**CHE1031 Lecture 4 HW Key**

Problems must be solved, or written out, in their entirety with all work shown on engineering graph paper. You must label each set in the upper left hand corner with your name, the date and the chapter. Problems must be identified by number and all work must be shown with answers boxed. Be sure your handwriting is legible. An example is posted in the ‘course basics’ section of our Moodle page.

**4.1: Solutions & solvents**

1. A solution of 0.1 M acetic acid (HC2H3O2) conducts electricity to a light bulb, causing it to glow. How do you explain this?

2. When asked what causes electrolyte solutions to conduct electricity, a student responds that it is due to the movement of electrons through the solution. Is the student correct? If not, give a better explanation.

3. When dissolved in water, ionic compounds form strong electrolytes because they act as separate ions in solution. What properties of water make this dissociation happen? Do you think that salts would dissociate in molecular liquids like liquid Br2 or liquid mercury? Why or why not?

4. What ions are present when these compounds are added to water?

a. MgI2

b. Al(NO3)3

c. H(ClO4)

d. Na(C2H3O2)

**4.2: Solution concentration & stoichiometry**

5. Suppose you prepare 500 mL of a 0.10 M solution of salt, and let it sit uncovered for some time so that some water evaporates. What happens to the concentration of the solution?

6. How many mL of 0.120 M HCl are needed to neutralize 50.0 mL of 0.101 M Ba(OH)2 solution?

7. How many moles of KBr are present in 150 mL of a 0.275 M solution?

8. How many mL of 6.1 M HCl solution are needed to obtain 0.100 mol of HCl?

9. In each of the following pairs, which has the higher concentration of I-1 ion:

a. 0.10 M BaI2 or 0.25 M KI

b. 100 mL of 0.10 M KI or 200 mL of 0.040 M ZnI2

c. 3.2 M HI solution or a solution made by dissolving 145 g of NaI in water to 150 mL

10. How would you prepare 175.0 mL of 0.150 M AgNO3 solution if starting with pure and solid AgNO3?

11. A protocol tells you to use 100 mL of 0.50 M HNO3, but you only have 3.6 M HNO3. How would you make the dilution you need?

12. If 55.8 mL of BaCl2 solution is needed to precipitate all of the sulfate ion in a 752-mg sample of Na2(SO4), what is the molarity of the BaCl2 solution?

13. If 42.7 mL of 0.208 M HCl solution is needed to neutralize a solution of Ca(OH)2, how many grams of Ca(OH)2 must be in that solution?

**4.3: Precipitation reactions**

14. Write a balanced chemical equation & identify the precipitate (if any) when these solutions are mixed:

a. Na(C2H3O2) + HCl

b. K(OH) + Cu(NO3)2

c. Fe(SO4) + Pb(NO3)2

15. Write balanced net ionic equations for the reactions that occur here. Be sure to identify spectator ions:

a. Ba(NO3)2 + K2(SO4) 🡪

b. Fe(NO3)2 + K(OH) 🡪

16. Separate samples of a solution of an unknown ionic compound are treated with dilute Ag(NO3), Pb(NO3)2, and BaCl2. Precipitates form in all three cases. Which cation could the original solution contain?

a. Br-1

b. CO3-2

c. NO3-1

**4.4: Neutralization reactions**

17. Explain these observations:

a. NH3 contains no OH-1 ions, yet its aqueous solution is basic.

b. HF is weak, yet it is highly reactive.

c. Although H2(SO4) is a strong electrolyte, its aqueous solution has more H(SO4)-1 ions than SO4-2 ion.

18. Write the balanced molecular and net ionic equations for this neutralization reaction:

 Cr(OH)3 + H(NO2)🡪

19. Write the balanced molecular and net ionic equations for this neutralization reaction:

 H(C2H3O2) + Ba(OH)2 🡪

20. Write the balanced molecular and net ionic equations for this neutralization reaction:

 Al(OH)3 + HNO3 🡪

21. An 8.65-g sample of base made of an unknown from group 2A and hydroxide ion is dissolved in 85.0 mL of water. An acid base indicator is added, and the base is titrated with 2.50 M HCl solution; 56.9 mL of acid is required to complete the titration.

 a. What is the MW of the base?

 b. Which cation is in the base: Ca+2, Sr+2 or Ba+2?

**4.5: Redox reactions**

22. Oxidation:

a. Can oxidation happen without oxygen?

b. Can oxidation happen without reduction?

23. Using the activity series, write balanced chemical equations for these reactions. If there is no reaction, use the label “NR”.

a. hydrochloric acid is added to gold metal

b. chromium metal is added to cobalt (II) chloride solution

c. hydrogen gas is bubbled through silver nitrate solution

24. Which of these are redox reactions? Indicate which compound is oxidized and which is reduced?

a. CH3CH2OH + 3O2 🡪 3H2O + 2CO2

b. ZnCl2 + 2NaOH 🡪 Zn(OH)2 + 2NaCl

25. Use these reactions to create an activity series for halogens:

Br2 + 2NaI 🡪 2NaBr + I2

Cl2 + 2NaBr 🡪 2NaCl + Br2

26. How do the position of the halogens in the periodic table relate to their locations in the activity series?

27. Do redox reactions happen when these molecules are mixed?

a. Cl2 and KI

b. Br2 and LiCl