DATE: NAME: CLASS:

UNIT 2 **Unit 2 Summary** BLM 2-1

Goal • Use this summary to review the concepts in Unit 2, Heat.

Chapter 4 Temperature describes how hot or cold an object is.

- Normal body temperature of humans is 37°C. (4.1)
- Body temperature is an indicator of health. (4.1)
- Hypothermia and hyperthermia can be life threatening. (4.1)
- Average air temperatures in Newfoundland and Labrador vary from –25°C to 20°C. (4.1)
- The first temperature sensing devices were developed in the 1500s. (4.2)
- The commonly used temperature scales are the Fahrenheit scale, the Celsius scale, and the Kelvin scale. (4.2)
- Thermometers must be calibrated by exposing them to substances at known temperatures. (4.2)
- Thermometers must contain a substance that changes as the temperature changes so that the change can be observed. (4.2)

Chapter 5 Scientists use the particle theory of matter to describe temperature.

- All matter consists of tiny particles that are always moving, have spaces among them, are attracted to each other, and particles of different substances are different. (5.1)
- The average kinetic energy of the particles in a substance is directly related to its temperature. (5.1)
- All pure substances can exist in any of the three states—solid, liquid, or gas, depending on the temperature. (5.2)
- The particle model of matter can explain why particles exist in different states. (5.2)
- Matter in any state expands when the temperature increases and contracts when the temperature decreases. (5.2)
- The changes of state are called melting, freezing, evaporation, condensation, sublimation, and deposition. (5.3)
- Every pure substance has its own melting point and boiling point under conditions of standard pressure. (5.3)
- The particle theory can explain changes of state (5.3)

Chapter 6 Heat is transferred from one object to another by three different processes.

- The three mechanisms of heat transfer are conduction, convection, and radiation. (6.1)
- Conduction and convection depend on the motion of particles. Radiation is energy carried by electromagnetic waves. (6.1)
- Absorption of radiant energy by an object depends on its lustre and colour. (6.1)
- Conductors are substances that conduct heat rapidly. (6.2)
- Insulators conduct heat very slowly. (6.2)
- The R-value of building materials describes their effectiveness as insulators. (6.2)
- Heat and temperature are related but are *not* the same quantity. (6.3)
- The amount of heat required to change the temperature of 1.00 g of a substance by 1.00°C is called its specific heat capacity. (6.3)

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DATE: NAME: CLASS:

UNIT 2 **Unit 2 Key Terms** BLM 2-2A

Unit 2 Key Terms

Goal • Use this word search puzzle to review Key Terms from Chapter 4.

Create a list of 20 words or phrases from the descriptions below. Then find the words in the puzzle that follows. Words in phrases are not found together in the puzzle.

1. Can indicate whether you are sick	
2. When the body is too cold to recover	
3. Comfortable surroundings at home	
4. Temperature measuring device in a thermostat	
5. To put the correct scale on a thermometer	
6. Sets zero for freezing point of water and one hundred for boiling point of water	
7. First widely used temperature scale	
8. Sets zero for coldest possible temperature	
9. Temperature sensing device made of two metals in which electric current shows temperature difference between ends of metals	
10. Image showing temperature that is taken with film sensitive to infrared radiation	
11. Common temperature measuring device	
12. Measures temperature changes but has no scale	
13. If your body temperature is above 37°C, you might have this	
14. These animals bask in the Sun to raise their body temperature	
15. This scientist invented one of the first instruments for measuring temperature	
16. Scientists often use this term to describe the coldest possible temperature	
17. You can use this to set the temperature of your home	
18. These are usually set at a temperature of 4°C	
19. You might choose a temperature of 160°C if you are using this	
20. To do this comfortably, many people set the temperature at 18°C	

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DATE: NAME:

BLM 2-2A continued

E	L	B	J	G	N	F	S	Y	T	O	T	A	E	F
B	R	O	I	M	A	U	G	H	A	H	A	I	T	A
N	A	U	O	M	I	L	E	A	E	K	R	M	U	H
Y	O	O	T	S	E	R	I	R	V	E	K	R	L	R
D	R	I	L	A	M	T	M	L	T	P	E	E	O	E
O	P	E	T	O	R	O	A	E	E	J	L	H	S	N
B	C	E	G	C	C	E	M	L	S	O	V	T	B	H
H	Z	R	E	O	E	O	P	T	L	Q	I	O	A	E
H	A	E	U	L	M	F	R	M	K	I	N	P	O	I
M	D	P	R	R	S	I	N	J	E	M	C	Y	V	T
B	L	B	E	O	P	I	N	I	C	T	M	H	E	W
E	W	H	T	A	T	S	O	M	R	E	H	T	N	N
D	T	H	T	H	E	R	M	O	S	C	O	P	E	W
L	I	Z	A	R	D	S	E	L	A	C	S	E	J	A
R	O	T	A	R	E	G	I	R	F	E	R	K	N	S

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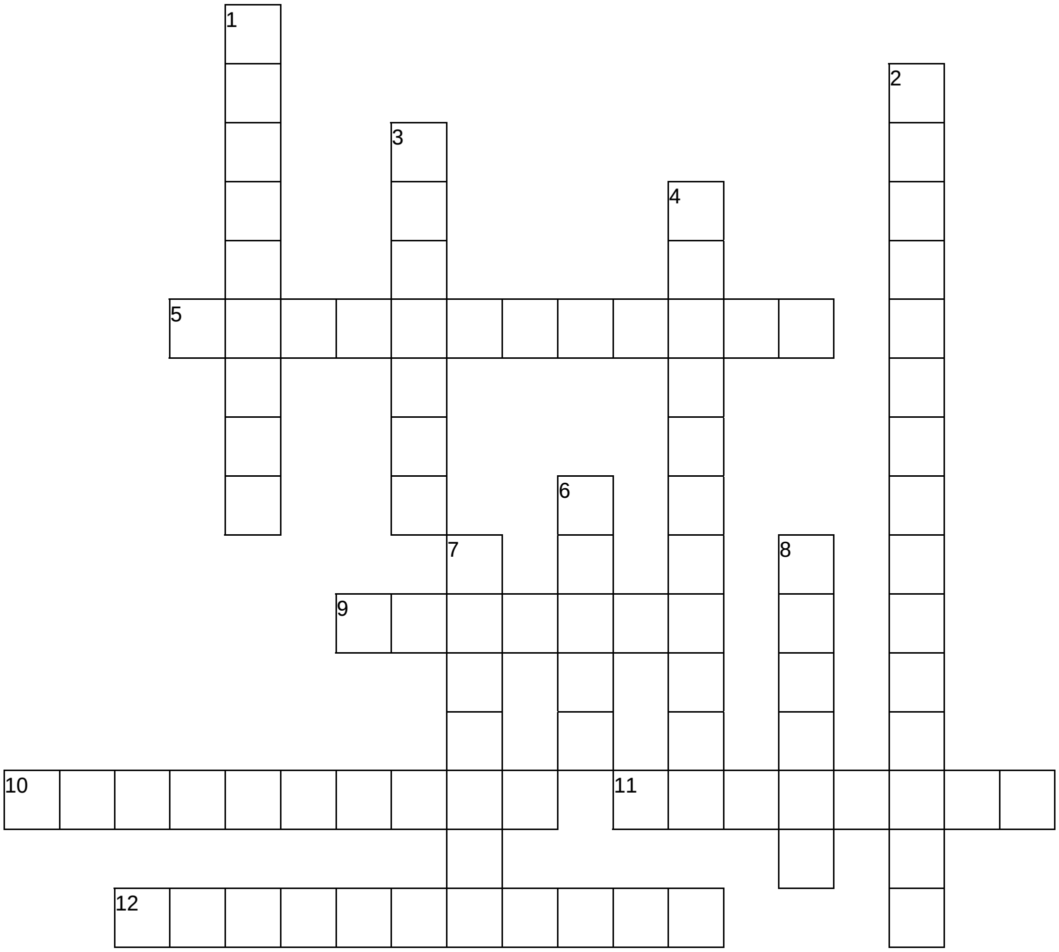
UNIT 2

Unit 2 Key Terms

BLM 2-2B

Goal • Use this crossword puzzle to review Key Terms from Chapter 4.



Across

5 Temperature sensing device that can withstand very high temperatures

9 Kept at –18°C

10 First widely used temperature scale

11 To place the correct scale on a thermometer

12 Indicates changes of temperature but not specific temperature

Down

1 A number that combines the effects of cold temperatures and wind

2 Temperature sensor used in thermostats

3 Animals that generate enough heat to maintain a constant temperature

4 Body temperature is dangerously low

6 Bake at 250°C

7 Scale in which zero is the temperature at which water freezes

8 Scale starts at absolute zero

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UNIT 2

Unit 2 Key Terms

BLM 2-2C

Goal • Use this word search puzzle to review Key Terms from Chapter 5.

Create a list of 20 words or phrases from the descriptions below. Then find the words in the puzzle that follows. Words in phrases are not found together in the puzzle.

1. A moving object has this	
2. Explains what all matter is made of	
3. State of matter in which particles are not exerting forces on one another	
4. State of matter in which particles exert attractive forces on one another but can still slide past one another	
5. State of matter in which particles cannot move away from their neighbouring particles	
6. Temperature at which a substance changes from a liquid to a solid	
7. Changing from a gas to a liquid	
8. Changing from a gas to a solid	
9. Changing from a liquid to a gas	
10. Changing from a liquid to a solid	
11. Changing from a solid to a liquid	
12. Temperature at which a substance changes from a solid to a liquid	
13. Changing from a solid to a gas	
14. Directly related to the average kinetic energy of the particles of a substance	
15. When a substance is heated, it undergoes thermal __ __ __ __ __ __ __ __ __	
16. When a substance is cooled, it undergoes thermal __ __ __ __ __ __ __ __ __ __ __	
17. A graph of the temperature plotted against time when a substance is being heated	
18. Holds particles of a solid together	
19. Has mass and takes up space	
20. In addition to the speed of an object, it affects the objects kinetic energy	

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P	C	H	S	S	A	M	C	M	A	T	T	E	R	N
A	I	E	I	F	Y	R	O	E	H	T	D	N	E	O
R	T	A	X	K	L	P	N	C	N	P	O	V	B	I
T	E	T	E	P	Z	O	D	U	G	I	A	S	B	T
I	N	I	N	R	A	I	E	X	T	P	B	E	N	C
C	I	N	M	C	U	N	N	I	O	I	T	C	V	A
L	K	G	U	E	E	T	S	R	D	R	D	R	B	R
E	X	R	K	N	L	O	A	I	S	I	A	O	I	T
M	V	T	E	C	P	T	T	R	O	O	U	F	C	N
E	N	R	B	E	I	H	I	L	E	N	L	Q	G	O
U	G	I	D	O	T	B	O	N	H	P	S	I	I	C
Y	H	U	N	G	Y	Z	N	Z	G	H	M	A	D	L
Q	N	O	I	T	A	M	I	L	B	U	S	E	G	W
A	T	T	R	A	C	T	I	V	E	G	I	B	T	K
G	N	I	Z	E	E	R	F	B	O	I	L	I	N	G

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DATE: NAME: CLASS:

CHAPTER 5 | BLM 2-2D

Unit 2 Key Terms

Goal • Use this word scramble puzzle to review Key Terms from Chapter 5.

Unscramble each of the clue words. Record the letters in the framed boxes in the row of empty boxes below the words. Unscramble these letters to complete the phrase that names the category describing all of the terms.

donsitaconen

petisodino

trapevenioo

gezenrif

litengm

blatinisomu

Phrase that describes all of the terms above

_ h _ _ _ _   _ _   _ _ _ _ _

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UNIT 2

Unit 2 Key Terms

BLM 2-2E

Goal • Use this word search puzzle to review Key Terms from Chapter 6.

Create a list of 20 words or phrases from the descriptions below. Then find the words in the puzzle that follows. Words in phrases are not found together in the puzzle.

1. The transfer of heat in which particles collide with one another and pass energy from one to the next	
2. The transfer of heat in which energetic particles move from one place to another	
3. The name of the motion of a fluid in which warm fluids rise and cooler fluids move in below.	
4. The transfer of heat in which energy can travel through empty space	
5. The ability of a material to conduct heat	
6. Matter that transfers heat very slowly	
7. The technical term for heat contained in a substance	
8. The amount of heat needed to raise the temperature of one gram of a substance by one degree Celsius	
9. There are three methods by which this happens	
10. Convection cannot occur in this state of matter	
11. A form of convection current in nature	
12. A substance must do this to receive heat by radiation	
13. State of matter that has a horizontal surface in its container	
14. When they collide, heat can be transferred by conduction	
15. A form of radiant energy that carries television signals	
16. A form of radiant energy that you can see	
17. A form of radiant energy that is most responsible for transmitting heat	
18. If a material does this to radiant energy, it does not become warmer	
19. A system that transfers heat between the ground and the air inside a building	
20. A device in a car that releases heat to the outside air	

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P	A	R	T	I	C	L	E	S	Q	B	N	C	U	R
S	K	R	E	F	S	N	A	R	T	R	Z	O	L	E
N	O	I	T	C	E	V	N	O	C	O	V	N	G	F
R	D	G	S	R	U	O	N	N	E	S	M	D	L	L
O	R	E	G	R	I	R	O	Y	C	B	C	U	A	E
T	V	Y	R	D	O	I	R	O	X	A	K	C	M	C
A	U	I	A	A	T	T	N	E	P	H	L	T	R	T
I	L	R	S	A	R	D	A	A	N	A	D	I	E	S
D	H	I	I	I	U	F	C	L	M	T	P	V	H	P
A	E	D	G	C	B	I	N	R	U	U	S	I	T	E
R	A	E	T	H	T	L	E	I	M	S	I	T	O	C
R	T	I	J	Y	T	H	E	P	H	D	N	Y	E	I
R	O	Z	O	C	T	S	D	I	L	O	S	I	G	F
N	L	I	Q	U	I	D	S	W	A	V	E	S	O	I
E	U	G	U	K	I	Z	P	F	M	C	W	Z	W	C

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DATE: NAME: CLASS:

UNIT 2 | BLM 2-2F

Unit 2 Key Terms

Goal • Use this encryption puzzle to review Key Terms in Chapter 6.

The terms below are encrypted by replacing the Roman letters with Greek letters. Use the encryption code at the bottom of the page to decode the terms. Write the Roman letters in the boxes below the Greek letters. Then explain how the last term is related to the first three terms.

χ ο ν δ υ χ τ ι ο ν

χ	ο	ν	δ	υ	χ	τ	ι	ο	ν

χ ο ν ϖ ε χ τ ι ο ν

χ	ο	ν	ϖ	ε	χ	τ	ι	ο	ν

ρ α δ ι α τ ι ο ν

ρ	α	δ	ι	α	τ	ι	ο	ν

ε ν ε ρ γ ψ τ ρ α ν σ φ ε ρ

ε	ν	ε	ρ	γ	ψ		τ	ρ	α	ν	σ	φ	ε	ρ

Greek	α	β	χ	δ	ε	φ	γ	η	ι	ϕ	κ	λ	μ
Roman	a	b	c	d	e	f	g	h	i	j	k	l	m

Greek	ν	ο	π	θ	ρ	σ	τ	υ	ϖ	ω	ξ	ψ	ζ
Roman	n	o	p	q	r	s	t	u	v	w	x	y	z

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DATE: NAME: CLASS:

CHAPTER 4 **Chapter 4 Review** BLM 2-10

Goal • Check your understanding of Chapter 4.

What to Do

Circle the letter of the best answer.

1. Which is normal body temperature for a person?
   A. 37°C
   B. 37°F
   C. 98.6°C
   D. 98.6 K

2. A temperature of 22°C would be normal for which case?
   A. body temperature for a bird
   B. comfortable room temperature
   C. outside temperature in Newfoundland and Labrador in January
   D. oven temperature when baking pizza

3. In what way does a thermoscope differ from a thermometer?
   A. A thermometer has no scale.
   B. A thermoscope has a Fahrenheit scale and a thermometer has a Celsius scale.
   C. A thermoscope has no scale.
   D. A thermoscope uses coloured water while a thermometer uses alcohol.

4. Which was the first widely used temperature scale?
   A. Celsius scale
   B. Fahrenheit scale
   C. Kelvin scale
   D. Thomson scale

5. What happens when a bimetallic strip is heated?
   A. An electric current flows along the strip.
   B. Contracts because metals undergo thermal contraction.
   C. It bends because the two metals expand by a different amount.
   D. Vibrates because the heating adds energy to the strip.

6. When you want to measure the temperature of an extremely hot gas, which is the best device to use?
   A. bimetallic strip.
   B. glass thermometer.
   C. photographic film.
   D. thermocouple.

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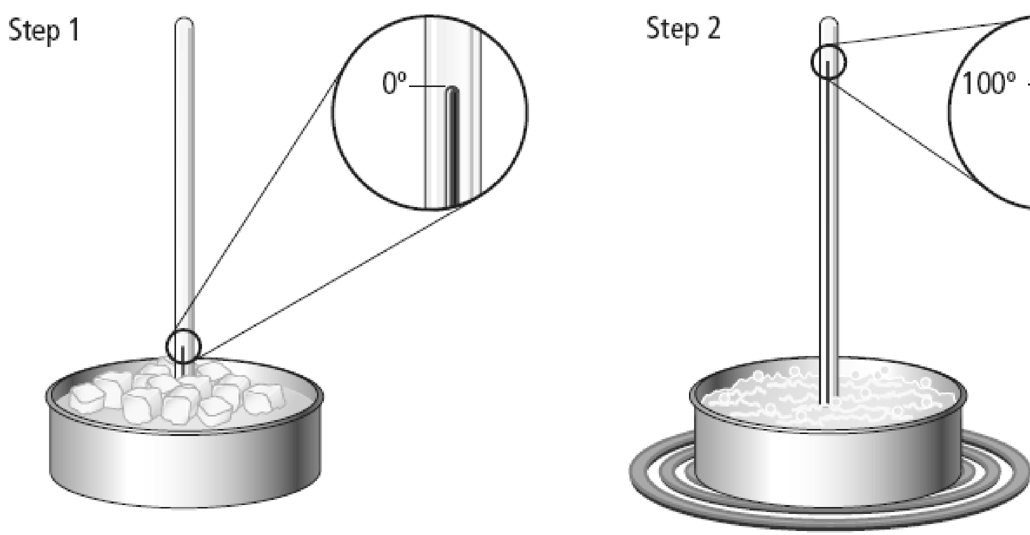
Match the term on the left with the best description on the right. Each description may be used only once.	
Term	**Description**
_____ 7. body temperature	A. is used in thermostats to turn a furnace on and off
_____ 8. room temperature	B. is a picture of infrared radiation given off by an object
_____ 9. bimetallic strip	C. an electric current indicates temperature
_____ 10. hypothermia	D. causes the body to function so slowly that a person might not recover
_____ 11. thermogram	E. is higher for birds than for mammals
_____ 12. thermoscope	F. is an arbitrarily chosen temperature scale
	G. is not a specific temperature but is a range of temperatures
	H. is the first temperature detecting instrument developed by scientists

Short Answer Questions

13. Explain how to calibrate a thermometer. Use the pictures shown here to help with your explanation.



____

____

____

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14. What type of information can you get by taking your temperature? Give an example.

____

____

____

15. Explain how at least three of your senses (sight, smell, and feel) can tell you that a stove burner is hot.

____

____

____

16. Describe what Fahrenheit used as 0° and as 100° when he selected values for his temperature scale.

____

____

____

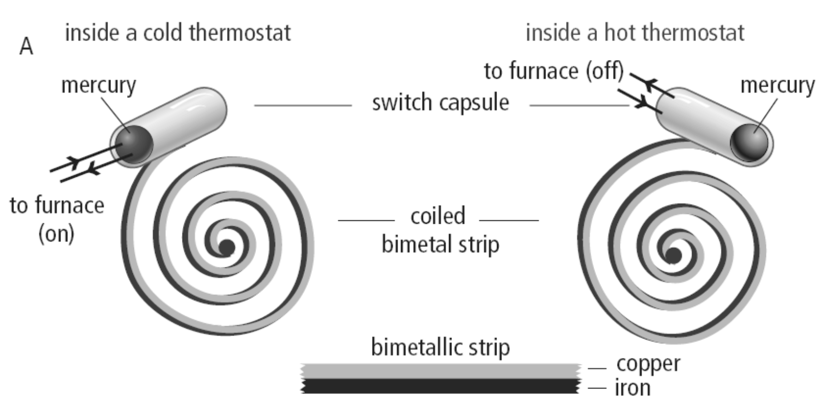
17. Explain what causes a bimetallic strip to bend.

____

____

____

18. Use the diagram below to explain how a thermostat turns an oven on and off.



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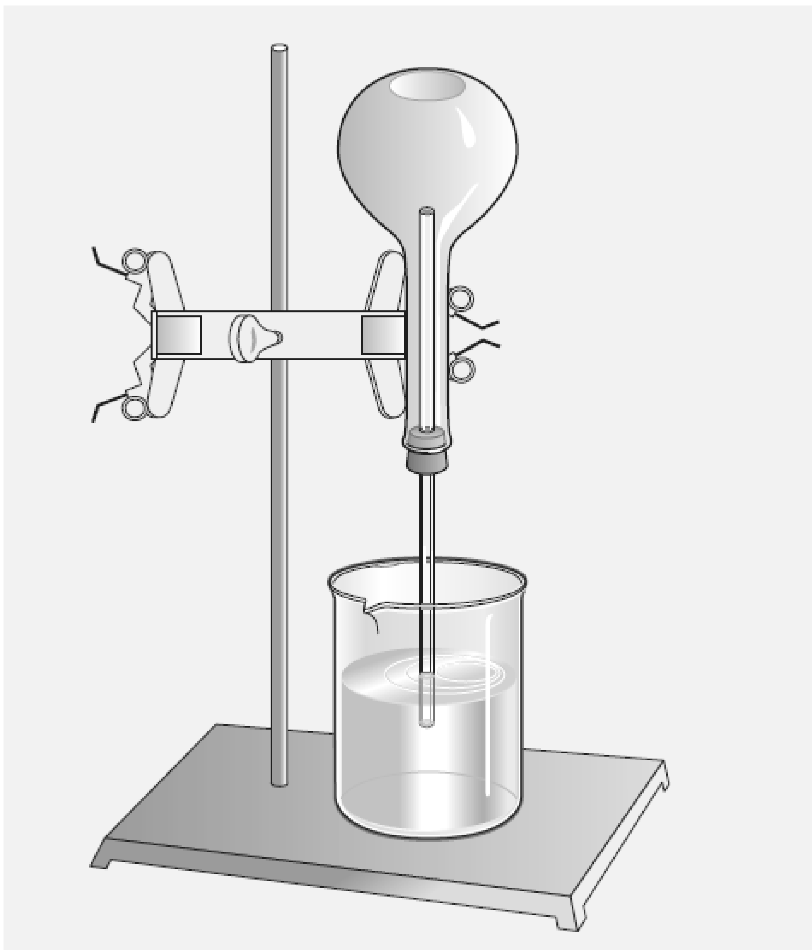
19. Explain how you can detect a temperature change with the apparatus below.



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Modelling the Particle Theory Observation Chart

Goal • Record your results for Find Out Activity 5-1A, Modelling the Particle Theory, in the chart below, and answer the questions that follow.

Trial	Volumes	Predicted Total Volume (mL)	Actual Total Volume (mL)
1	50 mL water 50 mL water		
2	50 mL water 50 mL ethanol		
3	50 mL marbles 50 mL sand		
4	Trial 3 plus 50 mL water		

What Did You Find Out?

1. If the 50 mL of water and the 50 mL of water did not add up to 100 mL, explain why.

2. If the 50 mL of water and the 50 mL of ethanol did not add up to 100 mL, explain why.

3. If the 50 mL of marbles and the 50 mL of sand did not add up to 100 mL, explain why.

4. If the 50 mL of marbles, 50 mL of sand, and 50 mL of water did not add up to 150 mL, explain why.

5. If you added the substances in Trial 3 to the cylinder in reverse order, would the total volume be greater or less? Explain.

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DATE: NAME: CLASS:

CHAPTER 5

Expanding Solids Observation Chart

BLM 2-12

Goal • Record your results for Investigation 5-2D, Expanding Solids, in the table below and answer the questions that follow.

Part 1

Heating	
Time	**Height of mass above table**

Cooling	
Time	**Height of mass above table**

Analyze

1. (a) If the wire sags, the mass moves down. Does this mean that the wire is getting longer or shorter?

____

____

(b) What is happening to the length of the wire if the mass moves up?

____

____

2. If the wire sags, are its particles getting farther apart or closer together? Explain why they would do this. (Hint: Think about their motion.)

____

____

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Part 2

Analyze

1. As a class, brainstorm possible reasons that can explain your observations. If possible, propose an experiment that will test your ideas.

Conclude and Apply

2. How did the demonstration give evidence that solids can expand? Explain what you did to cause the expansion and which part of the apparatus (the ball, the ring, or both) expanded.

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3. Explain precisely what you think happens to the particles that make up the apparatus when the ball and ring are heated. How does this change in the individual particles, due to heating, bring about a change in the overall structure of the ball and ring? How does the change in the structures cause the outcomes that you observed when testing whether the ball would fit through the ring?

4. What do you think happens to the particles when the apparatus is cooled?

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CHAPTER 5

How Low Can It Go? Observation Chart

BLM 2-13

Goal • Record your results for Find Out Activity 5-3A, How Low Can It Go?, in the chart below. Plot the results on the graph. Then answer the questions that follow.

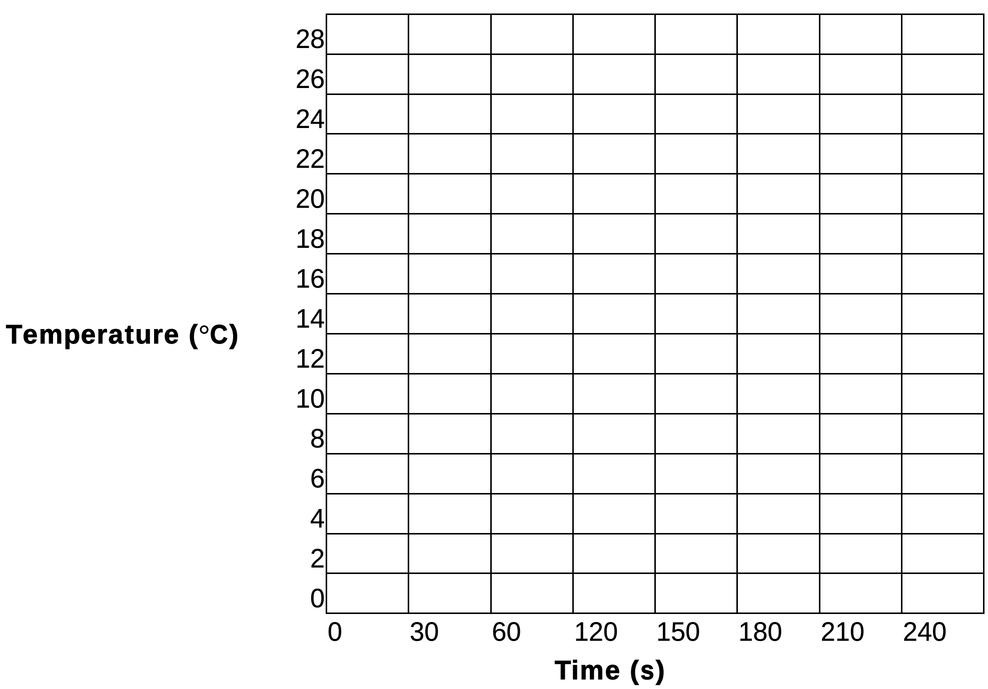
Beside the zeros in the time columns, write in the temperature columns the temperatures that you measured for the water and alcohol before starting the fan.

Water	
Time (s)	**Temperature (°C)**
0	

Alcohol	
Time (s)	**Temperature (°C)**
0	

Plot both sets of data on the graph below. Draw the two lines in different colours.

Temperature versus Time



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DATE: NAME:

BLM 2-13 continued

What Did You Find Out?

1. In which liquid were the particles evaporating faster? How do you know?

2. Which of the two cloths would take longer to dry completely? What would happen to the temperature of the cloth after all of the liquid had evaporated?

3. In which liquid do you suppose the particles have a stronger attraction for one another? Why do you think so?

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CHAPTER 5

Melting Points and Boiling Points

Goal • Use this table to help answer questions in Think About It Activity 5-3B, State the State.

Melting Points and Boiling Points of a few Pure Substances

Substance	Melting Point (°C)	Boiling Point (°C)
Oxygen	–219	–183
Nitrogen	–210	–196
Rubbing alcohol	–88	82
Mercury	–39	357
Water	0	100
Sulfur	115	445
Tin	232	2602
Lead	328	1740
Aluminum	660	2519
Table salt	801	1413
Silver	962	2162
Gold	1064	2856
Iron	1535	2861

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What to Do

Use the information in the Table above to answer each of the following questions.

1. In what state (solid, liquid, or gas) would each substance be at the given temperature?

   a) oxygen at –50°C ___________________

   b) aluminum at 800°C ___________________

   c) table salt at 800°C ___________________

   d) gold at 3000°C ___________________

   e) iron at 2000°C ___________________

2. What change of state, if any, would each substance go through during the given temperature change?

   a) mercury cooling from –10°C to –45°C

   b) silver cooling from 1000°C to 950°C

   c) tin warming from 2200°C to 2300°C

   d) mercury warming from 300°C to 350°C

   e) iron cooling from 1600°C to 1500°C

What Did You Find Out?

Compare the melting points of aluminum and tin. Which metal do you suppose has stronger forces holding its particles together? Explain your reasoning.

____

____

____

____

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CHAPTER 5

Plateau Problem Observation Chart

Core Lab

BLM 2-15

Goal • Record your results for Investigation 5-3C, The Plateau Problem in the table below. Then answer the questions that follow.

Time (min)	Temperature of Melting Ice (°C)	Temperature of Boiling Water (°C)

Analyze

1. In this activity, you measured time and temperature.
   a) What was your dependent variable? (Which value was unknown until after you made an observation?)

   ____

   b) What was your independent variable? (What value did you select before making an observation?)

   ____

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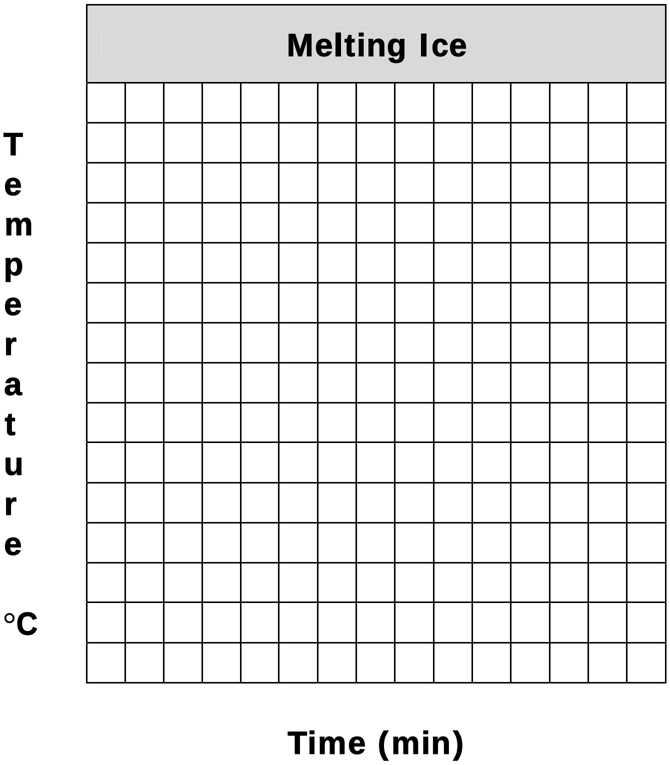
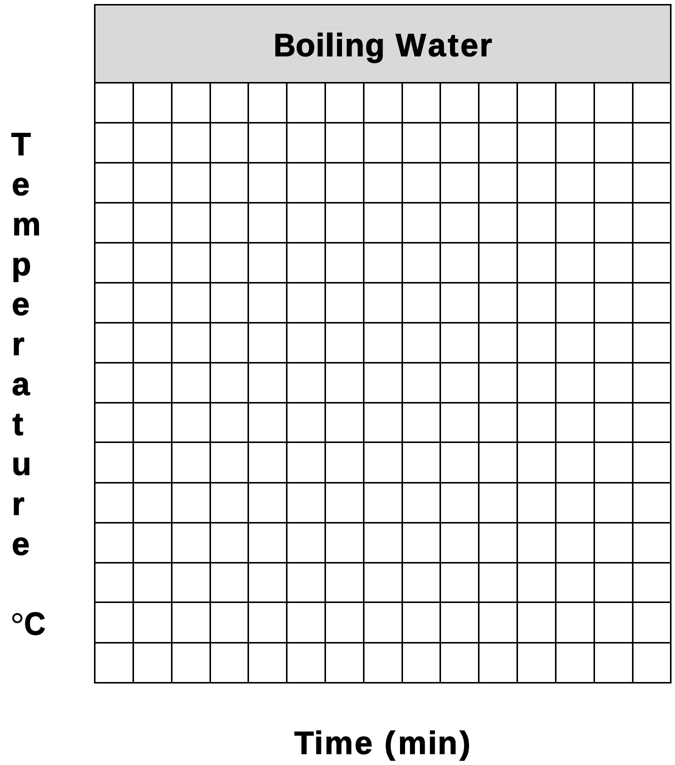
2. Draw two line graphs to show your temperature–time observations: one for the melting ice and one for the boiling water. Instead of joining the points dot-to-dot, draw a smooth line or curve that passes through or between the points (a best-fit line).





3. On your hot-water graph, mark the part where
   a) the water was hot but not yet boiling
   b) the hot water was boiling vigorously (called a “full rolling boil” in cooking)

4. Label any plateaus (flat, horizontal segments) on your graph.

5. Compare the temperature of your melting slush with the “official” temperature you learned in Chapter 4.
   a) If the two temperatures are almost the same, any small differences might be caused by errors in your equipment or measurements. Suggest at least two specific errors of this sort that might occur.

____

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b) If the two temperatures are quite different, the conditions in your laboratory or your sample might be responsible. Suggest at least two specific conditions that might cause this type of error.

____

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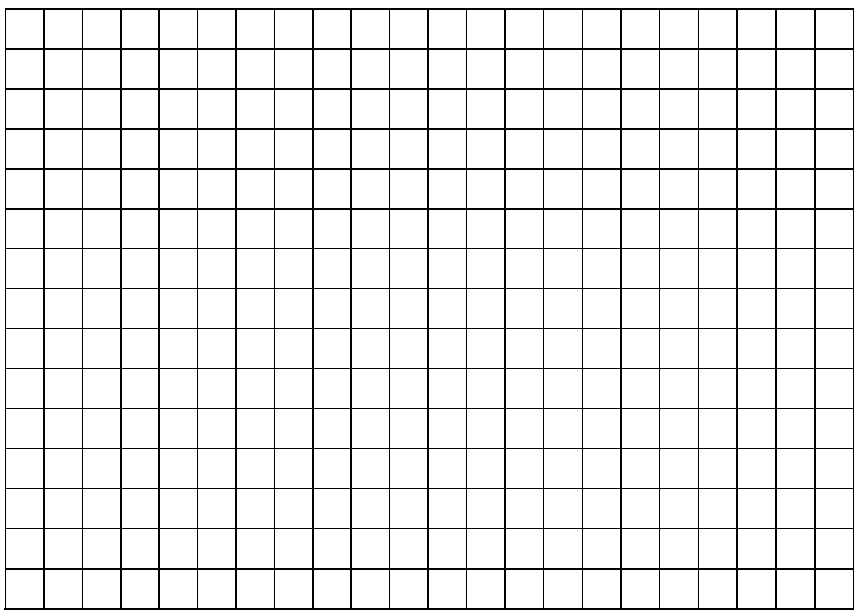
6. Imagine that you combined both parts of this investigation. Sketch a third graph that shows what would probably happen if you heated one sample from ice to water and then to water vapour.

Combined Ice to Water to Vapour

Temperature °C



Time (min)

7. On the temperature scale of your third graph, mark the melting point and the boiling point of your samples, according to your observations.

8. Combine all the results from your class to find the average melting point and the average boiling point for water. Are they closer to the expected values than your individual group values? If they are closer, explain why.

____

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Conclude and Apply

9. From your observations, write a clear answer to the question, “What happens to the temperature of water while it changes state?”.

10. How well do your observations support your hypothesis?

11. a) Identify any problems you had with the apparatus, procedure, or the way that you organized and worked together in your group.

    b) Describe one improvement that your group could make the next time you work together.

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DATE: NAME: CLASS:

CHAPTER 5 Gases Expanding and Contracting BLM 2-16

Goal • Apply the concept of expanding and contracting gases to everyday situations.

Think About It

Gases expand when their temperature increases and contract when their temperature decreases.

What to Do

Answer the following questions in the space provided.

1. Explain how a hot air balloon is lifted from the ground.

____

____

____

____

2. In the space below, draw a diagram of the hot air balloon rising into the air. Include arrows to show how the gas particles are moving in and around the balloon.

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Liquids Expanding and Contracting

Goal • Apply the concept of expanding and contracting liquids to everyday situations.

Think About It

Liquids expand when their temperature increases, and contract when their temperature decreases.

What to Do

Answer the following questions in the space provided.

1. A bowl of hot soup was left on the table to cool. After a few minutes, the amount of soup in the bowl appeared to have decreased. Why?

____

____

____

2. When manufacturers pack liquids into bottles and jars, they leave a small space at the top before putting on the lids. Why?

____

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3. Mercury expands and contracts by a greater amount than alcohol. Which liquid would be better in a thermometer? Why?

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DATE: NAME: CLASS:

CHAPTER 5

Solids Expanding and Contracting

BLM 2-18

Goal • Apply the concept of expanding and contracting solids to everyday situations.

Think About It

Solids expand when their temperature increases, and contract when their temperature decreases.

What to Do

Answer the following questions in the spaces provided.

1. Why is it important to place gaps at regular intervals in sidewalks?

2. Steel bolts used to connect things together are sometimes heated and put in place while they are still hot. Why?

3. Concrete and steel expand at almost the same rate. Based on this information, explain why these equal expansion rates are important in the construction of tall buildings.

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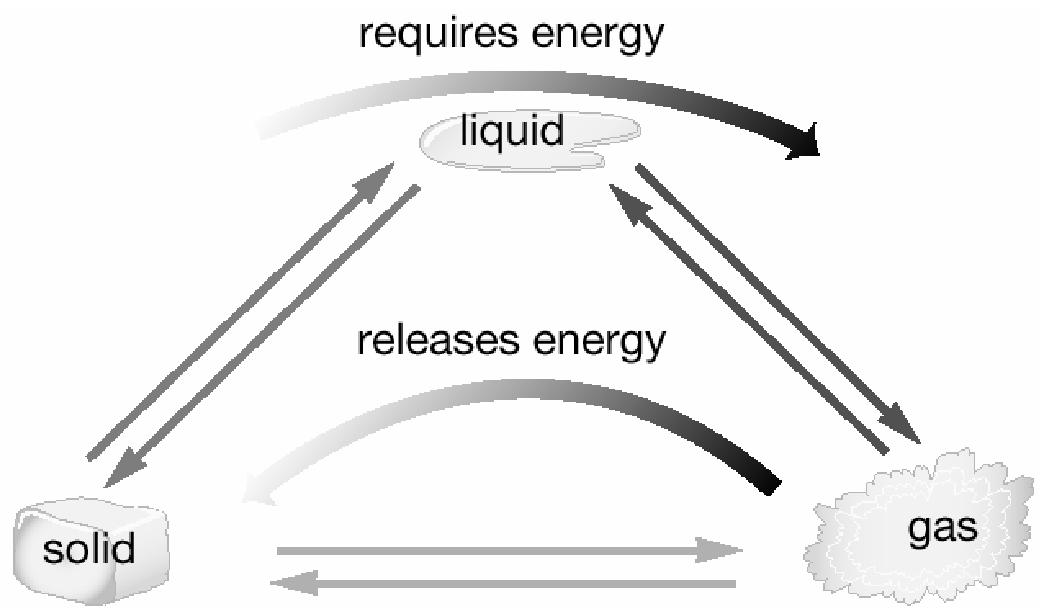
DATE: NAME: CLASS:

CHAPTER 5 **Learn the Lingo** BLM 2-19

Goal • Learn the vocabulary that describes changes of state.

Think About It
There are six possible changes of state, as shown by the arrows on the diagram below. Several of the changes have common names, which you probably know. Some of the changes are identified by technical terms used in science. It will be easier for you to describe and read about changes of state if you learn and practise using the terms.



What to Do
Answer the following questions.

1. Beside the correct arrow in the diagram, write each technical term from the table.

Term	Change
freezing	liquid to solid
condensation	gas to liquid
deposition	gas directly to solid
evaporation	liquid to gas
melting	solid to liquid
sublimation	solid directly to gas

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2. Read each statement below. Then write a description of each statement, using a technical term, as shown in the example.

   Example:
   Wet clothes dry in the sunshine.
   Description: evaporation of liquid water

   (a) Melted wax in a candle hardens when the candle is blown out.

   Description: ______________________________

   (b) A warm wind makes snow on the ground disappear, but no puddles of water form.

   Description: ______________________________

   (c) In the winter, invisible moisture in the air sometimes forms frost on car windows.

   Description: ______________________________

   (d) On a cold day, you can "see your breath."

   Description: ______________________________

3. Classify the six changes of state according to the change of thermal energy they involve. Write your answers in the table below.

Receiving thermal energy	**Releasing thermal energy**

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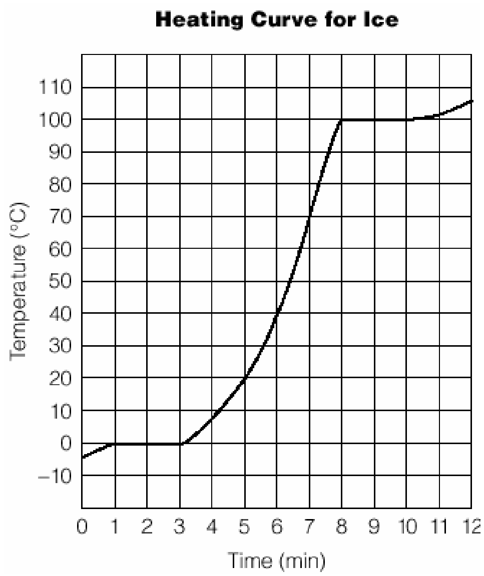
DATE: NAME: CLASS:

CHAPTER 5 # Hidden Heat BLM 2-20

Goal	• Extend your knowledge about the freezing point and boiling point of water.

Think About It

"Hidden heat" is a term used to describe the quantity of energy that flows into a substance as its state changes, without changing its temperature. The graph below is called a heating curve. It shows the temperature change that occurred when a block of ice was heated in an experiment.



What to Do

Use the graph to answer the following questions about this experiment.

1. (a) When did the ice begin to melt?

____

(b) How long did the ice take to melt completely?

____

(c) What does a plateau in the graph indicate about the temperature?

____

____

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(d) During the plateau, what is the added energy used for?

2. (a) Once the ice melted into water, what happened for the next 5 min?

(b) What occurred 8 min into the experiment?

(c) What does the second plateau in the graph represent?

3. Suppose the vapour were cooled in a freezing compartment where the internal temperature was –10°C. In the space below, sketch and label what the cooling curve might look like.

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Chapter 5 Review

Goal • Check your understanding of Chapter 5.

What to Do

Circle the letter of the best answer.

1. What determines the kinetic energy of an object?
   A. mass and weight
   B. size and shape
   C. speed and mass
   D. volume and speed

2. To what is the temperature of an object is directly related?
   A. the average kinetic energy of its particles
   B. the average speed of its particles
   C. the kinetic energy of its particles
   D. the total number of particles in the object

3. Which statement is true?
   A. A gas forms a surface inside its container.
   B. A gas takes the shape of its container and completely fills the container.
   C. A liquid has a fixed shape.
   D. A solid always forms a horizontal surface inside its container.

4. Which statement about thermal expansion is true?
   A. Liquids and gases can undergo thermal expansion but solids cannot.
   B. Only gases undergo thermal expansion.
   C. Solids, liquids, and gases expand by the same amount when heated.
   D. Thermal expansion in gases is much greater than thermal expansion of solids and liquids.

5. In what the state is a substance when its temperature is between its melting point and its boiling point?
   A. gas
   B. liquid
   C. solid
   D. plasma

6. According to the particle theory, particles that have enough energy to break all attractive forces with other particles of the same kind are in which state?
   A. gas
   B. liquid
   C. plasma
   D. solid

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Match the term on the left with the best description on the right. Each description may be used only once.	
Term	**Description**
_____ 7. matter _____ 8. thermal contraction _____ 9. temperature _____ 10. kinetic energy _____ 11. deposition _____ 12. boiling point	A. the decrease in the volume of a substance when it cools B. the change from a gas to a solid C. an object has this if it is moving D. the change from a gas to a liquid E. the temperature above which all of the substance is in the gaseous state F. anything that has mass and takes up space G. is directly related to the average kinetic energy of its particles H. the particles of an object are held together by strong attractive forces

Short Answer Questions

13. Name the two properties of an object that influence its kinetic energy.

____

____

14. List five important points that together describe the particle theory of matter.

____

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15. Describe one similarity and one difference between a gas and a liquid.

16. The following diagrams represent two different samples of the same gas. The lengths of the arrows represent the speed of the particles of the gases.

    (a) Which sample, A or B, has the higher temperature? Explain how you decided on your answer.

    (b) Explain why the volumes of the samples are different.

17. Explain why antifreeze is added to the water in the radiator of a car in the winter.

18. What is the difference between sublimation and evaporation?

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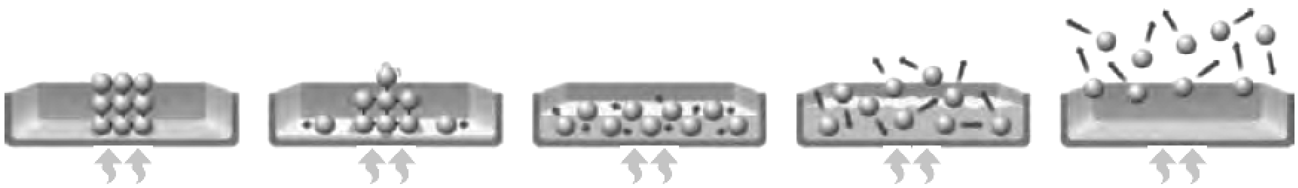
BLM 2-21 continued

19. The diagrams below represent the particles in a substance as heat is being added to the substance. Describe any temperature changes that are occurring in each of the stages of heating that are shown in the diagram. Explain why the temperature is change or why it is not changing.

A B C D E



A ____

____

B ____

____

C ____

____

D ____

____

E ____

____

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Absorb That Energy Observation Chart

Core Lab

Goal • Record your observations for Find Out Activity 6-1D in the table below and answer the questions that follow.

	Temperature (°C)	
Time (min)	**Can #1**	**Can #2**
0		

What Did You Find Out?

1. Compare the temperature change of the oil in the two cans. How well do your observations support your predictions?

____

____

2. If several groups tested the same prediction, how well did their results agree?

____

____

____

3. Combine the results of the entire class and come to an agreement about answers for both comparisons.

____

____

____

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4. What factors other than the one that you tested could be affecting the temperature change of the oil in the cans?

5. According to scientific theory, the same materials that absorb radiant energy efficiently should also emit the radiant energy efficiently. Suppose that you have pairs of similar objects with different surfaces as listed below. Which type of surface radiates energy better and therefore, cools down more quickly?

   a) a light-coloured surface or a dark-coloured surface

   b) a dull surface or a shiny surface

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CHAPTER 6

Keep it Cool Observation Chart

BLM 2-23

Goal • Record your observations for Investigation 6-2C, Keep it Cool, in the chart below and answer the questions that follow.

Insulation Material	Ice Cube Initial Mass (g)	Ice Cube Final Mass (g)	Ice Cube Lost Mass (g)
Wood shavings			
Foam pellets			
Bubble wrap			
Poured insulation			
Aluminum foil			
Empty can			

Analyze

1. In which container did the ice melt most? _______________ least? _______________

2. Which container had the best insulation? ______________________________________

3. Which container had the poorest insulation? ___________________________________

Conclude and Apply

4. Which would be the best material(s) to use to get the frozen dessert to the party?

____

____

5. Are there any other factors that you would have to consider when you are planning a way to carry your dessert to the party? Explain.

____

____

____

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When You're Hot…. Observation Chart

Goal • Record your observations for Investigation 6-2 D, When You're Hot, in the table below and answer the questions that follow.

Insulation Material	Advantages	Disadvantages

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Evaluate

1. Would you be able to keep hot chocolate warm with your insulated jar? ____________

2. How might you improve your plan? Make a list of things to consider including the following:

   a) ability to insulate

   ____

   ____

   b) ease of carrying

   ____

   ____

   c) Another thing to consider

   ____

   ____

   d) Another thing to consider

   ____

   ____

Write a paragraph describing your improved plan.

____

____

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CHAPTER 6

Keeping it Cool Observation Chart

BLM 2-25

Goal • Record your observations for Investigation 6-3B, Keeping it Cool, in the table below and answer the questions that follow.

	Substance	Time to raise temperature by 30°C
liquids	water	
	vegetable oil	
	____________	
solids	marbles	
	sand	
	steel shot	

What to Do

1. In the third row under "Substance," write the name of the oil that you used other than vegetable oil.

2. Enter into the table, the amounts of time that you measured for each substance to increase in temperature by 30°C.

3. Answer the questions below in the spaces provided.

Analyze

1. Which liquid(s) took the longest time to increase in temperature by 30°C?

____

2. Which liquids took about the same amount of time to warm by 30°C? Suggest a reason for this result?

____

____

3. Which solid(s) took the longest time to raise its temperature by 30°C?

____

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4. Which solids took about the same amount of time to warm by 30°C? Suggest a reason for this result?

____

____

Conclude and Apply

5. Compare the time it takes to heat the materials in Part 1 and Part 2.

____

____

a) Does the kind of material being heated affect the amount of heat needed to change its temperature?

____

b) What piece of information shows you the answer to 5a)?

____

____

____

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CHAPTER 6

Convection

BLM 2-26

Goal • Apply your knowledge and understanding of convection currents in nature.

What to Do

Fill in the blanks and follow the directions in the steps below.

1. Sea and land breezes are convection currents that occur in nature. Warmer air rises and cooler air moves in to take its place.

   (a) During the day, the land heats up faster than the sea. The warmer air above the ________ rises. This allows the __________ sea air to move in, causing a sea breeze. In the space below, draw and label a diagram of the air currents during a hot, sunny day by the sea.

   (b) During the night, the land cools faster than the sea. The warmer air above the __________ rises. The cooler air over the __________ moves in to take its place, creating a land breeze. In the space below, draw and label a diagram of the air currents during a night by the sea.

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(c) Under what conditions would no breezes occur?

(d) Explain how cold temperatures along a beach affect the direction of a sea breeze.

2. During the winter, colder water near the surface of a pond sinks. Warmer water at the bottom of the pond rises.

(a) Suggest a reason why ponds become stagnant in the summer.

(b) Many communities obtain their water supply from nearby ponds. What problem could convection currents in the pond cause when the pond is used to supply water to a community?

3. Find out more about warm air currents. How can birds use warm air currents?

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CHAPTER 6 **Insulation and R-Values** BLM 2-27

Insulation and R-Values

Goal • Practise solving problems related to insulating materials and their R-values.

What to Do

Answer the following questions in the space provided.

1. Complete the following table.

Insulating material	R-value	Thickness (mm)	Total R-value
25 mm fibreglass	3.14	50	
25 mm vermiculite		20	1.70
25 mm plywood	1.26		2.02
25 mm glass	0.91	70	
25 mm clay brick		100	1.36

2. If the same thickness of material is used, which is a better insulator, plywood or glass? How do you know?

____

____

____

3. The total R-value of a wall is found by adding together the R-values for the different layers of insulating material. In the space below, calculate the total R-value of a wall that has 100 mm of clay brick, 150 mm of fibreglass, and 10 mm of plywood. Show all your work.

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Heat versus Temperature

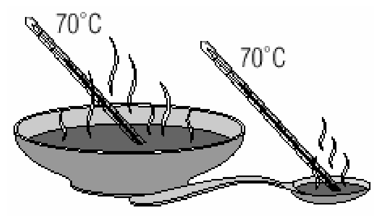
Goal • Reinforce the concepts of temperature and heat

Think About It

Temperature is a measure of the average kinetic energy of the particles in a material. **Heat**, or thermal energy, is the sum of the kinetic energies of all the particles in the material.

What to Do

Review the definitions of temperature and heat given above. Answer the following questions in the spaces provided.



1. (a) Why is the temperature of the little bit of soup in the spoon the same as the temperature of the larger volume of soup in the bowl?

____

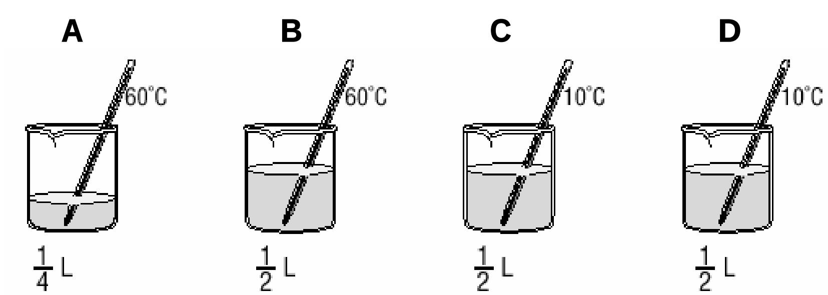
____

(b) Although their temperatures are the same, the bowl of soup has more heat, or thermal energy, than the spoonful of soup. Explain why.

____

____

2. Suppose you have the following four beakers of water.



(a) Use the particle model to predict the final temperature when the hot water in beaker **A** is poured into beaker **C** containing cold water.

____

____

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(b) Predict the final temperature when the hot water in beaker **B** is poured into beaker **D** containing cold water.

(c) Would your answer in part (b) be different if the original temperature of the ¼ L of hot water in Beaker A was much higher than 60°C, which is the original temperature of the ½ L of hot water in Beaker B?

(d) On what two factors does the final temperature of a mixture of hot and cold water depend?

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Goal • Use this word search puzzle to become familiar with terms related to the three types of thermal energy transfer.

What to Do

- Complete the word search below by locating the 19 words listed on the next page. Circle each letter in each word as you find it.
- When you have found all the words, there will be 78 letters left un-circled. Work your way across and down the word search to pick out these letters. Write them in the spaces on the next page to complete the sentence about energy transfer.

C	O	N	V	E	C	T	I	O	N	E	R	N	H	T
E	I	R	G	Y	B	O	F	R	O	E	M	E	A	R
S	U	T	B	C	S	R	L	T	F	A	A	W	R	A
N	E	C	E	C	O	E	O	L	T	T	H	A	O	N
D	A	U	T	N	H	N	E	S	I	A	S	V	T	S
N	E	R	L	A	G	C	D	N	B	S	H	E	C	F
O	I	R	G	A	T	A	S	U	H	A	I	S	U	E
I	E	E	A	R	V	U	M	T	C	E	M	O	D	R
T	P	N	E	R	L	I	R	O	A	T	T	U	N	R
A	S	T	E	A	F	T	S	O	R	A	I	S	O	S
I	O	S	T	D	U	N	B	R	S	T	T	O	C	A
D	U	O	N	I	C	E	I	W	I	T	C	H	N	A
A	R	L	O	A	W	S	D	I	U	L	F	E	E	R
R	C	T	E	N	E	R	G	Y	E	M	P	E	L	R
A	E	T	U	T	R	L	A	M	R	E	H	T	E	E

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DATE: NAME:

BLM 2-29
continued

ABSORB
COLLISIONS
CONDUCTION
CONDUCTOR
CONVECTION
CURRENTS
ELECTROMAGNETIC
ENERGY
FLUIDS
HEAT INSULATOR
INFRARED
RADIANT
RADIATION
REFLECT
RSI VALUE
SOURCE
THERMAL
TRANSFER
WAVES

A thermal energy transfer involves the transfer of

___ ___ ___ ___ ___ ___   ___ ___ ___ ___   ___

___ ___ ___ ___ ___ ___ ___ ___ ___   ___ ___ ___ ___   ___ ___ ___   ___

___ ___ ___ ___ ___ ___   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___   ___ ___

___   ___ ___ ___ ___ ___ ___ ___ ___ ___   ___ ___ ___ ___   ___

___ ___ ___ ___ ___   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ .

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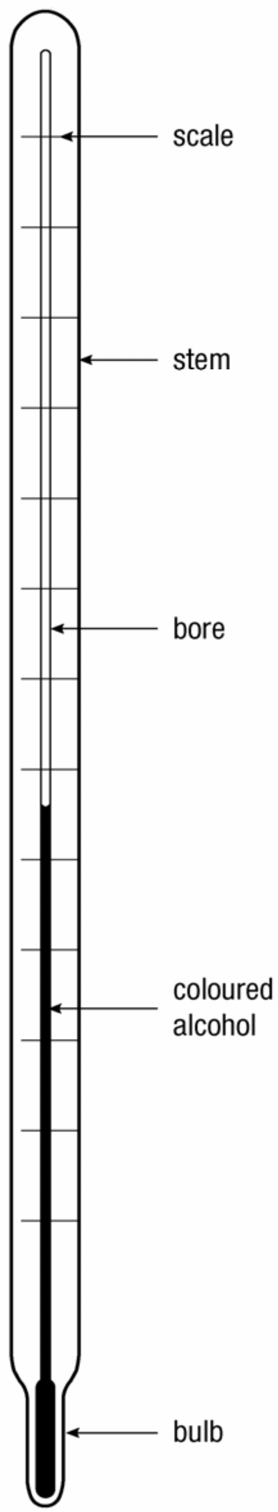
CHAPTER 4 | **Parts of a Thermometer** | BLM 2-3

Parts of a Thermometer

Goal • Review the parts of a laboratory thermometer.



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DATE: NAME: CLASS:

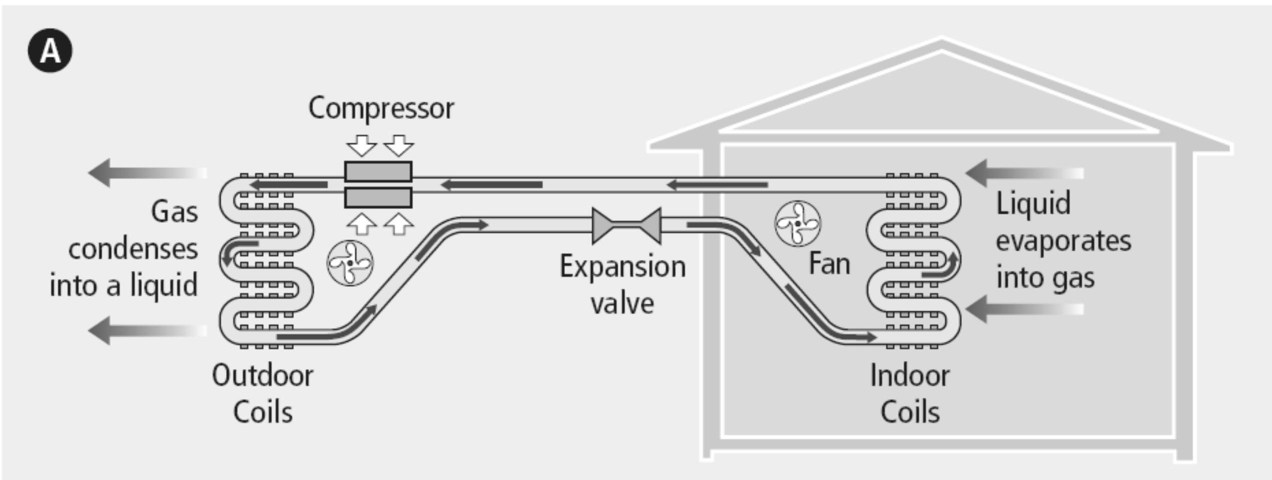
CHAPTER 6

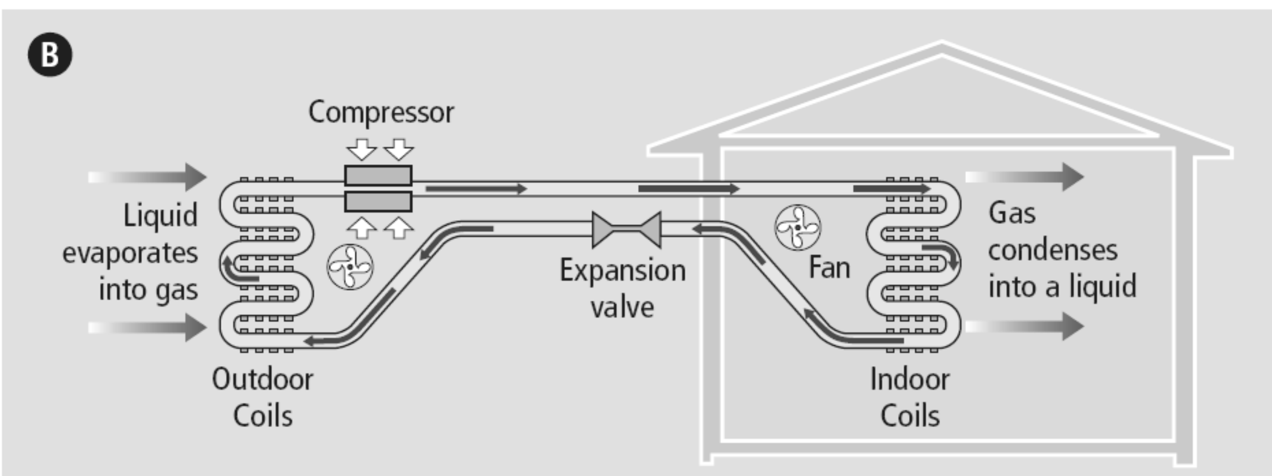
Air-to-Air Heat Pump

BLM 2-30

Goal • Use this to review the function of air-to-air heat pumps for heating and cooling homes.

The diagram below shows the important features of air to air heat pumps. Diagram A shows the process of cooling a house in the summer. Diagram B shows the heating of a house in winter. Fill in the table on the next page by explaining the function of each of the features in the diagrams in summer and in winter.





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DATE: NAME:

BLM 2-30 continued

	Summer	Winter
Outdoor coils		
Compressor		
Expansion valve		
Indoor coils		

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Chapter 6 Review

Goal • Check your understanding of Chapter 6.

What to Do

Circle the letter of the best answer.

1. Which statement is **true** of conduction?
   A. Energetic particles collide with neighboring particles and pass energy to them.
   B. Energetic particles move from one place to another, carrying energy with them.
   C. Radiant energy is absorbed and increases the energy of the particles of the object.
   D. Waves carry energy from one object to another.

2. Which statement is **true** of convection?
   A. Collisions of particles results in the transfer of energy.
   B. Energetic particles remain in one place.
   C. Energetic particles move from one place to another.
   D. It is the only means of energy transfer in solids.

3. Which form of energy transfer can carry energy through empty space?
   A. conduction
   B. convection
   C. evaporation
   D. radiation

4. Which statement about conduction of heat is **true**?
   A. Air, trapped in small spaces, is the best conductor of heat.
   B. Cast iron skillets have the highest thermal conductivity of all cookware.
   C. Metals conduct heat more efficiently than non-metals.
   D. The best radiators are made of plastic.

5. Which statement best describes the climate of a costal city compared to a city that is surrounded by land?
   A. It is cooler both in winter and summer in the costal city.
   B. It is cooler in the summer and warmer in the winter in the costal city.
   C. It is cooler in the winter and warmer in the summer in the costal city.
   D. It is warmer both in winter and summer in the costal city.

6. The specific heat capacity of water is larger than the specific heat capacity of alcohol. When you add the same amount of heat to 100 g of each liquid, how does the temperature of the water increase?
   A. The increase cannot be compared to the increase in the temperature of the alcohol.
   B. The increase is greater than the increase in the temperature of the alcohol.
   C. The increase is less than the increase in the temperature of the alcohol.
   D. The increase is the same as the increase in the temperature of the alcohol.

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Match the term on the left with the best description on the right.
Each description may be used only once.

Term	Description
_____ 7. conduction	A. the transfer of heat by electromagnetic waves
_____ 8. convection	B. the amount of heat necessary to raise the temperature of 1.0 g of a substance by 1.0°C
_____ 9. radiation	C. a substance that transfers heat very slowly
_____ 10. conductor	D. the transfer of energy that occurs when a heated fluid expands and rises, carrying heat with it
_____ 11. insulator	E. the cooling of a substance by evaporation of water
_____ 12. thermal energy	F. the technical term for heat
	G. the transfer of heat that occurs when energetic particles collide with particles beside them and pass energy to them
	H. a substance with a high thermal conductivity

Short Answer Questions

13. Explain why convection does not occur in solids.

____

____

14. Explain how water waves can transfer energy from one place to another when the water itself stays in the same place.

____

____

____

15. List at least three different examples of types of electromagnetic waves.

____

____

____

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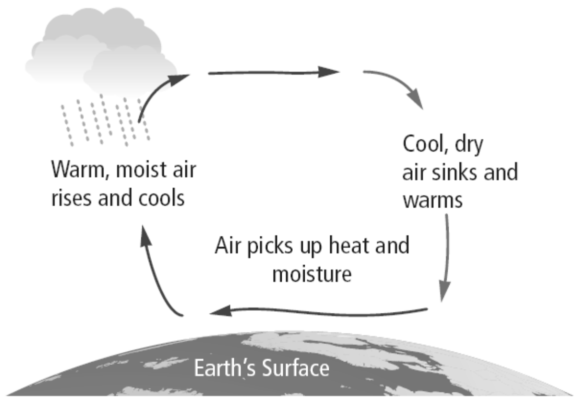
16. Use the following diagram to explain the relationship between convection and wind.



17. Name two characteristics of an object that can influence the amount of radiant energy it can absorb.

18. State two important characteristics of a good radiator. Explain why each characteristic is important.

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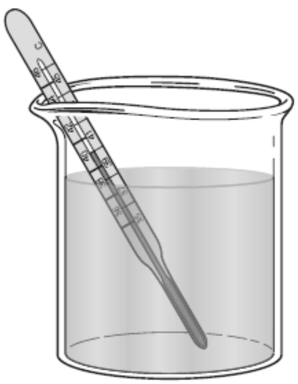
19. Imagine that half of the water in the beaker in diagram A was poured into another beaker as shown in diagram B.

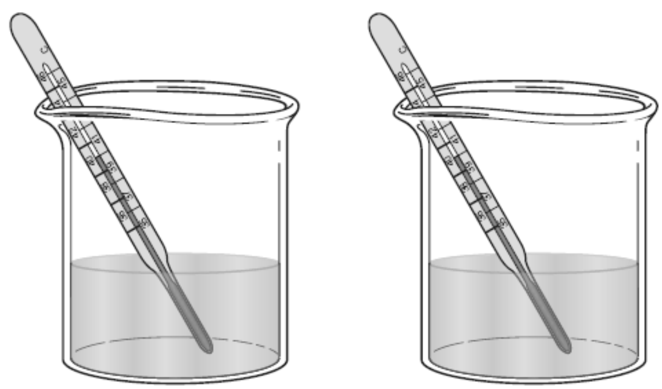
    a) State what property of the water in the two beakers in B is the same as that property of the water in the original beaker in A. Explain why it is the same.

    b) State what property of the water in the two beakers in B is different than the same property in the original beaker in A. Explain why it is different.

A



B



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Unit 2 Review

Goal • Check your understanding of Unit 2.

What to Do

Circle the letter of the best answer.

1. Which temperature is best temperature for the inside of a refrigerator?
   A. –89°C
   B. –18°C
   C. 0°C
   D. 4°C

2. What is absolute zero?
   A. 0°C on the Celsius scale
   B. the coldest possible temperature
   C. the coldest temperature ever recorded on Earth
   D. the coldest temperature that can be achieved in a laboratory

3. Which term describes the change of state from a solid to a gas?
   A. deposition
   B. evaporation
   C. melting
   D. sublimation

4. The melting point of table salt is 801°C and the boiling point is 1413°C. What will be the state of table salt at a temperature of 1550°C?
   A. gas
   B. liquid
   C. plasma
   D. solid

5. When the same amount of radiant energy shines on each of the following materials, which will increase in temperature the most?
   A. aluminum foil
   B. black cloth
   C. mirror
   D. white paper

6. Which statement describes the total kinetic energy of the particles in a substance?
   A. It always increases as the substance absorbs heat.
   B. It is a measure of the temperature of the substance.
   C. It is equal to the average kinetic energy of all of the particles in the substance.
   D. It is the sum of the kinetic energies of the particles in the substance.

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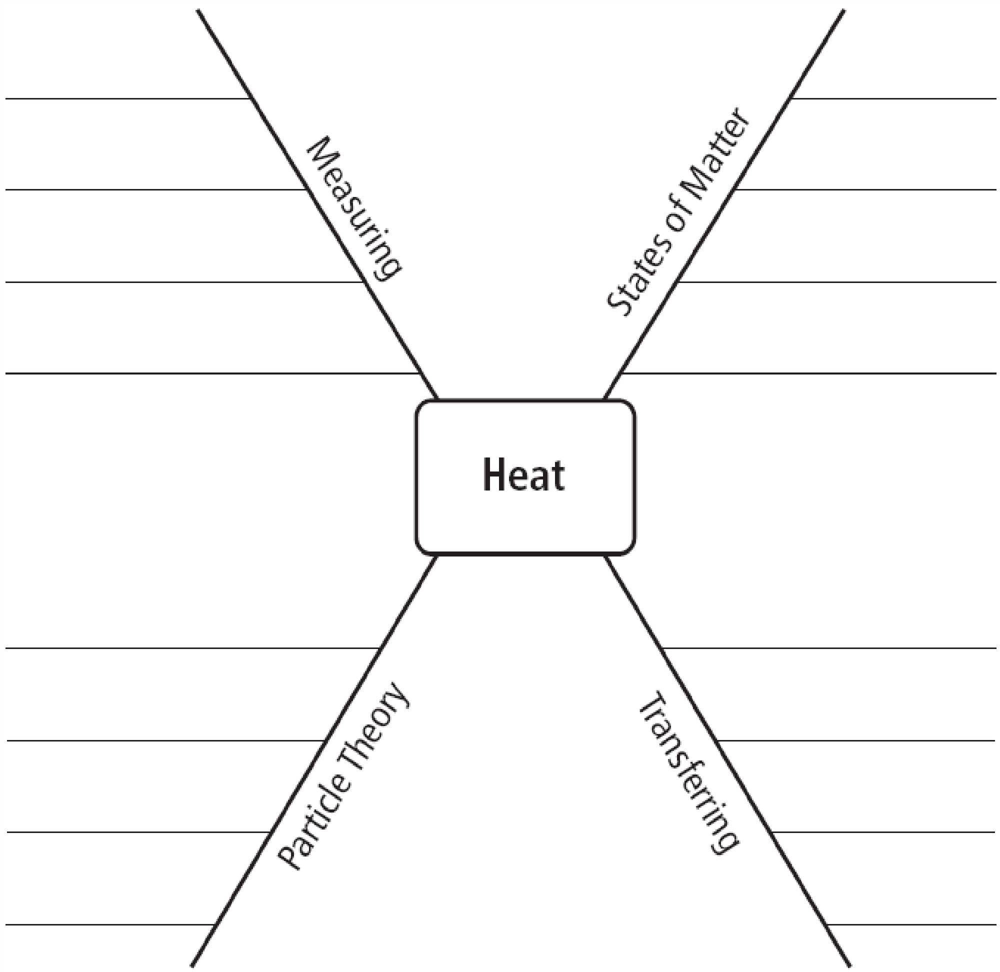
Write the terms below on the appropriate lines on the following spider map.



7. all matter is made of particles
8. radiation
9. gas
10. thermometer
11. convection
12. all particles are moving
13. solid
14. thermocouple
15. there are spaces among all particles
16. changes of state
17. conduction
18. liquid
19. there are attractive forces between particles
20. thermogram
21. conductor
22. thermoscope
23. waves

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Short Answer Questions

24. What characteristics must a substance have in order to use it in a temperature measuring device?

25. Use the particle theory to describe what must happen in order for a solid to melt.

26. Explain why it is important for people who design buildings and bridges to understand thermal expansion of materials? Give an example of what could happen if the possibility of thermal expansion was not considered when building a structure.

27. Consider a house that is heated by hot water running through baseboard radiators. Explain how conduction, convection, and radiation each contribute to the warming of the house.

28. What is the benefit of having a copper bottom on a frying pan?

29. What is the very best insulator? Explain why it is such a good insulator.

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BLM 2-2A, Unit 2 Key Terms
1. body temperature
2. hypothermia
3. comfortable room temperature
4. bimetallic strip
5. calibrate
6. Celsius
7. Fahrenheit
8. Kelvin
9. thermocouple
10. thermogram
11. thermometer
12. thermoscope
13. infection
14. lizards
15. Galileo
16. absolute zero
17. thermostat
18. refrigerator
19. oven
20. sleep

E	+	B	+	G	+	+	S	+	T	+	T	A	E	F
+	R	+	I	M	A	U	+	H	+	H	+	I	T	A
N	+	U	O	M	I	L	E	+	E	+	R	M	U	H
Y	O	O	T	S	E	R	I	R	+	E	K	R	L	R
D	R	I	L	A	M	T	M	L	T	+	E	E	O	E
O	P	E	T	O	R	O	A	E	E	+	L	H	S	N
B	C	E	G	C	C	E	M	L	S	O	V	T	B	H
+	Z	R	E	O	E	O	P	T	L	+	I	O	A	E
+	A	E	U	L	M	F	R	M	+	I	N	P	O	I
M	+	P	R	R	S	I	N	+	E	+	C	Y	V	T
+	L	+	E	O	P	+	+	I	+	T	+	H	E	+
E	+	H	T	A	T	S	O	M	R	E	H	T	N	+
+	T	+	T	H	E	R	M	O	S	C	O	P	E	+
L	I	Z	A	R	D	S	E	L	A	C	S	+	+	+
R	O	T	A	R	E	G	I	R	F	E	R	+	+	+

BLM 2-2B, Unit 2 Key Terms
1. windchill
2. bimetallic strip
3. mammals
4. hypothermia
5. thermocouple
6. pizza
7. Celsius
8. Kelvin
9. freezer
10. Fahrenheit
11. calibrate
12. thermoscope

BLM 2-2C, Unit 2 Key Terms
1. kinetic energy
2. particle theory

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3. gas
4. liquid
5. solid
6. freezing point
7. condensation
8. deposition
9. evaporation
10. freezing
11. melting
12. melting point
13. sublimation
14. temperature
15. expansion
16. contraction
17. heating curve
18. attractive forces
19. matter
20. mass

P	C	H	S	S	A	M	C	M	A	T	T	E	R	N
A	I	E	+	+	Y	R	O	E	H	T	+	N	E	O
R	T	A	X	+	+	P	N	+	+	+	O	V	+	I
T	E	T	E	P	+	O	D	+	+	I	A	S	+	T
I	N	I	+	R	A	I	E	+	T	P	+	E	+	C
C	I	N	M	C	U	N	N	I	O	+	+	C	+	A
L	K	G	U	E	E	T	S	R	D	+	+	R	+	R
E	+	R	+	N	L	O	A	I	S	I	+	O	+	T
+	V	+	E	+	P	T	T	R	O	O	U	F	+	N
E	+	R	+	E	I	+	I	+	E	N	L	Q	+	O
+	G	+	D	O	+	+	O	N	+	P	S	I	I	C
Y	+	+	N	+	+	+	N	+	G	+	M	A	D	L
+	N	O	I	T	A	M	I	L	B	U	S	E	G	+
A	T	T	R	A	C	T	I	V	E	+	+	+	T	+
G	N	I	Z	E	E	R	F	B	O	I	L	I	N	G

BLM 2-2D, Unit 2 Key Terms
condensation
deposition
evaporation
freezing
melting
sublimation
change of state

BLM 2-2E, Unit 2 Key Terms
1. conduction
2. convection
3. convection current
4. radiation
5. conductivity
6. insulator
7. thermal energy
8. specific heat capacity
9. heat transfer
10. solid
11. wind
12. absorb
13. liquids

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14. particles
15. radio waves
16. light
17. infrared
18. reflect
19. geothermal heat pump
20. radiator

P	A	R	T	I	C	L	E	S	+	B	+	C	+	R
+	+	R	E	F	S	N	A	R	T	R	+	O	+	E
N	O	I	T	C	E	V	N	O	C	O	+	N	+	F
R	D	+	S	R	U	O	+	N	+	S	+	D	L	L
O	+	E	G	R	I	R	O	+	C	B	C	U	A	E
T	V	Y	R	D	O	I	R	O	+	A	+	C	M	C
A	+	I	A	A	T	T	N	E	P	+	L	T	R	T
I	L	R	S	A	R	D	A	A	N	A	+	I	E	S
D	H	I	I	I	U	F	C	L	M	T	P	V	H	P
A	E	D	G	C	B	I	N	R	U	U	S	I	T	E
R	A	+	T	H	T	L	E	I	M	S	+	T	O	C
R	T	I	+	Y	T	H	E	P	+	+	N	Y	E	I
+	O	+	+	+	T	S	D	I	L	O	S	I	G	F
N	L	I	Q	U	I	D	S	W	A	V	E	S	+	I
+	+	+	+	+	+	+	+	+	+	+	+	+	+	C

BLM 2-2F, Unit 2 Key Terms
conduction
convection
radiation
energy transfer

BLM 2-4, Reading a Thermometer
1. a) 34.9°C
   b) 18.4°C
   c) –5.1°C

BLM 2-5, The Thermometer
1. coloured alcohol
4. Celsius

BLM 2-6, Motion Within a Thermometer

scale	P
stem	A
bulb	R
degrees	T
water	I
heat	C
energy	L
motion	E
bore	S

BLM 2-7, "Fixed" Temperatures
1. a) The salt dissolves in the water at the surface of the ice cube and lowers the melting temperature. The ice begins to melt.
   b) Salt lowers the freezing temperature of the ice and causes it to melt.
2. a) 97°C
   b) 92.5°C

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c) 5000 m
d) The lower boiling point will allow water in a pan on a camp stove to boil at a lower temperature. The food will not get as hot in the boiling water because it is lower than 100°C.

BLM 2-8, Wind Chill
1. –33
2. Keep as much of your skin covered as possible at all times.
3. 2 to 5 min
4. Wind chill is not a temperature so units should not be used. It depends on how living skin feels and not on a specific temperature.
5. 45 km/h and –20°C; 50 km/h and –20°C; 15 km/h and –25°C
6. 35 km/h
7. –20°C; There is a risk of frostbite within 10 to 30 min of exposure.
8. –48; The risk of frost bite is high. It could occur in 2 to 5 min of exposure.

BLM 2-9,

1. and 2. The western and southern borders of Labrador are connected to land. The eastern border of Labrador and all of Newfoundland are in contact with ocean water.
3.

	Location (beside land, water, or both)
Coldest in Winter	land
Warmest in Winter	water
Coolest in Summer	both
Warmest in Summer	water

4. Areas away from water seem to have the coldest temperatures in winter. These maps do not give definitive information about summer.

BLM 2-10, Chater 4 Review
1. A
2. B
3. C
4. B
5. C
6. D
7. E
8. G
9. A
10. D
11. B
12. H
13. Put the thermometer bulb in ice water. Mark the liquid level and label it 0°. Put the thermometer bulb in boiling water. Mark the liquid level and label it 100°. Measure the distance between the marks. Divide it by 10 and label each tenth of the distance. Label each section as 10°, 20°, etc.
14. You can find out if your body temperature is too high or too low. For example, if it is above 37°C, you probably have an infection.
15. You can see the red colour of a hot burner. You can smell something cooking on the burner. You can feel the radiant heat from the burner when you are near it.
16. On the Fahrenheit scale, 0°F is the coldest temperature that Fahrenheit was able to generate with salt

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and ice in water. A temperature of 100°F was intended to be normal body temperature.
17. The two metals in a bimetallic strip expand by different amounts when heated. Strips of the two metals are attached together and when they are heated, the one that expands less pulls on the other causing the two to bend.
18. When the air around the thermostat is cool, the bimetallic strip cools and uncoils. When it does so, it tips the capsule so that the drop of mercury touches the two wires that go to the furnace. The mercury makes an electrical connection between the wires and an electric current flows. This current turns on the furnace. When the air warms, the bimetallic strip warms and coils tighter. As it does so, it tips the capsule so that the drop of mercury rolls away from the wires. The electric current no longer flows and this interruption of the current turns the furnace off.
19. If the air inside the inverted flask cools, in contracts and water rises up into the glass tube. If the air inside the inverted flask warms, it expands and pushes the water down the tube.

BLM 2-11, Modelling the Particle Theory Observation Chart
1. If the two 50 mL samples of water do not add up to 100 mL, it will be due to spillage.
2. The volume of water plus alcohol will be less than 100 mL. The particles of alcohol fit into spaces between water particles.
3. The 50 mL samples of marbles and sand will be less than 100 mL because sand fits in the spaces between marbles.
4. The 50 mL samples of marbles, sand, and water will be less than 150 mL because sand fits in the spaces between marbles and the water fits into the space between sand particles.
5. If you added marbles to sand, the volume would be larger because the sand would pack down and the marbles would not be able to move into the sand.

BLM 2-12, Expanding Solids Observation Chart
1. a) In order for the wire to sag and for the mass moves down, the wire must get longer.
b) If the mass moves up, the wire must be getting shorter.
2. If the wire sags and it gets longer, the particles must be getting farther apart. When a solid is heated, the particles move faster and push each other apart farther.

BLM 2-13 How Low Can It Go? Observation Chart
1. The particles were evaporating faster in the alcohol. When energetic particles move into the gaseous state, the less energetic particles are left in the liquid and the temperature is lower. The temperature of the alcohol dropped faster than that of the water.
2. The cloth with water would take longer to dry completely because alcohol evaporates faster. When the cloths were dry, the temperature would return to the temperature of the air because nothing was evaporating and changing the average energy of the particles.
3. Water particles have a stronger attractive force because it took longer for them to pull apart from each other.

BLM 2-14, Melting Points and Boiling Points
1. a) gas
b) liquid
c) solid
d) gas
e) liquid
2. a) freezing
b) freezing
c) no change
d) no change
e) freezing

The melting point of aluminum is higher than the melting point of tin. Therefore, aluminum particles need more energy to break away from each other. Thus, the forces holding aluminum particles together must be stronger than the forces holding tin particles together.

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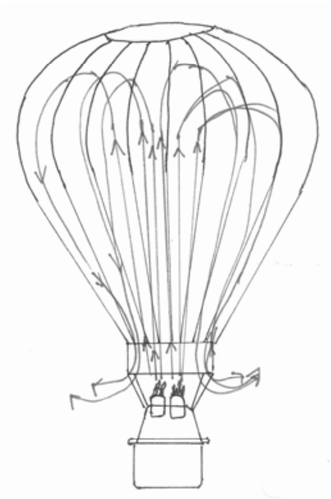
BLM 2-15, Plateau Problem Observation Chart

1. a) Temperature was the dependent variable.
b) Time was the independent variable.
2. The lines will probably curve a bit but will eventually be horizontal.
3. a) At the beginning, the line will probably be curving up slightly. It is on this curve that the water is hot but not yet boiling.
b) When the hot water is boiling vigorously, the line will be horizontal.
4. Most of both graphs should be plateaus.
5. a) The measured boiling point and melting point should be near 100°C and 0°C. They will probably be slightly off. The measured boiling point will probably be slightly less than 100°C and the melting point will probably be slightly higher than 0°C.
b) A very low atmospheric pressure could cause the measured temperatures to be quite different than the theoretical values. Also, poorly calibrated thermometers could be the problem. Incorrect reading of the thermometers could also be a cause of a difference in the experimental and theoretical values.
6. The curve should start low and rise gently then level off. When all of the ice was melted, the temperature would rise. As the water began to boil, the temperature would plateau. Finally, when all of the water turned to steam, the temperature of the steam would rise.
7. The melting point will be near 0°C and the boiling point will be near 100°C.
8. The average will probably be closer to the theoretical values than many of the individual measurements. Averaging several experimental measurements causes random errors to cancel each other.
9. The temperature of water remains the same while it changes state.
10. The observations will probably be strongly supporting of the students' hypotheses.
11. a) Students might have disagreed on the readings. Students might have found it difficult to keep the thermometer from touching the sides or bottom of the container.
b) They might suggest that they find a better way to support the thermometer. They might assign tasks more specifically.

BLM 2-16, Gases Expanding and Contracting

1. As the air in a balloon heats, it expands. Since the balloon does not expand and since it is open at the bottom, some air leaves the balloon as the air expands. There is less air in the balloon or, to say it another way, the air is less dense. Because it is less dense, it weighs less than it did when it was the same temperature as the surrounding air. Because the air inside the balloon is lighter, the balloon rises.
2. The hot air that fills a balloon is less dense than the air outside the balloon. Therefore, the balloon rises in the denser air. When the air in the balloon cools, air from the outside can enter and the balloon begins to slowly fall. When the pilot turns on the propane burner, it heats the air which then expands. The hot air rises inside the balloon and pushes the cooler air out of the bottom of the balloon. Once again, the air inside the balloon is less dense than the outside air and it rises. The students diagram should look similar to the one below.



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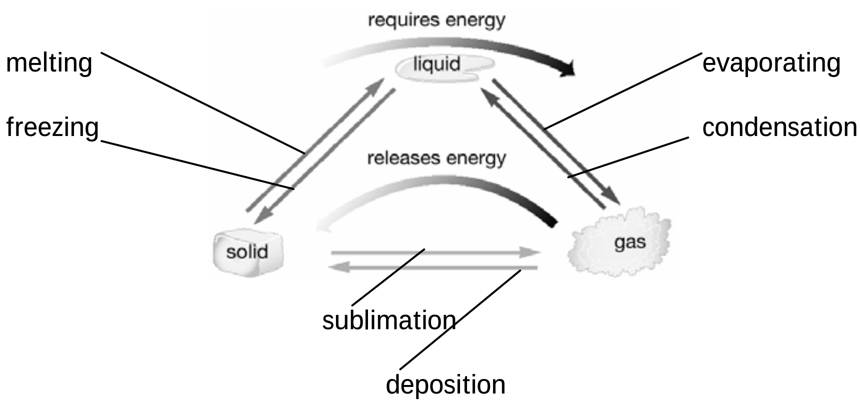
BLM 2-17, Liquids Expanding and Contracting
1. As the soup cools, it contracts thus there appears to be less soup.
2. As the liquids warm, they will expand. If there was no air space above the liquids, the bottles would burst when the liquids heat.
3. Mercury would make a better thermometer because each degree mark would be farther apart making it easier to read the values precisely.

BLM 2-18, Solids Expanding and Contracting
1. As the concrete heats up in the summer sun, it expands. If there were no gaps, the sidewalk would buckle.
2. If the steel bolts are hot when put in place, they will be in their expanded form. As they cool, they will contract. Then, if the steel bolts heat up for any reason, such as a very hot summer day, there is room for expansion without causing damage to the structure.
3. Steel bars form a framework around which concrete is poured. The concrete solidifies around the steel. If one expanded or contracted more than the other, the concrete would crack.

BLM 2-19, Learn the Lingo
1.



2. a) freezing of liquid wax
b) solid snow sublimes
c) gaseous water deposits on the windows
d) gaseous water condenses
3.

Receiving thermal energy	Releasing thermal energy
melting	freezing
evaporating	condensation
sublimation	deposition

BLM 2-20, Hidden Heat
1. a) 1 min
b) two minutes
c) The temperature was not changing.
d) The temperature did not during the plateau. The energy was used to pull particles apart from each other.
2. a) The temperature of the water rose from 0°C to 100°C.
b) The water began to evaporate.
c) The second plateau occurred when the water was evaporating.
3. The cooling curve would be a mirror image of the heating curve. Because the water is in the form of a vapour, its temperature must be above 100°C. Thus, at time zero, the curve would start above 100°C. As it cooled, the temperature would drop to 100°C. When the temperature reached 100°C, the vapour would begin to condense. As more heat was removed, the condensation would continue but the temperature would not change. After all of the vapour condensed, the temperature would, once again, begin to drop. It would

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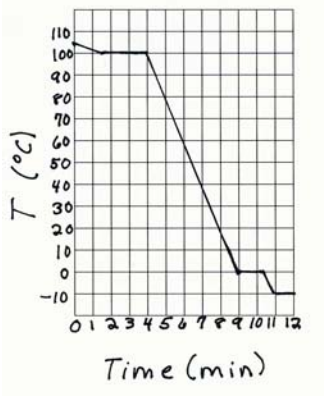
continue to drop until the temperature reached 0°C at which time the liquid would begin to freeze. The temperature would remain at 0°C until all of the liquid froze. Finally, after all the water froze, the temperature would, again, begin to drop until it reached –10°C, the temperature of the freezer.



BLM 2-21 Chapter 5 Review
1. C
2. A
3. B
4. D
5. B
6. A
7. F
8. A
9. G
10. C
11. B
12. E
13. Its mass and its speed
14. i All matter is made of tiny particles.
ii These particles are always moving.
iii There are spaces among particles.
iv There are attractive forces between the particles.
v The particles of one substance differ from the particles of other substances.
15. Liquids and gases both take the shape of their containers. Gases fill their container but liquids do not. Liquids form a surface inside the container.
16. a) Sample B is at a higher temperature than sample A. Since the two gases are the same, the masses of the particles are the same. The particles in B are moving faster therefore have more kinetic energy. The gas in sample B is, therefore, at a higher temperature than the sample of gas in A.
b) The faster moving particles hit the walls of the container harder and more frequently and thus push the walls out.
17. A solution of antifreeze and water has a lower freezing point than does pure water. Therefore, when it gets cold in the winter, the solution will not freeze. If it did freeze, it could crack the radiator or engine.
18. In sublimation, the matter goes directly from a solid to a gas without ever being a liquid. Evaporation is the change of state in which a liquid becomes a gas.
19. A The temperature is increasing because the sample is a solid and not changing state.
B The sample is melting and therefore the temperature is not changing.
C The temperature is increasing because the sample is in the liquid state and not changing state.
D The sample is evaporating therefore the temperature is not changing.
E. The sample has completely evaporated and is entirely in the gaseous state. As heat is added, the temperature of the gas increases.

BLM 2-22, Absorb That Energy Observation Chart
1. The temperature of the oil in black and/or dull cans will increase in temperature faster than the temperaure of the oil in white and/or shiny cans.

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2. The results will probably agree.
3. The class results will probably agree that dull and black surfaces absorb more light energy than do white and shiny surfaces.
4. The distance of the cans from the light source will affect the results. If different light sources were used, it would greatly affect the results. Accurate timing and reading of thermometers is also critical.
5. a) A dark coloured surface would radiate heat more efficiently than a light coloured surface.
b) A dull surface would radiate heat more efficiently than a shiny surface.

BLM 2-23
1. The answers will depend, not only on the type of material in the can, but also on the way the can is packed. Considering that the empty can is the control, the can with aluminum foil will probably be the one in which the ice melted most. Most likely, the can with poured insulation or foam pellets will be the can in which the ice melted least.
2. The best material will be the one in which the ice melted least. As stated above, it will probably be the poured insulation or the foam pellets.
3. Most likely, the aluminum foil will be the poorest insulation.
4. Once again, the best material will probably be the poured insulation or the foam pellets.
5. Other factors to consider for carrying a frozen desert in an insulated container would be the size, shape, and weight of the container.

BLM 2-24
Some possible answers are given in the chart

Insulation Material	Advantages	Disadvantages
wood chips	light weight easy to handle fairly good insulator	hard to obtain there are better insulating materials
plastic bags	inexpensive easy to obtain easy to handle	not a very good insulator
wool material	easy to handle fairly easy to obtain	somewhat expensive there are better insulating materials
aluminum foil	inexpensive easy to obtain easy to handle	very poor insulator
newspapers	very inexpensive always available easy to handle	not a very good insulator
foam pellets	good insulator relatively easy to obtain easy to handle lightweight	might make the container quite large

BLM 2-25
1. water
2. The two types of oil took similar times to warm by 30°C.
3. The marbles and sand took longer times to warm by 30°C than did the steel shot.
4. The marbles and sad took similar times to warm by 30°C. They are made of similar materials so their specific heat capacities are similar.
5. The liquids in part 1 took longer times to warm by 30°C than did the solids in part 2. (NOTE: Since the liquids had to be in water in order to heat them evenly, the amounts of water will affect the results somewhat.

BLM 2-26, Convection
1. a) land; cooler

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b) sea; land
c) If the temperature did not change or changes extremely slowly, there would be no breeze.
d) Cold temperatures along a beach cause the air to move out to sea because the warmer air over the water is rising.
2. a) In the summer, the surface of the pond water is heated. The warm air remains on top of the pond and the cooler water remains on the bottom, thus no mixing occurrs.
b) Convection currents could bring debris up from the bottom of a pond making it more difficult to purify the water.
3. Birds can glide on warm air currents and rise higher in the sky with the warm air.

BLM 2-27, Insulation and R-Values
1. Total R-value for fibreglass is 6.28
R-value for 25 mm vermiculite is 2.13
Thickness of plywood is 40 mm
Total R-value for glass is 2.55
R-value for 25 mm clay brick is 0.34
2. Plywood has a higher R-value than glass for the same thickness therefore it would be a better insulator.
3. The total R-value of the wall is 20.70.

BLM 2-28, Heat versus Temperature
1. a) Temperature is related to the *average* kinetic energy of the particles. When you take a spoonful of soup out of a bowl, the particles are evenly mixed and the average kinetic energy of the particles in the spoon is the same as it is for the soup in the bowl.
b) The thermal energy is related to the *sum* of the kinetic energies of all the particles. Therefore, at the same temperature, a larger number of particles have a larger amount of thermal energy.
2. (a) When the hot water in beaker A is poured into beaker C, the temperature of the mixed water will be closer to 10°C than to 60°C (approximately 27°C) because there was twice as much water at 10°C than there was at 60°C before mixing. When the hot water in beaker B is poured into beaker D, the temperature will be half way between 10°C and 60°C (35°C) because there are equal amounts of water at each temperature.
(b) The mixture of B and D would have a higher temperature than the mixture of A and C.
(c) Depending on the new temperature of A, it is possible that the temperature of the mixture of the new A and C could be higher than the temperature of the mixture of B and D.
(d) The final temperature of the mixtures depends on the amount of water in the two original beakers and the temperature of the water in the two original beakers.

BLM 2-29, Thermal Energy Transfer

C	O	N	V	E	C	T	I	O	N	E	R	N	H	T
E	I	R	G	Y	B	O	F	R	O	E	M	E	A	R
S	U	T	B	C	S	R	L	T	F	A	A	W	R	A
N	E	C	E	C	O	E	O	L	T	T	H	A	O	N
D	A	U	T	N	H	N	E	S	I	A	S	V	T	S
N	E	R	L	A	G	C	D	N	B	S	H	E	C	F
O	I	R	G	A	T	A	S	U	H	A	I	S	U	E
I	E	E	A	R	V	U	M	T	C	E	M	O	D	R
T	P	N	E	R	L	I	R	O	A	T	T	U	N	R
A	S	T	E	A	F	T	S	O	R	A	I	S	O	S
I	O	S	T	D	U	N	B	R	S	T	T	O	C	A
D	U	O	N	I	C	E	I	W	I	T	C	H	N	A
A	R	L	O	A	W	S	D	I	U	L	F	E	E	R
R	C	T	E	N	E	R	G	Y	E	M	P	E	L	R
A	E	T	U	T	R	L	A	M	R	E	H	T	E	E

energy from a substance that has a higher temperature to a substance with a lower temperature

BLM 2-30, Air-to-Air Heat Pump
Summer:
Outdoor coils; when the gas condenses to a liquid, it releases energy to the outdoors
Compressor; compresses the gas to transform it to a liquid

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Expansion valve; allows the liquid to expand and cool
Indoor coils; as the liquid expands it is transformed to a gas and thus absorbs heat from the indoors
Winter:
Outdoor coils; expanded liquid evaporates to a gas and absorbs energy from the outdoors
Compressor; compresses the gas to a liquid
Expansion valve; Allows liquid to expand and cool
Indoor coils; as gas condenses to a liquid, it releases energy into the indoors

BLM 2-31, Chapter 6 Review
1. A
2. C
3. D
4. C
5. B
6. C
7. G
8. D
9. A
10. H
11. C
12. F
13. Convection requires that particles of a substance move from one place to another. Particles of a solid cannot move away from each other.
14. Waves can be formed by something exerting energy on the water at one place. The water in one place pushes on the water beside it and makes it go up and down. Each section of water causes the next section to go up and down. Something sitting on the water a long way from the source of the waves then moves up and down because the water on which it is floating is moving up and down.
15. radio, microwaves, infrared, light, ultraviolet, X-rays, gamma rays
16. When cool air rises, warm air moves horizontally and takes its place. When the cool air drops, the warm air that rose, moves horizontally and takes its place and, in the process, it cools. All of the motions together form a circle. The part of the circle that is near the surface of Earth is the wind that we feel.
17. Its colour and luster.
18. A good radiator must conduct heat efficiently and have a large surface area. It must conduct heat efficiently so it can transfer the heat from the inside to the outer surface quickly. It must have a large surface area so it will be in contact with a large amount of air on the outside.
19. a) The temperature of the water in the two beakers labelled B is the same as the temperatue of the water in the original beaker (A) before it was separated. Temperature is related to the *average* kinetic energy of the particles in the water. The average kinetic energy does not change when water is poured from one beaker to another.
b) The thermal energy of the water in the two beakers (B) after the water was separated into two beakers is NOT the same as it was when it was in the original beaker (A). Thermal energy is the *sum* of the kinetic energies of all of the particles. Since there are fewer particles in the beakers in B, there is less thermal energy in each beaker than there was in the original beaker (A).

BLM 2-32, Unit 2 Review
1. D
2. B
3. D
4. A
5. B
6. D
Measuring Heat: 10., 14., 20., 22.
States of Matter: 9., 13., 16., 18.
Particle Theory: 7., 12., 15., 19.,
Transferring Heat: 8., 11., 17., 21., 23.

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24. A substance must change in a visible or measurable way in order to be used to measure temperature.
25. In order to melt, the solid must absorb enough energy so that the particles have enough energy to break away from the attractive forces with the neighboring particles.
26. The design of buildings and bridges must allow for the thermal expansion and thermal contraction of the materials and prevent damage to the structure when these changes occur. For example, the concrete surface of a bridge could expand on a hot summer day. If there was no room for expansion, the concrete would crumble.
27. Heat is conducted from the water inside the radiators to the outside surface and is conducted to the layer of air in contact with the surface. When the air in contact with the surface of the radiator becomes warm, the heat is transferred throughout the room by convection. Radiation occurs when the flames in the furnace radiate energy to the metal container that holds the water that is being heated. To some extent, radiation also occurs from the surface of the radiators to the room air.
28. Copper is a very good conductor of heat. It efficiently conducts heat from the stove coil through the copper bottom to the material on the inside of the frying pan.
29. A vacuum is the very best insulator because there are no particles present to carry out conduction or convection.

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DATE: NAME: CLASS:

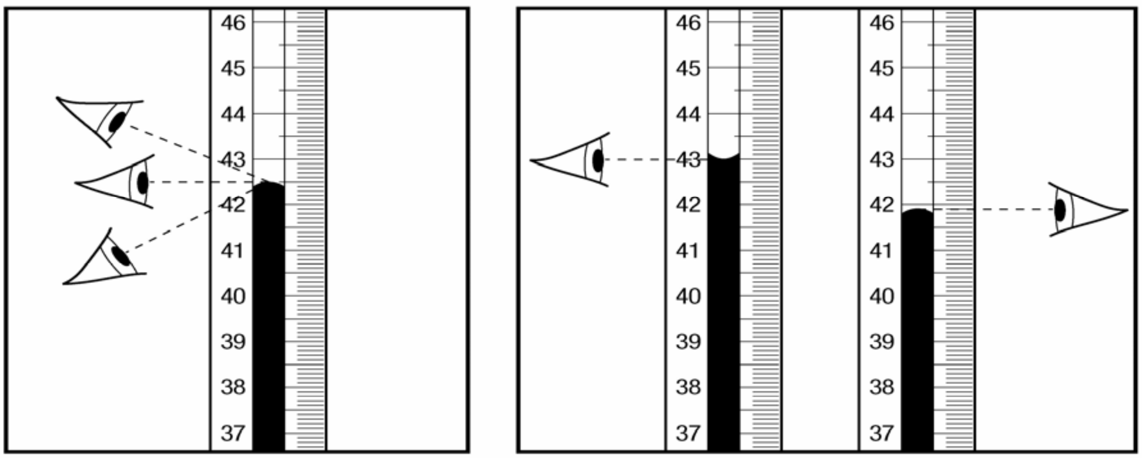
CHAPTER 4 **Reading a Thermometer** BLM 2-4

Reading a Thermometer

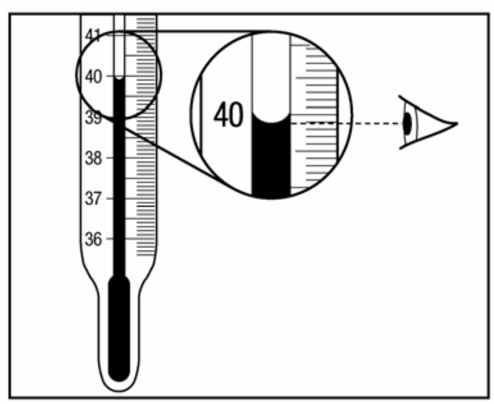
Goal • Learn to read a thermometer accurately.

Think About It

- When experimental measurements are made, errors caused by carelessness (like misreading a number on the scale) can occur. The most common errors are parallax errors and reading errors
- A parallax error occurs when your eye is not placed directly opposite the scale where the reading is being taken.
  When reading liquid levels, your eye must be lined up with the top or bottom of the meniscus.



- A reading error occurs when you must estimate because the liquid lies somewhere between scale divisions. Try to estimate as accurately as possible (to the nearest half degree).



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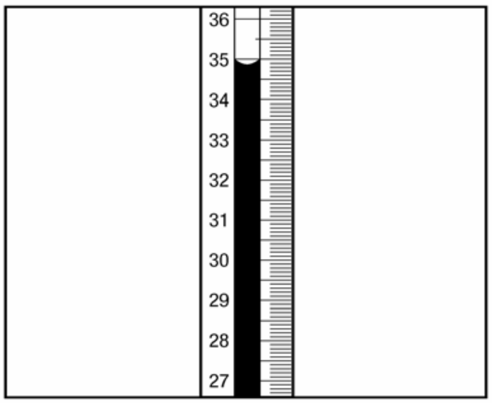
What to Do

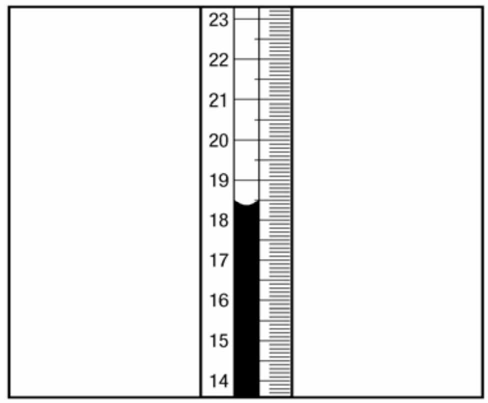
- Use the information on the previous page to help you write answers to the following questions in the space provided.

1. What is the temperature reading indicated by each thermometer?

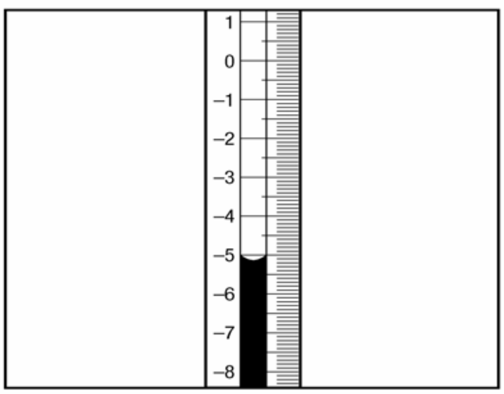
a)



b)



c)



2. Draw a thermometer to illustrate each of the temperatures below.

a) 52.0°C b) –2.0°C c) 20.5°C

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CHAPTER 4

The Thermometer

BLM 2-5

Goal • Review the parts of a laboratory thermometer and some common temperatures.

What to Do

- Write answers to the questions below and follow the instructions given to complete the diagram of the thermometer.

1. What liquid is in the thermometer?

____

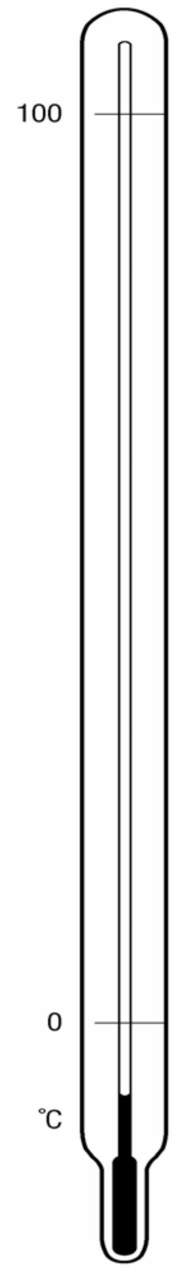
2. On the diagram of the thermometer, label the stem, bulb, and bore.

3. With a ruler, accurately mark off the scale divisions between the two reference points. Mark every 10 degrees.

4. In what temperature scale is this thermometer now calibrated?

5. Extend the liquid level inside the thermometer until it shows a reading equal to normal human body temperature.

6. Add the following two labels to the diagram:
   (a) temperature of freezing water,
   (b) temperature of boiling water.



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CHAPTER 4

Motion Within a Thermometer

BLM 2-6

Goal • Review key terms related to thermometers and thermal energy.

What to Do

- Look at the words in the first column. Drop one of the letters and you will have the scrambled word that matches the definition in the second column. Write the word in the blank spaces provided and write the dropped letter in the last column. When you are finished, the letters in the last column will spell out an important word.
  The word is ___ ___ ___ ___ ___ ___ ___ ___ ___.

PLACES	a set of marks and numbers used for measurement ___ ___ ___ ___ ___	
STEAM	the outer, long part of the thermometer ___ ___ ___ ___	
BLURB	acts as the reservoir of the thermometer ___ ___ ___ ___	
GESTERED	equal temperature intervals ___ ___ ___ ___ ___ ___ ___	
WAITER	boils at 100°C measured at sea level ___ ___ ___ ___ ___	
TEACH	changes in thermal energy that occur due to particle movement ___ ___ ___ ___	
GREENLY	measured in joules ___ ___ ___ ___ ___ ___	
EMOTION	particles are always in "__________" ___ ___ ___ ___ ___ ___	
ROBES	narrow opening through which liquid moves in a thermometer ___ ___ ___ ___	

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DATE: NAME: CLASS:

CHAPTER 4 | BLM 2-7

"Fixed" Temperatures

Goal • Extend your knowledge about the freezing point and boiling point of water.

Think About It

A "fixed" temperature is a temperature at which a certain change always takes place *under given conditions*. For example, water always boils at a temperature of 100°C *when measured at sea level*. Pure water always freezes at 0°C.

What to Do

Write answers to the following questions in the space provided.

1. Adding salt to water decreases the water's freezing point. That is, a lower (colder) temperature than 0°C is required for salty water to freeze.
   (a) What happens when you sprinkle salt on an ice cube?

   ____

   ____

   (b) Why is salt put on roads in the winter?

   ____

   ____

2. At sea level, water boils at 100°C. At higher altitudes, however, water boils at lower temperatures. The air pressure at higher altitudes is lower. At lower air pressures, less thermal energy is needed for water to reach its boiling point. In fact, the temperature at which water boils decreases by 3°C for every 1000 m above sea level.

   (a) At what temperature does water boil in a town located 1000 m above sea level?

   ____

   (b) At what temperature does water boil in a town located 2500 m above sea level?

   ____

   (c) Suppose the temperature of boiling water is only 85°C. At what altitude above sea level was the temperature measured?

   ____

   (d) How might a lower boiling point affect people who go camping in the mountains?

   ____

   ____

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DATE: NAME: CLASS:

CHAPTER 4 **Wind Chill** BLM 2-8

Goal • Use this wind chill chart to determine the wind chill given temperature and wind speed.

Canadian Wind Chill Chart

Temperature (°C)

Wind Speed (km/h)	5	0	–5	–10	–15	–20	–25	–30	–35	–40	–45	–50
5	4	–2	–7	–13	–19	–24	–30	–36	–41	–47	–53	–58
10	3	–3	–9	–15	–21	–27	–33	–39	–45	–51	–57	–64
15	2	–4	–11	–17	–23	–29	–35	–41	–48	–54	–60	–66
20	1	–5	–12	–18	–24	–30	–37	–43	–49	–56	–62	–68
25	1	–6	–12	–19	–25	–32	–38	–44	–51	–57	–64	–70
30	0	–6	–13	–20	–26	–33	–39	–46	–52	–59	–65	–72
35	0	–7	–14	–20	–27	–33	–40	–47	–53	–60	–66	–73
40	–1	–7	–14	–21	–27	–34	–41	–48	–54	–61	–68	–74
45	–1	–8	–15	–21	–28	–35	–42	–48	–55	–62	–69	–75
50	–1	–8	–15	–22	–29	–35	–42	–49	–56	–63	–69	–76
55	–2	–8	–15	–22	–29	–36	–43	–50	–57	–63	–70	–77
60	–2	–9	–16	–23	–30	–36	–43	–50	–57	–64	–71	–78
65	–2	–9	–16	–23	–30	–37	–44	–51	–58	–65	–72	–79
70	–2	–9	–16	–23	–30	–37	–44	–51	–58	–65	–72	–80
75	–3	–10	–17	–24	–31	–38	–45	–52	–59	–66	–73	–80
80	–3	–10	–17	–24	–31	–38	–45	–52	–60	–67	–74	–81

Source: Environment Canada, Wind Chill Information Site: www.windchill.ec.gc.ca

Frost Bite Guide

Low risk of frostbite
Risk of frostbite in 10 to 30 min of exposure
High risk of frostbite in 5 to 10 min of exposure
High risk of frostbite in 2 to 5 min of exposure
High risk of frostbite in 2 minutes of exposure or less

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What to Do

Answer the following questions about wind chill.

1. What is the wind chill if the temperature is –20°C and the wind speed is 35 km/h?

   ____

2. How can you protect yourself from frostbite if you have to go out when the wind chill is very low?

   ____

   ____

3. Estimate how quickly frostbite could occur if the wind chill is –50. _________________

4. Why do you think there is no unit provided for wind chill? _______________________

   ____

5. List two combinations of temperature and wind speed that will result in a wind chill of –35.

   ____________________ or ____________________

6. If the wind chill is –60 and the temperature is –40°C, what is the wind speed? _______

7. If the wind speed is 30 km/h and the wind chill is –33, what is the temperature? What is the risk of frostbite?

   ____

8. If the temperature is – 30°C and the wind speed is 40 km/h, what is the risk of frostbite?

   ____

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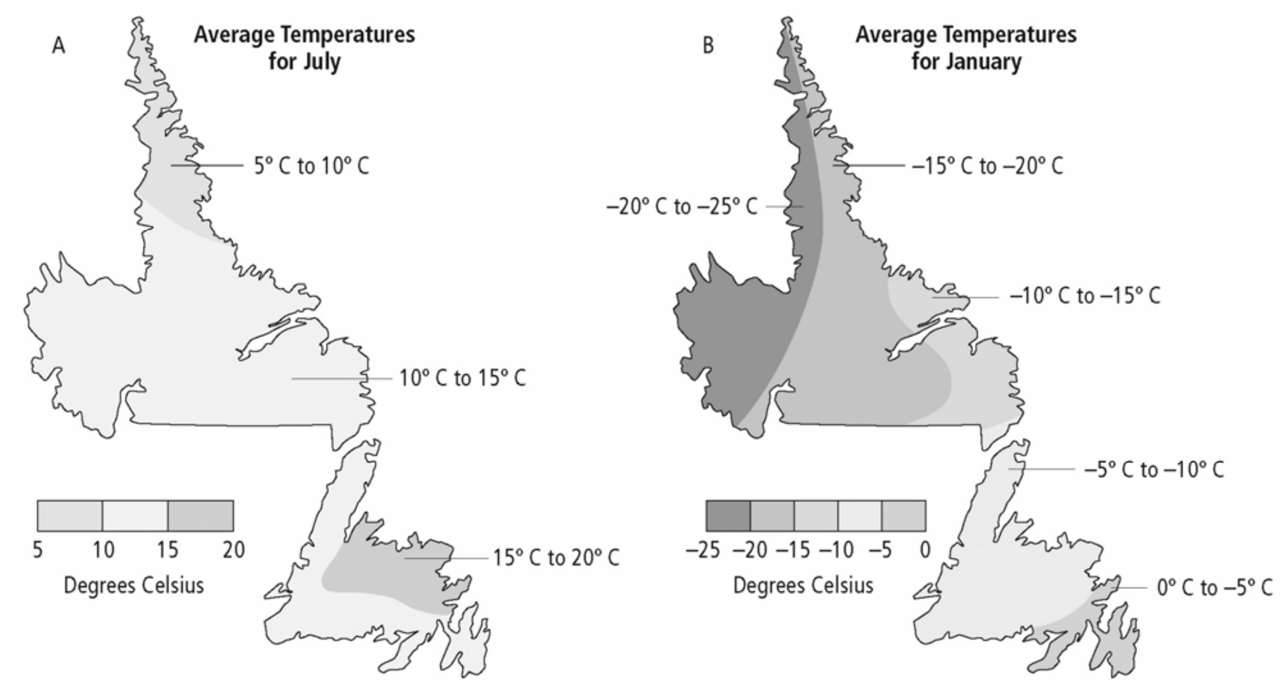
Goal	• Increase your skills in interpreting climate maps.

Map A in the figure shows the average temperatures in Newfoundland and Labrador in July and Map B shows the average temperatures in January.



What to Do

Use the maps in the figure above to help you follow the directions and answer the questions below.

1. On the maps above, shade and label areas on the borders of Newfoundland and Labrador that are connected to land.

2. Label the areas that are in contact with ocean water.

3. Fill in the table on the next page with “land,” “water,” or “both” according to temperature ranges on the maps and the labels that you placed on the maps.

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DATE: NAME:

BLM 2-9
continued

	Location (beside land, water, or both)
Coldest in Winter	
Warmest in Winter	
Coolest in Summer	
Warmest in Summer	

4. In the space provided below, write a short paragraph that describes the differences in climate between regions that are connected to land and regions that are beside water.

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