

Unit
4Handout
2*Lesson 4: Investigating Heat Transfer and the Movement of Air***Purpose:**

- Recognize that differences in air temperature connects to the movement of air.
- Investigate the effect of surface temperature on the temperature of air above the surface and its resulting movement.

Guiding Questions:

How do surface temperatures on the earth affect the temperature of the air above it and the way air moves?

Getting Started

1. Look back at handout 1. Re-read your definitions of the terms weather and climate. Then, read "Weather Versus Climate" on page 44. How accurate was your definition? In the space below, write down the book definitions of weather and climate from page 44.

a. Weather:

b. Climate:

2. On the next page of this sheet is a data table. The table shows early summer temperatures of land and of its nearby ocean. Which column (A or B) is land? Which is the ocean? What evidence do you have to support your choice?

(One more question on the next page.)

Table 1 Summer Temperatures Near Portland, Maine

Time	Column A (Temperature, °C)	Column B (Temperature, °C)
6:00 A.M.	14	18
8:00 A.M.	17	19
10:00 A.M.	18	19
Noon	23	19
2:00 P.M.	26.5	19
4:00 P.M.	27	20
6:00 P.M.	27	20
8:00 P.M.	20	20
10:00 P.M.	18	20
Midnight	16	20
2:00 A.M.	15	20
4:00 A.M.	14	19

3. How do you think the temperature of earth's surface affects the temperature of the air above it? You can use the data table above to help you think about the answer to this question.

INVESTIGATION 4.1: INVESTIGATING THE TEMPERATURE OF AIR

In this investigation you will explore how the temperature of a surface affects the temperature of an air mass around it. This investigation begins on p. 61 of the WNC textbook.

Directions. Read the procedure on pages 61-63. Then, answer the following questions about the procedure.

1. How will you determine the correct temperature of the air in the cylinder using the thermometer?

2. How often and for what time will you record data?

3. How and what data will you collect of the hot water and crushed ice?

Directions. Start with step 5 on page 61. Complete all steps (5-12) as instructed. Record your data in the table below.

Table 1 Temperature Changes

	Cold Convection Tube		Hot Convection Tube	
	Container of Crushed Ice: Temperature (°C)		Container of Hot Water: Temperature (°C)	
Time (minutes)	Temperature (°C) Thermometer A (top)	Temperature (°C) Thermometer B (bottom)	Temperature (°C) Thermometer A (top)	Temperature (°C) Thermometer B (bottom)
0:00				
1:00				
2:00				
3:00				

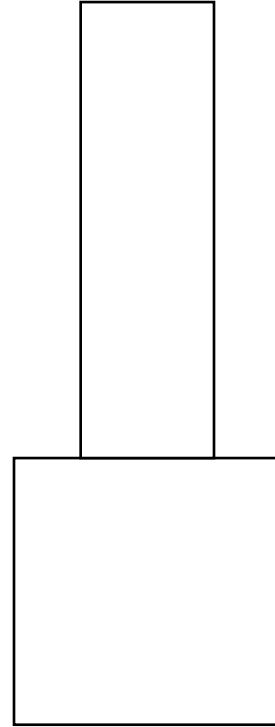
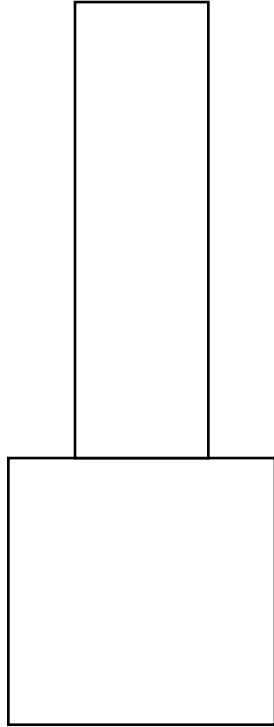
INVESTIGATION 4.2: INVESTIGATING HOW WARM AIR AND COOL AIR MOVE

In this investigation you will explore how warm and cool air move. You will do this using a similar setup to what you had in investigation 4.1. You will use smoke to track the movement of the air.

Directions. Read the procedure on 7bscience.com. Then, answer the following questions about the procedure.

1. How do you think air will move above a hot surface?
2. How do you think air will move above a cold surface?

Directions. In the diagram on the next page, show how the air moves in each container. You will need to indicate which is ice and which is hot water. Also, write one sentence that describes what happens.



INVESTIGATION 4 ANALYSIS

Directions. Answer the following questions regarding our investigations in lesson 4. Use evidence (supporting data) from the investigation to support your answers.

1. You may have predicted that the air temperature above a cold substance will decrease. However, we did not observe this happen. Write an explanation for why the air temperature in the convection tube with hot water increased whereas the air temperature in the convection tube with ice did not change. (Hint: think about convection and what happens with heated/cooled substances.)

(Continued on next page.)

2. Based on the second activity (handout 113), how did the air, visible because of the smoke, move in the Convection Tube with crushed ice? Explain why you think this happened. Use evidence from the lesson to support your answer.

3. What happened to the air inside the Convection Tube with hot water? Explain why you think this happened.

4. Why do you think moisture formed on the inside of the Convection Tube with hot water? How do you think this relates to the process of cloud formation on earth?

5. Apply what you observed in this lesson to the earth. If the earth's surface is colder than the air above it, what will happen to the air? If the surface is hot and damp, what will happen to the air above it?

6. Read "Air Masses" on page 66. What can happen where two air masses meet?

7. Develop a working definition for "stable air mass" and "unstable air mass." To help you with this, think about how the smoke moved in each tube: which was more stable, which was unstable? How is this connected to surface and air temperature?
8. Apply what you observed in this lesson to cloud formation. When do you think clouds are more likely to form: when air remains close to the earth's surface or when air rises and moves quickly to high altitudes? Support your choice with evidence from this lesson.