

Moving Masses

Background

Though all air looks the same—invisible—it has very different characteristics from place to place. Air masses are large bodies of air that have distinct temperatures and relative humidity. When air masses meet, they do not mix easily. Warmer air masses ride over cooler air masses, and cooler air masses wedge themselves underneath warmer air masses. This happens because cool air is more dense than warm air.

The boundary that forms between warm and cool air masses is called a front. As warmer air comes in contact with colder air and is forced to rise, it expands into the lower pressure found at higher altitudes. This expansion cools the air and the moisture in the air condenses, forming clouds. If the warm air continues to rise and expand, rain or snow may form.

Clouds are a visible result of the interactions of air masses. Clouds have many patterns, and by looking at cloud types it is possible to predict changes in the weather and the movement of fronts.

Procedure

1. Find the page of cutouts. Separate the three strips, cutting along the dotted lines. Also cut out the “city”.
2. Color the cold air blue.
3. Tape or glue the three large strips together by matching up the letters. For example, match up the letters A and tape. Then match up the letters B and tape.
4. To make the viewer itself, fold a piece of paper or thin cardboard in half lengthwise and make a vertical 6 cm cut about one-third of the way across the paper and about 2 cm above the bottom edge. Then make another cut about 7.5 cm away from the first one as shown in Figure 1.
5. Tape or glue the city below the two slits.
6. Feed the strip through the two slits. Pull from the right so that you start with Monday morning, as shown in Figure 2.

Objective

The objective of this activity is to investigate the types of clouds that occur when warm and cold fronts move in, and to use this knowledge to predict the weather changes over periods of a day or so.

Materials

For each student:

- ◇ scissors
- ◇ several blue crayons
- ◇ tape or glue
- ◇ paper or thin cardboard

Figure 1

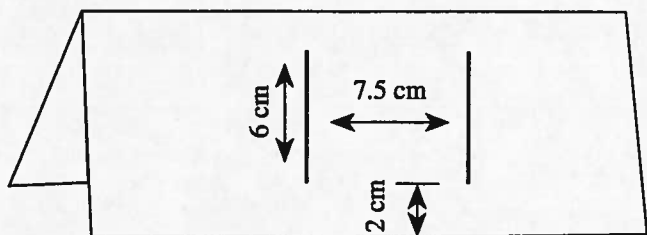
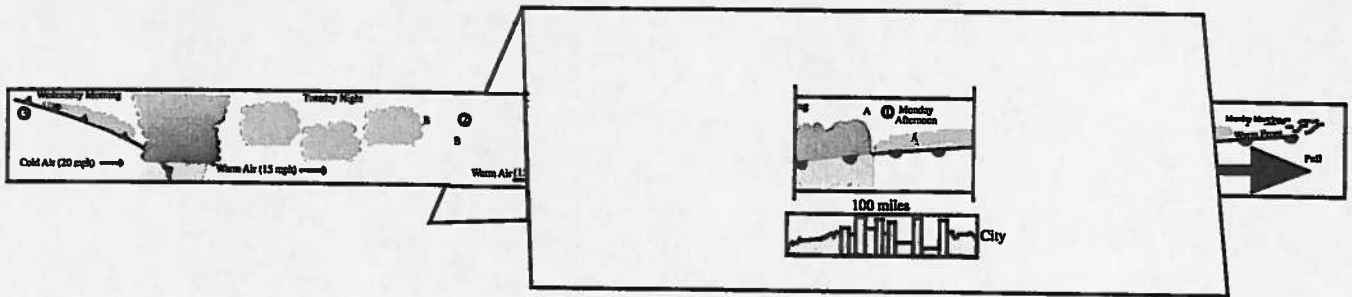


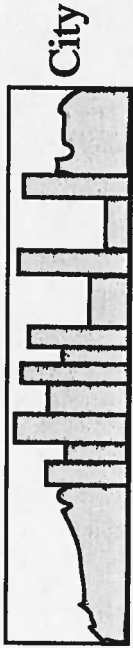
Figure 2



Questions/Conclusions

1. Describe the first type of cloud to appear on Monday morning.
2. What did the clouds look like by Tuesday morning when they were producing rain?
3. Why did the warm air rise up over the cold air on Monday?
4. Describe the type of clouds present as the cold front moved in on Wednesday morning.
5. If you saw thin wispy clouds followed by lower layered clouds, what type of weather might you expect in the near future?

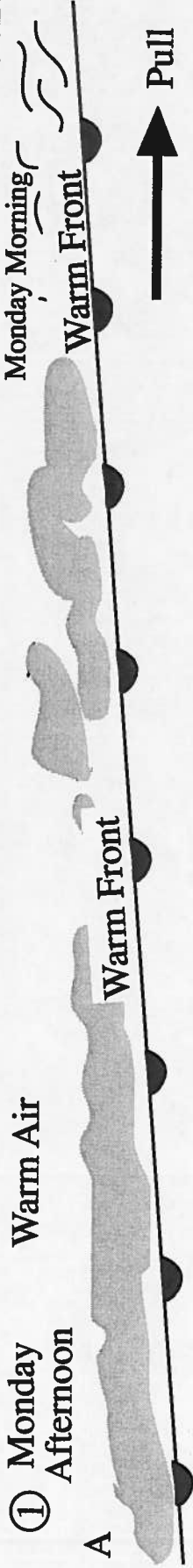
100 miles



City

① Monday Afternoon

Warm Air



Monday Morning

Warm Front

Pull

Cold Air (10 mph)

Tuesday Afternoon

Tuesday Morning

A

②

B

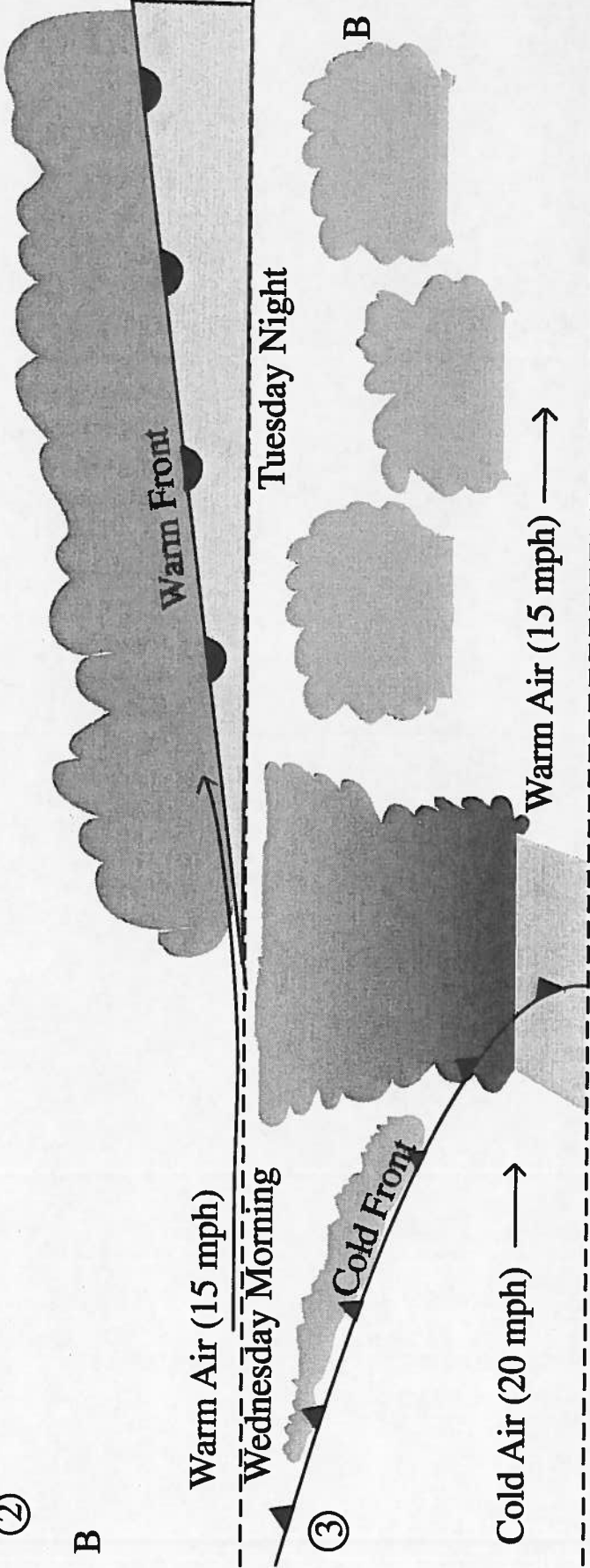
Warm Air (15 mph)

Wednesday Morning

③

Cold Front

Cold Air (20 mph)



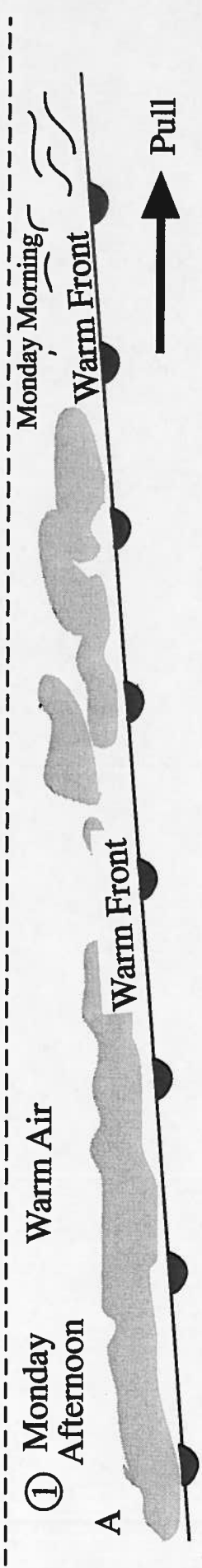
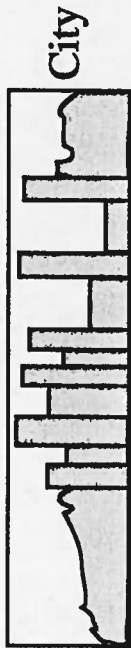
Warm Front

Tuesday Night

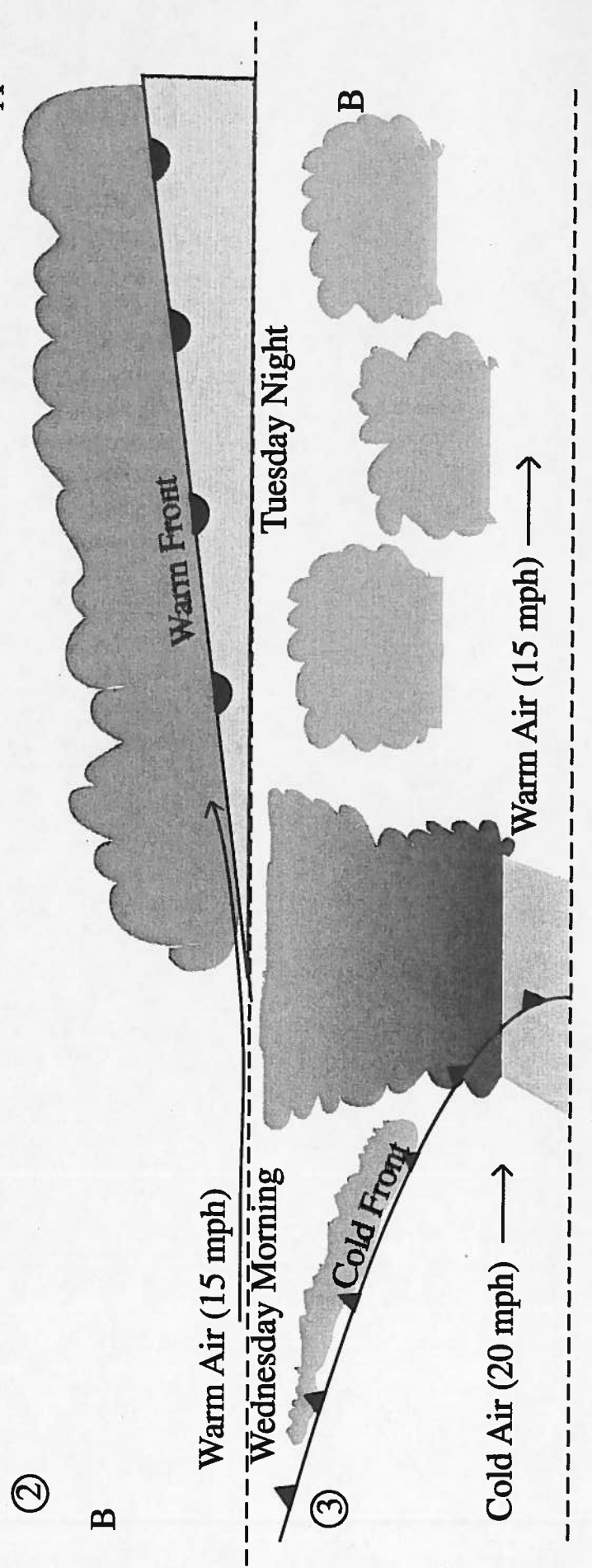
B

Warm Air (15 mph)

100 miles



Cold Air (10 mph)



Moving Masses

Materials

For each student:

- ◇ scissors
- ◇ several blue crayons
- ◇ tape or glue
- ◇ paper or thin cardboard

What is Happening?

Fronts are responsible for most of the cloudiness, rain, and snow in the United States, especially in the winter. A front is a boundary that exists between air masses of different temperature and humidity. The boundary exists because these air masses do not readily mix. The warmer air, being less dense, rides up over the cold air. As this happens, the moisture in the warm air will condense—forming clouds, rain, or snow—because the warm air expands and cools into regions of lower pressure. As warm air rises and cold air sinks, energy is released in the form of winds and a storm is born.

There are various types of fronts, and they are named according to their direction of movement. The two types discussed in this activity are warm and cold fronts. In a warm front, warm air advances replacing cooler air. In a cold front, cold air advances replacing warmer air. In each case, characteristic clouds form that allow the prediction of coming weather. The model in this activity is designed to help students recognize these characteristic types of clouds. A representation of what the cut out model might look like on a weather map is shown in Figure 1.

The cut out model is only two dimensional. Fronts and airflow are three dimensional. The fronts and their movement are actually into and out of the page in addition to across it. It is important to convey to students that the sequence of clouds presented in this activity represents an *idealized* front.

Figure 1



Important Points for Students to Understand

- ◇ Air masses of different temperature and humidity do not readily mix.
- ◇ The boundary between air masses of different temperatures is called a front.
- ◇ When warmer air meets colder air, the warmer air is forced to rise and cool, and the moisture in the warmer air may condense forming clouds, and eventually rain, or snow.

Time Management

This activity can be done in one class period or less.

Preparation

Be sure that all supplies are centrally located or already distributed to groups. There is a variety of posters and charts with photographs of cloud types (see the Annotated Bibliography). These visual aids may assist the discussion of cloud types.

Suggestions for Further Study

The names for the different types of clouds were not discussed in this activity. Encourage students to investigate these on their own. Have separate classes do class predictions of the weather and compete with each other for the most accurate prediction (see Activity 1, "Weather Watch").

Students can make predictions about weather by looking at the weather maps in newspapers. Other sources of weather maps include local television news weather reports and The Weather Channel. These usually include the cold and warm fronts across the nation. This is also a good opportunity for them to learn the symbols used to represent the different types of fronts.

Suggestions for Interdisciplinary Reading and Study

Clouds can provide the motivation for a writing exercise. Most people have imagined that clouds look like people, animals, or other things. Students can be asked to write an essay describing the scene they see in the sky on a cloudy day. Myra Cohn Livingston's poem "Clouds" is an example of what such an exercise might look like in verse form.

Sayings and folklore about weather can be found in almost every culture. Some of the sayings that predict weather are based on careful observation and are fairly accurate. For example, examine the poem titled "Weather Signs," which appears at the start of Activity 1. Encourage students to read and interpret such sayings. Have them research the origin of the sayings and determine if they are based on sound principles.

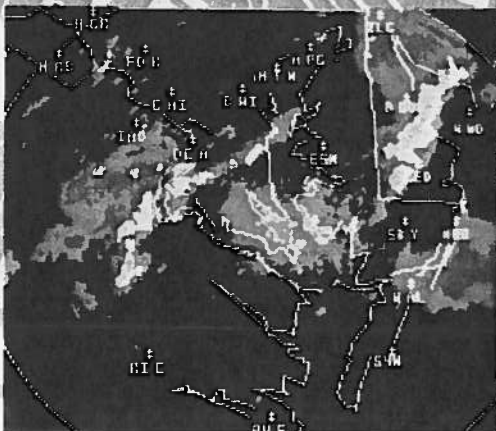
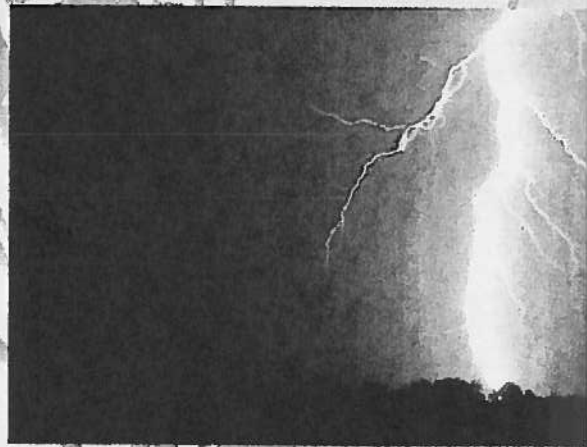
Answers to Questions for Students

1. Thin, wispy, feather-like clouds (cirrus clouds).
2. Much thicker and gray.
3. It was less dense.
4. Tall, towering, billowing clouds. Various shades of white, gray, or black.
5. Warm front moving in with increased cloudiness and rain or snow likely.

**PROJECT
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Second Edition