

# PART II- REVIEW FINAL EXAM- CHEM 111

Name \_\_\_\_\_  
Last First

1. What is the net-ionic equation for the reaction that occurs when:

a. nitrous acid and sodium hydroxide solutions are mixed.

b. potassium hydroxide and hydrofluoric acid solutions are mixed.

2. Which of the elements given below will have:

**Ba Mg Cl Te I**

a. largest atomic size.

b. highest ionization potential

c. lowest electronegativity

d. lowest electron affinity

3.a. Name the three classes of compounds that are considered as electrolytes.

i. \_\_\_\_\_ ii. \_\_\_\_\_ iii. \_\_\_\_\_

b. Label each of the following as strong electrolyte, weak electrolyte, or non-electrolyte.

**(You must know the list of soluble salts, strong acids and strong bases to answer this question.)**

i.  $\text{NaC}_2\text{H}_3\text{O}_2$  \_\_\_\_\_ ii.  $\text{HC}_2\text{H}_3\text{O}_2$  \_\_\_\_\_ iii.  $\text{HCN}$  \_\_\_\_\_

iv.  $\text{HClO}_2$  \_\_\_\_\_ v.  $\text{NH}_4\text{BrO}_4$  \_\_\_\_\_ vi.  $\text{C}_4\text{H}_{12}$  \_\_\_\_\_

4. Tell if a precipitate may form upon mixing each of the following solutions:

**(You must know the list of solubility rules to answer this question)**

a. ammonium chloride and lead (II) nitrate.

b. barium nitrate and potassium sulfate.

c. nickel (II) sulfate and sodium hydroxide.

5. a. Define: isoelectronic

b. Which of the following isoelectronic species has the largest size?

**Se<sup>2-</sup> Br<sup>-</sup> Kr Sr<sup>2+</sup>**

6. Write an equation illustrating
- the heat of formation of  $\text{LiCl (s)}$
  - the lattice energy of  $\text{CsBr(s)}$
  - the dissociation energy of  $\text{Cl}_2 \text{ (g)}$
  - the sublimation energy of  $\text{Mg (s)}$
  - the electron affinity of  $\text{I(g)}$
  - the first ionization energy of  $\text{Ca(g)}$

7. Consider the types of crystalline solids:

**a) ionic, b) metallic, c) covalent network, and d) molecular**

to answer the questions given below:

Which conducts electricity in the solid state? \_\_\_\_\_

Which conducts electricity only in the molten state (liquid state) \_\_\_\_\_

Which has low melting point? \_\_\_\_\_

Which is known to be the hardest? \_\_\_\_\_

Which is soft and does not conduct electricity? \_\_\_\_\_

Which has lattice points occupied by positive and negative ions? \_\_\_\_\_

Which has lattice points occupied by atoms? \_\_\_\_\_

8. List the major intermolecular force in each of the following

- a)  $\text{H}_2$       b)  $\text{NH}_3$       c)  $\text{OCl}_2$  (bent geometry)      d)  $\text{CH}_4$  (tetrahedral geometry)

9. Define: molal boiling point elevation constant,  $K_b$ .

If  $K_b$  for water is  $1.86 \text{ }^\circ\text{C}\cdot\text{kg}/\text{mole}$ . How many units of degrees will a solution of  $1.00 \text{ m Mg}(\text{C}_2\text{H}_3\text{O}_2)_2$  rise in temperature?

10. A large value of an equilibrium constant, like  $10^{+7}$ , indicates that the position of equilibrium lies further to the \_\_\_\_\_.  
(right, or left)

11. Define: Normal boiling point

12. Draw the phase diagram for water and label the axis and the physical states in each region.

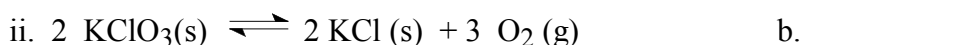
13. State the physical state of the dispersed phase and continuous phase in each of the following colloids:

a. a sol

b. an emulsion

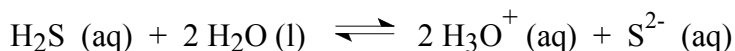
c. a gel

14. a.. Determine if a decrease in pressure at constant temperature favors the formation of reactants, the formation of products, or neither?



b. Which of the above equilibria has  $K_c = K_p$  ?

15. a. What is the equilibrium constant for the reaction given below, if  $K_{a1} = 1.0 \times 10^{-7}$  and  $K_{a2} = 1.4 \times 10^{-14}$



Answer: \_\_\_\_\_

b. What is the  $[\text{S}^{2-}]$  concentration of a 0.10 M  $\text{H}_2\text{S}(\text{aq})$ ?

Answer: \_\_\_\_\_

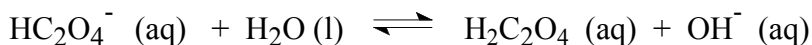
16. Determine if each solution given below is acidic, basic, or neutral at the **equivalence point**.

a. titration of  $\text{NH}_3(\text{aq})$  by  $\text{HCl}$  at the equivalence point. \_\_\_\_\_

b. titration of  $\text{HCHO}_2$  by  $\text{NaOH}$  at the equivalence point \_\_\_\_\_

c. titration of  $\text{NaOH}$  and by  $\text{HCl}$  at the equivalence point \_\_\_\_\_

17. Oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ , has values of  $K_{a1} = 5.6 \times 10^{-2}$  and  $K_{a2} = 5.1 \times 10^{-6}$ . Find  $K_b$  for the following equilibrium:



Answer: \_\_\_\_\_

18. Determine if each solution given below is a buffer.

a. 0.4 mole  $\text{NH}_3$  and 0.2 mole  $\text{HCl}$                       a. \_\_\_\_\_

b. 0.5 mole  $\text{NH}_3$  and 0.5 mole  $\text{HCl}$                       b. \_\_\_\_\_

c. 0.2 mole  $\text{HF}$  and 0.4 mole  $\text{NaOH}$                       c. \_\_\_\_\_

d. 0.5 mole  $\text{HCN}$  and 0.2 mole  $\text{KOH}$                       d. \_\_\_\_\_

19. Alcohol and water form ideal solution. At a certain temperature the vapor pressure of alcohol is 140 torr and that of water is 50 torr. What is the total vapor pressure in a closed container that has a solution made of 2.8 mole alcohol and 7.8 mole water?

Setup:

Answer \_\_\_\_\_

20. A 0.010 M  $\text{NH}_3$  solution has  $[\text{OH}^-] = 1.00 \times 10^{-3}$  M. What is the percent dissociation of  $\text{NH}_3$  in the solution?

Setup:

Answer \_\_\_\_\_

21. The vapor pressure of water at a certain temperature is 450 torr. What is the vapor pressure of a solution that contains 2.00 moles sugar and 18 moles water at the same temperature?

Setup:

Answer \_\_\_\_\_

22. Cadmium (molar mass= 112.4 g/mole) crystallizes in a body-centered cubic system. What is the mass of a unit cell of cadmium?

Setup:

Answer \_\_\_\_\_

23. A metal crystallizes in a body-centered cubic lattice. The radius of the atom is  $2.22 \times 10^{-8}$  cm. Calculate the volume of the unit cell.

Setup:

Answer \_\_\_\_\_

24. A metal crystallizes in a face-centered cubic lattice. The volume of the unit cell is  $1.64 \times 10^{-22}$  cm<sup>3</sup>. What is the radius of an atom of this metal?

Setup:

Answer \_\_\_\_\_

25.  $K_a$  for acetic acid, HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, is  $1.8 \times 10^{-5}$ . What is the [OH<sup>-</sup>] concentration for a 0.25 M of sodium acetate?

Setup:

Answer \_\_\_\_\_

26. It took 47 seconds for an unknown gas to effuse, whereas Cl<sub>2</sub>(g) (molar mass=71.00 g/mole) required 85 seconds. What is the molar mass of the unknown gas?

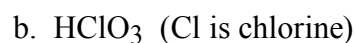
Setup:

Answer \_\_\_\_\_

27. The amount of phosphorus in a 17.50 g sample of a compound was determined by converting the phosphorus to  $\text{Ca}_3(\text{PO}_4)_2(\text{s})$ . The  $\text{Ca}_3(\text{PO}_4)_2$  weighed 28.55 g. What is the percent phosphorus in the original sample? (molar mass:  $\text{Ca}_3(\text{PO}_4)_2 = 279.3 \text{ g/mole}$ )  
Setup:

Answer \_\_\_\_\_

28. Draw the Lewis electron dot structure for the following:

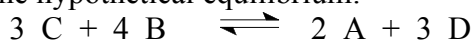


29. Find the concentration of  $[\text{Na}^+]$  after mixing 12.5 ml of 0.320 M  $\text{NaNO}_3$  and 8.44 ml of 0.540 M  $\text{Na}_3\text{PO}_4$ .

Setup:

Answer \_\_\_\_\_

30. Consider the hypothetical equilibrium:



If 3 moles of C and 4 moles of B are placed in a 4.00 liter container and allowed to reach equilibrium, the mixture is found to contain 1.5 moles of D. What is the amount of C at equilibrium?

Setup:

Answer: \_\_\_\_\_

