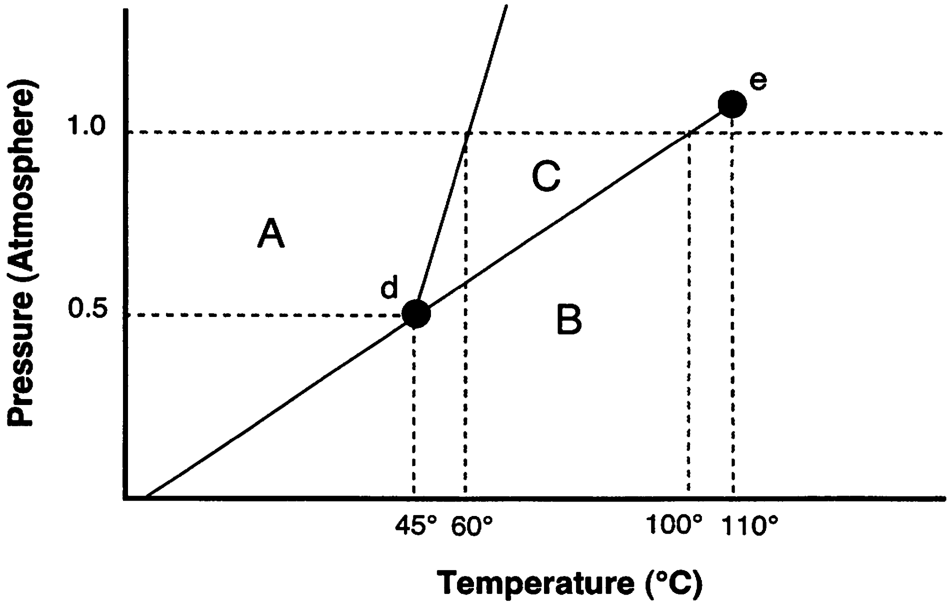
Chemistry
Ms. Ye

Name ______________________
Date ______________Block___

Do Now: Phase Diagram Practice



Answer the following questions using the chart above.

1. What section represents the solid phase? _________
2. What section represents the liquid phase? _________
3. What section represents the gas phase? _________
4. What letter represents the triple point? _________
5. What letter represents the critical point? _________
6. What is this substance's normal melting point? _________
7. What is this substance's normal boiling point? _________
8. Above what temperature is it impossible to liquify this substance no matter what the pressure? _________
9. At what temperature and pressure do all three phases coexist? _________
10. Is the density of the solid greater than or less than the density of the liquid? _________
11. Would an increase in pressure cause this substance to freeze or melt? _________

Heat, Kinetic Energy, and Changes in State of Matter

***Kinetic Energy**=the energy associated with ____

***Temperature**=measure of the ____ of a sample.

***Heat**=is measured as the______________ that is ________________ from one object to another because of a ____________________________________. The direction of heat flow is always from the _______________ object to the _______________ object.

***Specific Heat Capacity**: The amount of ______________________________ to _____________ ________________________________ of ______________ of a substance by _____________

Specific Heat Practice: The specific heat capacities of several substances are listed in the following table.

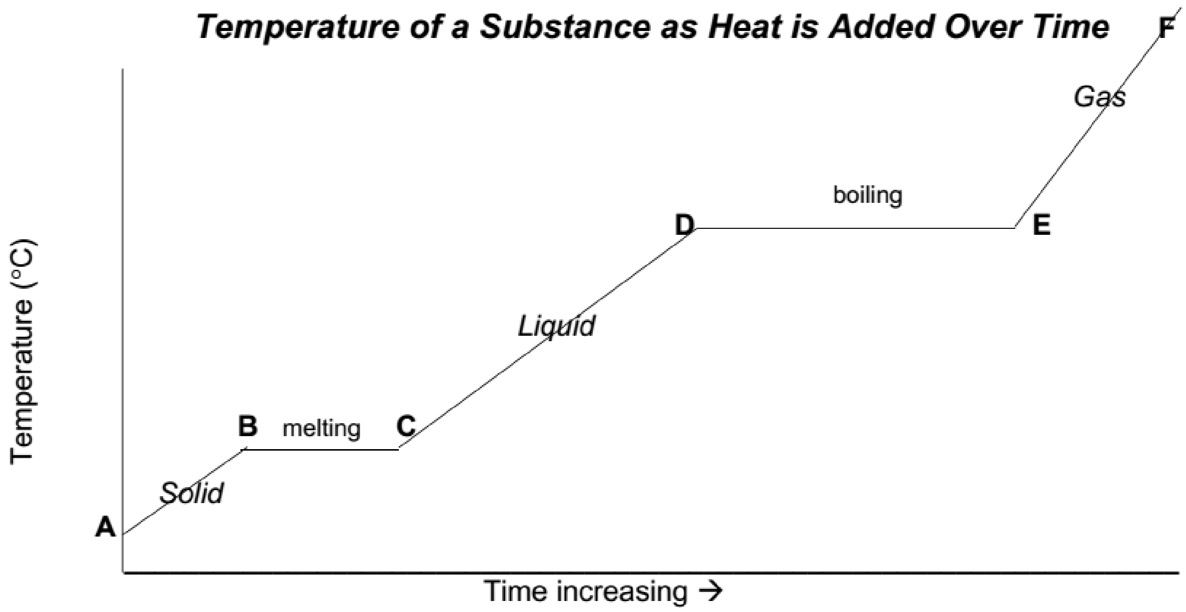
Substance	Specific Heat Capacity
Water, H_2O	4.18 J/g°C
Methanol, CH_3OH	2.43 J/g°C
Air	1.00 J/g°C
Aluminum, Al	0.88 J/g°C
Brass (Cu+Zn mixture)	0.38 J/g°C

1. Which substance listed requires the least amount of energy to raise the temperature of 1 gram of the substance by 1°C? Why?

2. Imagine that you place an aluminum pot filled with water on the stove. After several minutes, the metal is too hot to touch, but the water is barely warm. Use specific heat capacity to explain why.

3. Why do you think adding water to a balloon prevents it from bursting when heated whereas a balloon filled with just air will burst when heated?

Heating Curve



Use the graph above (known as a "heating curve") to answer the questions that follow.

1. During which 3 line segments does the temperature of the substance increase?

2. During which 2 line segments does the temperature of the substance remain the same?

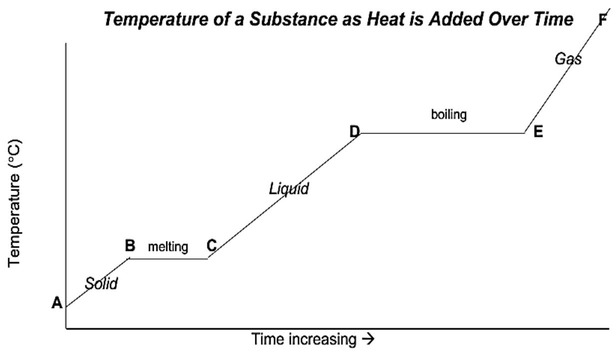
3. At which point do the molecules of the substance have the lowest average kinetic energy? The highest?

4. Which phases of matter are present during segment BC?

5. Which phases of matter are present during segment DE?

6. Even though heat is being added to the substance the entire time, why do you think there is no change in temperature during segments BC and DE? Where do you think the heat energy is going or being used for?

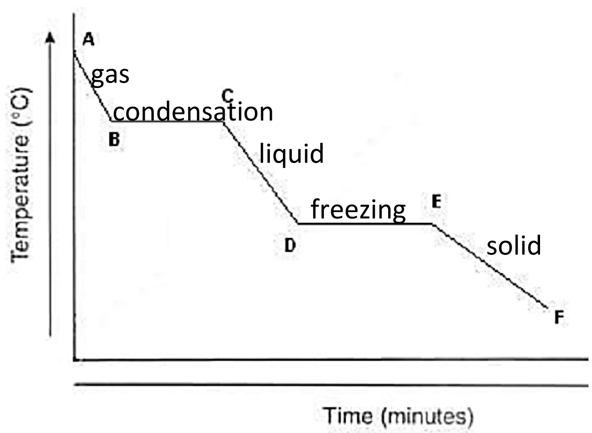
***Kinetic Energy**=the energy associated with moving particles; related to temperature. ***Potential Energy**=the energy associated with ____. It is _________________ to temperature; it is related with _____________________________.



Section of Heating Curve	ΔT (change in temp)	ΔKE (change in kinetic energy)	ΔPE (change in potential energy)
AB			
BC			
CD			
DE			
EF			

*The heat energy that is added is being transferred to either KE or PE *When **kinetic energy is changing, potential energy remains constant** *When potential energy is changing, kinetic energy remains constant

We can also apply the same concepts to a **cooling curve**, in which a substance is cooled (or heat is removed from a substance) over time.



Section of Heating Curve	ΔT (change in temp)	ΔKE (change in kinetic energy)	ΔPE (change in potential energy)
AB			
BC			
CD			
DE			
EF			

Heat Equations

Heat = Energy transferred due to a difference in temperatures. The amount of heat absorbed or released in a physical or chemical reaction can be calculated using the equation **q = mCΔT**

q = mCΔT or, think of it as unit cancellation: $J = (g) \times (\frac{J}{g°C}) \times (°C)$

q = heat (in Joules or J)
m = mass of sample (in grams)
C = heat capacity of sample
ΔT = change in temperature (Final Temp-Initial Temp)

Example: How much heat is required to raise the temperature of 5 grams of water from 20°C to 100°C? The specific heat of water is 4.18 J/g°C.

Note: For all the following problems, the specific heat of water is 4.18 J/°C.

1. You heat 1 gram of water from 25°C to 75°C. How many joules of energy are transferred to the water?

2. You cool 10 grams of water from 25°C to 0°C. How many joules of energy are transferred out of the water?

3. The temperature of a sample of water in the liquid phase is raised from 20°C to 50°C by the addition of 3762 Joules. What is the mass of water?

**Why can't we use the formula q= mCΔT when there is a phase change? Consider the problem "how many joules are required to melt 100 grams of ice at 0°C?"

Heat of Fusion: amount of ______________________________ required to change a substance from a

______________________to a ______________________ Heat energy to melt a substance: **$q=mH_f$**

Heat of Vaporization: amount of ____________________________ required to change a substance from a

_____________________ to a _________________; Heat energy to boil a substance: **$q=mH_v$**

$q=mH_f$ and $q=mH_v$ Problems:

1. How many joules are required to melt 100 grams of ice at 0°C? The heat of fusion for water is 334 J/g.

q=

m=

H =

2. How many joules are absorbed by a 50 gram sample of H_2O that is boiling? The heat of vaporization of water is 2260 J/g.

q=

m=

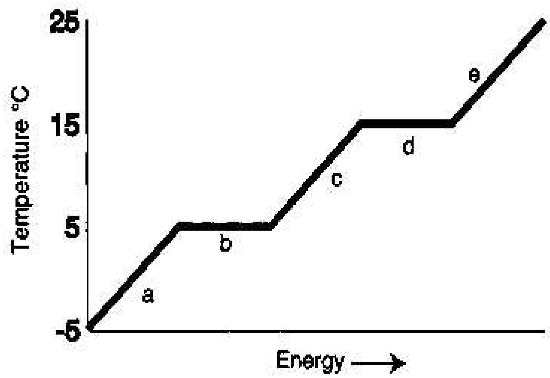
H =

3. 10 joules of heat is required to melt a sample of ice. What is the mass of the ice if the heat of fusion of H_2O is 334 J/g?

4. What is the total number of joules required to completely boil 100 grams of water at 100°C? The heat of vaporization of water is 2260 J/g.

5. 25.0 grams of a compound at its boiling point are converted to a gas by the addition of 34,400 Joules of heat. What is the heat of vaporization (H_v) for this compound?

Heat Homework:



HEATING CURVES. Use the heating curve below to answer the following questions.

1. What is the melting point of the substance? _____
2. What is the boiling point of the substance? ______
3. Which letter represents heating of the solid? ______
4. Which letter represents heating of the vapor? ______
5. Which letter represents melting of the solid? ______
6. Which letter represents boiling of the liquid? ______

Heat Equations:

Properties of Benzene (C_6H_6)		
Specific Heat Capacity: 1.6 J/g°C	Heat of Fusion: 127 J/g	Heat of Vaporization: 551 J/g

Using the above information about Benzene, answer the following questions. Assume the sample being heated is 50 grams of Benzene. Show your work!
Hint: Determine which heat equation you need to use, then plug in the values.

1. How much heat is required to raise the temperature of the sample from -14.5°C to 5.5°C?

2. How much heat is required to melt the sample at the melting point?

3. How much heat is required to raise the temperature of the sample of the liquid phase from 5.5°C to 80°C?

4. How much heat is required to boil the sample at its boiling point?

5. How much heat is required to raise the temperature of the sample in the gas phase from the end of 80°C to 100°C?