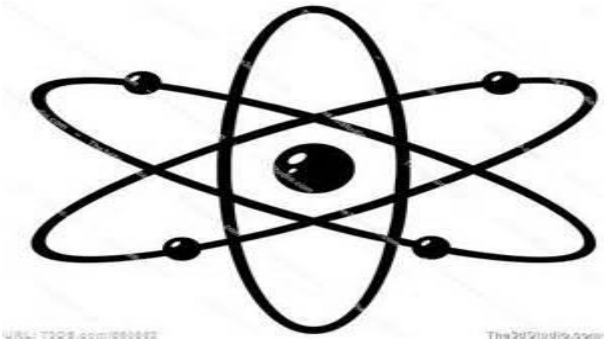
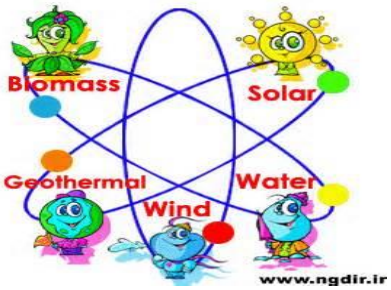
Broughton High School

CHAPTER 6

Thermal Energy





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Physical Science Vocabulary

Vocabulary for Chapter 6 – Thermal Energy

No.#	Term	Page #	Definition
1.	Degrees		
2.	Higher Specific Heat		
3.	Heat of Vaporization		
4.	Radiation		
5.	Temperature		
6.	Conduction		
7.	Boiling Point		
8.	100°C		
9.	Joules		
10.	Heat of Fusion		
11.	Expand		
12.	Heat		
13.	Convection		
14.	Melting Point		
15.	0° C		

No.	Term	Page #	Definition
16.	Liquids or gases (Fluids) transfer heat by of vaporization		
17.	Flat Line (No slope) on a heating/cooling curve		
18.	High Cp (Specific Heat)		
19.	2 containers with the same temperature		
20.	Direction of Heat Flow		

Unscramble Energy Vocabulary Words

GYENER

TINKCEI

TOLTANIPE

MCHIALEC

AHET

CNREULA

CITRTCIELEY

DAIRIOTAN

LEJSU

NOICUTCODN

VOTNCOCNIE

ROWK

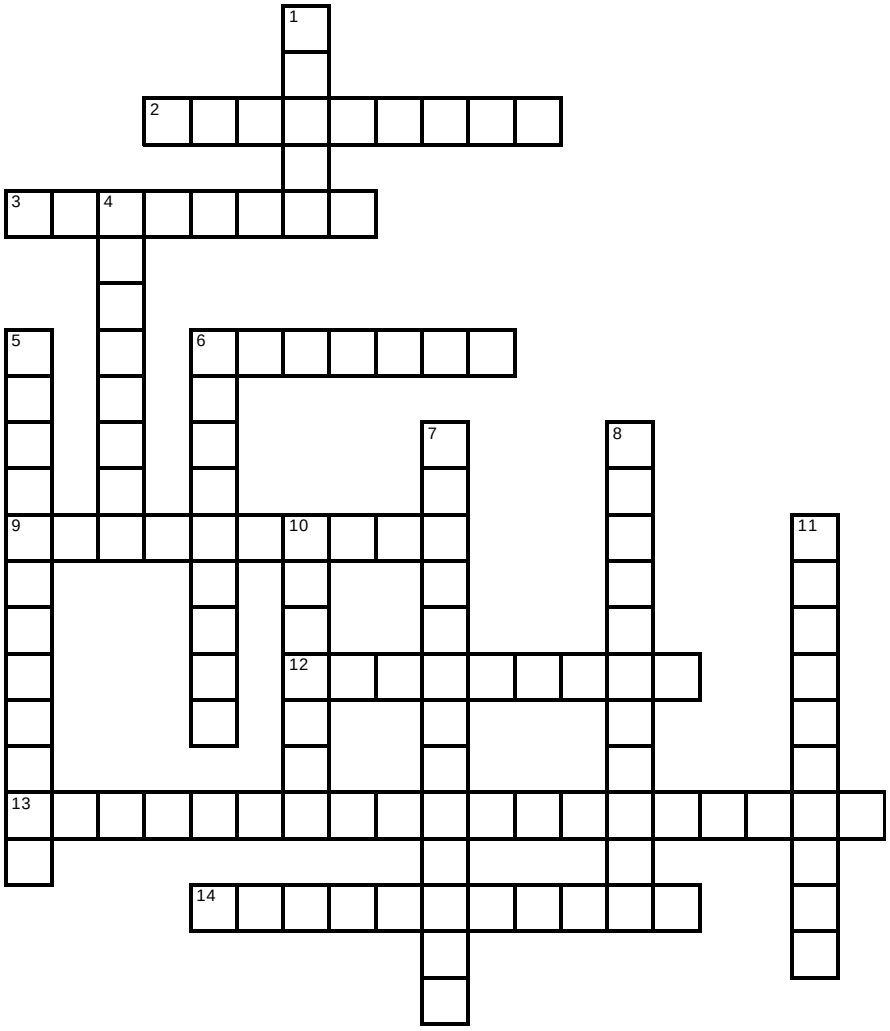
Heat Word Search

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

WORD BOX

Absolute Zero
Change Of State
Conduction
Conductor
Convection
Heat
Heat Engine
Insulation
Insulator
Radiation
Specific Heat Capacity
States of Matter
Temperature
Thermal Energy
Thermal Expansion
Thermal Pollution

Heat Crossword Puzzle



Across

2 A material that doesn't conduct heat well. (**9**)

3 What electromagnetic rays that transfer heat are called. (**8**)

6 Temperature is usually measured in degrees _____. (**7**)

9 Flow of heat between two objects that are touching. (**10**)

12 Heat transfer across empty space. (**9**)

13 How well a material conducts heat? (**7,12**)

14 A measure of how hot or cold something is. (**11**)

Down

1 The unit that heat is measured in. (**5**)

4 Force that generates heat when two objects are rubbing. (**8**)

5 The amount of heat energy a material required to change the temperature of a material. (**4,8**)

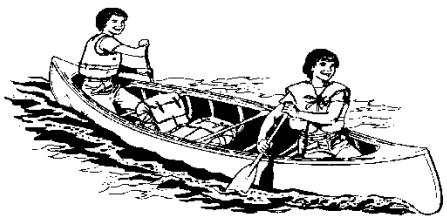
6 A material that does conduct heat well. (**9**)

7 Temperature is a measure of the average _____ of the particles in a material. (**7,6**)

8 A tool used to measure temperature. (**11**)

10 Another word for heat. (**7**)

11 Flow of heat in liquids and gases. (**10**)



Section 1: - Temperature and Heat

A. _____ - related to the average kinetic energy of an object's atoms or molecules.

B. _____ - the sum of the kinetic and potential energy of all the atoms in an object.

1. Thermal energy _____ as temperature increases.
2. At constant temperature, thermal energy increases if _____ increases.

C. Thermal energy that flows from something at a higher temperature to something at a lower temperature is called _____.

D. . _____ - amount of heat needed to raise the temperature of 1 kg of a material by 1 degree C or K.

E. Changes in thermal energy can be calculated as *change in thermal energy equals* _____ *times change in temperature times specific heat*.

1. When heat flows into an object and its temperature rises, the change in temperature is _____
2. When heat flows out of an object and its temperature decreases, the change in temperature is _____.
3. A _____ is used to measure specific heat.

Section 2: - Transferring Thermal Energy

A. _____ - transfer of thermal energy through matter by direct contact of particles.

1. Kinetic energy is transferred as particles _____.
2. _____, particularly metals, are good heat conductors.

B. .The transfer of energy by the motion of heated particles in a fluid is called _____.

1. Convection _____ transfer heat from warmer to cooler parts of a fluid.
2. Convection currents create _____ and _____ over different regions of Earth.

C. _____ - energy transfer by electromagnetic waves.

1. Some radiation is _____ and some is _____ when it strikes a material.
2. Heat transfer by radiation is _____ in a gas than in a liquid or solid.

D. Most living things control the flow of heat by using special features such as fur, _____, or scales.

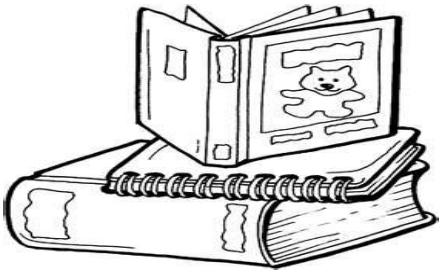
E. _____ - material that does not let heat flow through it easily.

1. Gases such as _____ usually make better insulators than liquids or solids.
2. A _____ layer in a thermos is a good insulator because it contains almost no matter to allow conduction or convection to occur.

Section 3: - Temperature and Heat

Directions: Determine whether then italicized term makes the statement true of false. If the statement is true write **true** in the blank. If the statement is **false**, with the correct term on the line that makes the statement true.

1. _____ Particles that make up matter are in *constant* motion.
2. _____ The faster particles move the *less* kinetic energy they have.
3. _____ *Temperature* is the measure of the average kinetic energy of the particles in an object.
4. _____ When temperature *increase*s, the kinetic energy of the particles decreases.
5. _____ The thermal energy of an object is the *total* energy of the particles in a material.
6. _____ A 5kg chunk of aluminum and a 5-kg block of silver that are at the same temperature have *the same* thermal energy.
7. _____ Heat flows from a *higher* temperature to a lower temperature.
8. _____ Heat is measured in *newton's*.
9. _____ Different materials need the same amounts of heat to have similar changes in
10. _____ The amount of energy it takes to raise the temperature of 1kg of a material 1 Kelvin is the specific heat of the material.
11. _____ Water has a relatively *low* specific heat.
12. _____ Materials with a high specific heat can absorb lot of energy and show *little* change in temperature.



Section 4: - Temperature and Heat (Directed Reading)

Directions: Determine In each of the following statements, a term has been scrambled. Unscramble the term and write it on the line.

1. _____ If the particles move *llsowy* the object's temperature falls.
2. _____ Conduction can take place in solids, liquids, and *sages*.
3. _____ Thermal energy includes both kinetic and *ttnepoail* energy.
4. _____ Any material that can flow is *lufdi*.
5. _____ Any material that allows heat to pass through it easily is a *roconcutd*.
6. _____ Materials with a high specific heat can absorb heat without a large *hngcae* in temperature.

7. _____ Radiation is the transfer of energy in the form of *vaews.*
8. _____ When an object increases in temperature it *naigs* thermal energy.
9. _____ Many conductors, such as silver and copper, are *lemtas*.
10. _____ Energy that travels by radiation is often called *darinta greeny*.
11. _____ Insulators, such as wood and air, are poor conductors of *thea*.
12. _____ The transfer of thermal energy by convection and conduction both require *atterm*.

Section 5: - Thermal Energy Equation

Directions: Answer the following questions about specific and thermal energy.

13. Change in thermal energy can be calculated using the equation $Q = m \times \Delta T \times C_p$
    a. In this equation, what does ***Q*** represent? _____.
    b. What does ***m*** represent? _____.
    c. What does **Δ*T*** represent? _____.
    d. What does ***C*** represent? _____.
    e. What does the symbol **Δ** mean? _____.
    f. Why is the symbol **Δ** used with T but not ***Q***?
    _____
    _____
    _____
14. What formula is used to calculate ΔT? _____.

Section 6: - Overview Thermal Energy I

Directions: Use the terms from the word bank to complete the summary statements.

Collusions	**Heat**	**Temperature**
Cooler	**Kinetic Energy**	**Thermal energy**
Faster	**Potential Energy**	**Warmer**

As the (**1**) _____ of an object increase, the particles in the object move (**2**) _____.

As a result the average (**3**) _____ of the particles increases.

The sum of the kinetic energy and the (**4**) _____ of the particles in an object is the (**5**) _____ of the object.

When a substance at a higher temperature comes in contact with a substance at a lower temperature, (**6**) _____ between the particles in the two substances cause thermal energy to move from the (**7**) _____ object to the (**8**) _____object.

Thermal energy that flows due to a difference in temperature is (**9**) _____.

Section 7: - Overview Thermal Energy II

Directions: Complete the concept map using the terms listed below.

Radiation **Insulators** **Electrical** **Conductors** **Forced-Air** **Convection**

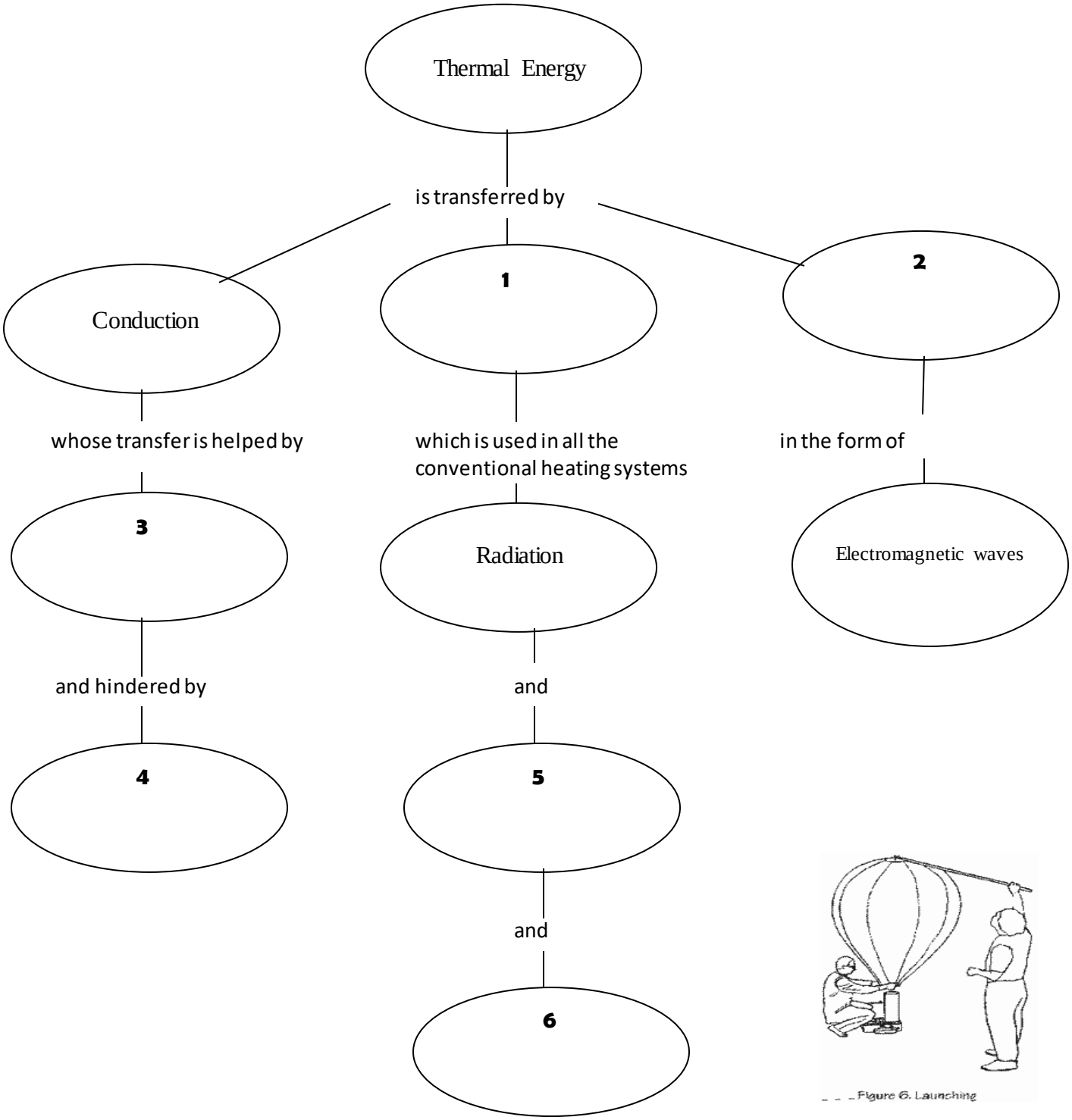


Figure 6. Launching

Section 8: Specific Heat *Broughton High School*

Specific Heat Equations I

Q = m Cp ΔT

1		1 kg	388 j/kg*C zinc	1°C
2		2 kg	385 J/kg*C copper	1°C
3		12 kg	228 J/kg*C tin	6°C
4		80 kg	449 J/kg *C gold	21°C
5		1 kg	129 J/kg*C lead	0.5°C
6		2kg	4,186 J/kg*C water	0.5°C
7		43 kg	2,400 J/kg*C ethyl alcohol	11°C
8		1 kg	450 j/kg*C iron	3°C
9		10 kg	920 J/kg*C aluminum	61°C
10		2.9 kg	385 J/kg*C copper	50°C

11 A 2kg block of which metal from the Table above would require 898J to raise its temperature by 1C°?

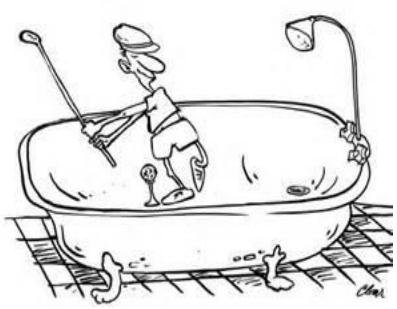
_____

12. Using the Cp values from above, how much heat is required to warm a 1 kg block of zinc from 10° – 12°C?

_____

13. A metal block and a brick of the same mass are placed in the Sun. What is the property of matter that will make one hotter to the touch than the other? _____

14. Using the Cp values from the Table above, circle the substance in each pair that will heat up ***fastest***.
    a. Zinc or Aluminum
    b. Lead or Gold
    c. Iron or Tin
    d. Copper or Water
    e. Water or ethyl Alcohol
    f. Copper or Zinc

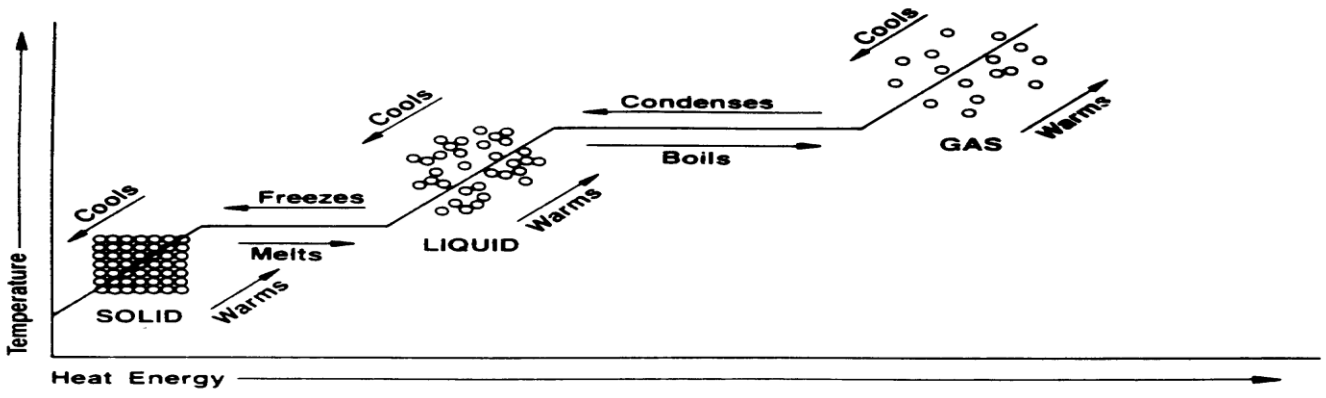


15. Circle the substance in each pair that will cool down ***slowly***.
    a. Water or Gold
    b. Water or Ethyl Alcohol
    c. Copper or Tin
    d. Lead or Iron

16. Circle the substance in the pair that will hold its heat the longest when at a temperature of 100°C.
    a. Copper or Iron
    b. Gold or Lead
    c. Water or Ethyl Alcohol
    d. Aluminum or Tin
    e. Zinc or Iron
    f. Tin or Lead

Directions: Circle the correct response

17. A High Specific Heat Capacity means the substance will:
    - Heat Up (quickly or slowly)
    - Cool down (quickly or slowly)
    - Will hold its heat for a (longer time or shorter time)



Section 9: Specific Heat *Broughton High School*

Specific Heat Equations II

Q = mass x ΔT x specific heat

Hint: ΔT = (Final temperature – Initial temperature)

1. How many joules of heat are required to raise the temperature of 25 kg of water from 10ºC to 90°C? The specific heat of water is 4,184 J/kgºC

Formula	Set Up & Solve	Answer

2. How many joules of heat are necessary to raise the temperature of 42kg of ice from -5°C to 25ºC of water?

Formula	Set Up & Solve	Answer

3. How much energy is needed to raise the temperature of 50 grams of ice at -70ºC to vapors at 107°C?

Formula	Set Up & Solve	Answer

4. How many joules are necessary to cool 60 grams of water vapor at 210°C to water at 60ºC?

Formula	Set Up & Solve	Answer

Q = mass x ΔT x specific heat

Hint: ΔT = (Final temperature – Initial temperature)

4. How many joules of heat are necessary to raise the temperature of 400 kg of vapor from 101°C to 131ºC?

Formula	Set Up & Solve	Answer

5. How much energy must be transferred as heat to 420 kg of water in a bathtub in order to raise the water's temperature from 25°C to 37ºC?

Formula	Set Up & Solve	Answer

6. How much energy must a refrigerator absorb from 225 grams of water so that the temperature of the water will drop from 35°C to 5ºC?

Formula	Set Up & Solve	Answer

Explain the specific heat difference between "Hot" & "Cold" objects?

_____
_____
_____
_____
_____
_____

_____
_____
_____
_____
_____
_____

1. _____ - a measure of the average kinetic energy of each particle within an object.
2. Three temperatures scales: _____, _____, _____
3. _____ the total energy of the particles that make up an object.
4. _____ - thermal energy moves from an object at a higher temperature to an object at a lower temperature.
5. Heat transfer occurs by: _____.
6. _____ -transfers heat well.
7. _____ - The amount of heat necessary to raise a given mass of a substance by a specific temperature. Matter can exist in three states of matter: solid, liquid, and gas.
8. Matter can undergo a change in of matter when _____ energy is _____ or _____.
9. When a substance is changing its state of matter, the temperature remains _____.
10. There are _____ changes.
11. In general, matter _____, when it is heated and _____ when it is cooled.
12. _____ -the physical change of matter from one state or (***phase***) to another.
13. _____ -The change from a solid to the liquid form of matter.
14. _____ - The temperature at which a substance melts.
15. _____ - The change from a liquid to a solid.
16. _____ - The temperature at which a substance freezes.
17. _____ - The change from the liquid to a gas.
18. _____ - Vaporization that occurs at the surface of a liquid.
19. _____ - Vaporization that occurs below the surface of a liquid.
20. _____ - The temperature at which a liquid substance boils.
21. _____ - The change from a gas to a liquid.

Question:

22. Why is it true that a cup of boiling water contains less heat than a large iceberg?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

23. Which beaker of water (in the picture) has more thermal energy of heat?

_____ _____

24. Why does a beaker of water at 80°C feel hot while a beaker of water at 10°C feel cold?

_____

_____

_____

_____

25. How do insulators slow the transfer of heat?

_____

_____

_____

26. In conduction, heat is transferred due to _____ through _____ and it occurs best in _____.

27. This transfer of heat occurs until _____ and that is called _____.

28. Convection is the transfer of heat through a _____ or a _____ using moving currents called _____.

29. These currents are the cause of the _____ and the _____.

30. Radiation is the transfer of heat through _____ and it can occur in _____ and there is no _____ required.

31. Dark or dull objects _____, _____ than shiny objects do.

32. The amount of heat energy required to raise the temperature of a material is called _____.

33. Which sample pictured will take longer to heat to 100°C? _____, _____

34. This means that _____, will take longer to cool down.

35. Heat (Q) depends on 3 things: _____, _____, and _____.

Find your way out?

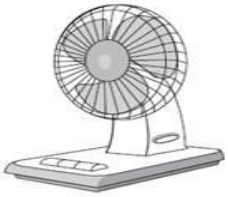
END

Forms of Heat Energy

QUESTION ONE

These devices transform electrical energy into other useful forms of energy.

1
Kettle



2
Fan

3
Reading lamp

4
Bell

Match the useful forms of energy, **A**, **B**, **C** and **D**, with the devices numbered **1–4**.

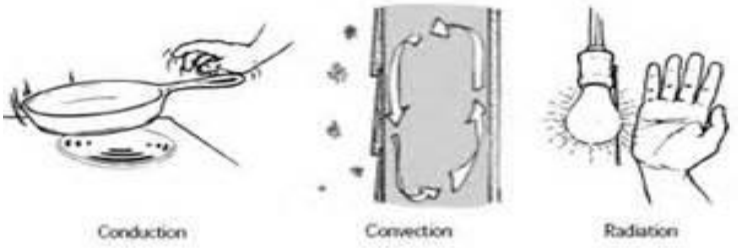
A heat (thermal energy)

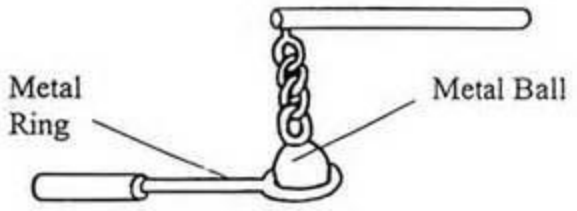
B light

C movement (kinetic energy)

D sound

Explain the different forms of Energy.





Conduction: _____

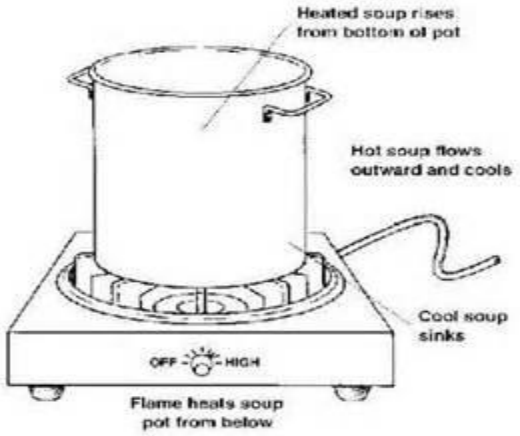
Convection: _____

Radiation: _____

Explain the heating of the metal ring?

_____

_____



Explain the heating of water inside this pot?

_____

_____

_____

_____

_____

_____

_____

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Section 12: Study Guide

SPECIFIC HEAT QUESTIONS

Directions: Use the reference data below to answer the following

Water = 4.19 J/g°C **Aluminum** = 0.92 J/g°C **Iron** = 0.45 J/g°C **Copper** = 0.38 J/g°C

1. At 100 degrees Celsius, which will cool faster; water or iron _____.
2. If 100 g of iron, copper, and aluminum were all heated to the same temperature, which of the three will contain the most heat? _____.
3. Which requires the most heat to change its temperature one degree? _____.

Directions: Check which one will require more heat

4. _____ 25 g of iron from 20 to 50°C _____ 55 g of iron from 20 to 50°C
5. _____ 15 g of iron from 45 to 75°C _____ 15 g of aluminum from 45 to 75°C
6. _____ 10 g of iron from 10 to 50°C _____ 10 g of iron from 30 to 50°C
7. Which of the metals in the table would experience the largest temperature increase for a given amount of heat input?

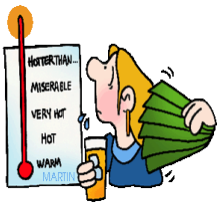
a. Copper
b. Gold
c. Lead
d. Zinc

Material	Specific Heat [J/(kg °C)]
Copper	385
Gold	449
Lead	129
Tin	228
Zinc	388

8. Using the table, how much heat would be required to raise the temperature of 4.0 kg of copper by 2.0ºC?

a. 190 J
b. 380 J
c. 3100 J
d. 790 J

Material	Specific Heat [J/(kg °C)]
Copper	385
Gold	449
Lead	129
Tin	228
Zinc	388



9. What is the difference between heat and temperature?

_____
_____
_____
_____

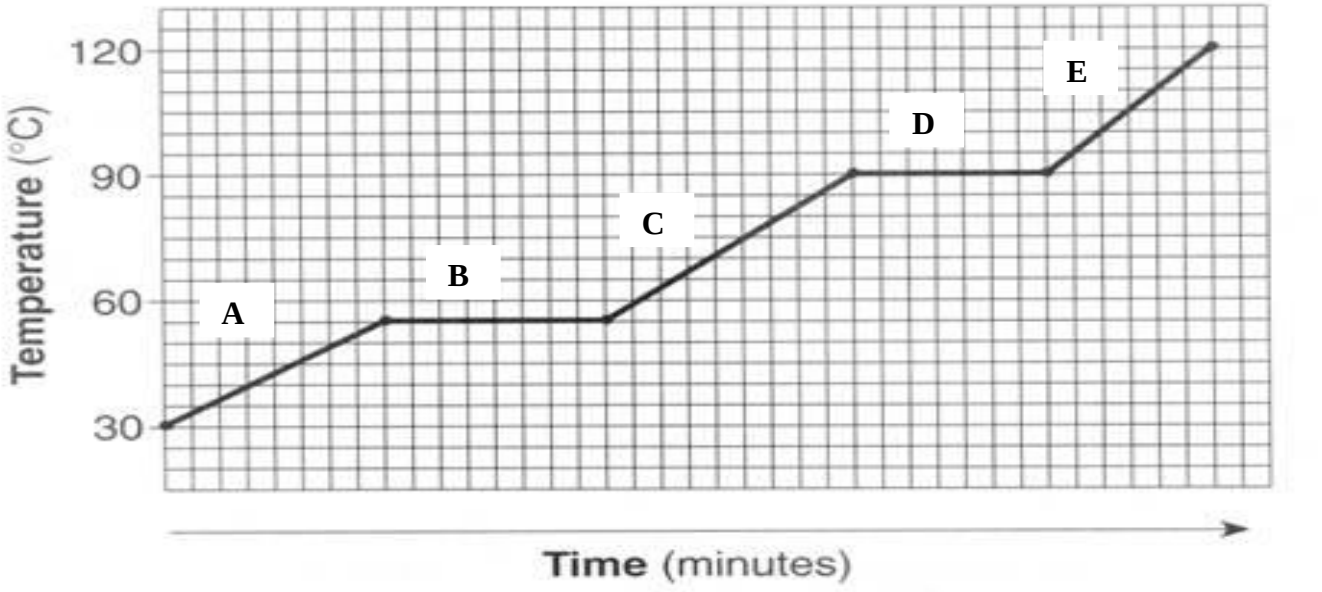
HIGHER TEMPERATURE

Directions: check which has the higher temperature

10. _____ your body temperature _____ comfortable classroom temperature
11. _____ boiling water _____ hot tap water
12. _____ a cellar in the summer _____ an attic in the summer

INTERPRETING GRAPHICS

Use the graph below to choose the best answer for each question.



13. Which section(s) of the graph show an increase in potential energy? _____.
14. Which section(s) of the graph show an increase in kinetic energy? _____.
15. Which section(s) of the graph represents melting? _____.
16. Which section(s) of the graph represents boiling? _____.
17. What is the boiling point of the substance? _____.
18. A student sitting near you says that the substance represented on the graph is water. You do not think so because:

_____
_____

19. Which section(s) of the graph show constant temperature? _____.
20. Which section(s) of the graph show an increase in temperature? _____.

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Specific Heat Problems

Heat or energy can be measured in units of calories of joules. When there is a temperature change (ΔT), heat (Q) can be calculated using the formula:

Formula: Q = mass x ΔT x specific heat - Hint: ΔT = (Final temperature – Initial temperature)

1. How many joules of heat are required to raise the temperature of 215 kg of water from 10ºC to 90°C? The specific heat of water is 4,184 J/kgºC.

Formula	Set Up & Solve	Answer

2. How many joules of heat are necessary to raise the temperature of 42kg of ice from -15°C to 25ºC of water?

Formula	Set Up & Solve	Answer

3. How much energy is needed to raise the temperature of 50 grams of ice at -70ºC to vapors at 107°C?

Formula	Set Up & Solve	Answer

4. How many joules are necessary to cool 60 grams of water vapor at 210°C to water at 60ºC?

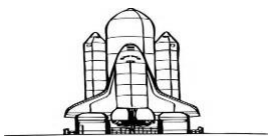
Formula	Set Up & Solve	Answer

5. How many joules of heat are necessary to raise the temperature of 40kg of vapor from 101°C to 131ºC?

Formula	Set Up & Solve	Answer

What is the only year is the space shuttle take ice cream in space?

_____



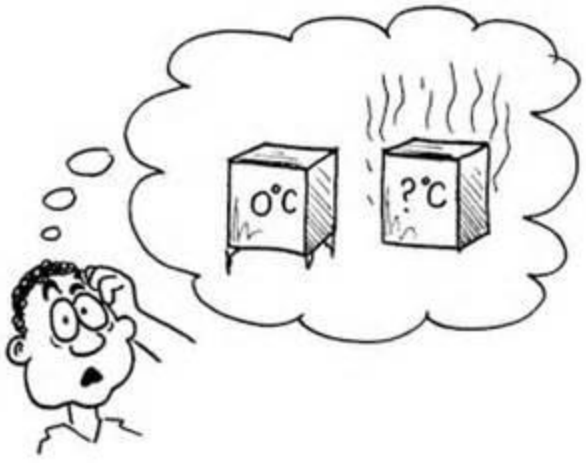
Specific Heat Problems

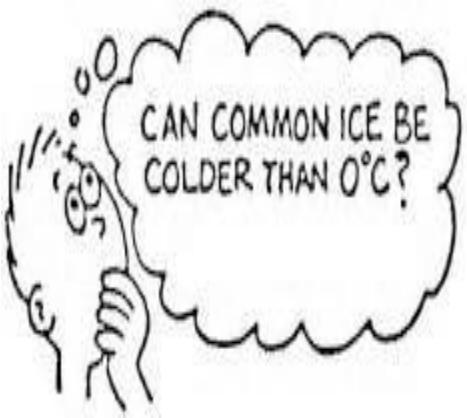
6. How much energy must be transferred as heat to 420 kg of water in a bathtub in order to raise the water's temperature from 25°C to 37ºC?

Formula	Set Up & Solve	Answer

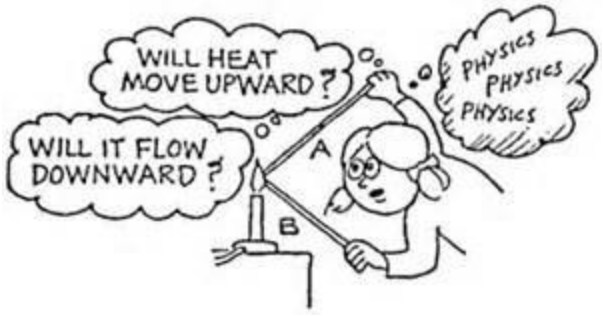
7. How much energy must a refrigerator absorb from 225 grams of water so that the temperature of the water will drop from 35°C to 5ºC?

Formula	Set Up & Solve	Answer





_____ _____



_____ _____

Chapter 6: Thermal Energy – Study Guide

1. When you measure the temperature of an object, you are measuring _____.

- **A)** the average chemical energy of its particles
- **B)** the sum of its kinetic and potential energies
- **C)** the average kinetic energy of its particles
- **D)** the specific heat of the object

2. Which of the following substances has the highest specific heat?

- **A)** glass
- **B)** iron
- **C)** water
- **D)** carbon

3. Which of the metals in the table would experience the largest temperature increase for a given amount of heat input?

Material	Specific Heat [J/(kg °C)]
Copper	385
Gold	449
Lead	129
Tin	228
Zinc	388

- **A)** copper
- **B)** gold
- **C)** lead
- **D)** zinc

4. Using the table, how much heat would be required to raise the temperature of 4.0 kg of copper by 2.0ºC?

Material	Specific Heat [J/(kg °C)]
Copper	385
Gold	449
Lead	129
Tin	228
Zinc	388

- **A)** 190 J
- **B)** 380 J
- **C)** 3100 J
- **D)** 790 J

5. A 10.0 kg block of lead is heated in the Sun from 25.0ºC to 30.0ºC. Use the table to help calculate the change in the block's thermal energy?

Material	Specific Heat [J/(kg °C)]
Copper	385
Gold	449
Lead	129
Tin	228
Zinc	388

- **A)** 900 J
- **B)** 1300 J
- **C)** 6400 J
- **D)** 3900 J

6. Energy is transferred from the sun to the Earth by _____.

- **A)** conduction
- **B)** convection
- **C)** radiation
- **D)** conduction and radiation

7.

8. Which of these substances is likely to be the best insulator?

- **A)** ice
- **B)** steel
- **C)** oxygen
- **D)** water

9. A heat source is located under one end of a solid material. What process, represented in the illustration, carries heat to the other end of the block?

- **A)** convection
- **B)** conduction and radiation
- **C)** conduction
- **D)** radiation

10. According the first law of thermodynamics, the increase in thermal energy of a system is equal to _____.

A) work done on the system minus heat added to the system

B) heat added to the system minus work done on the system

C) work done on the system plus heat added to the system

D) the heat added to the system

11. Which of the following is most likely to conduct heat most efficiently?

A) air

B) wood

C) metal

D) fiberglass

12. Find the change in thermal energy of a 20-kg wooden chair that warms from 15º to 30º if the specific heat of wood is 700 J/(kgº).

A) 140,000 J

B) 210,000 J

C) 490,000 J

D) 1,090,800 J

13. Find the change in thermal energy of a 20-kg wooden chair that warms from 20º to 55º if the specific heat of wood is 700 J/(kgº).

A) 140,000 J

B) 210,000 J

C) 490,000 J

D) 1,090,800 J

14. Find the change in thermal energy of a 20-kg wooden chair that warms from 15º to 20º if the specific heat of wood is 700 J/(kgº).

A) 28,000 J

B) 210,000 J

C) 140,000 J

D) 490,000 J

15. Find the change in thermal energy of a 20-kg wooden chair that warms from 25º to 35º if the specific heat of wood is 700 J/(kgº).

A) 140,000 J

B) 210,000 J

C) 363,600 J

D) 490,000 J

16. Find the change in thermal energy of a 20-kg wooden chair that warms from 30º to 45º if the specific heat of wood is 700 J/(kgº).

A) 140,000 J

B) 210,000 J

C) 490,000 J

D) 1,090,800 J

17. The air in a living room has a mass of 72 kg and a specific heat of 1010 J/(kgº). What is the change in thermal energy of the air when it warms from 15º to 30º?

A) 140,000 J

B) 210,000 J

C) 490,000 J

D) 1,090,800 J

18. The air in a living room has a mass of 72 kg and a specific heat of 1010 J/(kgº). What is the change in thermal energy of the air when it warms from 20º to 55º?

A) 210,000 J

B) 490,000 J

C) 1,090,800 J

D) 2,545,200 J

19. The air in a living room has a mass of 72 kg and a specific heat of 1010 J/(kgº). What is the change in thermal energy of the air when it warms from 15º to 20º?

A) 140,000 J

B) 210,000 J

C) 363,600 J

D) 1,090,800 J

20. Thermal energy is the _____ of the particles in a material.

A) total energy

B) temperature

C) potential energy

D) average kinetic energy

21. Which of the following conducts heat most effectively?

A) gas

B) solid

C) plasma

D) liquid

22. _____ is a measure of the average kinetic energy of all the particles in an object.

- **A)** Radiation
- **B)** Temperature
- **C)** Density
- **D)** Conduction

23. Refrigerators use the process of _____ to remove heat from the interiors.

- **A)** evaporation
- **B)** compression
- **C)** sublimation
- **D)** combustion

24. The transfer of energy through matter by the direct contact of particles is called _____.

- **A)** radiation
- **B)** confluence
- **C)** conduction
- **D)** convection

25. Which of the following has an external combustion engine?

- **A)** air conditioner
- **B)** modern steam engine in a power station
- **C)** gasoline engine in a car
- **D)** early steam locomotive

26. Any material that flows is a _____.

- **A)** liquid
- **B)** gas
- **C)** fluid
- **D)** current

27. A(n) _____ is something that absorbs radiant energy from the Sun.

- **A)** radiator
- **B)** combustion engine
- **C)** solar collector
- **D)** heating coil

Chapter 6: Thermal Energy – Study Guide

28. _____ is the transfer of energy in the form of electromagnetic waves.

A) Conduction

B) Radiation

C) Refraction

D) Convection

29. Which of the following heating systems utilizes fuel to heat a mass of surrounding air that is blown through a series of ducts?

A) forced air

B) electrical

C) solar

D) radiator

30. Heat engines convert _____ energy into _____ energy.

A) potential, kinetic

B) mechanical, thermal

C) kinetic, potential

D) thermal, mechanical

31. A(n) _____ is a material that does not allow heat to move through it easily.

A) insulator

B) fluid

C) current

D) conductor

32. Which of the following would be the best material to use for making tea kettles?

A) aluminum, specific heat 920

B) graphite, specific heat 710

C) copper, specific heat 380

D) iron, specific heat 450

33. The opposite of evaporation is _____.

A) condensation

B) conduction

C) radiation

D) convection