CHE 107 # EXAMINATION I **11 Feb. 1999**

University of Kentucky **Department of Chemistry**

Name: _____ SID: _____ Seat No.: _____ Room: _____

	1.	Argon has a higher melting point than neon because of its:
		A. ionic bonds. C. permanent dipole moment. B. stronger dispersion forces. D. hydrogen bonding.

	2.	In **each pair**, which has the **higher** boiling point? I. O_2 or N_2 II. NH_3 or PH_3
		A. O_2 and NH_3 B. O_2 and PH_3 C. N_2 and NH_3 D. N_2 and PH_3

	3.	The measure of a fluid's resistance to flow is
		A. surface tension. C. viscosity. B. capillary action. D. vapor pressure.

	4.	Which of the following lists a compound which is (1) an ionic crystal, (2) a molecular crystal and (3) a metallic crystal respectively?

	(1)	(2)	(3)
A.	sodium chloride	sodium	sodium chromate
B.	potassium acetate	carbon dioxide	aluminum
C.	tungsten	diamond	nickel
D.	dihydrogen sulfate	lead	potassium

	5.	A unit cell is
		A. a cube. B. an ionic crystal. C. the basic repeating unit of a crystalline solid. D. used in defining the liquid state of matter.

6. Which of the following compounds has the **lowest** vapor pressure at 0.0 °C?

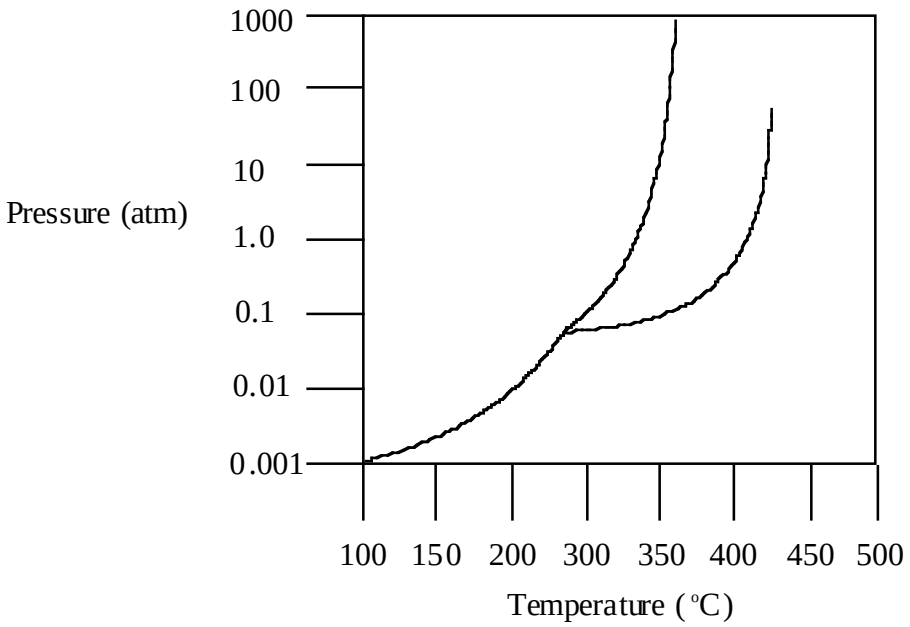
	boiling point
CBr_4	190°C
$CHBr_3$	150°C
CH_2Br_2	98°C
CH_3Br	4°C

A. CBr_4 B. $CHBr_3$ C. CH_2Br_2 D. CH_3Br

7. How much energy is released when 7.55 g of water at 33.5 °C is cooled to –10.0 °C? (The specific heat of ice is 2.03 J/g°C, of water is 4.184 J/g°C and of steam is 1.99 J/g°C. The molar heat of fusion of water is 6.01 kJ and the molar heat of vaporization of water is 40.79 kJ.)

A. 3.73 kJ B. 8.90 kJ C. 67.2 kJ D. 2.61 kJ

8. According to the phase diagram shown below, what is the normal **boiling** point of this substance?



A. 280°C B. 325°C C. 340°C D. 410°C

	9.	Which of the following are **more** soluble in CCl_4 than in water? HCl, O_2, CO_2, CH_3OH, Na_2SO_4, CH_4

A. HCl, CH_3OH, Na_2SO_4 C. O_2, CO_2, CH_4

B. HCl, Na_2SO_4, O_2 D. O_2, CO_2, CH_3OH, CH_4

	10.	An aqueous solution that is 0.90% NaCl by mass is isotonic with respect to the fluid inside a red blood cell. Calculate the **molality** of this solution.

A. 9.80×10^{-2} *m* B. 0.155 *m* C. 0.531 *m* D. 5.25 *m*

	11.	The solubility of O_2 in water

A. increases with increasing temperature and increasing O_2 pressure.
B. increases with increasing temperature and decreasing O_2 pressure.
C. increases with decreasing temperature and increasing O_2 pressure.
D. increases with decreasing temperature and decreasing O_2 pressure.

	12.	What mass of sucrose, $C_{12}H_{22}O_{11}$, must be added to 500. g of water to give a solution with a vapor pressure 1.5 mm Hg less than that of pure water at 30 °C? The vapor pressure of water at 30 °C is 31.8 mm Hg.

A. 470 g B. 1.38 g C. 342 g D. 171 g

	13.	Calculate the freezing point (in °C) of a solution made by dissolving 10.0 g of sodium acetate ($NaC_2H_3O_2$) in 125. g of water. The freezing point depression constant of water is 1.86 °C/*m*.

A. –4.45°C B. –3.63°C C. –12.5°C D. –1.81°C

	14.	What is the osmotic pressure of an aqueous solution containing 2.50 g of urea, CON_2H_4, in 350 mL of solution at 25 °C?

A. 0.100 atm B. 0.244 atm C. 1.02 atm D. 2.91 atm

	15.	A solution that contains 3.86 g of X, a molecular compound, in 150 g of ethyl acetate boils at 78.21 °C. What is the molar mass of X? The normal boiling point of ethyl acetate is 77.06 °C and K_b for ethyl acetate is 2.77 °C/*m*.

A. 150 g/mol B. 9.30 g/mol C. 0.415 g/mol D. 62.0 g/mol

16. The osmotic pressure of a 0.0500 M $Ca(NO_3)_2$ solution is 3.06 atm at 25 °C. What is the van't Hoff factor, i, for $Ca(NO_3)_2$ at 25 °C?

A. 2.50 B. 1.22 C. 3.00 D. 2.67

17. Which one of the following is the correct equilibrium constant expression for the reaction? $CO(g) + O_2(g) \rightleftharpoons 2\ CO_2(g)$

A. $K_C = \frac{[CO_2]}{[CO][O_2]}$

B. $K_C = \frac{[CO_2]^2}{[CO]^2 + [O_2]}$

C. $K_C = \frac{2[CO] + [O_2]}{2[CO_2]}$

D. $K_C = \frac{[CO_2]^2}{[CO]^2[O_2]}$

18. Arrange the following reactions, occurring at 500 K, in order of **increasing** tendency to go to completion.

1. $2\ NOCl(g) \rightleftharpoons 2\ NO(g) + Cl_2(g)$ $K_p = 1.7 \times 10^{-2}$
2. $N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$ $K_p = 1.5 \times 10^{3}$
3. $2\ SO_3(g) \rightleftharpoons 2\ SO_2(g) + O_2(g)$ $K_p = 1.3 \times 10^{-5}$
4. $2\ NO_2(g) \rightleftharpoons 2\ NO(g) + O_2(g)$ $K_p = 5.9 \times 10^{-5}$

A. 1 < 2 < 3 < 4
B. 4 < 3 < 1 < 2
C. 3 < 4 < 1 < 2
D. 2 < 1 < 4 < 3

19. Equilibrium is established for the reaction at 35 °C.

$2\ NOCl(g) \rightleftharpoons 2\ NO(g) + Cl_2(g)$ $K_C = 1.6 \times 10^{-5}$

What is the equilibrium concentration of $NOCl(g)$ at 35 °C when the equilibrium concentrations of NO and Cl_2 are 1.0×10^{-2} M and 1.2×10^{-2} M respectively at 35 °C?

A. 0.27 M B. 3.7 M C. 0.075 M D. 2.7 M

20. For the equilibrium

$PH_3(g) + BCl_3(g) \rightleftharpoons PH_3BCl_3(s)$

$K_p = 19.2$ at 60 °C. What is K_c for this reaction at 60 °C?

A. 2.57×10^{-2} B. 466 C. 525 D. 1.44×10^{4}

21. For the following reaction, $K_C = 51$ at 448 °C:

$$H_2(g) + I_2(g) \rightleftharpoons 2\ HI(g)$$

Predict which way the reaction will proceed to equilibrium if we start with 0.020 mol of HI, 0.010 mol H_2 and 0.030 mol of I_2 in a sealed 2.0 L container.

A. The reaction will proceed to the right.
B. The reaction will proceed to the left.
C. The reaction is already at equilibrium.
D. This can not be determined from the data given.

22. For the equilibrium

$$N_2(g) + O_2(g) \rightleftharpoons 2\ NO(g)$$

$K_c = 2.5 \times 10^{-3}$ at 2400 K. What is K_C for the equilibrium

$$NO(g) \rightleftharpoons (1/2)\ N_2(g) + (1/2)\ O_2(g)$$

at 2400 K?

A. -1.25×10^{-3} B. 200 C. 400 D. 20

23. 2.50 moles of NOCl were placed in a 5.00 L reaction vessel at 427 °C. After equilibrium was reached 2.20 moles of NOCl remained. What is the equilibrium constant, K_C, for the reaction at 427 °C?

$$2\ NOCl(g) \rightleftharpoons 2\ NO(g) + Cl_2(g)$$

A. 4.09×10^{-3} B. 5.58×10^{-4} C. 1.79×10^{3} D. 2.42×10^{2}

24. Hydrogen iodide decomposes according to the equation

$$2\ HI(g) \rightleftharpoons H_2(g) + I_2(g)$$

$K_C = 0.0156$ at 400 °C. What is the equilibrium concentration of I_2 at 400 °C when 5.00 mol of HI is injected into a 10.0 L flask and the resulting system allowed to come to equilibrium at 400 °C?

A. 0.0100 M B. 0.0831 M C. 0.0500 M D. 7.56×10^{-3} M

25. The reaction of nitrogen gas with hydrogen to form ammonia is endothermic. Which of the following sets of conditions leads to the formation of the greatest amount of NH_3?

$$N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g)$$

A. high temperatures, low pressures
B. high temperatures, high pressures
C. low temperatures, low pressures
D. low temperatures, high pressures