

## Exam IV – Chapters 11, 13, 14, 15, 17, 18

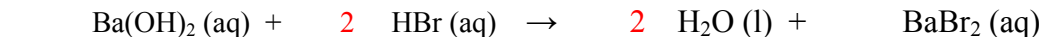
$$PV=nRT \quad R = 0.0821 \text{ L atm / mol K}$$

1. (4 pts) What is the molarity of a 500.0 mL solution made by dissolving 5.500 g of potassium sulfate in water?

$$K_2SO_4 = 174.27 \text{ g/mol}$$

$$5.500 \text{ g} (1 \text{ mol}/174.27 \text{ g}) = 0.03156 \text{ mol} \quad M = \text{mol/L} = 0.03156 \text{ mol} / 0.5000 \text{ L} = 0.06312 \text{ M } K_2SO_4$$

2. (6 pts) What volume, in mL, of a 2.50 M Ba(OH)<sub>2</sub> solution is required to reach the equivalence point when titrated with 45.0 mL of a 3.60 M solution of HBr?



$$45.0 \text{ mL HBr} (1 \text{ L} / 1000 \text{ mL})(3.60 \text{ mol HBr} / 1 \text{ L})(1 \text{ mol Ba(OH)}_2 / 2 \text{ mol HBr})(1 \text{ L} / 2.50 \text{ mol Ba(OH)}_2)(1000 \text{ mL} / 1 \text{ L}) \\ = 32.4 \text{ mL Ba(OH)}_2$$

3. (4 pts) What is the mass of solute in 50.0 g of a 33.0 % NaF solution?

$$33.0\% = (X \text{ g solute} / 50.0 \text{ g solution}) \times 100\% = 16.5 \text{ g solute}$$

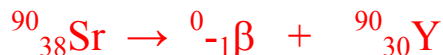
4. (6 pts) What pressure, in atm, does CO<sub>2</sub> have when a 450.0 mL vessel containing 2.567 g of C<sub>3</sub>H<sub>8</sub> have at 33.5 °C according to the following reaction?



$$2.567 \text{ g C}_3\text{H}_8 (1 \text{ mol} / 44.11 \text{ g C}_3\text{H}_8)(3 \text{ mol CO}_2 / 1 \text{ mol C}_3\text{H}_8) = 0.1745 \text{ mol CO}_2$$

$$P = \frac{nRT}{V} = \frac{(0.1745 \text{ mol CO}_2)(0.0821 \text{ L atm/mol K})(306.65 \text{ K})}{(0.4500 \text{ L})} = 9.76 \text{ atm}$$

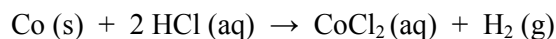
5. (4 pts) What radioisotope is produced when a Sr-90 nucleus decays by beta emission? Write the equation.



6. (9 pts each) Classify the following solutions as acidic, basic, or neutral (circle one):

- |   |               |              |                |
|---|---------------|--------------|----------------|
| a. A solution containing $1.00 \times 10^{-6} \text{ M OH}^-$ | acidic        | <b>basic</b> | neutral        |
| b. A solution containing $1.00 \times 10^{-3} \text{ M H}^+$  | <b>acidic</b> | basic        | neutral        |
| c. A solution containing $0.0000001 \text{ M OH}^-$           | acidic        | basic        | <b>neutral</b> |

7. (12 pts total) Please answer all questions regarding the following Redox reaction:



The substance oxidized is Co.

The substance reduced is H in HCl.

The oxidizing agent is HCl.

The reducing agent is Co.

8. (4 pts) How much of a 225 mg sample of lead-210 remains after 111.5 years? The half-life for  $^{210}\text{Pb}$  is 22.3 years.

$$111.5 / 22.3 = 5 t_{1/2} \quad 225/2^5 = 7.03 \text{ mg}$$

9. (12 pts) Isopropanol,  $\text{C}_3\text{H}_7\text{OH}$  (l), is a polar solvent often found in household rubbing alcohol. Circle the appropriate answer for the following:

- |  |                |                  |                 |                   |
|--|----------------|------------------|-----------------|-------------------|
| a. $\text{CCl}_4$ (l)                    | soluble        | insoluble        | miscible        | <b>immiscible</b> |
| b. $\text{CH}_3\text{CH}_2\text{Br}$ (l) | soluble        | insoluble        | <b>miscible</b> | immiscible        |
| c. $\text{CaF}_2$ (s)                    | <b>soluble</b> | insoluble        | miscible        | immiscible        |
| d. $\text{CO}_2$ (s)                     | soluble        | <b>insoluble</b> | miscible        | immiscible        |

10. (3 pts) What is the oxidation number for sulfur in  $\text{SO}_3$  (g)?

- a. -2                      b. -6                      **c. +6**                      d. +2                      e. 0

11. (3 pts) What is the oxidation number for nitrogen in  $\text{N}_2$  (g)?

- a. -2                      b. -4                      c. +2                      d. +1                      **e. 0**

12. (3 pts) In an oxidation-reduction reaction, the substance being oxidized decreases its oxidation number.

- a. True  
**b. False**

13. (3 pts) Which of the following is an example of an Arrhenius base?

- a.  $\text{KCl}$  (aq)  
**b.  $\text{KOH}$  (aq)**  
c.  $\text{KNO}_3$  (aq)  
d.  $\text{H}_2\text{SO}_4$  (aq)

14. (3 pts) When calcium phosphate is placed in water it is a

- a. strong electrolyte  
**b. weak electrolyte**  
c. nonelectrolyte

15. (3 pts) Circle the correct answer below that is a property of liquids:

- a. Definite shape and fixed volume  
**b. Flow readily**  
c. Can expand and compress considerably  
d. Can be crystalline or noncrystalline

16. (3 pts) Intermolecular forces or bonds exist between \_\_\_\_\_.
- two atoms in a polar molecule
  - two atoms in a nonpolar molecule
  - two different ions in an ionic compound
  - two different molecules
17. (3 pts) Acetone, which is the active ingredient in nail polish remover, boils at 56°F. Considering the boiling point of water, check all of the statements below that are correct:
- The intermolecular forces between water molecules are stronger than those between acetone molecules.
  - Acetone's vapor pressure should be higher than water's.
  - Acetone's surface tension should be higher than water's.
  - Acetone's viscosity should be lower than water's.

Consider the following choices for problems 18-22 (3 pts each):

- |                             |                              |
|-----------------------------|------------------------------|
| a) an ionic bond            | d) a London dispersion force |
| b) a polar covalent bond    | e) a dipole-dipole force     |
| c) a nonpolar covalent bond | f) a hydrogen bonding force  |

18. What holds the atoms together in a  $\text{CCl}_4$  molecule is   b  .
19. What holds two  $\text{Br}_2$  molecules together is   d  .
20. The K-O bond in  $\text{K}_2\text{O}$  is   a  .
21. What holds two HBr molecules together is   e  .
22. What holds the atoms together in a water molecule is   b  .

**Extra Credit: (5 pts)**

A 2.00 M solution of  $\text{CaCl}_2$  in water has a density 1.17 g/mL. What is the m/m% of  $\text{CaCl}_2$ ?