Chemistry 11

Name: Key
Date:
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Solution Practice Test

1. During a lab activity, you dilute 45 mL of a 8.5 M HCl solution to a final volume of 120 mL. What is the resulting HCl concentration?
   a. 2.3 M
   b. 3.2 M
   c. 5.1 M
   d. 23 M

   $C_1V_1 = C_2V_2$
   $(8.5M)(45mL) = C_2(120mL)$
   $C_2 = 3.2M$

2. Which of the following equations correctly represents the dissociation of calcium chloride in water?
   a. $CaCl_{(aq)} \rightarrow Ca^{+}_{(aq)} + Cl^{-}_{(aq)}$
   b. $CaCl_{2\,(aq)} \rightarrow Ca^{2+}_{(aq)} + Cl^{-}_{(aq)}$
   c. $CaCl_{2\,(aq)} \rightarrow Ca^{2+}_{(aq)} + 2Cl^{-}_{(aq)}$
   d. $CaCl_{2\,(aq)} + H_2O \rightarrow Ca^{2+}_{(aq)} + 2Cl^{-}_{(aq)}$

3. When added to a solution containing Mg^{2+}, which anion will create a precipitate?
   a. NO_3^-
   b. Cl^-
   c. OH^-
   d. S^{2-}

   low solubility

4. When added to an iron (III) iodide solution, which of the following compounds will create a precipitate?
   a. cesium nitrate
   b. hydrochloric acid
   c. copper (II) sulphate
   d. ammonium hydroxide

   $FeI_{3(aq)} + NH_4OH_{(aq)} \rightarrow NH_4I_{(aq)} + Fe(OH)_{3(s)}$

5. How many mL of 0.550 M NaOH would be required to titrate 25.0 mL of a 0.388 M solution of hydrochloric acid?
   a. 17.6 mL
   b. 25.0 mL
   c. 35.4 mL
   d. 46.9 mL

   $NaOH + HCl \rightarrow NaCl + H_2O$

   $0.025L_{HCl} \times \frac{0.388mol_{HCl}}{1L} \times \frac{1mol_{NaOH}}{1mol_{HCl}} \times \frac{1L_{NaOH}}{0.550mol} \times \frac{1000mL}{1L}$

   $= 17.6mL_{NaOH}$

6. A student must prepare a 3.00 L solution of 0.750 M NaOH. She is given a stock solution of 12.0 M NaOH.
   a. What volume of stock solution is needed to prepare the final solution?

   $C_1V_1 = C_2V_2$
   $(12.0M)(V_1) = (0.750M)(3.00L)$
   $V_1 = 0.188L_{NaOH}$

   b. What volume of water was added to prepare the final solution?

   $3.00L - 0.188L = 2.81L_{H_2O}$

7. MnSO4 was dissolved in water. What is the ionization equation?

$MnSO_{4\,(aq)} \rightarrow Mn^{2+}_{(aq)} + SO_4^{2-}_{(aq)}$

8. A chemist mixes a 225 mL of a 3.8 M Na_2CO_3 solution with 3.8 g of K_2CO_3. What is the concentration of each ion in this solution?

$[Na_2CO_3]$

$Na_2CO_3 \rightarrow 2Na^+ + CO_3^{2-}$

3.8M 7.6M 3.8M

$[K_2CO_3]$

$\frac{3.8g\,K_2CO_3}{225mL} \times \frac{1000mL}{1L} \times \frac{1\,mol\,K_2CO_3}{138.21g} = 0.12M\,K_2CO_3$

$K_2CO_3 \rightarrow 2K^+ + CO_3^{2-}$

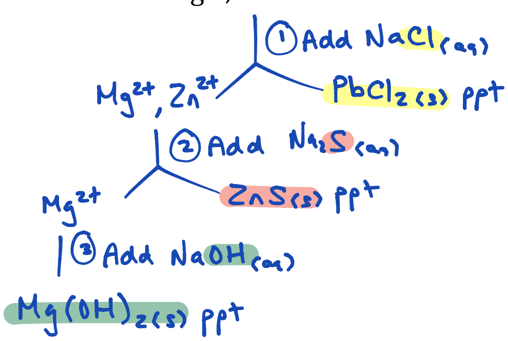
0.12M 0.24M 0.12M

$[Na^+] = 7.6M$ $[CO_3^{2-}] = 3.9M$ $[K^+] = 0.24M$

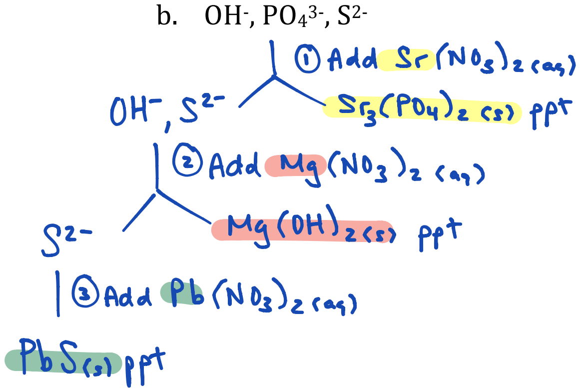
9. For the following solutions, use a flow chart to describe the process of separating the ions from each other.

(other answers possible)

a. Mg^{2+}, Pb^{2+} and Zn^{2+}



b. OH^-, PO_4^{3-}, S^{2-}



10. Predict the products in the following reactions. Then, balance the equations. Be sure to indicate the state (aq or s), of each product.

a. _____ $CaCl_{2\,(aq)}$ + __2__ $KNO_{3\,(aq)} \rightarrow Ca(NO_3)_{2\,(aq)} + 2\,KCl_{(aq)}$

b. __2__ $HCl_{(aq)}$ + _____ $Ca(OH)_{2\,(aq)} \rightarrow 2\,H_2O_{(aq)} + CaCl_{2\,(aq)}$

11. Write a formula equation, complete ionic equation and net ionic equation for the following reactions:

a. Strontium hydroxide and zinc chloride

Formula: $Sr(OH)_{2(aq)} + ZnCl_{2(aq)} \rightarrow SrCl_{2(aq)} + Zn(OH)_{2(s)}$

Complete Ionic: $Sr^{2+}_{(aq)} + 2OH^-_{(aq)} + Zn^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow Sr^{2+}_{(aq)} + 2Cl^-_{(aq)} + Zn(OH)_{2(s)}$

Net Ionic: $Zn^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Zn(OH)_{2(s)}$

b. Ammonium bromide and copper (I) sulphate

$2NH_4Br_{(aq)} + Cu_2SO_{4(aq)} \rightarrow 2CuBr_{(s)} + (NH_4)_2SO_{4(aq)}$

$2NH_4^+_{(aq)} + 2Br^-_{(aq)} + 2Cu^+_{(aq)} + SO_4^{2-}_{(aq)} \rightarrow 2CuBr_{(s)} + 2NH_4^+_{(aq)} + SO_4^{2-}_{(aq)}$

$2Cu^+_{(aq)} + 2Br^-_{(aq)} \rightarrow 2CuBr_{(s)}$

12. Determine whether the following are soluble or have low solubility.

a. Barium chloride soluble / low solubility *(circle one)*

b. $Sn(OH)_4$ soluble / low solubility *(circle one)*

13. A titration was performed that required 12.7 mL of 0.150 M $Mg(OH)_2$ to titrate 25.00 mL of a hydrochloric acid, HCl, solution. Determine the molarity of the hydrochloric acid.

$$2HCl + Mg(OH)_2 \rightarrow MgCl_2 + 2H_2O$$

$$12.7\,mL_{Mg(OH)_2} \times \frac{1\,L}{1000\,mL} \times \frac{0.150\,mol_{Mg(OH)_2}}{1\,L} \times \frac{2\,mol_{HCl}}{1\,mol_{Mg(OH)_2}} = 0.00381\,mol_{HCl}$$

$$\frac{0.00381\,mol_{HCl}}{25.00\,mL} \times \frac{1000\,mL}{1\,L} = \boxed{0.152\,M_{HCl}}$$

14. Consider the following results from a titration lab.

4.50 g of KOH was dissolved to make a 100. mL solution
Below is the volume of the KOH solution needed to neutralize 15.0 mL H_3PO_4.

	Trial #1	Trial #2	Trial #3	Trial #4
Initial reading of burette (mL)	2.56	8.95	13.35	17.55
Final reading of burette (mL)	8.95	13.35	17.55	21.75
Volume of KOH (mL)	6.39 mL	4.40 mL	4.20 mL	4.20 mL

a. What is the concentration of the standardized solution of KOH?

$$\frac{4.50\text{ g KOH}}{100.\text{ mL}} \times \frac{1000\text{ mL}}{1\text{ L}} \times \frac{1\text{ mol KOH}}{56.11\text{ g KOH}} = \boxed{0.802\text{ M}_{KOH}}$$

b. What was the average volume of KOH was needed? (Only use data from three trials!!)

*eliminate outliers!

$$\frac{4.40\text{ mL} + 4.20\text{ mL} + 4.20\text{ mL}}{3} = \boxed{4.27\text{ mL KOH}}$$

c. What is the concentration of the acid?

$$H_3PO_4 + 3KOH \longrightarrow K_3PO_4 + 3H_2O$$

$$4.27\text{ mL}_{KOH} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{0.802\text{ mol KOH}}{1\text{ L}} \times \frac{1\text{ mol }H_3PO_4}{3\text{ mol KOH}} = 0.00114\text{ mol }H_3PO_4$$

$$\frac{0.00114\text{ mol }H_3PO_4}{15.0\text{ mL}} \times \frac{1000\text{ mL}}{1\text{ L}} = \boxed{0.0760\text{ M }H_3PO_4}$$