Name: ______________________ Date: ______________ Hr.______

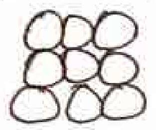
Unit 8 Homework Packet

Part 1: Phases of Matter

1. An ice cube is in the Solid phase.

2. Solids have a definite shape and definite volume.

3. Describe how the molecules are arranged and moving in the solid phase. Include a picture with your description.



particles are tightly packed due to strong intermolecular forces. They only vibrate

4. The phase change from a solid to a liquid is called melting.

5. A glass of water is in the liquid phase.

6. Liquids have a definite volume but not a definite Shape.

7. Describe how the molecules are arranged and moving in the liquid phase. Include a picture with your description.

particles are further apart than a ~~gas~~ solid and closer than a gas allowing particles to spread out. Energy is medium as is the intermolecular forces.

8. In order to get liquid water to become water vapor energy must be absorbed (added) to the liquid water.

9. The phase change from liquid to gas is called vaporization. There are two types of vaporization. evaporation which occurs only at the surface while boiling occurs anywhere within the liquid.

10. Gases have no definite Shape and no definite volume.

11. Describe how the molecules are arranged and moving in the gas phase. Include a picture with your description. Spread far apart

moving quickly - high energy

12. The phase change from a gas back to a liquid is called Condensation

13. During this phase change energy is released (given off) by the gas molecules as they slow down and rearrange into liquid molecules.

14. The phase change from a liquid back to solid is called freezing.

15. Dry ice turning directly into a gas is an example of what kind of phase change?
Sublimation

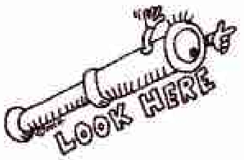
16. On a cold winter morning when you go out to a car and there is frost all over the windows where did the ice come from?

the gas vapor in the air

17. Frost is an example of what phase change? deposition

18. Pretend you are a molecule of ice. Write a paragraph about how your structure and properties change as you move from solid ice to liquid water, and ending with the gas water vapor.

Part 2: Phase Word Wizards



Challenge: Find three words that go together in each group of four words. One word will not fit in the group as well as the others.
- **Circle the word you are not going to use.**
- **Explain how the remaining words are related to each other.**

Example: solid liquid gas sublime
Answer1: Liquid is taken out because it is not a part of the process of sublimation. A solid sublimes to become a gas.

solid liquid gas sublime
Answer 2: Sublime is taken out because the other three are the phases of matter.

1. liquid gas solid ~~condense~~

   Phases of Matter

2. evaporate ~~freezing~~ boil vaporization

   all forms of change of a liquid to a gas

3. solid liquid melt ~~evaporate~~

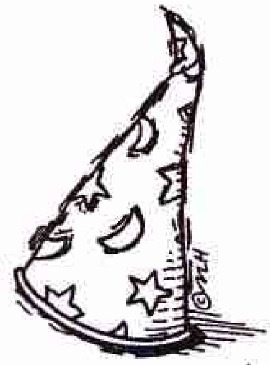
   evaporate is with a liquid and gas

4. shape liquid ~~volume~~ gas

   liquids and gases do not have a definite shape

5. liquid gas condense ~~sublimation~~

   Sublimation is a change from solid to gas



6. liquid volume solid shape

   2 ways to answer cross off volume both liquid/solid have definite shapes
   Cross off liquid because solid has definite shape & volu

7. rain condense ~~freezing~~ water vapor

   all 3 have liquid water

Part 3: Phase Change Identification

Write the name of the process next to each statement. The processes are:

deposition	**melting**	**condensation**
freezing	**vaporization**	**sublimation**

melting **1. Icicles drip**

vaporization **2. Wet clothes dry**

vaporization **3. Fog disappears**

Condensation **4. Water in the air becomes dew on the grass**

freezing **5. Kool-aid becomes popsicles**

Sublimation (Vaporization) **6. Frozen laundry becomes dry on the clothesline**

freezing **7. Water becomes ice**

melting **8. Frost becomes water**

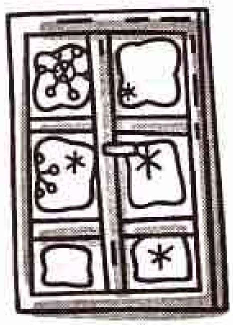
Vaporization **9. Water becomes steam**

Vaporization **10. Mud puddles disappear**

melting **11. Popsicles become pop**

Condensation **12. Water forms on windows – windows fog up**

Deposition **13. Water in the air (water vapor) becomes frost**



vaporization **14. Wet hair dries**

Condensation **15. Water in the air (water vapor) becomes rain**

Vaporization **16. Foggy windows clear up**

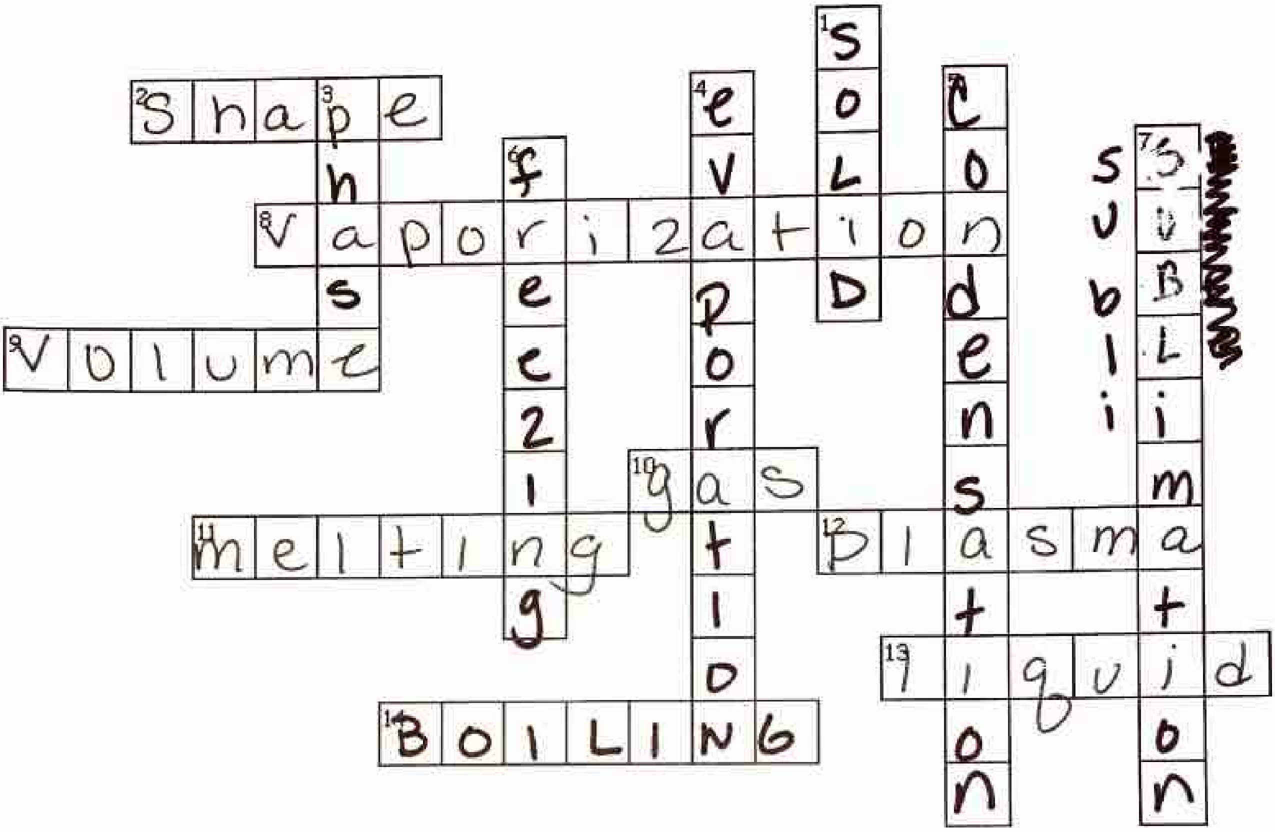
freezing **17. Water in the air becomes snow**

Vaporization **18. Perfume can be smelled**

Vaporization **19. Gasoline can be ignited without touching a match to the liquid.**

Sublimation **20. Dry ice can be used to make fake smoke and not make a mess.**

Part 4: Phases of Matter Crossword

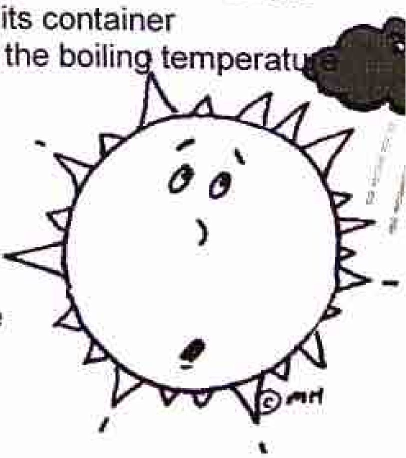


Across

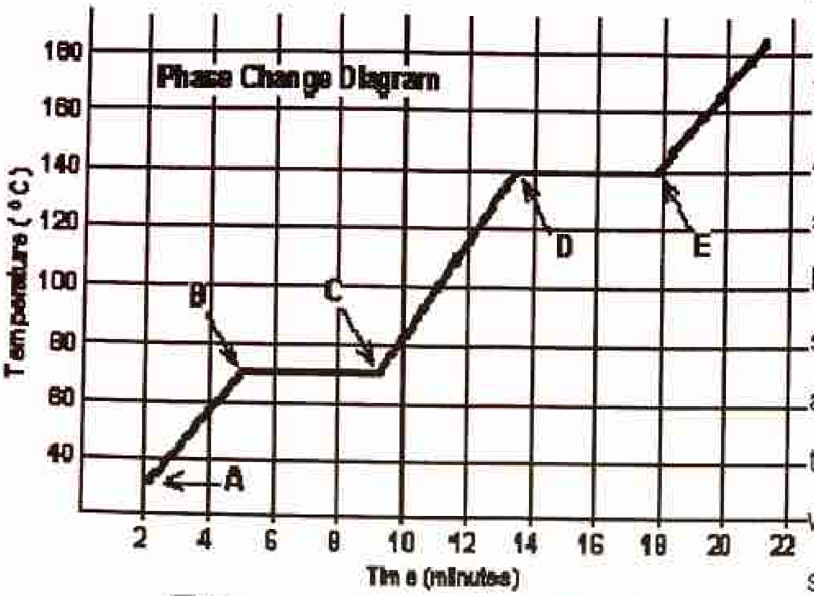
2. Only the solid phase has a definite ___________
8. Water becomes steam
9. The amount of space something takes up
10. The phase of matter which has no definite volume or shape and it tends to take the shape of its container
11. The change of a solid to a liquid
12. Matter which exists only at a very high temperature and is made of atomic nuclei and electrons
13. The phase of matter which has a definite volume and takes the shape of its container
14. The formation of bubbles of gas within a liquid which has been heated to the boiling temperature

Down

1. The phase of matter which has a definite shape and volume
3. One of the forms or states that matter can have
4. The change of a liquid to a gas at a temperature below the boiling point
5. The change of a gas to a liquid
6. The change of a liquid to the solid phase
7. The change from a solid to a gas without passing through the liquid phase



Part 3. Phase Change Diagram



The graph was drawn from data collected as a substance was heated at a constant rate. Use the graph to answer the following questions.

At **point A**, the beginning of observations, the substance exists in a solid state. Material in this phase has Definite volume and Definate shape. With each passing minute, Heat E is added to the substance. This causes the molecules of the substance to move more rapidly which we detect by a temperature rise in the substance. At **point B**, the temperature of the substance is 70 °C. The solid begins to melt. At point C, the substance is completely melted or in a liquid state. Material in this phase has definite volume and no definite shape. The energy put to the substance between minutes 5 and 9 was used to convert the substance from a Solid to a liquid. This heat energy is called the **latent heat of fusion**.

Between 9 and 13 minutes, the added energy increases the temperature of the substance. During the time from **point D to point E**, the liquid is vaporizing. By **point E**, the substance is completely in the gas phase. Material in this phase has no defined volume and no defined shape. The energy put to the substance between minutes 13 and 18 converted the substance from a liquid to a gas state. This heat energy is called the **latent heat of vaporization**. Beyond **point E**, the substance is still in the gas phase, but the molecules are moving fast as indicated by the increasing temperature.

Which of these three substances was likely used in this phase change experiment?

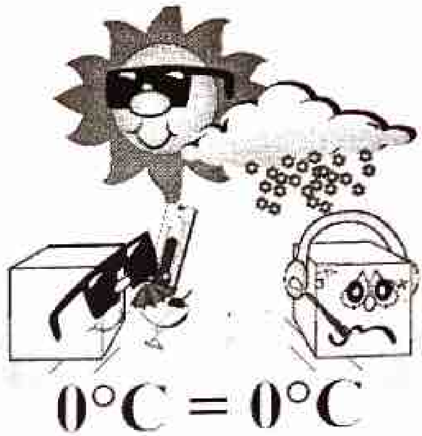
Substance	Melting point	Boiling point
Bolognium	20 °C	100 °C
Unobtainium	40 °C	140 °C
Foosium	70 °C	140 °C

Foosium
melts @ 70°C
Vaporizes @ 140°C

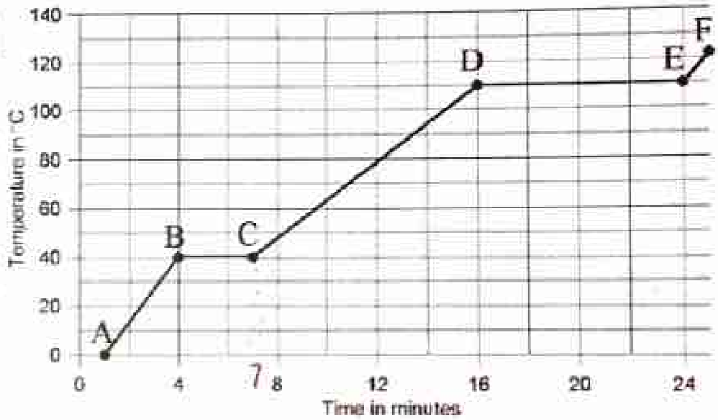
Part 6: Heating/Cooling curve

Heating/Cooling Curve

As a substance is heated, its particles begin to move faster and spread apart. The speed of the particles is related to their kinetic energy. The relative position of the particles is related to their potential energy. As solids, liquids, and gases are heated, most of the energy that is absorbed is converted to kinetic energy, and the temperature goes up. But as a substance melts or vaporizes, its particles spread out tremendously. As a result, the energy absorbed produces changes in the potential energy of the particles, so the temperature does not change as the phase changes. For that reason, the freezing point and the melting point of a substance are the same.



Base your answers to the following questions on the graph below which shows 10.0 kg of a substance that is solid at 0°C and is heated at a constant rate of 60 kilojoules per minute.



40°C 1. What is the temperature at which the substance can be both in the solid and the liquid phase?

B-C

D-E 2. During which lettered intervals is the internal potential energy of the substance increasing?

A-B

C-D

E-F 3. During which lettered intervals is the kinetic energy of the particles increasing?

16-7=9min

9×60=540 KJ 4. How much heat is added to the substance from the time it stops melting to the time that it begins to boil?

7×60

420 KJ 5. What is the total heat needed to melt the substance (starting at time 0)?

24×60

1440 KJ 6. What is the total heat needed to vaporize the substance (starting at time 0)?

D-E @ 110°C 7. What is the heat of vaporization of the substance?

AB 8. During which lettered intervals is the substance solid?

C-D 9. During which lettered intervals is the substance in the liquid phase?

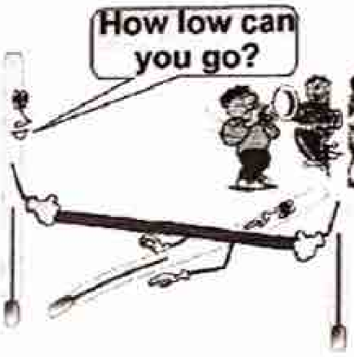
E-F 10. During which lettered intervals is the substance in the vapor phase?

110°C 11. What is the temperature at which the substance can be both in the liquid and the vapor phase?

Part 7: Temperature Scales

The Kelvin Scale

We often measure temperatures with the Celsius scale. The Celsius scale can have negative temperatures. This is because it is based on the freezing and boiling points of water. The freezing point of water is arbitrarily assigned the value of 0°C while the boiling point is assigned a value of 100°C. There are 100 equal divisions. This determines the size of the Celsius degree. It is possible to get colder than the freezing point of water. This is why there are negative temperatures in the Celsius scale. The question is, then, how low can temperature go? Lord Kelvin answered this question in the mid 1880s. Using a Celsius thermometer, Kelvin determined that temperatures can go as low as –273°C, but no lower. This means that the Celsius scale and the Kelvin scale are the same except for their origin. The zero on the Kelvin scale is absolute zero, whereas the zero on the Cesius scale is 273 kelvins (273 K). The relationship between the Kelvin and Celsius temperature is as follows:



The Temperature Limbo

$$K = °C + 273 \quad and \quad °C = K - 273$$

Answer the questions below based on your reading and the equations above.

1. What are the Celsius equivalents for each of the Kelvin temperatures below? -273°

a. 273 K 0°C	d. 623 K 350°C	g. 500 K -227°C
b. 373 K 100°C	e. 80 K -193°C	h. 13 K -260°C
c. 15 K -258°C	f. 0 K -273°C	i. 157 K -116

2. What are the Kelvin equivalents for each of the Celsius temperatures below? +273

a. 273°C 546K	d. 623°C 896K	g. 500°C 773K
b. 373°C 646K	e. 80°C 353K	h. 13°C 286K
c. 15°C 288K	f. 0°C 273K	i. 157°C 430K

3. How does the size of the Kelvin and the Celsius degree compare? Explain. They are the same 1°C is the same as 1° K.

Name: ______________________ Date: ____________

Unit 8 Homework Packet #2

Part 7: A Review "Break"...

Name the following compounds. Remember, they may be either ionic or covalent compounds, so m[ake] sure you use the right naming method!

1) LiBr Lithium Bromide

2) Na_2O Sodium Oxide

3) $CaSO_4$ Calcium Sulfate

4) $Be(NO_3)_2$ Beryllium Nitrate

5) NO Nitrogen Monoxide

Write the formulas for the following compounds. Remember, they may be either ionic or covalent compounds, so make sure you use the right method!

6) sodium nitride Na_3N

7) sulfur dioxide SO_2

8) ammonia NH_3

9) calcium phosphate Ca_3P_2

10) aluminum nitrate $Al(NO_3)_2$

Balance the following equations:

11) 2 NaCN + 1 $CuCO_3$ → 1 Na_2CO_3 + 1 $Cu(CN)_2$

12) 1 $Al(OH)_3$ + 3 Cs → 3 CsOH + 1 Al

13) 1 MgS + 1 OF_2 → 1 MgF_2 + 1 SO

14) 1 S_8 + 8 H_2 → 8 H_2S

15) 2 LiCl + 1 Br_2 → 2 LiBr + 1 Cl_2

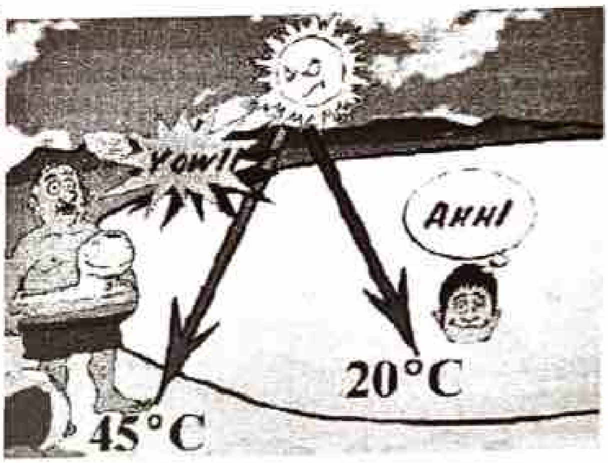
16) 1 $Pb(NO_3)_2$ + 2 HF → 2 HNO_3 + 1 PbF_2

17) 2 $GaBr_3$ + 3 Na_2SO_4 → 6 NaBr + 1 $Ga_2(SO_4)_3$

18) 4 P_2S_2 → 2 P_4 + 1 S_8

Part 8: Measuring Specific Heat

Specific Heat



The sun beat down on the beach, reflecting off the smooth surface of the lake and the bright white sand. A beach-goer stepped eagerly off the blanket anticipating the relief of the cool water. Yipes!!! The sand was hot! How could the sand be so hot and the water so cool with the same sun beating down on them? Simple. Water has a higher specific heat than sand. Water is more resistant to temperature change. The amount of heat needed to raise something's temperature is calculated as shown below.

$$Q = m\Delta T c_p$$

Q = joules; m = mass in grams

ΔT = change in temperature $[\Delta T = T_f - T_i]$

T_f = final temperature (°C)

T_i = starting temperature (°C)

c_p = specific heat (J/g°C) $= \dfrac{Q}{m\Delta T}$

Sample Problem 1

The specific heat of gold is 0.134 J/g°C. How many joules will it take to make the temperature of a 20.0 g nugget go up 10.0°C?

$$Q = (20\ g)\ (10°C)\ (0.134\ J/g°C) = 26.8\ J$$

Sample Problem 2

What is the specific heat of silicon if a 5.00 g sample is heated from 22.0°C to 42.0°C by adding 75.24 J?

$$\Delta T = T_f - T_i = 42.0°C - 22.0°C = 20.0°C$$

$$c_p = \frac{Q}{m\Delta T} \frac{75.24\ J}{(5.00g)(20.0°C)} = 0.752 \frac{J}{g°C}$$

Answer the following questions by referring to the examples and equations above.

1. The specific heat of aluminum is 0.88 J/g°C. How many joules will it take to make the temperature of a 50. g nugget go up from 20.°C to 70.°C?

$50g \cdot 50°C \cdot .88 \frac{J}{g°C} = 2200\ J$

2. What is the specific heat of silver if an 80.0 g sample is heated from 24.0°C to 49.0°C by adding 468.2 J?

$\frac{468.2}{80g \cdot 25°C} = \frac{468.2}{2000} = 0.2341\ J/g°C$

3. The specific heat of iron is 0.46 J/g°C. How many joules will it take to make the temperature of a 150. g bar go up from 25°C to 60.°C?

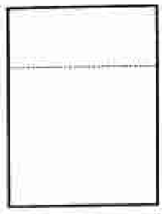
$150g \cdot 35°C \cdot .46 = 2415\ J$

4. What is the specific heat of copper if a 75 g sample is heated from 20.°C to 24°C by adding 117 J?

$\frac{117 J}{75 \cdot 4} = \frac{117}{300} = 0.39 \frac{J}{g°C}$

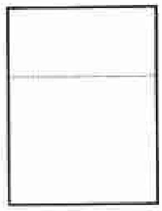
Part 9: Review Through Pictures SKIP

1. You need 3 pieces of white paper.
   (Make folds as seen in the three diagrams to the right)
   - Fold one 9.6 cm down.
   - Fold one 11.7 cm down.
   - Fold one exactly in half



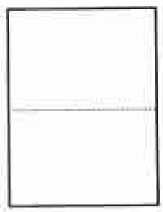
Paper 1: Fold at 9.6 cm mark

2. Nest the papers together to create a flip book.
   Paper 1 should be on the outside, 2 next, then 3 in the very center (as seen in the diagram to the right)



Paper 2: Fold at 11.7 cm mark

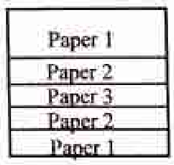
3. Label the overlaps
   - Types of Energy
   - Heat, Temperature, Cold
   - Energy Transfer
   - Laws of Thermodynamics



Paper 3: Fold in half

4. Divide each page into 3 vertical columns.

5. Label each column with the following headings
   - Types of Energy: Kinetic, Potential, Thermal
   - Heat, Temperature, Cold
   - Energy Transfer: Conduction, Convection, Radiation
   - Laws of Thermodynamics: First, Second, Third



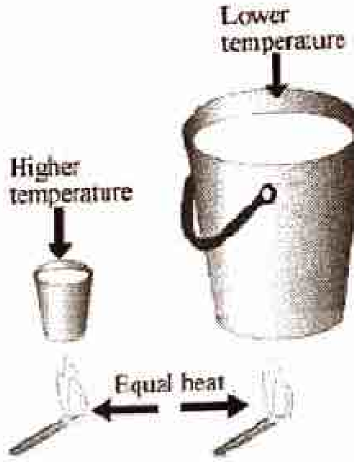
6. Draw a picture to represent each topic in the appropriate column.

7. Write a quick one sentence overview of each topic below the picture.

Part 10: Calculating Joules

Calculating Joules

When you heat a solid, it's temperature generally goes up. There is a relationship between heat and temperature, but they are not the same thing. It would take a lot more energy to heat up the ocean than to warm a cup of tea. The ocean has a larger mass. It has many more molecules to share energy with. Mass is not the only thing that influences the way the temperature changes in response to heat. When the same sun beats down on the beach, the sand gets a lot hotter than the water. Water has a higher heat capacity than sand. The relationship between mass, temperature change, specific heat, and energy are shown below.



$$Q = m\Delta T c_p$$

Q = heat (J) m = mass in grams

ΔT = change in temperature $[\Delta T = T_f - T_i]$

T_f = final temperature

T_i = starting temperature

c_p = 4.2 J/g°C

Sample Problem

How many joules are needed to heat 50.0 grams of water from 20.00°C to 25.00°C?

$$\Delta T = 25.00°C - 20.00°C = 5.00°C$$

$$Q = (50.0g)(5.00°C)\left(4.2\frac{J}{g°C}\right) = 1050J$$

Answer the questions below based on the procedure in the example above.

1. How many joules are needed to change the temperature of 100 g of water from 20°C to 40°C?

   100g · 20°C · 4.2 = 8400J

2. How many joules are needed to change the temperature of 15 g of water from 65°C to 95°C?

   15g · 30°C · 4.2 = 1890 J

3. How many joules are needed to change the temperature of 40 g of water from 33°C to 23°C?

   40g · 10°C · 4.2 = 1680J

4. How many joules are needed to change the temperature of 25 g of water from 40°C to 100°C?

   25 · 60°C · 4.2 = 6300J

5. How many joules are needed to change the temperature of 22 g of water from 18°C to 33°C?

   22g · 15°C · 4.2 = 1386J

Unit 8 Review Sheet

Complete the following review to hand in the day of the test. Make sure to study notes in addition to this!

Define:

- Heat of vaporization
- Heat of fusion
- Thermal energy
- Specific Heat
- Thermal equilibrium
- Absolute zero

See Quizlet

Define and provide units for:

- Heat (units)
  J (Joules)
- Temperature (units)
  °C or K

1. Describe each of the three main states of matter in terms of separation of molecules, energy of molecules, rate of energy transfer, movement of molecules, intermolecular forces, shape, and volume

Solid - molecules close, low E; transfers E well; movement - vibrate/low; definite shap[e], definite volu[me]

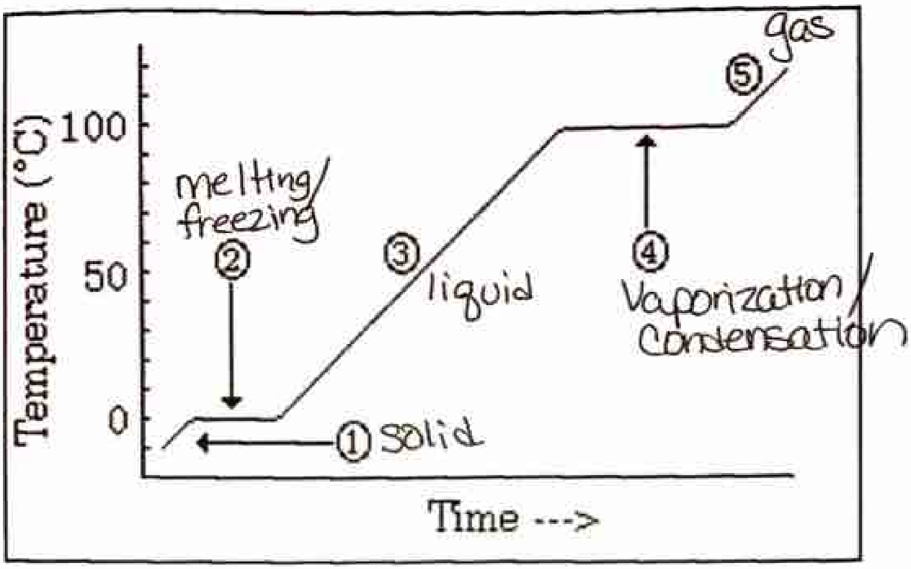
liquid - molecules med. close, mid energy; Transfer E better than gas not as good as solid; definite volum[e], no def. shape

gas - molecules move fast, spread out; movement - mid; high E; poorly transfers E; no definite shape or volu[me]

2. What do we know about plasma?

Highest energy
found in space

3. Label the phase change diagram with the names of the phase changes and the names of the states of matter.



4. On a phase change diagram, what is happening with the energy and temperature at the horizontal lines?

Does not break the covalent bond the energy is used to break down the Inter molecular forces

5. How are evaporation and boiling similar? Different?

They are both the change from a liquid to a gas

evaporation only happens at the surface
boiling throughout the liquid

6. Why can you fish in a lake all year long?

Ice floats and the bottom remains a liquid because H_2O has a high specific heat

7. Explain the difference between heat and temperature.

Energy that moves (transfers) hot to cold

Temp measure av. kinetic energy of molecules

8. Explain how a thermometer works.

In warmer - The thermometer absorbs the HE causing the fluid to rise & expand

In cooler - The thermometer releases HE causing the fluid to condense

9. Why does cold not exist?

Because Cold is the absense of heat
Cold cannot be transferred

10. What are the three temperature scales? What are they each based on?

K - 0 absolute zero
C - 0 is solid (freezing) 100° boiling
F - 32 is freezing 212 boiling

11. What happens to most materials when they get hot? Why?

they expand because molecules are moving

12. Why is water special in terms of expansion and contraction? → above 4°C

when freezes

13. What has more thermal energy: a bathtub full of warm water or a lake full of warm water? Why?

lake of warm water because it has more particles

14. Explain what conduction is and how it works.

Transfer of E by molecules bumping into one another

15. Give examples of conductors and insulators. What makes something a good conductor? easily transfers heat E

Conductors- metals

Insulators- nonmetals

16. Explain convection. Describe convection currents!

transfer of heat E in ~~liquids~~ fluids (liquids/gases)

Hot fluids rise (less dense)

Cold fluids sink (more dense) creates convection cells

17. Explain radiant energy. Give examples.

transfer Heat E through EM waves

Sunlight from the sun

18. What objects emit radiation? What objects are best at emitting radiation? are good object that absorbers of radiant heat

all objects that give off heat

19. Complete this statement: Good absorbers are good emitters, and Bad absorbers are bad emitters

20. Explain how the specific heat capacity of water affects the weather of Michigan.

Because water has a high Cp the summers are cooler because the lakes take a long time to heat & warmer winters because the lakes take along time to cool

21. Substance A has a lower specific heat than substance B. They are placed on the same hot plate at the same setting. Which would heat up fastest? Why?

Substance A because it takes less Heat E to change the temperature