Condensation!

Lesson Overview

This activity demonstrates how heat affects the states of matter. Connections can be made to the water cycle to include evaporation, condensation, and precipitation.

Suggested Grade Levels: 2-6

Standards for Lesson

Content Standard A: Science as Inquiry
Content Standard B: Physical Science
Content Standard D: Earth and Space Science
VA SOL:
2.1 a, b, d; 2.3 b; 3.1 a, j; 3.9 b; 4.1 a, b, c; 4.6 a, b; 5.1 f, g, h; 5.4 a, c;
6.1 a, e, f, k; 6.3 e; 6.4 e; 6.5 b; 6.6 b, e; LS.1 b, f, g, j;
PS.1 a, g, n; PS.2 a, c, e; PS.5 a; PS.6 a, c; PS.7 b, d

Time Needed

This lesson takes several class periods. Sample schedule:

Day One:	Complete the **Engage** and **Explore** portion of the lesson
Day Two:	Complete the **Explain** portion of lesson
Day Three:	Complete the **Elaborate** and **Evaluate** portion of the lesson

Materials for Lesson

- Hot plate

- Erlenmeyer flask
- Rubber stopper
- Clear flexible tubing
- Test Tube
- Clear cup or beaker
- Ice

Content Background

All matter is made up of atoms and molecules. Molecules in all matter are in constant motion no matter what state. Water commonly exists in three states of matter: solid, liquid, and gas.

- Solids: Have a definite shape and volume. Molecules are close together and vibrate.
- Liquids: Take the shape of the container and have a definite volume. Molecules are farther apart and slide past each other.
- Gases: Spread out to fill and take the volume of the container. Molecules are far apart and move very quickly.

Changes in states of matter happen when there are changes in how the molecules are moving. As matter heats up, the molecules move faster and farther apart resulting in state, or phase, changes.

Engage

THINK-PAIR-SHARE: Begin the lesson by having the students talk to a partner about what they think it means to observe. Share some of those ideas as a whole group. Record and accept all student responses.

Tell students that today they are going to think and act like scientists by making some observations as they observe a demonstration and record data about what they see using pictures, words, or a combination of the two. Remind students that scientists use their senses (sight, touch, hearing, smell, and taste) to help them make observations. Today, students will mainly use their sight, touch, and hearing as they make their observations. Provide each student a copy of the data collection sheet (included in the unit).

Explore

Heat some water in an Erlenmeyer flask over the hot plate. (You may wish to begin the heating process ahead of time as you discuss the data collection sheet with students since the boiling process will take several minutes). Connect the clear tubing through the hole in the rubber

stopper and secure the stopper to the top of the flask. Make sure the tubing extends through the stopper into the flask. The end of the tubing should extend slightly past the stopper. The opposite end of the tubing should extend into the open part of a test tube that sits a small distance away from the hot plate. (See diagram 1 to view the set up for the demonstration).

Have the students make observations using their data collection sheet. They should see changes in the water, i.e. bubbles and steam (water vapor) as the water boils. They may also hear the water boiling. The steam will be moving through the tubing but will not be clearly visible as it exits the opposite end of the tubing in the test tube. It is not necessary to use or formally introduce the terminology (i.e. water cycle, evaporation, condensation, precipitation, and water vapor) at this time. In this exploration phase, the students are being provided an opportunity to develop their understanding of the processes and concepts involved. The terminology and concepts will be formally introduced in the concept elaboration phase of the lesson. Allow students sufficient time to make their observations and record their data and questions.

Explain

ROUND ROBIN: Students share observations with their teammates. Each student shares one observation. Teammates discuss the observation. If all agree, each student records it on their data collection sheet. Continue until all students have shared at least one observation with teammates.

Discuss students' observations with the class. As students mention observations associated with a phase change, ask them if they know what is happening to the molecules for that phase change. For example, the student notices that the water boils. Ask students if they know what the water molecules are doing when the water boils. If students mention the term (evaporation), repeat it, but don't emphasize the term unless students already know it. Have students draw a picture of the molecules in their science notebook.

Elaborate

Next, tell the students that you are going to change one thing on purpose in the investigation to see if any changes result. Tell the students that when scientists change one thing on purpose in an experiment they call this the **independent variable**. Place the test tube (still connected to the clear plastic tubing) into a clear beaker filled with ice. Have the children tell you what you are changing on purpose (**independent variable**: placing the test tube into the container of ice). Ask students what remains exactly the same (water boiling, clear tube, same stopper, same test tube etc.). Ask students to predict what they think will happen after the test tube is placed into the beaker of ice. Have students continue to make and record their observations for a few more minutes. Ask students what they noticed when they observed the demonstration both times. (See if students connected what they saw to vocabulary or concepts from the previous lessons on

matter or if they used any of the terminology such as evaporation, condensation, precipitation, rain, water cycle etc). Encourage students to share some of the questions they recorded on their data collection sheet and the connections they made to their world.

*Note to the teacher: (Explanation of what happens): The changes in heat energy caused the liquid water in the Erlenmeyer flask to change into a gas (steam/water vapor). The air surrounding the test tube will be cooler. As the steam (water vapor) continues to exit the tube, the water vapor will cool and begin to condense forming water drops or precipitation. The change in heat energy from the ice resulted in cooling temperatures causing the condensation. That is why the steam/water vapor or gas eventually turned the water back into a liquid (water drops = precipitation).

Evaluate

Ask students to consider the following essential questions as you conclude the demonstration lesson. Ask students how the demonstration investigation they just completed helps them to begin to answer these questions? Allow sufficient time for a culminating discussion.

- What tools or process skills are used to study the weather?
- Why are investigations important?
- How can we investigate?

Demonstration (Lesson 1)

Diagram 1

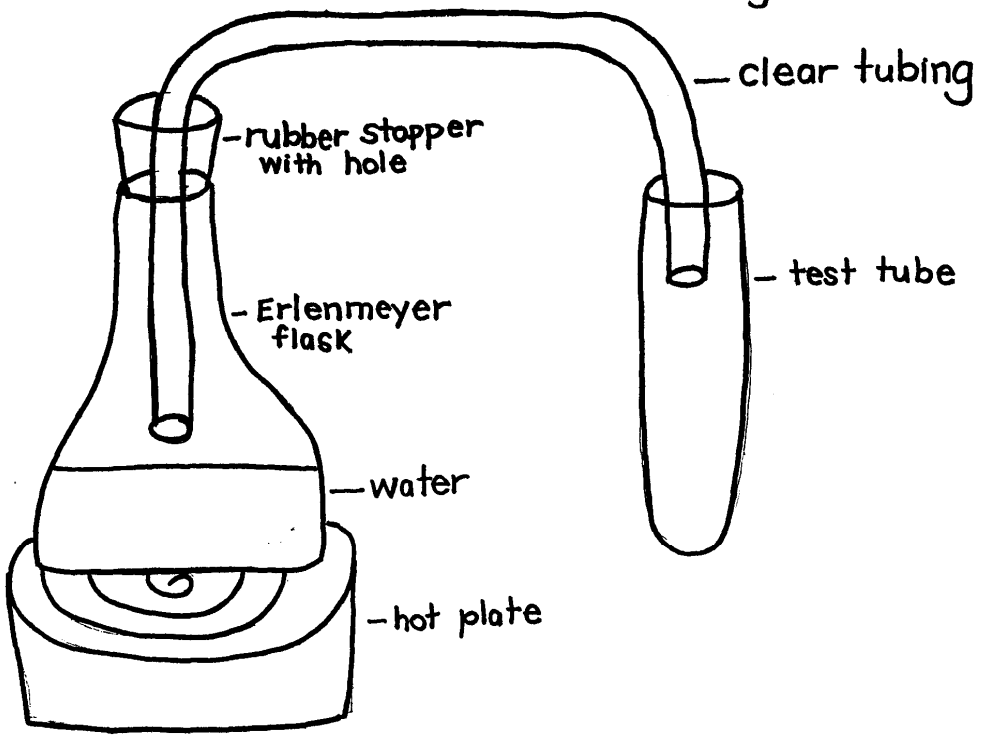
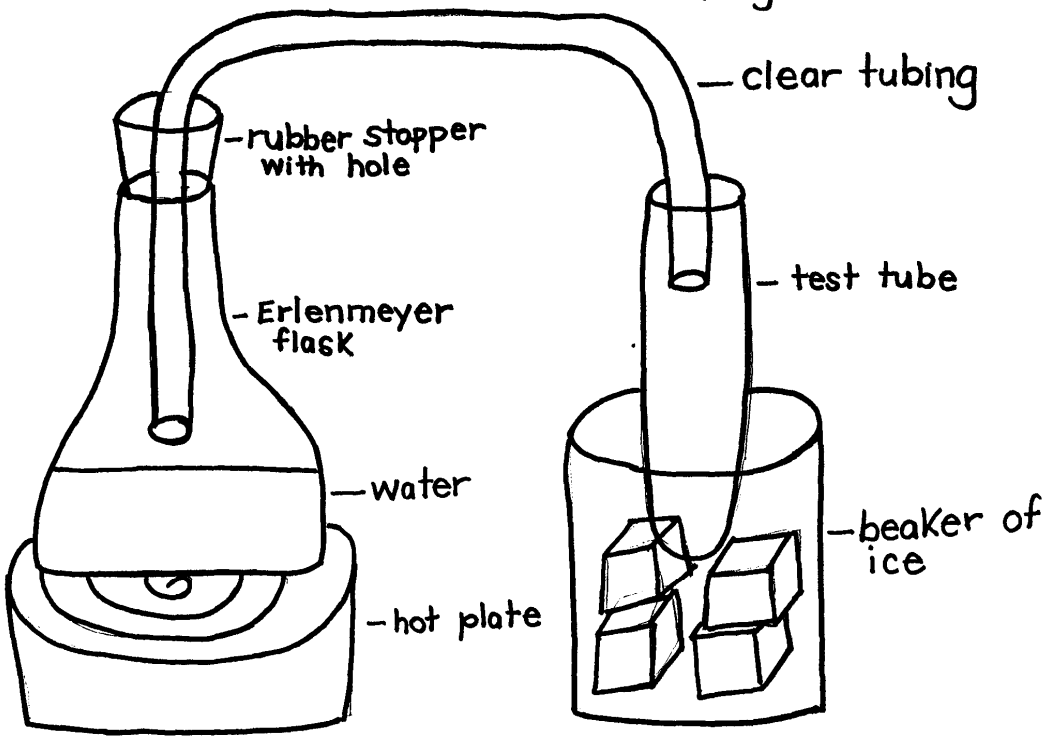
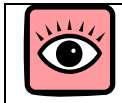


Diagram 2



Observations

I will use the following senses to make my observations:

 **Write down what you see with your eyes.**	 **Write down what you smell with your nose.**	 **Write down what you hear with your ears.**

Here are some connections to my world:

Here are some questions I have.

Observations

I will use the following senses to make my observations:

 **Write down what you see with your eyes.**

Write down what you smell with your nose.

Write down what you hear with your ears.

Connection to my World

Where have you seen something like this before?

Here are some questions I have.