**Chapter 10 – 11 Short Answer Problems**

**Intermolecular Forces and Physical Properties**

1. Compare and contrast typical dipole-dipole forces with hydrogen bonding interactions.
2. Describe the relationship between molecular size and strength of London dispersion forces.
3. How do the following physical properties depend on the strength of intermolecular forces?
	1. Surface tension: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Viscosity: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. Melting point: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. Boiling point: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	5. Vapor pressure: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Identify the most important types of interparticle forces (LD, Dipole, H-bonding, Ionic) present in the solids of each of the following substances.
	1. Ar
	2. HCl
	3. HF
	4. CaCl2
	5. CH4CO
	6. NaNO3
	7. NH3
	8. CHCl3
	9. BF3
5. Predict which substances in each of the following pairs would have the greater intermolecular forces.
	1. CO2 or OCS
	2. PF3 or PF5
	3. SO3 or SO2
6. In each of the following groups of substances, pick the one that has the given property. Justify your answer.
	1. Highest boiling point: HCl, Ar, or F2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Highest freezing point: H2O, NaCl, or HF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. Lowest vapor pressure at 25oC: Cl2, Br2, I2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. Lowest freezing point: N2, CO, or CO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	5. Lowest boiling point: CH4, CH3CH3, or CH3CH2CH3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	6. Highest boiling point: HF, HCl, or HBr \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Liquids & Vapor Pressure**

1. In what ways are liquids similar to solids?
2. In what ways are liquids similar to gases?
3. How does each of the following affect the rate of evaporation of a liquid in an open dish?
	1. Intermolecular forces: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Temperature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. Surface area: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What do we mean that we say that a liquid is *volatile*? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
Do volatile liquids have large or small vapor pressures at room temperature? \_\_\_\_\_\_\_\_\_\_\_\_
What strengths of intermolecular forces occur in highly volatile liquids?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Hydrogen peroxide (H2O2) is a syrupy liquid with a relatively low vapor pressure and a normal boiling point of 152.2oC. Explain the differences of these physical properties from those of water.
6. The solubility of sodium chloride in water at 25oC is 12.0 g in 100 mL of solution. How many grams of sodium ion will be found in one liter of solution?
7. Consider the following vapor pressure vs. temperature plot for three different substances A, B, C. If the three substances are CH4, SiH4, and NH3, match each curve to the correct substance. Explain your choices.


**Structures and Properties of Solids**

1. What type of solid will each of the following substances form?
[ionic, molecular, atomic (metallic or covalent network?)]
	1. CO2
	2. Si
	3. CH4
	4. Ru
	5. I2
	6. KBr
	7. H2O
	8. NaOH
	9. U
	10. CaCO3
	11. PH3
	12. Diamond
	13. Cu

**Phase Changes and Heating Curves**

1. As you are heating up a substance, why doesn’t the temperature increase continuously over time? That is, why does the temperature stay constant for periods of time?
2. Why is the enthalpy of vaporization for water much greater than its enthalpy of fusion? What does this say about changes in intermolecular forces in going from a solid to liquid to vapor?
3. A substance, X, has the properties below. Sketch a heating curve for substance X starting at -50.oC.



**Molarity**

1. What is the molarity of a solution in which 58g of NaCl are dissolved in 1.0L of solution?

2. What is the molarity of a solution in which 10.0g of AgNO3 is dissolved in 500mL of solution?

3. How many grams of KNO3 should be used to prepare 2.00L of a 0.500 M solution?

4. To what volume should 5.0 g of KCl be diluted in order to prepare a 0.25 M solution?

5. How many grams of CuSO4 are needed to prepare 100.0 mL of a 0.10 M solution?

**Solubility Curves**

1. Which SALT is least soluble in water at 20oC?

2. How many grams of KCl can be dissolved in 200g of water at 80oC?

3. At 40oC, how much KNO3 can be dissolved in 300g of water?

4. At 30oC, 90g of NaNO3 is dissolved in 100g of water. Is this solution saturated, unsaturated or super saturated?

5. Which salt is most soluble at 10oC?

6. If a saturated solution of NH4Cl (at 70oC) is cooled until it is at 50oC. How much would precipitate out of the solution?

7. Which substance shows the least change in solubility from 0oC to 100oC?