Name _____ Block: _____ Date: _____

Chemistry 12

REVIEW - UNIT 3: SOLUBILITY

1. Identify each of the following as **ionic** or **molecular** substances:

   a) $NaCl_{(aq)}$ ....._____

   b) $CH_3COOH_{(aq)}$ ....._____

   c) $CCl_{4(l)}$ ....._____

   d) $HNO_{3(aq)}$ ....._____

   e) $C_2H_{6(l)}$ ....._____

2. A good way to test a liquid to see if it contains ***ions*** is to _____

   _____

3. Define a ***saturated solution*** _____

   _____

4. Define an ***unsaturated solution*** _____

   _____

5. What is meant by ***solubility*** ? _____

   _____

6. On the "Solubility Table", what, precisely, does the word ***soluble*** mean? _____

   _____

7. The process of an ionic solid breaking down into individual ions is called _____

8. Does an *increase in temperature* always increase the ***rate*** of dissolving? _____

9. Does an *increase in temperature* always increase the solubility of a substance in water? _____. Explain.

10. A chemistry stockroom contains a bottle of 12.0 M HCl. A teacher needs to make up 800.0 mL of a 3.0 M solution of HCl. What volume of the stock solution (12.0 M) does the teacher need to use?

11. A chemistry student dilutes a 0.20 M solution by adding 200.0 mL of water to 50.0 mL of the original solution. Calculate the ***molar concentration*** of the final solution.

12. A student has 600.0 mL of a 0.30 M solution of HNO_3. How much water must she add in order to make it a 0.15 M solution? (Be careful that you answer the question!)

13. If 25.0 mL of 0.90 M HCl is added to 125.0 mL of water, what is the final [HCl]?

14. Calculate the $[Fe^{3+}]$ in a 0.25 M solution of $Fe_2(SO_4)_3$?

15. Calculate the $[Na^+]$ in a 0.55 M solution of sodium acetate. (Write the proper formula for sodium acetate first.)

16. Calculate the $[Na^+]$ in a 0.55 M solution of sodium carbonate. (Write the proper formula for sodium carbonate first.)

17. Calculate the $[Na^{+}]$ in a 0.55 M solution of sodium phosphate. (Write the proper formula for sodium phosphate first)

18. 300.0 mL of 0.500 M NaCl is mixed with 400.0 mL of 0.200 M HCl. Calculate the final total $[Cl^-]$.

19. 200.0 mL of 0.500 M NaCl is mixed with 300.0 mL of 0.200 M $CaCl_2$. Calculate the final total $[Cl^-]$.

20. An aqueous solution of $Pb(NO_3)_2$ is mixed with an aqueous solution of KBr and a precipitate forms.

    a) Write a ***balanced formula equation*** for this reaction. (*Include all subscripts.*)

    _____

    b) Write a ***balanced total ionic equation*** for this reaction. (*Include all subscripts.*)

    _____

    c) Write a balanced ***net ionic equation*** for this reaction. (*Include all subscripts.*)

    _____

21. An aqueous solution of $Al(NO_3)_3$ is mixed with an aqueous solution of $(NH_4)_2S$ and a precipitate forms.

    a) Write a ***balanced formula equation*** for this reaction. (*Include all subscripts.*)

    _____

    b) Write a ***balanced total ionic equation*** for this reaction. (*Include all subscripts.*)

    _____

    c) Write a balanced ***net ionic equation*** for this reaction. (*Include all subscripts.*)

    _____

22. Devise a procedure to ***separate*** the ions in a mixture which contains the following sets of ions. Be specific about what you add and what happens when you add it. Remember, you cannot add single ions, only compounds or aqueous solutions of the compounds.

    a) Ba^{2+} , Mg^{2+} and Na^{+}

b) Ag^{+} , Cu^{2+} and Mg^{2+}

23. Complete the ***balanced dissociation equation*** and write the ***K_{sp} expression*** for the dissolving of the following substances (*Include all subscripts.*):

a) $CaCO_{3(s)}$

Ksp =

b) $Ag_2SO_{4\ (s)}$

Ksp =

c) $Ba(OH)_{2(s)}$

Ksp =

24. Calculate the ***molar solubility*** of $BaCO_3$ in water.

25. Calculate the ***molar solubility*** of $Mg(OH)_2$ in water.

26. Calculate the number of grams of CaC_2O_4 which will dissolve in 1.5 L of water at 25°C.

27. Calculate the number of grams of SrF_2 which will dissolve in 0.50 L of water at 25°C.

28. At a certain temperature the ***molar solubility*** of $Zn(OH)_2$ is 1.65×10^{-5} M.

    a) Write the ***solubility equilibrium equation*** for $Zn(OH)_{2(s)}$

    _____

    b) Write the ***Ksp expression*** for $Zn(OH)_2$.

    c) Calculate the ***Ksp*** for $Zn(OH)_2$.

29. The solubility of $CoCO_3$ in water is 1.189×10^{-3} ***grams per liter.*** Calculate the ***Ksp*** for $CoCO_3$.

30. Will a precipitate form if 100.0 mL of 1.0×10^{-3} M $Pb(NO_3)_2$ solution is added to 100.0 mL of 2.0×10^{-3} M $MgSO_4$ solution? Show all calculations and include the Trial Ksp.

31. Will a precipitate form if 2.50 grams of Na_2SO_4 is added to 60.0 mL of a 2.0×10^{-4} M solution of $BaCl_2$? Show all calculations and include the Trial Ksp.

32. Calculate the ***maximum concentration*** of fluoride ion possible in a solution in which $[Sr^{2+}] = 5.0 \times 10^{-3}$ M.

33. Predict what would happen to the ***solubility*** of $PbSO_{4(s)}$ if some K_2SO_4 solution is added. Explain your answer and include the use of an equilibrium equation.

34. The solubility of $ZnCO_3$ in water is quite low. What could you add to increase the solubility? _____

Explain fully how your method would work. Include the use of equilibrium equations.

35. A solution containing silver ions (Ag^+) is titrated with 0.100 M KSCN solution to find the $[Ag^+]$ in the sample. The indicator $Fe(NO_3)_{3\ (aq)}$ is used to signal when the stoichiometric point is reached. It is found that 11.8 mL of 0.100 M KSCN is needed to titrate a 25.0 mL sample of Ag^+ solution. Determine the $[Ag^+]$ in the sample.

36. In order to find the concentration of chloride ion in a sample of pool water, a 100.0 mL sample of the pool water was titrated with 0.200 M $AgNO_3$ solution, using sodium chromate solution ($Na_2CrO_{4\ (aq)}$) as an indicator. At the stoichiometric point, it was found that 23.7 mL of $AgNO_3$ solution had been added. Determine the $[Cl^-]$ in the pool water sample.