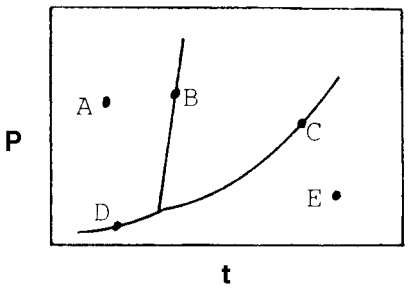
South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

13 • IMF's, Liquids & Solids

Station 1 – PHASE DIAGRAMS



Label the "triple point" on the diagram.
Label the "critical point" on the diagram.

Boiling liquid would be found at Point ___.

The name of the phase change that occurs by increasing temperature at Point D is _____.

Which two phases are in equilibrium at Point B? _____ & _____

Indicate the region where the gas can no longer be liquefied by increasing the pressure.

Is this a phase diagram of H_2O? _____ Explain.

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Station 2 – IMF's

Match the statement with the IMF:

A. Dipole-Dipole
B. Covalent network
C. Hydrogen-bonding
D. Ionic
E. Metallic
F. London Dispersion Forces

_____ 1. Is used to explain why BP of Xe > Kr > Ar > Ne > He
_____ 2. Is present in $C_{(graphite)}$ but not in $C_{(diamond)}$
_____ 3. Is used to explain why Cu is a good conductor
_____ 4. Is used to explain why NaCl(l) is a good conductor
_____ 5. Is used to explain why ICl has a higher BP then Br_2
_____ 6. Is used to explain why vapor pressure of CH_3OH is less than CH_4.

List the 8 substances that are covalent network solids:

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Station 3 – MORE IMF's

Match the IMF with its description:

___ 1. hydrogen bonding
___ 2. dipole-dipole attractions
___ 3. London dispersion forces
___ 4. ionic interactions
___ 5. metallic bonding

A. a lattice of positive ions in a sea of delocalized electrons
B. positive ends of polar molecules attract negative ends of other polar molecules
C. lattice of alternating positively and negatively charged particles
D. polar interactions in molecules with especially polar intramolecular attractions
E. polarized electron clouds induce dipoles in their neighboring atoms

Write these attractive forces in order from weakest to strongest:

Covalent Network / Hydrogen-Bonding / Metallic / Dipole-Dipole / Ionic / London Dispersion Forces

Indicate the **strongest** IMF in each of the following:

SO_2	_____	NH_3	_____	Xe	_____
CO_2	_____	KOH	_____	XeF_4	_____
CH_3OH	_____	K_2S	_____	SF_4	_____
Na	_____	H_2S	_____	CH_4	_____

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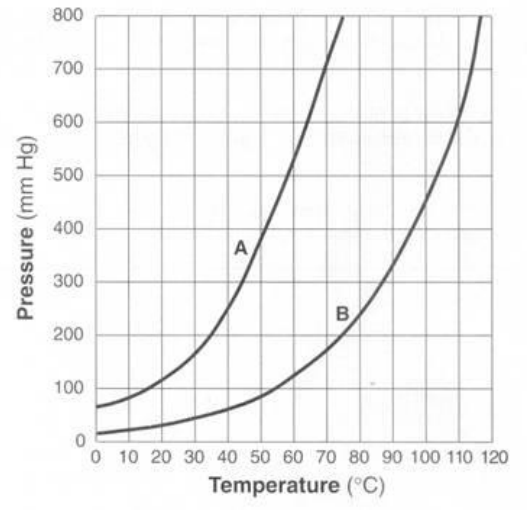
Station 4 – BOILING

A liquid will boil when it's _____ _____ is equal to the _____ above the liquid.



Here is a graph of the vapor pressures of two liquids, A and B.

Which compound has the greater IMF's? _____

Could A or B be H_2O? _____ Justify your answer.

What is the normal boiling point of A? _____
What is the normal boiling point of B? _____

If beakers of liquids A and B were placed in a bell jar connected to a vacuum pump at room temperature (20°C), which liquid would begin to boil first when the vacuum pump was turned on? _____ At what pressure would this occur? _____mmHg.

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Station 5 – PROPERTIES OF SUBSTANCES

In each case, circle the choice with the HIGHER value for the property listed:

Boiling Point:	Cl_2	or	Br_2
Melting Point:	Si	or	S
Melting Point:	KBr	or	LiF
$\Delta H_{vaporization}$:	HF	or	HCl
Vapor Pressure:	C_3H_8	or	CH_4
Boiling Point:	H_2O	or	NH_3
Vapor Pressure:	CH_3OH	or	C_2H_5OH
$\Delta H_{vaporization}$:	HCl	or	HBr

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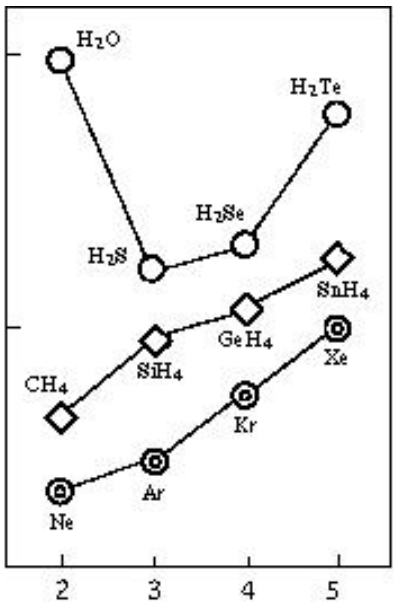
Station 6 – EXPLAINING TRENDS



This graph shows the BP's of analogous compounds using elements from periods 2, 3, 4, and 5.

Explain why the BP of Xe > Kr > Ar > Ne:

Explain why the BP of H_2Te > H_2Se > H_2S:

Why is the BP of H_2O > the others in its group?

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Station 7 – ENERGY OF PHASE CHANGES

1. The heat of vaporization of methane, CH_4, at its boiling point is 9.20 kJ/mol.
   How much heat energy is required to vaporize 100. G of methane at its boiling point?

2. Methanol, CH_3OH, (molar mass 32.04 g/mol) has a heat of vaporization of 39.2 kJ/mol and a density of 0.7914 g/mL. How much energy is needed to vaporize 350. mL of methanol?

3. The greatest change in energy for a substance is seen with which process? _____
   a) vaporization b) condensation c) fusion d) sublimation e) melting

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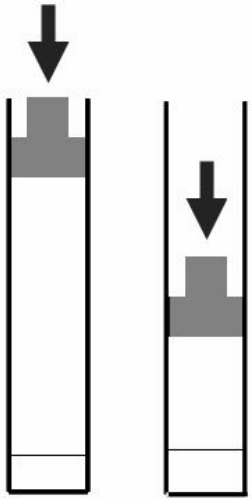
Station 8 – EQUILIBRIUM VAPOR PRESSURE

Which of the following has the lowest equilibrium vapor pressure? _____
a) F_2 b) H_2O c) HF d) NaCl e) Br_2



Liquid "X" is at equilibrium with its vapor in a cylinder and piston apparatus. When the volume of the space above the liquid is 100 mL and the temperature 25°C, the vapor pressure of "X" is 120 torr.
What will the vapor pressure of "X" be when the volume above the liquid is 50 mL and the temperature is 25°C? _____

a) 240 torr b) 120 torr c) 60 torr d) 480 torr e) 30 torr

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Station 9 – VISUALIZING SOLIDS

For each image, name the type of solid and the IMF(s) illustrated.