

**AP Chemistry Problem Set Chapter 10**

Name \_\_\_\_\_

Due: Monday, January 8<sup>th</sup>, 2007

30 points – 5 points for completion, 3 random essay problems will be graded, each worth 5 points. Each multiple choice must be answered (1 point each). Staple this sheet to the front of your essay responses.

**Multiple Choice.** Please indicate your multiple choice answers below.

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_  
 6. \_\_\_\_\_ 7. \_\_\_\_\_ 8. \_\_\_\_\_ 9. \_\_\_\_\_ 10. \_\_\_\_\_

Use the following answers for questions 1 - 2. (1984 - #8 & 9)

- (A) A network solid with covalent bonding
- (B) A molecular solid with zero dipole moment
- (C) A molecular solid with hydrogen bonding
- (D) An ionic solid
- (E) A metallic solid

1. Solid ethyl alcohol, C<sub>2</sub>H<sub>5</sub>OH
2. Silicon dioxide, SiO<sub>2</sub>

Use these answers for questions 3-6 (1989 #11 – 14)

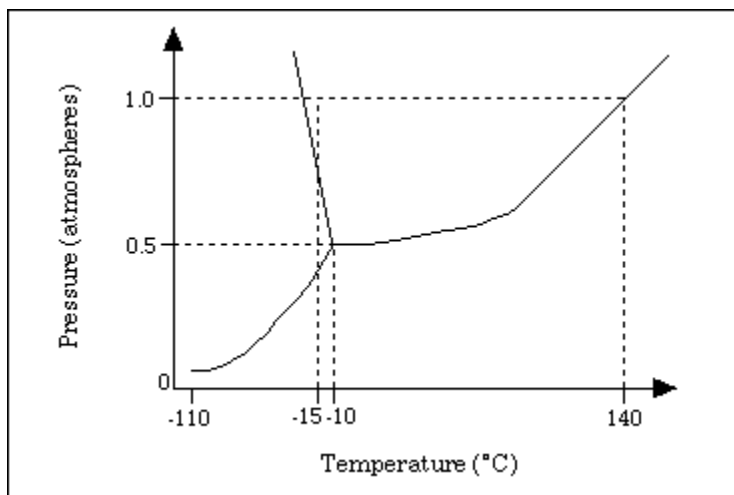
- (A) hydrogen bonding
- (B) hybridization
- (C) ionic bonding
- (D) resonance
- (E) van der Waals forces (London dispersion forces)

3. Is used to explain why iodine molecules are held together in the solid state
4. Is used to explain why the boiling point of HF is greater than the boiling point of HBr
5. Is used to explain the fact that the four bonds in methane are equivalent
6. Is used to explain the fact that the carbon-to-carbon bonds in benzene, C<sub>6</sub>H<sub>6</sub>, are identical

Use the following diagram for questions 7-8 (1989 - #49&51)

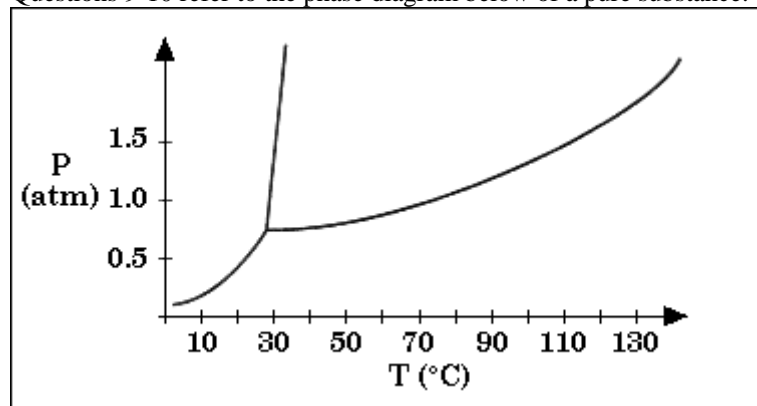
7. The normal boiling point of the substance represented by the phase diagram above is
  - (A) -15 °C
  - (B) -10 °C
  - (C) 140 °C
  - (D) greater than 140 °C
  - (E) not determinable from the diagram

8. For the substance represented in the diagram, which of the phases is most dense and which is least dense at -15 °C.



	Most Dense	Least Dense
(A)	Solid	Gas
(B)	Solid	Liquid
(C)	Liquid	Solid
(D)	Liquid	Gas
(E)	The diagram gives no information about densities.	

Questions 9-10 refer to the phase diagram below of a pure substance. (1994 – #5 & 7)



(A) Sublimation

(B) Condensation

(C) Solvation

(D) Fusion

(E) Freezing

9. If the temperature increases from 10° C to 60° C at a constant pressure of 0.4 atmospheres, which of the processes occurs?

10. If the pressure increases from 0.5 to 1.5 atmospheres at a constant temperature of 50° C, which of the processes occurs?

### Essay

#1 (1985 - #9)

Substance	Melting Point, °C
H <sub>2</sub>	129
C <sub>3</sub> H <sub>8</sub>	190
HF	92
CsI	621
LiF	870
SiC	>2,000

(a) Discuss how the trend in the melting points of the substances tabulated above can be explained in terms of the types of attractive forces and/or bonds in these substances.

(b) For any pairs of substances that have the same kind(s) of attractive forces and/or bonds, discuss the factors that cause variation in the strengths of the forces and/or bonds.

#2 (1988 - #5)

(a) Xenon has a higher boiling point than neon has.

(b) Solid copper is an excellent conductor of electricity, but solid copper chloride is not.

(c) SiO<sub>2</sub> melts at a very high temperature, while CO<sub>2</sub> is a gas at room temperature, even though Si and C are in the same chemical family.

(d) Molecules of NF<sub>3</sub> are polar, but those of BF<sub>3</sub> are not.

#3 (1988 - #8)

The normal boiling and freezing points of argon are 87.3 K and 84.0 K, respectively. The triple point is at 82.7 K and 0.68 atmospheres.

(a) Use the data above to draw a phase diagram for argon. Label the axes and label the regions in which the solid, liquid, and gas phases are stable. On the phase diagram, show the position of the normal boiling point.

(b) Describe any changes that can be observed in a sample of solid argon when the temperature is increased from 40 K to 160 K at a constant pressure of 0.50 atmospheres.

(c) Describe any changes that can be observed in a sample of liquid argon the pressure is reduced from 10 atmospheres to 1 atmosphere at a constant temperature of 100 K, which is well below the critical temperature.

(d) Does the liquid phase of argon have a density greater than, equal to, or less than the density of the solid phase? Explain your answer, using information given in the introduction to this question.

**#4 (1989 - #6)**

The melting points of the alkali metals decrease from Li to Cs. In contrast, the melting of the halogens increases from  $F_2$  to  $I_2$ .

- (a) Using bonding principles, account for the decrease in the melting point of the alkali metals.
- (b) Using bonding principles, account for the increase in the melting points of the halogens.
- (c) What is the expected trend in the melting points of the compounds LiF, NaCl, KBr, and CsI? Explain this trend using bonding principles.

**#5 (1992 - #8)**

Explain each of the following in terms of atomic and molecular structures and/or intermolecular forces.

- (a) Solid K conducts an electric current, whereas solid  $KNO_3$  does not.
- (b)  $SbCl_3$  has a measurable dipole moment, whereas  $SbCl_5$  does not.
- (c) The normal boiling point of  $CCl_4$  is  $77^\circ C$ , whereas that of  $CBr_4$  is  $190^\circ C$ .
- (d)  $NaI(s)$  is very soluble in water whereas  $I_2(s)$  has a solubility of only 0.03 gram per 100 grams of water.