



Convection Currents

A. Scientist: _____
 Date: _____
 Time: _____ (including AM or PM)

B. INQUIRY QUESTION

How does the uneven heating of the Earth affect weather patterns?

C. TESTABLE QUESTIONS

1. Will the cooler container (ice) or the warmer container (candle) affect the temperature at the top of each tube more?
2. In which direction, from hot to cold or cold to hot, will air currents most likely move?



D. PREDICTION

I predict that...

1. _____
2. _____

E. MATERIALS

- | | |
|--|--|
| <input type="checkbox"/> (2) Convection tubes | <input type="checkbox"/> (1) Light |
| <input type="checkbox"/> (2) Small plastic containers | <input type="checkbox"/> Piece of plastic wrap |
| <input type="checkbox"/> (1) Piece of plastic tubing | <input type="checkbox"/> Rubber band |
| <input type="checkbox"/> Pencil | <input type="checkbox"/> One-minute timer |
| <input type="checkbox"/> Reusable Ice | <input type="checkbox"/> (1) Set of gloves per student |
| <input type="checkbox"/> Tea candle | <input type="checkbox"/> Student procedure sheet |
| <input type="checkbox"/> (2) Equipment set-up diagrams | |
| <input type="checkbox"/> Wizard Stick | |

F. PROCEDURE

Part 1

1. Read the temperature of the thermometer in each of the convection tubes. **Record** the initial temperatures in the **DATA AND OBSERVATIONS** section.
2. Fill one plastic container with ice, and cover it with plastic wrap using a rubber band. Place it under the convection tube labeled ICE.
3. Put the candle in the other plastic container, and ask your instructor to light the candle. Place it under the convection tube labeled CANDLE.
4. Use your one-minute timer and time **TWO** minutes (you must flip the timer once). While you wait, **read** steps 5, 6, and 7 with your team.



5. After two minutes, read the **final** temperature of the thermometer in each convection tube. **Record** this information in the data chart.
6. Blow out your candle.
7. If you have extra time, calculate the change in temperature and record it in the **DATA AND OBSERVATIONS** section.
8. Let your instructor know you are ready to begin Part 2 and learn about the Wizard Stick.

Part 2

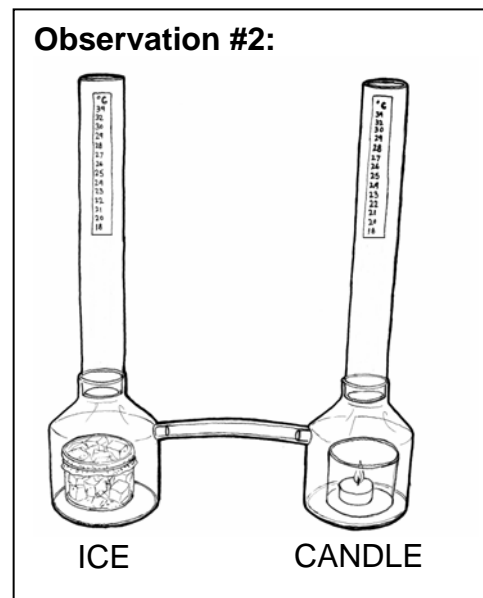
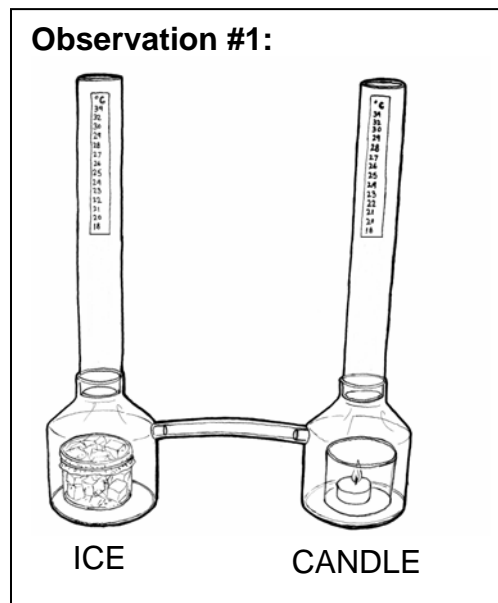
1. Connect the convection tubes by placing the plastic tubing over the nozzles on the sides of each tube. Refer to the diagram.
2. Ask your instructor to relight your candle.
3. Observation #1: Start the Wizard Stick, and turn it upside down over the top of the convection tube labeled ICE. Keep the Wizard Stick going for 5 seconds. Observe the movement of the smoke.
4. Draw arrows in the direction the smoke moved during Observation #1 in the **DATA AND OBSERVATIONS** section.
5. Observation #2: Start the Wizard Stick, and turn it upside down over the top of the convection tube labeled CANDLE. Keep the Wizard Stick going for 5 seconds. Observe the movement of the smoke.
6. Draw arrows in the direction the smoke moved during Observation #2 in the **DATA AND OBSERVATIONS** section.
7. **Challenge:** If you have time, ask your instructor for the “Challenge” worksheet and materials. Follow the directions on the worksheet to complete the challenge.
8. Clean your station so that it looks as clean as it did when you got there, if not cleaner.
9. Discuss the **CONCLUSION** questions with your investigation team and then as a whole group.

G. DATA AND OBSERVATIONS

Part 1 Data: Record the **initial** and **final** temperature of the thermometer in each of the convection tubes.

	Initial (beginning) Temperature °F / °C	Final (after 2 minutes) Temperature °F / °C	Change in Temperature (Final – Initial) °F / °C
Container with Ice 	____ °F / ____ °C	____ °F / ____ °C	____ °F / ____ °C
Container with Candle 	____ °F / ____ °C	____ °F / ____ °C	____ °F / ____ °C

Part 2 Observations: Draw **arrows** showing the direction that you observed the smoke traveling.



H. CONCLUSION

Today I learned that ...

Be sure to include the answers to the following questions.

1. Which container, the one with ice or the one with the candle, had a greater effect on the temperature at the top of the tube? Why?

2. In what direction did the smoke move when you put it into the “cold” convection tube? Why?

3. In what direction did the smoke move when you put it into the “hot” convection tube? Why?

4. You created a *convection current* in this investigation, which is the movement of air from one place to another. What is the common term for the movement of air from one place to another?

5. If you sit at the beach on a warm, sunny day, would you feel the wind coming from the *ocean to the land* or from the *land to the ocean*? Explain your answer.

I. LINE OF LEARNING

J. NEW VOCABULARY

List any new vocabulary words you learned from doing this investigation. Use the glossary to write the definition of each word.



The Water Cycle

A. Scientist: _____
 Date: _____
 Time: _____ (including AM or PM)

B. INQUIRY QUESTION

How does water move through the Earth's system?



C. TESTABLE QUESTION

Is it possible to move water from one flask to another without removing the rubber stoppers?

D. PREDICTION

I predict that...

E. MATERIALS

- | | |
|---|--|
| <input type="checkbox"/> Safety shield | <input type="checkbox"/> Hot plate |
| <input type="checkbox"/> (1) Pair of gloves per student | <input type="checkbox"/> Student procedure sheet |
| <input type="checkbox"/> (1) Pair of safety goggles per student | <input type="checkbox"/> Diagram of equipment set-up |
| <input type="checkbox"/> (2) 250 mL flasks | <input type="checkbox"/> Reusable ice |
| <input type="checkbox"/> Tray for ice | <input type="checkbox"/> Warm water |
| <input type="checkbox"/> Stand for ice tray | <input type="checkbox"/> Clear plastic tubing |
| <input type="checkbox"/> (2) Rubber stoppers with thermometers inserted | |
| <input type="checkbox"/> Graduated cylinder | |
| <input type="checkbox"/> One-minute timer | |

F. PROCEDURE

Part 1: Equipment Set-up

- Put on safety goggles and gloves. You must keep these on until the end of the investigation.
- Measure 75 mL of warm water with the graduated cylinder. Ask your instructor for two 250 mL flasks. Pour the water into one of the flasks. This will be the "hot" flask.
- Place the empty flask in the ice tray. This will be the "cold" flask. Place ice around the flask until the tray is filled.
- Put the rubber stoppers into the top of each flask.

5. Read the initial (beginning) air temperature of each flask in Fahrenheit (°F) and Celsius (°C). Record the initial air temperature for each flask in the **DATA AND OBSERVATIONS** section.
6. Record the initial (beginning) volume of water for each flask in the **DATA AND OBSERVATIONS** section.
7. Ask your instructor to check your equipment set-up. **Your instructor will place your equipment behind the safety shield.**

Part 2: Observations

1. Turn over your one-minute timer. After one minute, record your observations in the cold flask, connector tube, and hot flask by circling key terms in the **DATA AND OBSERVATIONS** section. After you have recorded your observations, turn over the one-minute timer.
2. After each minute, follow the directions on the data table to record observations in the cold flask, connector tube, and hot flask in the **DATA AND OBSERVATIONS** section. Don't forget to record the temperature after three minutes. Record observations after each minute until time is up.
3. Have a member of your team ask for your instructor. Your instructor will remove your equipment and help you with step 4.
4. Record the final volume of water in each flask in the **DATA AND OBSERVATIONS** section.
5. Clean up your station. Your station should look as clean as it did when you got there, if not cleaner.
6. Calculate the change in water volume for each flask by using the following equations:

Cold Flask:

Final Volume _____ mL – Initial Volume _____ mL = Change in Volume _____ mL




Hot Flask:

Initial Volume _____ mL – Final Volume _____ mL = Change in Volume _____ mL

7. Record the change in volume in the **DATA AND OBSERVATIONS** section.
8. Use your data and knowledge of the water cycle to answer the **CONCLUSION** questions.

G. DATA AND OBSERVATIONS

Fill out the data table for each minute of your investigation. Circle the words that best describe your observations. You may circle more than one word.

Time (minutes)	 Cold Flask	Connector Tube 	 Hot Flask
Start Record Temperature and Volume	Temperature ____ °F ____ °C Initial Volume ____ mL		Temperature ____ °F ____ °C Initial Volume ____ mL
1 minute Circle your observation	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling
2 minutes Circle your observation	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling
3 minutes Circle your observation	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling
Record the temperature	Temperature ____ °F ____ °C		Temperature ____ °F ____ °C
4 minutes Circle your observation	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling
5 minutes Circle your final observation	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling	Condensation Cooling Evaporation Heating Precipitation Boiling
Final Record Temperature and Volume	Temperature ____ °F ____ °C Final Volume ____ mL		Temperature ____ °F ____ °C Final Volume ____ mL

Calculations:

Calculate the Change in Volume:

Cold Flask:

Final Volume ____ mL – Initial Volume ____ mL = **Change in Volume** ____ mL

Hot Flask:

Initial Volume ____ mL – Final Volume ____ mL = **Change in Volume** ____ mL

H. CONCLUSION

Today I learned ...

Be sure to include the answers to the following questions.

1. Did the volume of water in both the cold flask and the hot flask change?

2. What is the estimated volume of water in each flask at the end of the investigation?

3. What did you observe in the flask on the hot plate? Explain your answer.

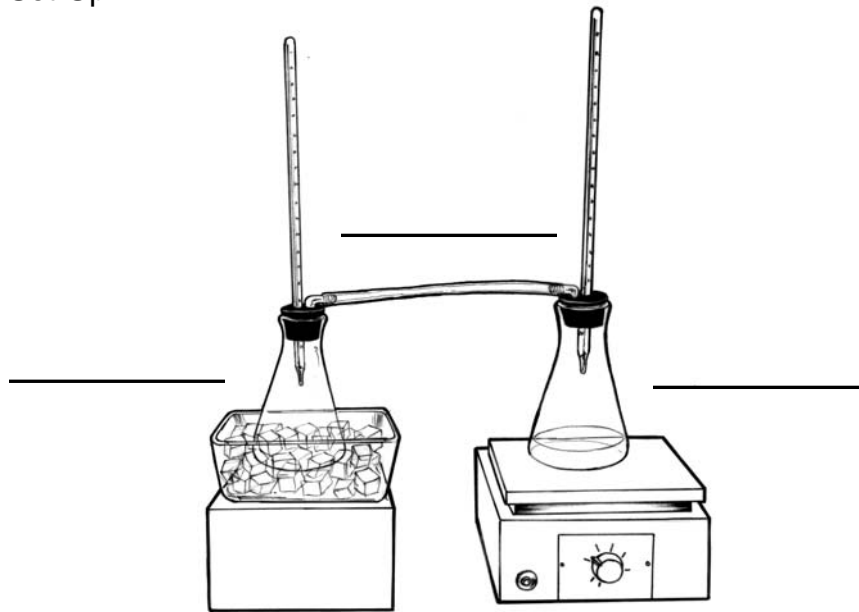
4. What did you observe in the flask in the ice? Explain your answer.

5. What is the energy source in your investigation? What is the energy source that drives the water cycle on Earth?

6. How can you use this investigation to explain how water from the ocean in California gets to the desert in Arizona?

- 7. Look at the diagram of the experiment set-up below. Label the following parts of the water cycle on your diagram: condensation, precipitation, and evaporation.

Experiment Set-Up:



I. LINE OF LEARNING

J. NEW VOCABULARY

List any new vocabulary words you learned from doing this investigation. Use the glossary to write the definition of each word.

Weather Definitions

Instructions: List weather conditions that accompany each type of system and front.

High-pressure System

1. _____
2. _____
3. _____
4. _____

Low-pressure System

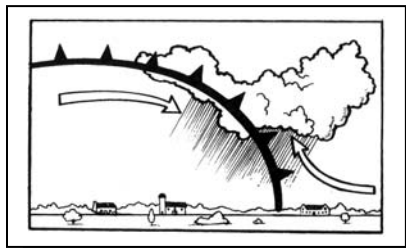
1. _____
2. _____
3. _____
4. _____

Warm Front

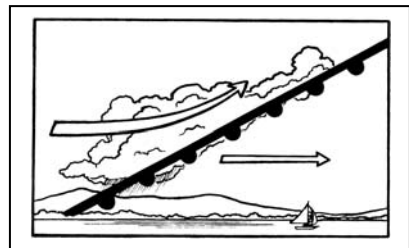
1. _____
2. _____
3. _____
4. _____

Cold Front

1. _____
2. _____
3. _____
4. _____



Cold Front



Warm Front



Weather Maps

A. Scientist: _____
 Date: _____
 Time: _____ (including AM or PM)

B. INQUIRY QUESTION

How do weather maps help meteorologists generate weather forecasts?



C. TESTABLE QUESTION

In which direction, from west to east or east to west, will a pressure system move across the United States?

D. PREDICTION

I predict that...

E. MATERIALS

- | | |
|--|-------------------------------------|
| <input type="checkbox"/> Weather maps from the last three days | <input type="checkbox"/> Calculator |
| <input type="checkbox"/> Ruler | <input type="checkbox"/> Pencil |

F. PROCEDURE

1. Ask your instructor for the weather maps from the last three days, and set them next to each other in numerical order.
2. Look at Map Number 1, and choose one high-pressure system **or** one low-pressure system. You will track this system across the United States over the last three days and predict where this system is today.
3. Look at Map Number 1, and find the system that you chose to track. Put either a high-pressure symbol or a low-pressure symbol on your big map to show where the system was **three** days ago. **Leave the symbol on your map.**
4. Look at Map Number 2, and find the system you are tracking. Put a second high-pressure symbol or low-pressure symbol on your big map to show where the system was **two** days ago. **Leave the symbol on your map.**
5. Look at Map Number 3, and find the system you are tracking. Put a third high-pressure symbol or low-pressure symbol on your big map to show where the system was **yesterday**. **Leave the symbol on your map. Your weather map should have three symbols on it.**

6. Ask your instructor for a ruler and a calculator. You will use these tools and the map scale below to determine the distance the system traveled each day.
7. Find the symbols on your big map that show where the system was **three** days ago and where the system was **two** days ago. Use the ruler to measure the distance between these two symbols. Use this distance and the map scale to complete **Calculation 1** to determine the distance in miles the system traveled in one day. Write your answer in the **DATA AND OBSERVATIONS** section.

Map Scale: 1 centimeter = 40 miles

Calculation 1: _____ to _____ : _____ X _____ = _____
 date date # of cm traveled # miles/centimeter miles traveled

8. Find the symbols on your big map that show where the system was **two** days ago and where the system was **yesterday**. Use the ruler to measure the distance between these two symbols. Use this distance and the map scale to complete **Calculation 2** to determine the distance in miles the system traveled in one day. Write your answer in the **DATA AND OBSERVATIONS** section.

Calculation 2: _____ to _____ : _____ X _____ = _____
 date date # of cm traveled # miles/centimeter miles traveled

9. Use your calculations to predict where the system is **today**. Place either a high-pressure or a low-pressure symbol on your big map in the place that you think it will be today. Use the symbols to show the sky conditions (sunny or cloudy) that you predict will be around the system.
10. Ask your instructor for today's weather map to find out if your prediction is correct.

G. DATA AND OBSERVATIONS

Calculation 1: _____ to _____ : _____
 date date miles traveled

Calculation 2: _____ to _____ : _____
 date date miles traveled



H. CONCLUSION

Today I learned that...

Be sure to include the answers to the following questions.

1. Did you track a high-pressure system or a low-pressure system? Did the pressure system move from west to east or from east to west?

2. Based on your calculations, where did you predict the system would be today? Name the state or region.

3. Did you think it would be sunny or cloudy there today? Why?

4. How accurate was your prediction? If your prediction was not accurate, why do you think that is? (For example, did the pressure system slow down, speed up, or stay in the same place?)

I. LINE OF LEARNING

J. NEW VOCABULARY

List any new vocabulary words you learned from doing this investigation. Use the glossary to write the definition of each word.