

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

[10 pt] 1. Define (using sentences) each of the following Intermolecular Forces (IMF's) including their relative strengths. In addition draw an example illustrating the attractive force between **TWO** molecules. Properly label all charges (+/-) and partial charges ( $\delta^+$ / $\delta^-$ ).

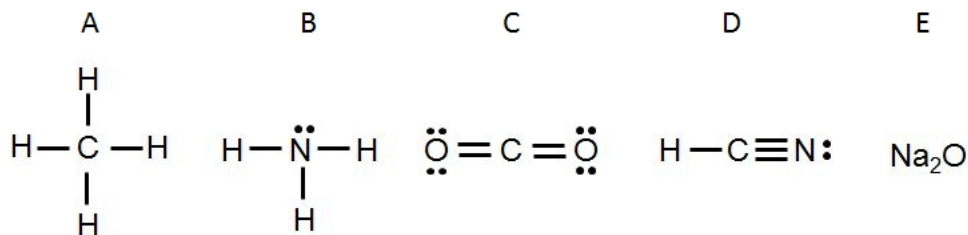
(a) London Dispersion Forces (LDF)

(b) Dipole-Dipole Forces (DD)

(c) Hydrogen Bonding (HB)

(d) Ion-Dipole (ID)

[8 pt] 2. Answer the following question about the molecule below:



(a) Below each molecule list the attractive forces present in each molecule.

(b) Order the molecules from lowest Vapor Pressure to Highest Vapor Pressure. Explain.

(c) Which molecule(s) are most likely to dissolve in water? Explain.

2(c) \_\_\_\_\_

(d) Which molecule(s) are most likely to dissolve in hexane? Explain.

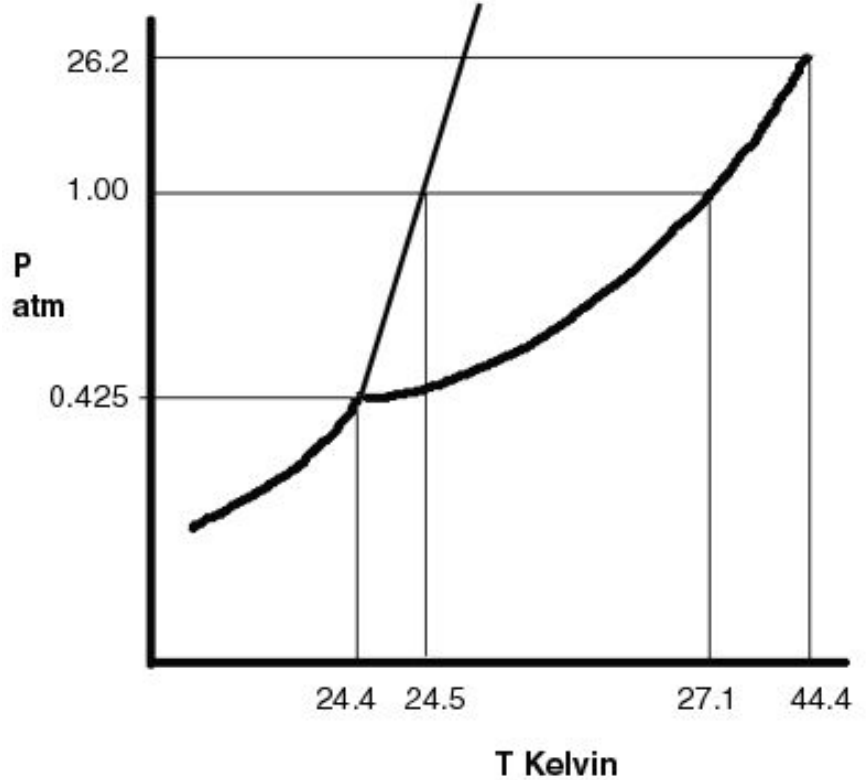
2(d) \_\_\_\_\_

[4 pt] 3. Complete the following with (D)irectly proportional, (I)nversly proportional, (N)o relationship or (F)thisIhavenoideawhattheansweris.

- (a) Vapor Pressure to Temperature 3(a) \_\_\_\_\_
- (b) Vapor Pressure to Size of the Container 3(b) \_\_\_\_\_
- (c) Vapor Pressure to IMF between molecules 3(c) \_\_\_\_\_
- (d) Vapor Pressure to the amount of liquid 3(d) \_\_\_\_\_

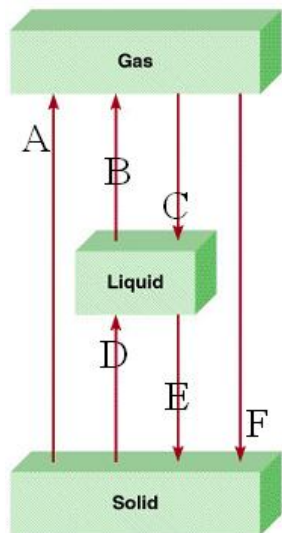
[10 pt] 4. Properly label all of the following points on the phase diagram, and answer the questions below.

- (a) Solid Phase
- (b) Liquid Phase
- (c) Gas Phase
- (d) Supercritical Fluid
- (e) Triple Point
- (f) Critical Point
- (g) Where Vaporization occurs
- (h) Where Condensation occurs
- (i) Where Melting occurs
- (j) Where Freezing occurs
- (k) Where Sublimation occurs
- (l) Where Deposition occurs
- (m) Normal Boiling Point
- (n) Normal Melting Point
- (o) Melting Curve
- (p) Vaporization Curve
- (q) Sublimation Curve



[5 pt] 5. Explain how a solution can evaporate (go from the liquid state to the gas state) when the temperature is below the boiling point of the liquid, and the atmospheric pressure is 760 mmHg. (For example, on a sunny day a puddle of water will evaporate even though the temperature is well below the boiling point of water.) A sketch might be useful too, so give me one!

[6 pt] 6. Identify each of the following phase transitions.



(a)

(b)

(c)

(d)

(e)

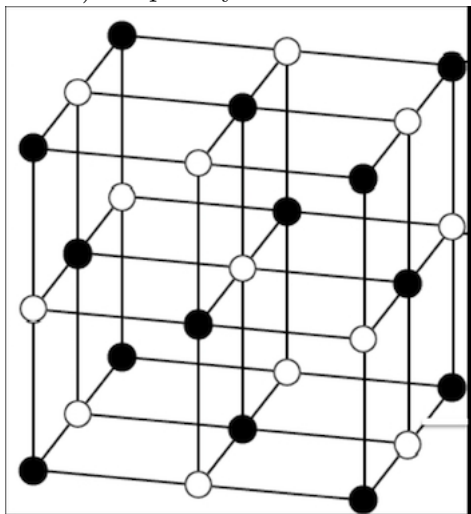
(f)

[5 pt] 7. Calculate the heat (in kJ) required to turn 2.5 kg of **ETHANOL** ice at  $-112^{\circ}\text{C}$  to ethanol liquid at  $65^{\circ}\text{C}$  .

7. \_\_\_\_\_

[4 pt] 8. Define the terms 'Constructive' and 'Destructive' Interference and sketch a picture illustrating both. How is this phenomenon used in X-ray diffraction to determine the distance between atoms in a solid?

- [6 pt] 9. A new mineral has been discovered containing an unknown metal X (black atoms) and oxygen (white atoms). Explain your answers in the space provided.



(a) What is the formula for the new mineral  $X_{\#}O_{\#}$ ?

(b) What is the charge on the unknown metal cation?

- [6 pt] 10. Answer the following questions using the graph given in class or the solubility table on your Cheat Sheet:

(a) Is a solution consisting of 25.0 grams of KBr in 43.0 mL of water 10(a) \_\_\_\_\_  
 (U)nsaturated,  
 (S)aturated or (SS)upersaturated at 50.°C? Explain.

(b) If you start with a saturated solution of  $BaCl_2$  at 40°C, and heat it to 90°C, 10(b) \_\_\_\_\_  
 how many more grams of  $BaCl_2$  can be dissolved ? Explain.

- [6 pt] 11. Sketch a picture showing how KBr would dissolve in water. Label any IMF between the solute-solute, solute-solvent and solvent-solvent.

[4 pt] 12. Complete the following with (D)irectly proportional, (I)nversely proportional, (N)o relationship or (F)thisIhavenoideawhattheansweris.

(a) Solubility of Solids in Liquids and Temperature 12(a) \_\_\_\_\_

(b) Solubility of Gases in Liquids and Temperature 12(b) \_\_\_\_\_

(c) Solubility of Solids in Liquids and Pressure 12(c) \_\_\_\_\_

(d) Solubility of Gases in Liquids and Pressure 12(d) \_\_\_\_\_

[4 pt] 13. Complete the following with (D)irectly proportional, (I)nversely proportional, (N)o relationship or (F)thisIhavenoideawhattheansweris.

(a) Mols solute and Boiling Point 13(a) \_\_\_\_\_

(b) Mols solute and Freezing Point 13(b) \_\_\_\_\_

(c) Mols solute and Osmotic Pressure 13(c) \_\_\_\_\_

(d) Mols solute and Vapor Pressure 13(d) \_\_\_\_\_

[3 pt] 14. What is the van't Hoff factor, and how does it effect Colligative Properties

[4 pt] 15. Which solution will have a higher osmotic pressure. Solution A made by dissolving 25.0 g of KCl in 100.0 mL of water, or Solution B made by dissolving 15g of NaCl in 100.0 mL of water? Show work or Explain your answer to receive full credit.

15. \_\_\_\_\_

[5 pt] 16. 5.00 grams of an unknown compound when dissolved in 125 mL of water resulted in an osmotic pressure of 10.0 atm at 25 °C. What is the molecular weight (MW) of the unknown compound? \_\_\_\_\_

[5 pt] 17. Explain why the **boiling point** of an impure solution is higher while the **freezing point** of an impure solution is lower than that of the pure solution. Include in your discussion a sketch of a phase diagram illustrating your explanation.

18. **Bonus:** Potassium crystallizes in a body-centered cubic lattice with a density of 0.856 g/cm<sup>3</sup> at 25°C.

(a) How many atoms are there per unit cell?

18(a) \_\_\_\_\_

(b) Determine the radius of a K atom.

18(b) \_\_\_\_\_

[5 pt] 19. Make sure to eat a rice crispy treat and have a great day! Oh yes, I should ask a question. What is your favorite food?