

## Activity 2.6 Warm Front/Cold Front

### Teacher Background

Air masses of different temperatures and densities (see Activity 1.4) are in constant battle with one another. As one air mass moves in, another must move on and out or up. The boundary between the two air masses is called a “front.” The triangles or semicircles symbolizing the front point in the direction it’s traveling. There are four types of fronts. Students will likely be very familiar with these from TV newscasts and weather maps seen in newspapers.

**Cold Front:** (blue triangles) Cold air is denser and so pushes warm air out of its way, like a snow plow moving down the street, forcing the warm air to rise steeply. Cumulus and cumulonimbus clouds form and rain, thunderstorms, hail and tornadoes can occur.

**Warm Front:** (red half-circles) Warm air slides up and over cold air. Cirrus clouds form ahead of the front. As the front comes closer, stratus clouds form at lower levels in the atmosphere. These clouds can change to nimbostratus clouds and produce rain, snow, sleet and freezing rain.

**Stationary Front:** (blue triangles and red half-circles on opposite sides of the front) Neither warm air nor cold air is able to get the upper hand and advance. This causes widespread clouds on both sides of the front.

**Occluded Front:** (alternating triangles and half-circles on same side of the front) Cold, warm and cool air come together. In a “cold occluded” front, cold air pushes under cool air and in a “warm occluded” cool air rises over cold air.

### Objectives

Students will become familiar with the four different types of fronts.

Students will observe the behavior of warm and cold air in simple models of the different fronts.

Students will use their knowledge of fronts to predict the kind of weather that will be found along fronts found on a weather map.

### Vocabulary

front (warm, cold, stationary, occluded)

### Materials

clear plastic shoe box

two 100 ml beakers

hot plate

thermometer

thermal gloves or pot holders

ice

water

goggles

current weather map of USA (from links to be found at the LFSSTORM website)

Student Worksheets 2.6.1 and 2.6.2

WEATHERlogs

LFSSTORM Standards Correlation sheet (for teacher reference)

### Engage

Give each team a current weather map of the United States showing the location of the different fronts. (Or have them go online to review current conditions via the LIVE FROM THE STORM website.) Distribute Student Worksheet 2.6.1, Front Symbols and Weather Rules. Discuss the type of fronts found and what type of weather would normally be expected to occur in regions adjacent to the fronts. Locate a major city in that area and go online to find *today's* weather for that city. How does the actual weather compare to the students' predictions based on the type of front?

Excellent resource for interactive weather maps may be online under "Blue Skies" Java Weather Maps:

[http://cirrus.spri.umich.edu/javaweather/IIFs/us\\_st.html](http://cirrus.spri.umich.edu/javaweather/IIFs/us_st.html)

### Explain/Explore

#### Procedure

Allow students to form groups of 2-3 or assign them to groups: varied abilities and both sexes work best.

Distribute Student Worksheet 2.6.2 and review the procedures outlined on side 1. Have students implement the Activity, circulating among the groups to ensure safety procedures are being followed, answering questions and generally encouraging them. Make sure students are recording observations in WEATHERlogs.

Note: As soon as the beakers are placed in the shoebox, students should observe condensation growing directly above the hot water and spreading onto the side with the ice until it completely covers that part of the box. Help them understand what's happening: the air warmed by the hot water is rising to the top of the shoebox. As it circulates towards the side of the shoebox with the ice, the air is cooled thus causing it to condense. While this is occurring the cold air is sinking and slipping under the warm air on the warm water side of the shoebox.

#### TEACHER TIP:

When I do this activity I have the students heat the water. (Remind students not to place the thermometer on the bottom of the beaker and leave it there. They will get a much higher reading than the actual temperature of the water.) Once it reaches the correct temperature the teacher can carry the beakers to the tables. The tables should be heat resistant.

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### Expand/Adapt/Connect

Review the procedures outlined on Activity 2.6.2 Student Worksheet, side 2. Have students implement the Activity, circulating to ensure safety procedures are being followed, answering questions and generally encouraging all the students. Make sure they are recording careful observations in their WEATHERlogs.

Materials (for Expand/Adapt/Connect)

250 ml beaker  
100 ml of oil  
100 ml of water  
red food coloring

Wrap up the Activity with a whole class discussion, encouraging participation and student citation of results recorded in their WEATHERlogs. (The students should be able to observe the oil rise up and over the water and the water sink down and under the oil. It happens very quickly, so they need to observe immediately!)

Observe the sky for two weeks and make weather predictions based on the imminent arrival of fronts and the visible evidence of the clouds.

Suggested URLs

[http://www.comet.ucar.edu/dstreme/images/rad\\_frt.gif](http://www.comet.ucar.edu/dstreme/images/rad_frt.gif)

Map suggested for this Activity

<http://www.geo.lsa.umich.edu/~stixrude/GS201/Lectures/18Weather1/lecture.html>

Good images of different air masses and fronts

[http://ww2010.atmos.uiuc.edu/\(Gh\)/guides/mtr/af/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/af/home.rxml)

&

[http://ww2010.atmos.uiuc.edu/\(Gh\)/guides/crlm/act/fpr.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/crlm/act/fpr.rxml)

Air masses: where they originate, how they are modified and how precipitation develops along fronts