SCOPE, SEQUENCE, and COORDINATION

A National Curriculum Project for High School Science Education

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Student Materials

Learning Sequence Item:

941

Environmental Cycles

March 1996
Adapted by: Brett Pyle

Contents

Lab Activities

1. Perspiring Animals
2. What Has Transpired?
3. Transpiration the Sequel: Leaf in a Cup
4. Cloud Formation
5. Stormy Weather

Readings

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This micro-unit was adapted by **Brett Pyle** (Grady Middle School, Houston, Texas)

Student Sheet

Science as Inquiry

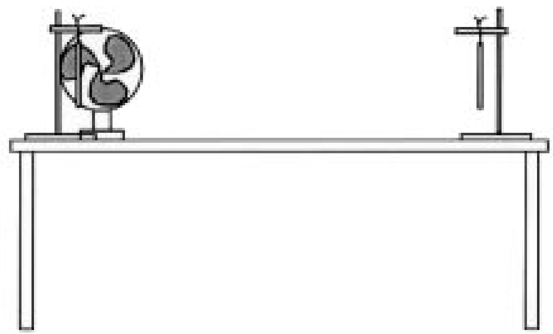
Perspiring Animals

How does perspiration affect body temperature?

Overview:

Have you ever rubbed alcohol on your skin? It feels so cool, much cooler than water. This activity will examine this cooling process.

Procedure:



Hang one thermometer from each ring stand. The thermometers should come to room temperature and should be at the same temperature. Record the starting temperature of each thermometer, then place the ring stands at opposite ends of the lab table and position the fan so that it blows on only one thermometer.

Turn on the fan and let it run for five minutes. While waiting, take turns standing with outstretched arms so that one hand is near each thermometer. Record your observations about how each hand feels (which one feels cooler) and then, after five minutes, record the temperature on each thermometer.

Next, wrap a small piece of gauze around the bulb of the thermometer and secure it with a rubber band. Wet both pieces of gauze. Again turn on the fan for five minutes with the same placement as before. While waiting, take turns standing with outstretched arms (one hand near each thermometer)—but this time have your lab partner mist the back of each hand with the sprayer. Record your observations and then record the temperature of each thermometer after five minutes.

Questions:

1. Discuss any differences in temperatures you observed during the course of the experiment and give a possible explanation for these differences.

2. Why does your hand feel cooler in front of the fan even when you don't spray it with water?

3. Explain how your body can cool itself even if the air temperature is above your body temperature.

4. Explain the different methods that marine mammals and fishes use to maintain a normal body temperature in cold water.

5. Dogs, unlike humans, have no sweat glands. How can dogs use evaporative cooling to cool themselves on hot days?

Student Sheet

Science as Inquiry

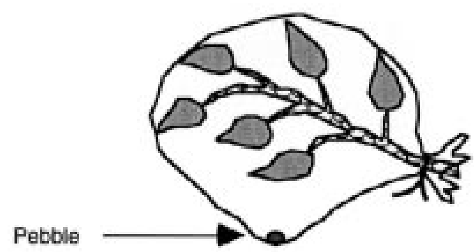
What Has Transpired?

How do we measure transpiration in plant leaves?

Overview:

Have you ever seen a plant sweat? It's hard to see, so do this activity carefully.

Procedure:



You will work in a group. Locate an accessible branch with several leaves near the end of the branch. Inflate (with outside air, not by blowing into it) and place a plastic bag over the end of the branch. Once the bag is situated, place a small piece of gravel in the bag and tie the bag around the branch, forming an airtight seal. Make a note of how many leaves were covered by the bag.

Leave the bag in place for 24 hours, then remove the bag and measure the water inside with a graduated cylinder. Determine the amount of water given off by one plant leaf in a 24 hour period.

Measure the same branch only during daylight hours and again during nighttime hours. One volunteer from each lab group needs to come before school to place the bag early in the morning (as close to sunrise as possible). The bag should then be removed after school (as close to sunset as is feasible) and a second bag placed on the same branch. Remove the second bag on the following morning.

Questions:

1. Use the data you collected to calculate the water lost to transpiration of one leaf in 24 hours.

2. Explain what you know about when most transpiration occurs. Support your answer with evidence.

3. What are the controlling factors on the process of transpiration? Cite evidence from your experiments to support your answer.

Student Sheet

Science as Inquiry

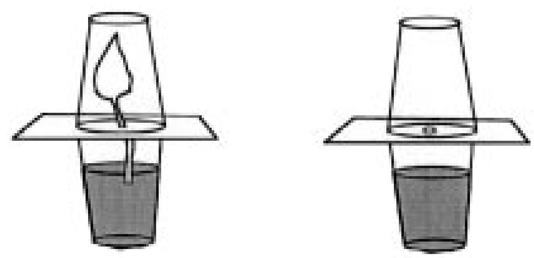
Transpiration the Sequel: Leaf in a Cup

How do we measure transpiration in plant leaves?

Overview:

How do plants get rid of water? This activity may be able to help you answer this question.

Procedure:



Fill one cup about halfway and then go outside and collect a fresh tree or shrub leaf and place it in the cup with the stem in the water. The leaf should be as big as possible and still be able to fit in the cup (the second cup will go on top). Once back in the classroom, place the stem of the leaf through the hole in the note card (provided), place the note card over the cup with water so that the stem is submerged, and place a second cup on top of the leaf. This process should be repeated with the remaining materials to form a second setup with no leaf to be used as a control.

Place the cups in a sunny window and let sit overnight. Make observations the next day and measure the amount of water that has condensed in the top cups. To determine the amount from plant transpiration, subtract the amount from the cup without a leaf (if any).

Compare the amount of water transpired during daylight hours compared to nighttime. One volunteer from each lab group needs to come before school to set up the cups early in the morning (as close to sunrise as possible). The cups should then be emptied, measured, and dried (as close to sunset as is feasible) and the cup replaced over the same leaf. The cup is removed the following morning and measurements made again. The students can then examine transpiration rates during the daytime and nighttime.

Questions:

1. How much water does one leaf give off in a 24 hour period? How do you know that all of this water came from the plant and not from the air?

2. Compare the amount of water produced during the day to that produced at night. Why do you think this occurs?

3. Explain what factors control the transpiration in plants. What is your evidence?

4. Find a small tree outside your classroom. Estimate the number of leaves on the tree. Calculate (based on your leaf data) the amount of water that tree transpires in one day.

Science as Inquiry

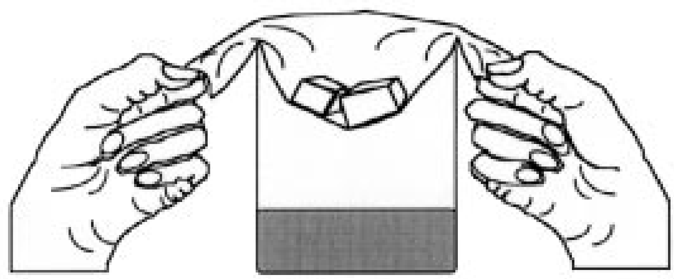
Cloud Formation

What conditions lead to cloud formation and precipitation?

Overview:

Some days are cloudy, some are not. Try making your own cloud in this activity.

Procedure:



Place 50 mL of cold water into the first beaker. Place two ice cubes into the plastic bag and then place the bag into the beaker so that the ice cubes are above the water. Hold the corners of the bag, pulling down around the edges so that the bag completely covers the opening of the beaker. Do not submerge the ice into the water. Observe for 2–3 minutes, describe the setup on paper and record observations.

Repeat the activity using 50 mL of hot water in the second beaker. Repeat process from above. Add ice to bag as it melts. Record your observations, then remove the ice bag from the second beaker. Light a match and let it burn for 2–3 seconds and then drop it into the hot water. Place the bag of ice back over the beaker and record observations. Describe the three different setups and record your observations of what occurred in each part.

Questions:

1. What effect did the temperature of the water have on the experiment?

2. What effect did the match have on the experiment?

3. Explain how this would relate to cloud formation. What are the controlling variables in the formation of clouds?

Science in Personal and Social Perspectives

Stormy Weather

What conditions produce storms?

Overview:

Lows, highs, hurricanes, thunderstorms and tornadoes. It is confusing, but let's examine this type of weather process.

Procedure:

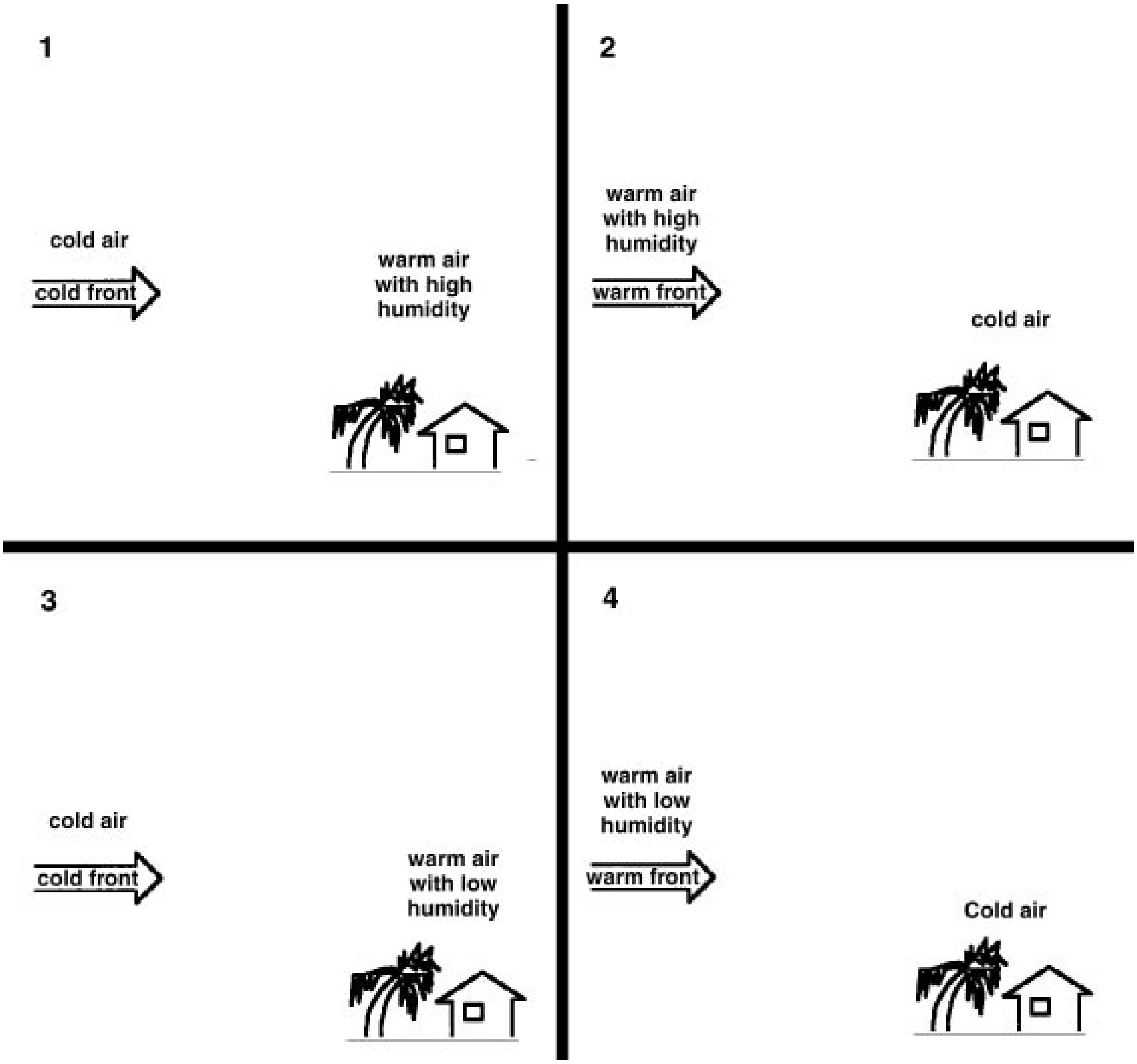
Complete the diagrams. Draw in a line representing the position of the front and show where, and what type of clouds will form from this interaction. Draw rain if it will occur in each situation.

Questions:

1. Discuss the variables that interact to create storms.

2. Explain how cold fronts or warm fronts can produce rain in some circumstances and not in others.

3. Describe how observations of cloud types can help you identify the difference between an on-coming cold front and an oncoming cold front.


1
cold air
cold front
warm air
with high
humidity
2
warm air
with high
humidity
warm front
cold air
3
cold air
cold front
warm air
with low
humidity
4
warm air
with low
humidity
warm front
Cold air

Diagrams