Chemistry 11

Solutions Unit Review

Name: Key
Date:
Block:

1. What mass of H_3PO_4 is contained in 83.5 mL of a 6.15 M solution?

$$mL \rightarrow L \times \frac{mol}{L} \times \frac{g}{mol} = g\ H_3PO_4$$

2. If 9.0 mL of 4.00 M HNO_3 solution is diluted to a volume of 600.0 mL, what will be the molarity of the diluted solution?

$$C_1V_1 = C_2V_2$$
$$? \quad \swarrow$$

3. What initial volume of 6.0 M hydrochloric acid is required to make 2.00 L of 0.500 M hydrochloric acid solution?

$$C_1V_1 = C_2V_2$$
$$\downarrow$$
$$?$$

4. How much water must be added to a 35.0 mL sample of 10.0 M HCl to give a resulting concentration of 0.350 M?

$$C_1V_1 = C_2V_2$$
$$\searrow\ ?$$

$$\text{Water to be added} = V_2 - 35.0\,mL$$

5. Write the balanced ionization equation for the following solutes in water:
   a. Na_2CO_3 $\quad Na_2CO_{3\,(aq)} \rightarrow 2Na^+_{(aq)} + CO_3^{2-}{}_{(aq)}$
   b. $MgSO_4$ $\quad MgSO_{4\,(aq)} \rightarrow Mg^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$
   c. Barium nitrate $\quad Ba(NO_3)_{2\,(aq)} \rightarrow Ba^{2+}_{(aq)} + 2NO_3^-{}_{(aq)}$

6. 250.0 mL of 0.60 M HCl is added to 300.0 mL of 1.0 M HBr. What is the final concentration of each ion in solution?

[HCl]

$C_1V_1 = C_2V_2$

$C_2 = ?$

[HBr]

$C_1V_1 = C_2V_2$

$C_2 = ?$

$HCl \rightarrow H^+ + Cl^-$

$C_2 \quad C_2 \quad C_2$

$HBr \rightarrow H^+ + Br^-$

$C_2 \quad C_2 \quad C_2$

add together for final answer

7. Write a formula equation, complete ionic equation and net ionic equation for the following reactions:
   a. Magnesium sulphide and zinc chloride

Formula: $MgS_{(aq)} + ZnCl_{2(aq)} \rightarrow MgCl_{2(aq)} + ZnS_{(s)}$

Complete Ionic: $Mg^{2+}_{(aq)} + S^{2-}_{(aq)} + Zn^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow Mg^{2+}_{(aq)} + 2Cl^-_{(aq)} + ZnS_{(s)}$

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

   b. Sodium carbonate and barium sulphide

$Na_2CO_{3(aq)} + BaS_{(aq)} \rightarrow BaCO_{3(s)} + Na_2S_{(aq)}$

$2Na^+_{(aq)} + CO_3^{2-}_{(aq)} + Ba^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow BaCO_{3(s)} + 2Na^+_{(aq)} + S^{2-}_{(aq)}$

$Ba^{2+}_{(aq)} + CO_3^{2-}_{(aq)} \rightarrow BaCO_{3(s)}$

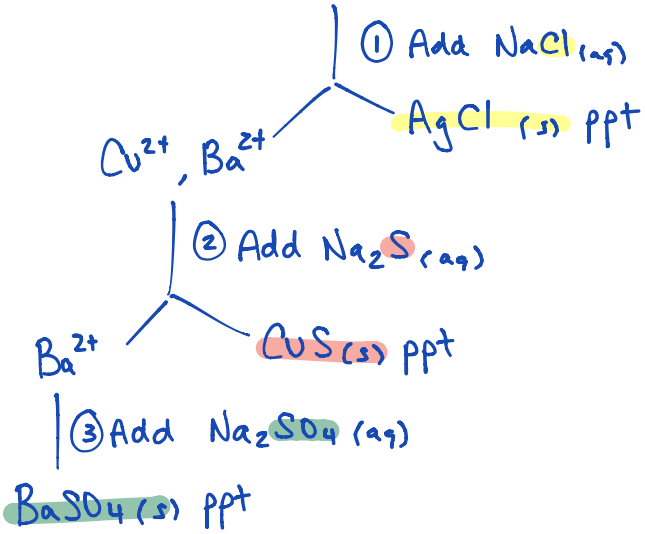
c. H_2SO_3 (aq) and $CaCl_2$ (aq) $\longrightarrow$ $2HCl_{(aq)} + CaSO_{3(s)}$

$2H^+_{(aq)} + SO_3^{2-}{}_{(aq)} + Ca^{2+}_{(aq)} + 2Cl^-_{(aq)} \longrightarrow 2H^+_{(aq)} + 2Cl^-_{(aq)} + CaSO_{3(s)}$

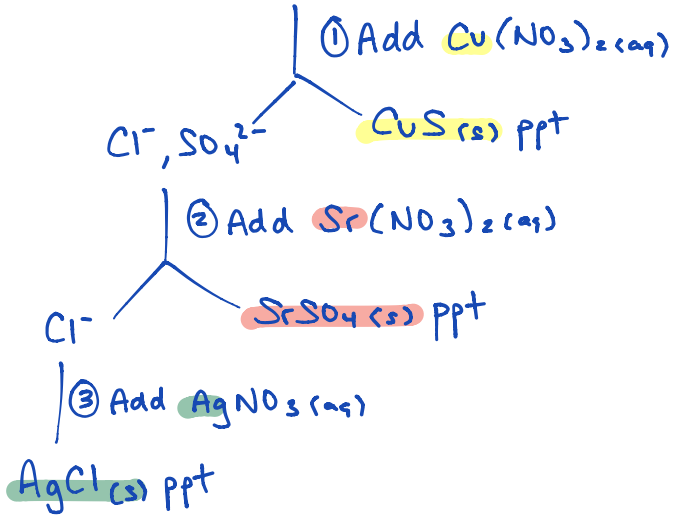
$Ca^{2+}_{(aq)} + SO_3^{2-}{}_{(aq)} \rightarrow CaSO_{3(s)}$

8. A solution contains the following ions. Using a flow chart, show what compounds could be added and in what order to separate these ions. *other answers possible

a. Cu^{2+}, Ba^{2+} and Ag^+.



b. Cl^-, SO_4^{2-}, S^{2-}



9. A titration was performed that required 14.7 mL of 0.102 M NaOH to titrate 25.00 mL of a hydrochloric acid, HCl, solution. Determine the concentration of the hydrochloric acid.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

$$L_{NaOH} \times \frac{mol_{NaOH}}{L} \times \frac{mol_{HCl}}{mol_{NaOH}} \times \frac{1}{L_{HCl}} = M_{HCl}$$

10. If 46.2 mL of 2.50 M NaOH is required to neutralize 1.54 M of a phosphoric acid, H_3PO_4, solution, what volume of phosphoric acid was needed to reach the equivalence point?

$$3\,NaOH + H_3PO_4 \longrightarrow Na_3PO_4 + 3H_2O$$

$$L_{NaOH} \times \frac{mol_{NaOH}}{L} \times \frac{mol_{H_3PO_4}}{mol\ NaOH} \times \frac{1L_{H_3PO_4}}{mol_{H_3PO_4}} = L_{H_3PO_4}$$

11. If 8.6 mL of 0.0994 M HNO_3 is required to neutralize 25.00 mL of a strontium hydroxide solution, what is the molarity of the strontium hydroxide?

$$2\,HNO_3 + Sr(OH)_2 \longrightarrow Sr(NO_3)_2 + 2H_2O$$

$$L_{HNO_3} \times \frac{mol_{HNO_3}}{L} \times \frac{mol\ Sr(OH)_2}{mol\ HNO_3} \times \frac{1}{L_{Sr(OH)_2}} = M_{Sr(OH)_2}$$

Answer Key

1. 50.3 g H_3PO_4
2. 0.060 M HNO_3
3. 0.17 L or 170 mL HCl
4. 965 mL H_2O
5. (see work done for this question above)
6. $[H^+]$ = 0.82 M $[Cl^-]$ = 0.27 M $[Br^-]$ = 0.55 M
7. (see work done for this question above)
8. (multiple answers possible – see work done for this question above)
9. 0.0600 M HCl
10. ~~0.025 L H_3PO_4~~ 0.0250 L H_3PO_4
11. 1.7×10^{-2} M $Sr(OH)_2$