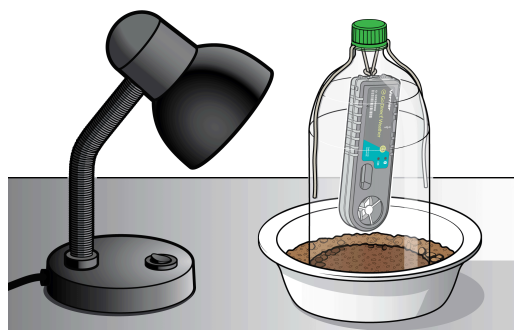
- Set up the six stations around your room. Each station should have one of the following.
  - Empty plastic container flipped upside down (2 L. bottle in the image below)
    - This will represent the closed environment.
  - Hygrometer velcroed inside the container
    - Make sure the hygrometer is set to °C.
  - Lamp placed next to the upside down empty plastic container.
  - Small plastic container with one of the Earth materials.
    - Control group container is empty.
    - These small plastic containers will be set inside the larger plastic containers.
      - wet sand = beach
      - dry sand = desert
      - crushed ice = snow covered ground
      - sod or a small potted plant = lawn
      - rocks & water = puddle on the sidewalk

#### **- Example Image for Bottle/Container Set Up →**

- Set up will be similar, although our materials are slightly different.

#### **- Notes for after the lab:**

- Air the bottles out and lightly shake them to remove any accumulated water before using in the next class.



### **Procedure:**

- **Day 1: Measuring Humidity Introduction & Demonstration**

- Have students read the article “[What is Air?](#)”
  - Questions to discuss after reading (Be sure to handout [Student Lab Worksheet](#))
    - What is air made of?
      - **Potential Answer:** Air is a mixture of different types of molecules in the gas state.
    - What is humidity, and how can it be measured?
      - **Potential Answer:** Humidity is how much water vapor is in the air. Humidity probes (hygrometers) measure relative humidity.
- Show students a hygrometer and explain how these tools measure the amount of water vapor (molecules of water in gas form) in the air.
  - Ask students where they have heard the word “humidity” before? What does it feel like when it is very humid outside?
    - Have a student read the hygrometer and have all students record this data on their lab paper.
  - Ask students what they could do to make the air near the probe more humid?
    - **Potential Answers:**
      - Put the hygrometer near the water
      - Breathe on the hygrometer
      - Put the hygrometer near steam or boiling water
      - Spray water near the hygrometer
    - Give each pair of students a hygrometer and have students breathe on their hygrometer and record the humidity in their data table.
    - Have one student place the hygrometer attached to the meter stick 6 inches above the boiling water. Everyone should then record the humidity in their data table.
  - Take students into the hallway to measure humidity and record.
  - Take students outside to measure the humidity and record.
- Have students compare the data in their data table.
  - Which location has the lowest humidity? Which location has the highest humidity? Why is this the case?
  - Have students reflect on these two questions to end class.
    - Where did all that water in the air come from?
    - If you could measure how much water went into the air, do you think there are some places in the world where more water goes into the air than in other places?

- **Day 2: Humidity in the Atmosphere Lab**

- Be sure to have all six stations set up.
- Today, students will be using a bottle system model of Earth surfaces to investigate humidity levels.
  - Explain to students what parts of the bottle system represent:
    - The bowl with Earth material represents an environment like a desert or a field.
      - Our six systems will be...
        - Wet Sand = Beach
        - Dry Sand = Desert
        - Ice = Snow Covered Ground

- Potted Plant = Lawn
- Rocks & Water = Puddle on the Sidewalk
- Empty container = Control
- The air in the bottle represents the atmosphere.
- The light represents the solar energy from the Sun.
- The bottle system is similar to the real world because real-world environments have Earth materials with air around them and get heated up by the Sun.
- The bottle system is different from the real world because the bottle is a closed system but Earth is not.
- Have students answer the question “Do you believe this is an environment where water could enter the atmosphere?” in the table on their lab paper.
- Then, before students collect data, they should make predictions as to what they believe the humidity levels will be for each simulated environment.
- Once predictions are made, students should travel in groups of three to each station and conduct a humidity & temperature reading.
- Once all students have collected data in their groups, reconvene and discuss data as a class.
- Have students answer conclusion questions on lab paper.
- **Sample Data:**

	<b>Beach - Wet Sand</b>	<b>Desert - Dry Sand</b>	<b>Snow - Ice</b>	<b>Lawn - Potted Plant</b>	<b>Puddle - Rocks &amp; Water</b>	<b>Control - Container w/ Hygrometer</b>
<b>Humidity</b>	54% & rising	10%	15%	15%	45% & rising	10%
<b>Temperature</b>	23.1 °C	23.6 °C	20.7 °C	22.6 °C	22.3 °C	21.0 °C

This lab was adapted from OpenSci Ed. [OpenSci Ed](#) is an awesome free resource that provides phenomena based curriculum.