LAB NOTEBOOK

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Name _____

Period _____ Date _____

CLASS WEATHER CHART

Date/ time	Temp. (°C)	Air pressure (mb)	Relative humidity	Wind speed	Wind direction	Visibility	Other observations

Date/ time	Temp. (°C)	Air pressure (mb)	Relative humidity	Wind speed	Wind direction	Visibility	Other observations

Name _____

Period _____ Date _____

AIR INVESTIGATIONS

Part 1: Record observations and questions.
While exploring air with a syringe, write three observations and three questions.

Observations

_____

_____

_____

_____

_____

Questions

_____

_____

_____

_____

_____

Part 2: Conduct an air investigation.

1. What do you want to find out? _____

_____

2. What materials will you use? _____

_____

3. How will you do this? Describe and draw. (Use the facing page to draw your setup.)

_____

_____

4. What did you observe? (Use the facing page.)

5. What did you find out? (Use the facing page.)

Name _____

Period _____ Date _____

EARTH'S-ATMOSPHERE QUESTIONS

1. What is the atmosphere? _____

2. Describe how the amount of air changes as you travel up through Earth's atmosphere.

3. Describe how the composition of gases changes as you travel up through Earth's atmosphere. _____

4. Describe how the temperature changes as you travel up through the atmosphere.

5. What layer of the atmosphere do you think is of greatest interest to meteorologists? Why do you think so? _____

6. What gases are found in the atmosphere? What gases are found only in the troposphere? _____

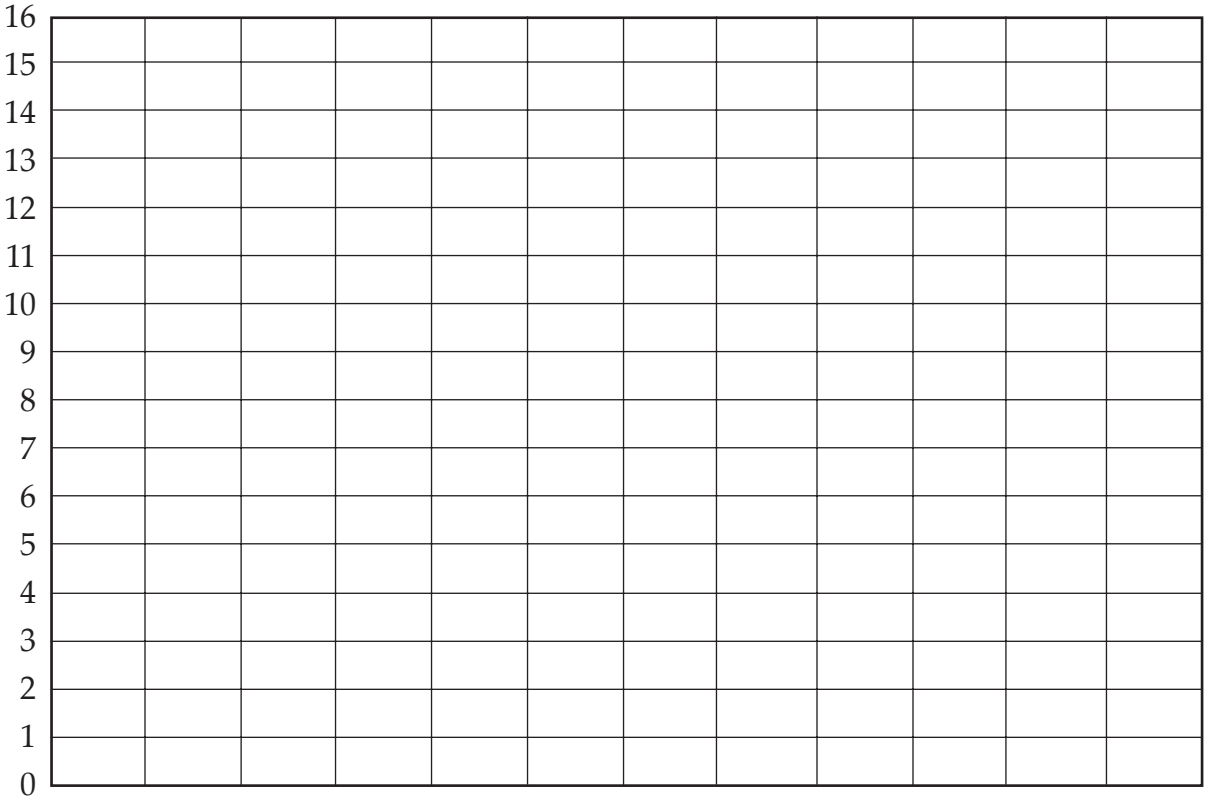
Name _____

Period _____ Date _____

SUNRISE/SUNSET TIMES FOR 2000

Sunrise and sunset times for the year 2000 in Berkeley			
Date	**Sunrise (a.m.)**	**Sunset (p.m.)**	**Hours of daylight**
January 21	7:21	5:20	
February 21	6:52	5:54	
March 21	6:10	6:22	
April 21	5:25	6:51	
May 21	4:54	7:17	
June 21	4:47	7:34	
July 21	5:04	7:26	
August 21	5:30	6:53	
September 21	5:56	6:07	
October 21	6:24	5:23	
November 21	6:56	4:54	
December 21	7:21	4:54	

Directions: Calculate the hours of daylight for each day and graph the results.



Name _____

Period _____ Date _____

SEASONAL CHANGES

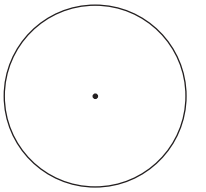
Directions: Open the Seasons simulation. Select Berkeley from the first list of cities. Click month by month through the year, stopping at the equinoxes and solstices.

1. Circle the description that best describes the amount of light and dark experienced in a day by people living in Berkeley at the times listed below.

Spring equinox (Mar. 21)	More light	Equal	More darkness	●
Summer solstice (June 21)	More light	Equal	More darkness	
Fall equinox (Sept. 21)	More light	Equal	More darkness	
Winter solstice (Dec. 21)	More light	Equal	More darkness	

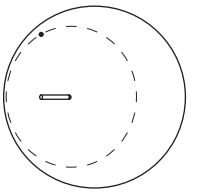
2. Set the Earth View to "Side." You are now out in space looking at the Sun-Earth system (the same view seen in the Orbit View window). What does Earth look like at each of the times above? Draw a little picture of Earth in the boxes to the right. Show the parts of Earth in the light and in the dark. (Spring equinox is drawn already.)

3. What shape is the path traced by Berkeley as Earth completes one rotation? Describe and draw the shape. _____
(To make sure, click the Advanced button and look at the North Pole in the Earth View window.)



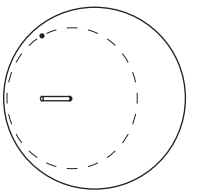
4. Where does the day/night line cross the Berkeley path at the summer solstice? Draw the top view, showing light and dark.

How long is the daylight? _____



5. Where does the day/night line cross the Berkeley path at the spring equinox? Draw the top view, showing light and dark.

How long is the daylight? _____



6. Select the cities between the equator and the North Pole one by one. Use the Earth View window to step through a day, hour by hour, on the summer solstice. Count and record the hours of daylight.
Repeat the process for the winter solstice. Record the length of the day for each city. Graph the results. What is the relationship between latitude and day length?

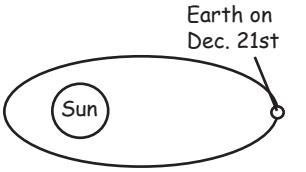
Name _____

Period _____ Date _____

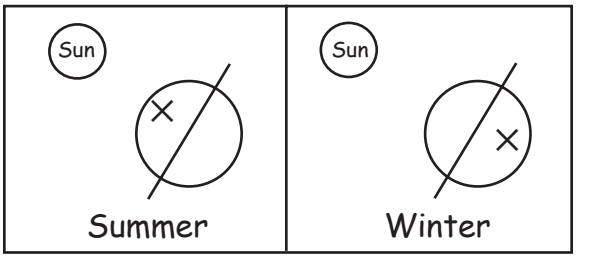
RESPONSE SHEET—SEASONS AND SUN

Directions: Below are the journal entries of three students writing about the reasons for the seasons. Read each entry, then write a short paragraph explaining to each student what they need to change about their thinking.

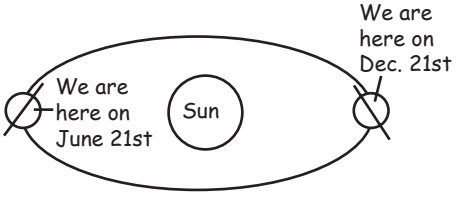
Student 1 wrote: The reason for the seasons is that Earth revolves around the Sun in an elliptical orbit. When Earth is farthest from the Sun, it is winter. When Earth is closest to the Sun, it is summer.



Student 2 wrote: Summer is when we are facing the Sun, and winter is when we are facing away from the Sun.



Student 3 wrote: The tilt always leans toward the Sun. It takes 365 days for Earth to rotate one time. So when we are on the side toward the Sun, it is summer. When we are on the side away from the Sun, it is winter.



Name _____

Period _____ Date _____

BEAM SPREADING

1. How do you explain the different shapes of the light spots?

2. When is the area of the spot largest?

3. Which spot delivers the greatest amount of energy to the floor?

4. If you put a penny in each light spot, explain which one will receive the most energy.

5. What influence does solar angle have on the heating of Earth?

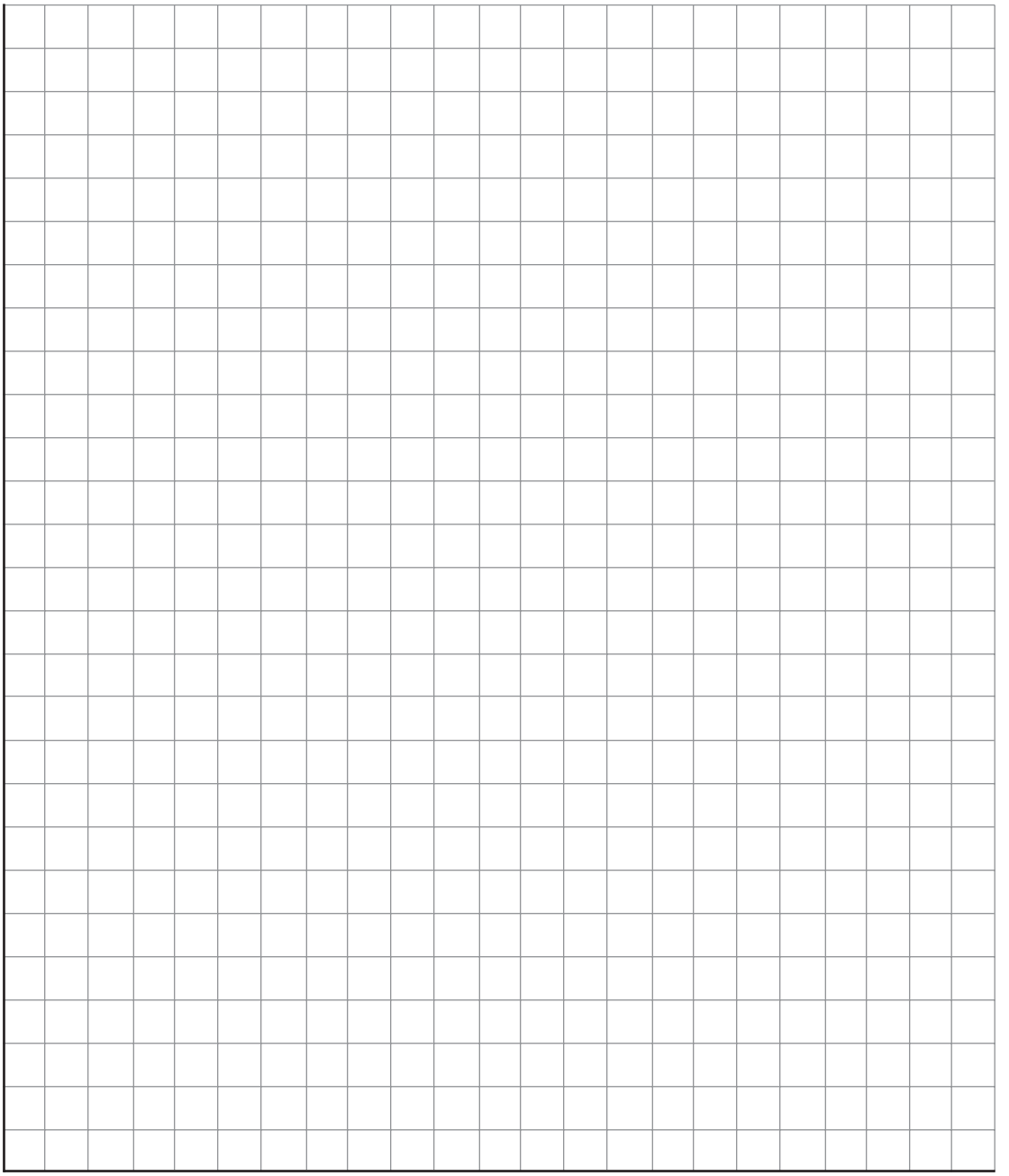
Name _____

Period _____ Date _____

EARTH-MATERIAL TEMPERATURES CHART

Time 3-minute intervals	Sand		Soil		Water		Air	
	Temp.	Temp. change	Temp.	Temp. change	Temp.	Temp. change	Temp.	Temp. change

EARTH-MATERIAL TEMPERATURES GRAPH



Name _____

Period _____ Date _____

HEAT CONDUCTION

1. Write a definition for heat.

2. Describe heat conduction.

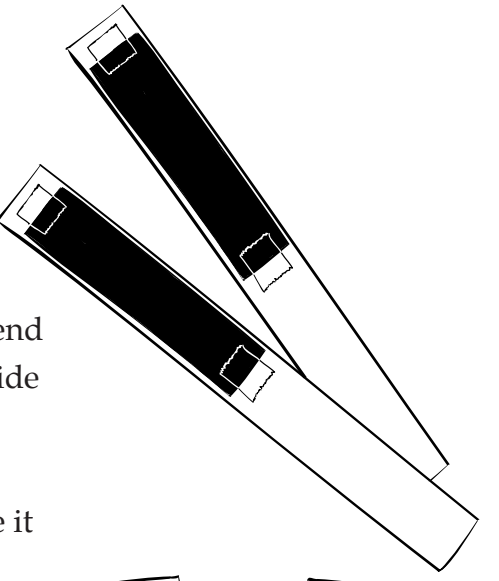
3. Explain your understanding of how heat transfers from one material to another.

4. Explain why a soda can feels cold when you take it out of the refrigerator.

Name _____

Period _____ Date _____

CONDUCTION THROUGH MATERIALS



Materials

1 Steel bar	1 Aluminum bar
2 Temperature strips	• Tape
1 Large clear cup	1 Plastic-foam cup
• Hot water	1 Thermometer

Preparation and setup

1. Position a temperature strip on the steel bar with one end close to the end of the steel bar. Make sure the shiny side is up. Tape it in place.
2. Prepare the aluminum bar in the same way.
3. Fill the plastic-foam cup half full with hot water. Place it in a large clear cup for stability.
4. Place the bars in the water with the temperature strips up.

Observations and conclusions

1. Starting temperatures

   water _____ steel _____ aluminum _____

2. What happened when the metal bars with temperature strips were placed in the hot water? _____

   _____

   _____

3. Feel the two metal bars. How did heat get from the hot water to the temperature strip far above the water level? _____

   _____

   _____

4. Did the metals conduct heat? Which metal is a better conductor? Why do you think so?

   _____

   _____

   _____

WARNING — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Name _____

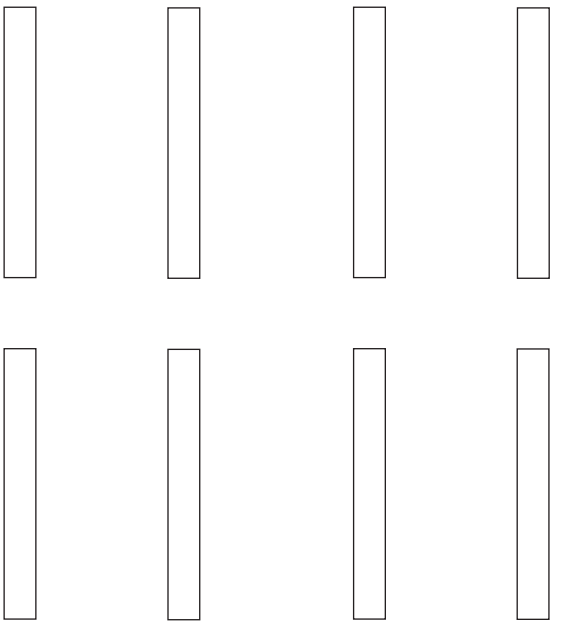
Period _____ Date _____

LIQUID LAYERS

Part 1: Layer salt solutions.

Find the sequence of colored salt solutions that will form clear layers.

1. Using the pipette, put a few drops of a colored solution into the straw. Try to layer a second color on top of the first color.
2. Use colored pencils to keep track of your results in the straws below. Circle the color combinations that produce layers.
3. Use the information to predict the order that will produce four colored layers.



Color	Mass	Volume

Part 2: Explain salt-solution layering.

What do you think caused the salt solutions to layer in this way?

WARNING — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Name _____

Period _____ Date _____

CALCULATING DENSITY

Write the equation for calculating density here.

Transfer the mass and volume data from the board into the table below. Calculate the density of the four solutions. Show your math work. Then solve the density problem at the bottom of the page.

Solution	Volume	Mass	Density
Red			
Green			
Yellow			
Blue			

Bianca and Joel mixed up a new salt solution and put in blue and red food coloring to make it purple. They then weighed 35 ml of the solution and found its mass to be 41 g. Where would the purple layer form if it were used with the four solutions above? Show your math.

The density of the purple solution is _____

The purple solution would form a layer _____

Name _____

Period _____ Date _____

RESPONSE SHEET—CONVECTION

Rico wanted to make a shake-up toy for his little sister.

He had some little plastic stars and leaves. His plan was to put the stars and leaves in a jar and fill it with liquid. When you shake the jar, everything swirls around together. Then the stars slowly float to the surface, and the leaves settle to the bottom.

Rico mixed up 500 cc of salt solution. He weighed it and found its mass to be 585 g. Will his shake-up toy work the way he wants it to if he uses this salt solution? Why or why not?

Remember, 1 ml = 1 cc.

Show your math.

Object or material	Density
Stars	1.12 g/cc
Leaves	1.25 g/cc
Salt solution	

Name _____

Period _____ Date _____

LAYERING HOT AND COLD WATER

Challenge

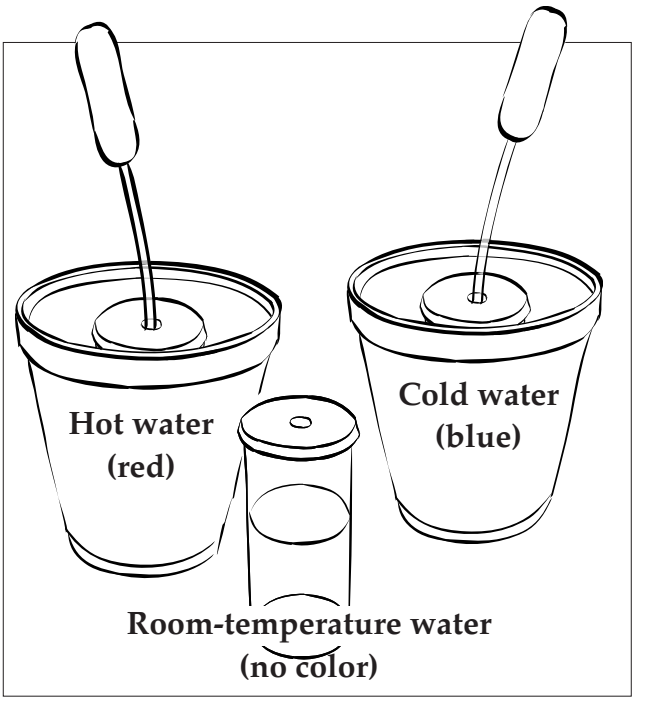
Create a layer of red water and a layer of blue water in your vial of plain water.

Prediction

Predict and draw the order of layers in a successfully layered vial.

Conduct the investigation

1. Draw and label your successful layers.



2. Which color is densest? _____

3. Which color is least dense? _____

4. What happens after the layered vial sits for 5 minutes? Explain why.

5. What do you think would happen if you placed the layered vial in a cup of hot water 2 cm deep? Explain why.

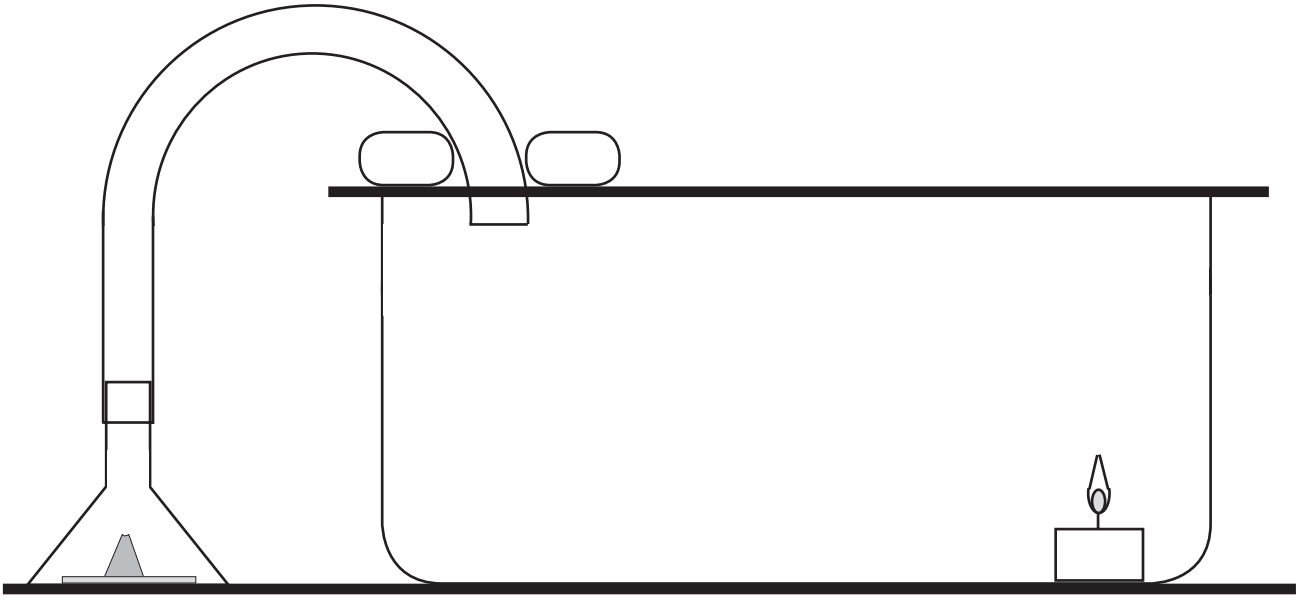
6. Explain the relationship between temperature and density.

Name _____

Period _____ Date _____

CONVECTION CHAMBER

Part 1: Draw what you observed in the convection chamber.



Part 2: Think about convection.

1. Explain how convection occurs in a convection chamber.

2. Explain heat transfers in a convection cell on Earth.

Name _____

Period _____ Date _____

RELATIVE HUMIDITY

Relative humidity is a comparison of the amount of water vapor in the air and the amount of water vapor needed to saturate the air at a particular temperature. Relative humidity is a percentage.

Example
Look at the chart on the right. If a kilogram of air at 5°C contains 5 grams (g) of water vapor, the air is saturated. The relative humidity at 5°C is 100%.

If that kilogram of air warms up to 15°C, it will need 10 g of water vapor to saturate it. But the air has only 5 g of water vapor, only half enough to saturate the air. The relative humidity at 15°C is 50%.

Grams of water vapor needed to saturate 1 kg of air at various temperatures

Temp.	Water vapor (g)
–40°C	0.1
–30°C	0.3
–20°C	0.8
–10°C	2.0
0°C	3.5
5°C	5.0
10°C	7.0
15°C	10.0
20°C	14.0
25°C	20.0
30°C	26.5
35°C	35.0
40°C	47.0

1. What is the relative humidity of a kilogram of air at 25°C that contains
   a. 20 g of water vapor?

   b. 5 g of water vapor?

   c. 10 g of water vapor?

   d. 16 g of water vapor?

2. A kilogram of air contains 7 g of water vapor. Its relative humidity is 50%. What is the temperature of the air? At what temperature would the air reach a relative humidity of 100%?

3. A kilogram of air has a relative humidity of 100%. It contains 2 g of water vapor. What will the relative humidity be when the air warms to 25°C?

Name _____

Period _____ Date _____

RESPONSE SHEET—WATER IN THE AIR

Christine and Ingrid trotted to the sideline after a tough soccer workout. Both were dripping with sweat. Christine said to Ingrid,

I have heard that sweating helps keep you cool when you are working hard. Could that be right?

Ingrid responded,

I think it has something to do with condensation, but I'm not sure how it works.

What would you tell the girls to help them better understand sweating and cooling?

Name _____

Period _____ Date _____

DEW-POINT QUESTIONS

1. Dew point is monitored by meteorologists. Why do you think meteorologists are interested in dew point?

2. Under what conditions would dew *not* form?

3. What do you think would happen to water vapor that condenses on a surface that has a temperature below 0°C? What is it called?

4. People who wear glasses often see condensation on their lenses when they walk from a cold, outdoor environment into a warm house. Why does that happen? How could they prevent it?

5. Do you think dew point is always the same? How could you find out? (Write your answer on the back of this sheet.)

Name _____

Period _____ Date _____

PRESSURE/TEMPERATURE DEMONSTRATION

Question

What happens to the temperature of a gas if you squeeze it into a smaller volume?

Materials

- Soda bottles
- Soda-bottle pump
- Liquid-crystal thermometers
- Masking tape

Observations and conclusion

1. Record your observations and conclusion.

2. Knowing what you do about the movement of molecules in a gas, explain the change in temperature as you changed the gas volume by squeezing the bottle or when additional air was forced into the volume of the bottle.

3. How is the bottle demonstration similar to what happened inside a syringe when you pushed in the plunger?

4. How do you think the temperature changes inside of the syringe when the air is compressed with the plunger?

Name _____

Period _____ Date _____

WEATHER-BALLOON SIMULATION

View and compare the weather-balloon launches for Chicago and Phoenix. Answer these questions.

1. What was the trend in air pressure as altitude increased in Chicago? In Phoenix?

2. Describe the temperature trends in both Chicago and Phoenix. Was the trend the same in both cities?

3. Which weather factors varied the most between Chicago and Phoenix?

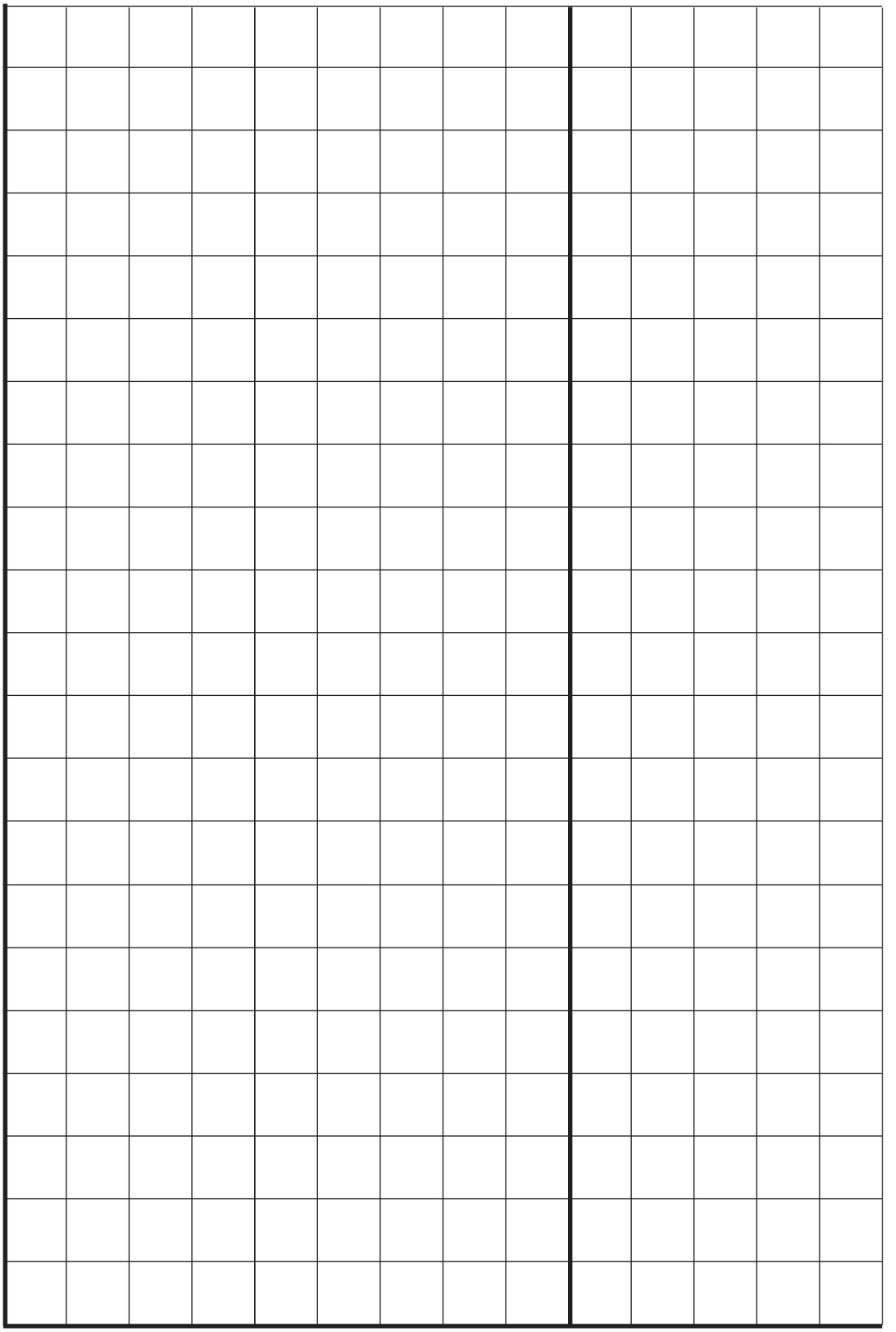
4. Do you think it might be a cloudy day in Chicago? What evidence do you have? At what altitude would you see clouds?

5. Do you think it might be a cloudy day in Phoenix? What evidence do you have? At what altitude would you see clouds?

Name _____

Period _____ Date _____

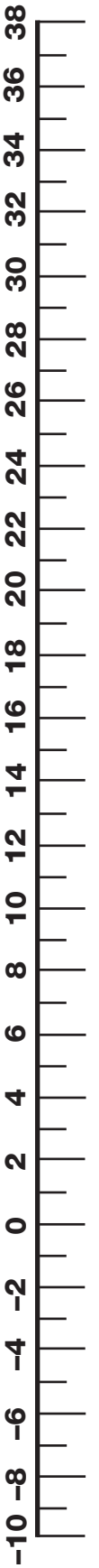
UPPER-AIR SOUNDING GRAPH



Name _____

Period _____ Date _____

TEMPERATURE NUMBER LINE



Name _____

Period _____ Date _____

WATER-CYCLE GAME

Directions: As you move through the water cycle, keep track of where you go.

	Round 1 locations	Round 2 locations	Round 3 (global warming)
Stop 1			
Stop 2			
Stop 3			
Stop 4			
Stop 5			
Stop 6			
Stop 7			
Stop 8			
Stop 9			
Stop 10			

Questions

1. Which location did you visit most often? _____

2. Which location did you visit the least? _____

3. Were there any locations you never visited? Which ones? _____

4. Write down one question you have about the water cycle after you finish the game.

Name _____

Period _____ Date _____

PRESSURE IN A JAR

Part 1: Prediction

Predict what will happen to the water in the clear tube when the jar is squeezed.

Part 2: Explore the jar

1. Construct a bottle-in-a-jar pressure indicator. Give it a squeeze. What happens?

2. Why do you think it behaves that way?

3. If you reduced the air pressure in the jar, what would happen to the level of water in the clear tube? Why?

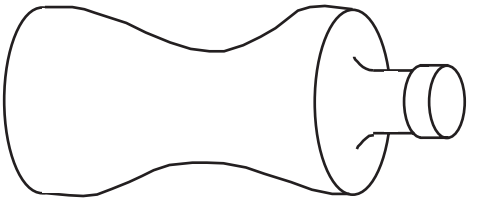
Name _____

Period _____ Date _____

RESPONSE SHEET—AIR PRESSURE AND WIND

At camp, Derek and his friends hiked up to a forest-fire lookout station at an elevation of 2445 m. On top of the mountain, Derek drank the last of the water he carried in a plastic bottle. He put the lid back on the bottle, tossed it in his day pack, and forgot about it.

When Derek returned home to Seattle 3 days later, and unpacked his stuff, he found his water bottle. It looked like this.



Derek thought,

I must have sat on my water bottle, or something, to squash it like that.

When he unscrewed the lid, he heard a hissing sound, and the bottle slowly returned to its proper shape. What do you think happened to Derek's bottle? Can you explain Derek's squashed bottle and the hissing sound?

Name _____

Period _____ Date _____

LOCAL WINDS

View the local-winds animations on the computer and follow the directions below.

Sea Breeze

Draw the land, water, and Sun.
Show circulation by convection.
Label the low- and high-pressure areas.
Draw an arrow showing the wind direction.

Land Breeze

Draw the land, water, and Sun.
Show circulation by convection.
Label the low- and high-pressure areas.
Draw an arrow showing the wind direction.

Name _____

Period _____ Date _____

Valley Breeze

Draw the mountain slope and Sun.
Show circulation by convection.
Label the low- and high-pressure areas.
Draw an arrow showing the wind direction.

Mountain Breeze

Draw the mountain slope and Sun.
Show circulation by convection.
Label the low- and high-pressure areas.
Draw an arrow showing the wind direction.

MAKING AN ANEMOMETER

Materials

2 Index cards, 7.5 cm × 13 cm
2 Straws, super jumbo
1 Straw, jumbo
7 Paper clips, regular
• Transparent or masking tape
1 Hole punch
1 Scissors
1 Metric ruler
1 Pencil

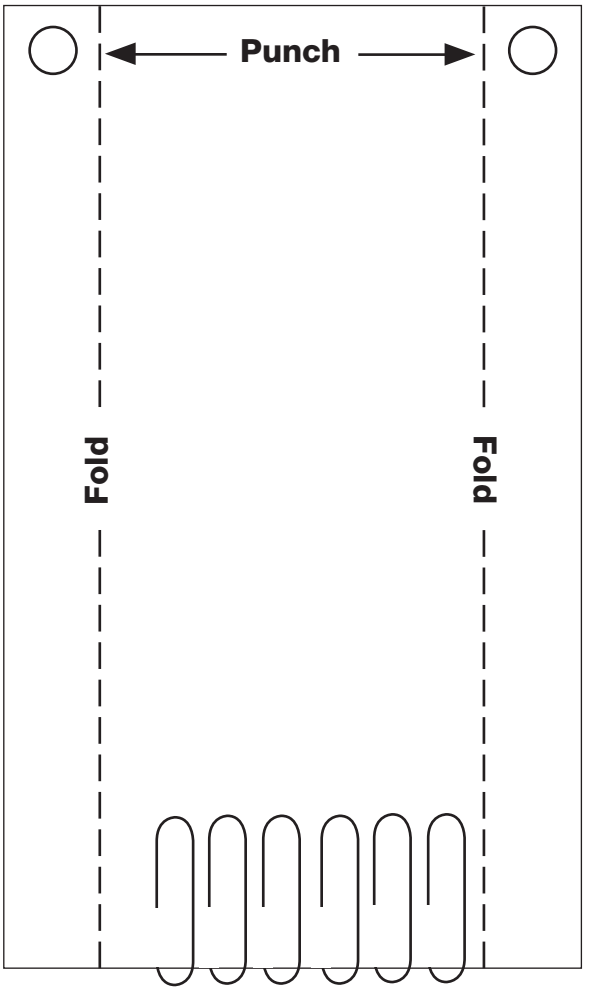
Preparation and assembly

1. Fold both edges of card 1 at a right angle. This will be easier if you draw lines 1.2 cm from the edges, pressing down hard with a pencil or ballpoint pen to crease the card.

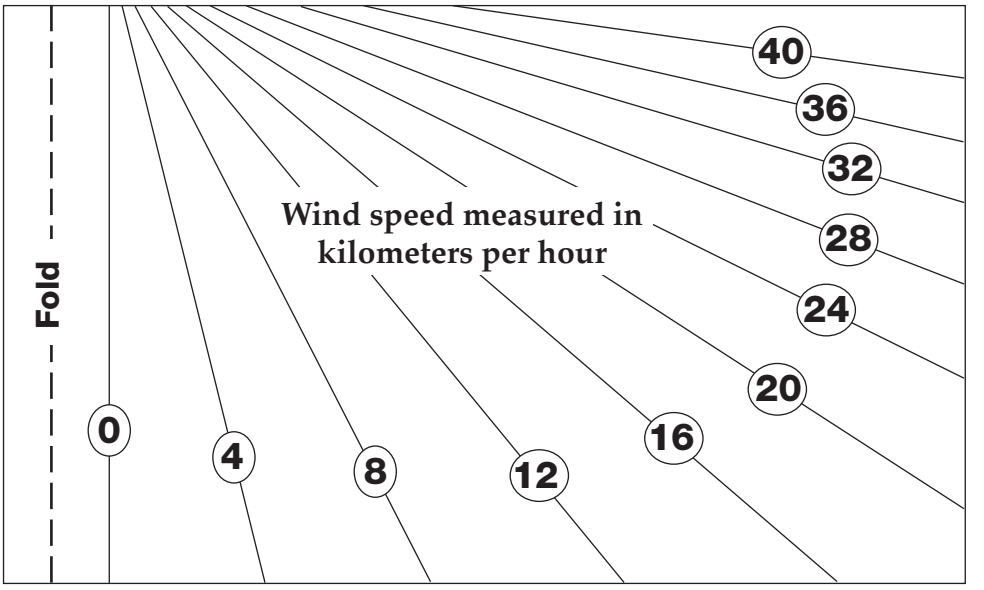
2. Punch two holes near the top of each folded edge.

3. Lay card 2 on the template on this page. Mark the edge of the card where the ends of the lines extend beyond the card. Draw lines between the marks and write the numbers on the lines.

4. Fold the edge of the card at a right angle.



Card 1



Card 2

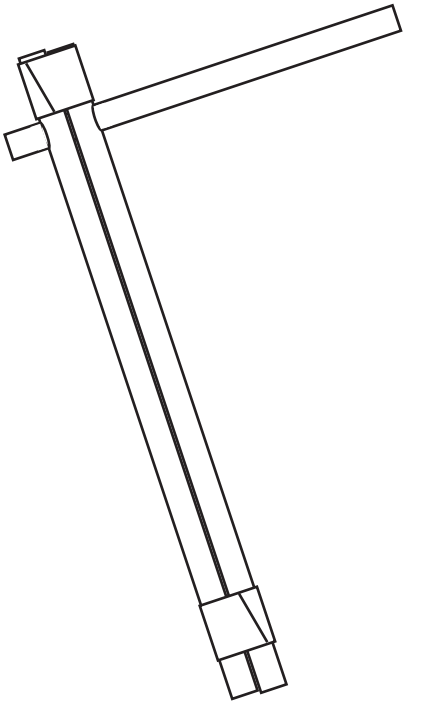
5. Punch a hole in two super jumbo straws about 2.5 cm from one end.

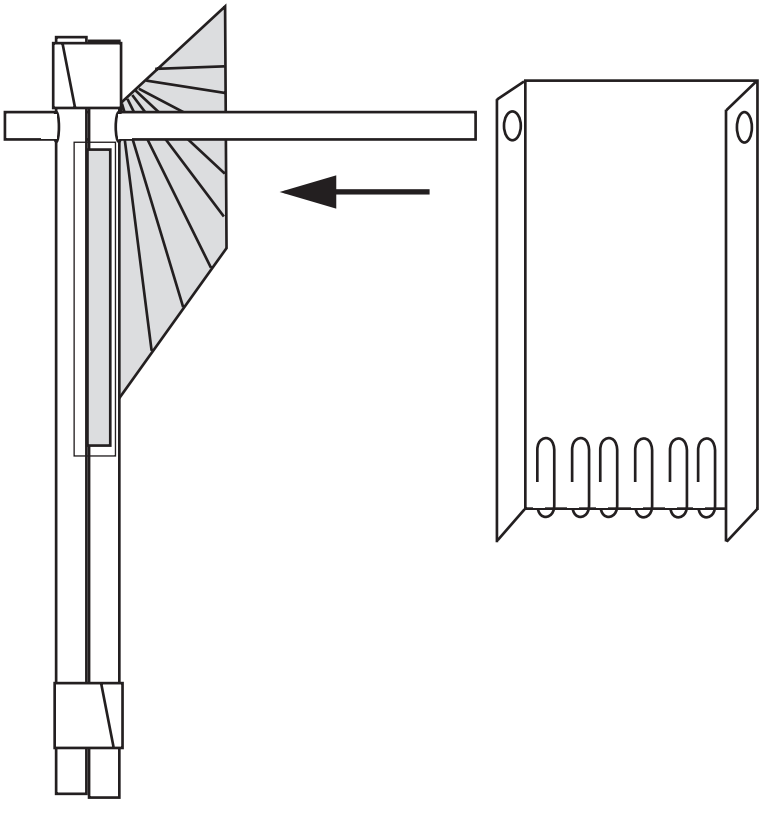
6. Cut a clear jumbo straw to a length of 12 cm. Slide the clear straw through the holes in the super jumbo straws. Tape the two super jumbo straws together top and bottom.

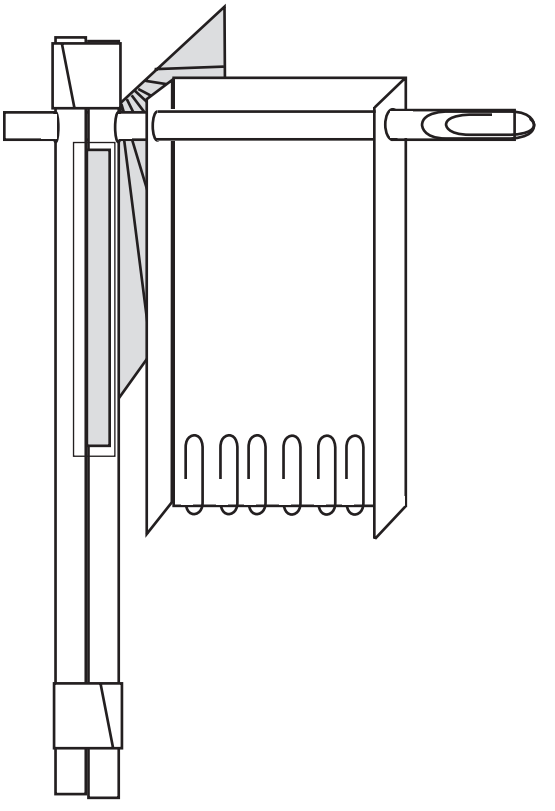
7. Slide card 2 between the two super jumbo straws. Push it up as far as it will go toward the jumbo straw. Tape the folded-over edge to hold card 2 in place.

8. Slide card 1 onto the jumbo straw. Attach six paper clips to the bottom of card 1, and one on the end of the jumbo straw to keep card 1 from sliding off the straw.

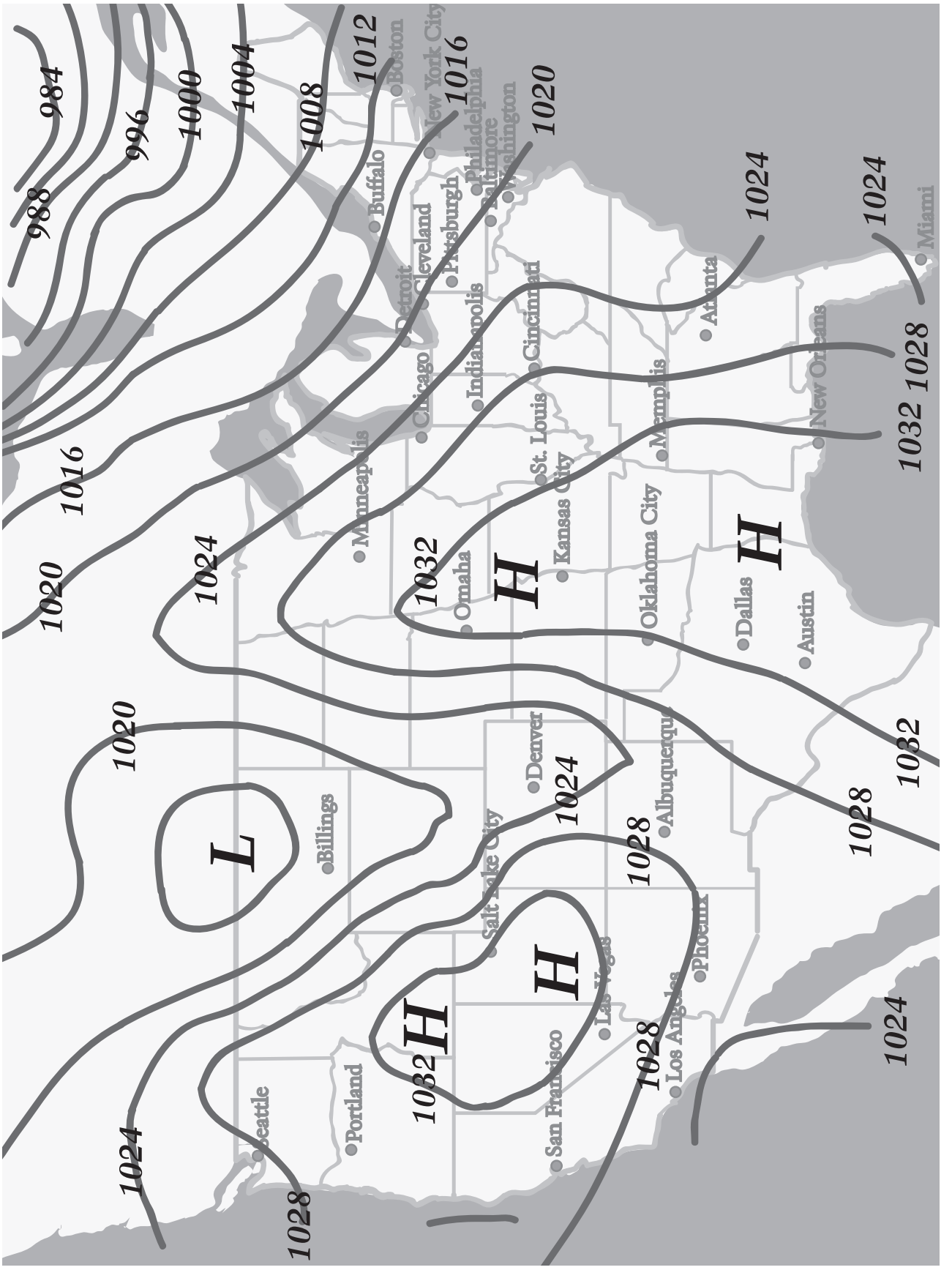
9. Hold the anemometer in the wind so that the wind hits the broad side of card 1. Read the wind speed in kilometers per hour from card 2.







PRESSURE MAP OF THE U.S.



Name _____

Period _____ Date _____

SOLAR-BALLOON OBSERVATIONS

1. Describe the bag's properties before it is used to model an air mass.

2. Describe what happened to the bag while it was outside.

3. How is the black-bag model like a real air mass and how is it different?

4. What questions do you have about the formation of air masses after observing this model?

Name _____

Period _____ Date _____

READING WEATHER MAPS

Use the *Sample Weather-Map Symbol* sheet and the *Surface Observations* map in the resources book to complete this sheet.

1. Find the weather-station data for San Francisco, California. Use the weather-map symbol to figure out the following:

   Temperature (°F) _____ Air pressure (mb) _____

   Wind direction _____ Cloud cover _____

   Wind speed (knots) _____

2. Which cities are experiencing haze? _____

   _____

3. Which cities are experiencing rain? _____

   _____

4. Which cities are experiencing fog? _____

   _____

5. Which city has the highest air pressure? How high is it? The lowest? How low is it?

   _____

   _____

6. Which areas of the United States are experiencing the warmest temperatures?

   _____

7. List two other observations about the weather across the United States for this date.

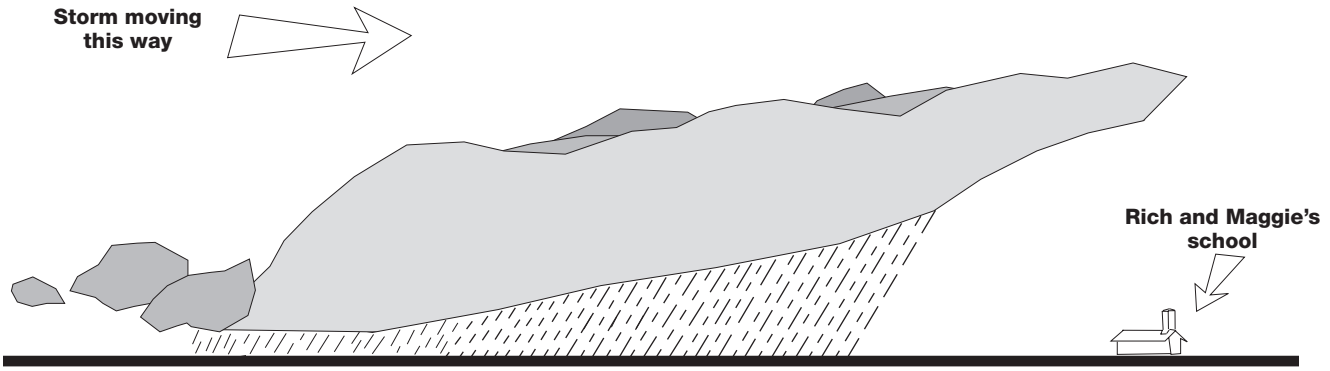
   _____

   _____

Name _____

Period _____ Date _____

RESPONSE SHEET—WEATHER AND CLIMATE



Rich and Maggie saw on the news that a rainstorm was heading their way.

"It is really cold today," Rich said. "That must be a cold front coming our way."

"I'm not sure," said Maggie. "Here's a picture of what I think the storm looks like. I'm trying to figure out where the warm air mass is and where the cold air mass is."

Can you help Rich and Maggie understand what is going on with the weather to create the big, wet storm?

ASSESSMENT—GENERAL RUBRIC

4 The student uses two or more facts to explain a bigger idea by making connections between those facts. All of the information is correct, and the connections and conclusions are correct.

3 The student uses two or more facts to attempt to explain a bigger idea by making connections between those facts. The facts or the connections have minor errors.

2 The student provides two or more facts that are related to the task or questions asked, but does not make any connections between the facts.

1 The student provides one fact that is related to the task or question asked.

0 The student does not answer the question, does not complete the task, or gives an answer that has nothing to do with what was asked.