Chemistry 12

Solubility Calculations Worksheet

Name: Key
Date:
Block:

1. 5.62g of Na_2SO_4 is dissolved in enough water to make 750.0 mL of solution.
   a. Calculate the $[Na_2SO_4]$.

$$\frac{5.62\text{g } Na_2SO_4}{750.0\text{mL}} \times \frac{1000\text{mL}}{1\text{L}} \times \frac{1\text{mol } Na_2SO_4}{142.1\text{g}} = 0.0527\text{M } Na_2SO_4$$

   b. Calculate the $[Na^+]$.

$$Na_2SO_4 \rightarrow 2Na^+ + SO_4^{2-}$$
$$0.0527\text{M} \qquad 0.105\text{M} \qquad 0.0527\text{M}$$
$$\times 2$$

2. 250.0mL of water are added to 600.0mL of a 6.0M HCl solution. Calculate the final [HCl].

$$C_1V_1 = C_2V_2$$
$$(600.0\text{mL})(6.0\text{M}) = (850.0\text{mL})(C_2)$$
$$C_2 = 4.2\text{M HCl}$$

3. Calculate the mass of K_2CrO_4 needed to make 3.00L of a 0.0200M solution.

$$\frac{3.00\text{L}}{1} \times \frac{0.0200\text{mol } K_2CrO_4}{1\text{L}} \times \frac{194.2\text{g}}{1\text{mol } K_2CrO_4} = 11.7\text{g } K_2CrO_4$$

4. 150.0 mL of a 0.400 M solution of $Mg(NO_3)_2$ is diluted to a volume of 500.0 mL by adding water. Calculate the final nitrate ion concentration.

$$C_1V_1 = C_2V_2$$
$$(0.400\text{M})(150.0\text{mL}) = (C_2)(500.0\text{mL})$$
$$C_2 = 0.120\text{M} = Mg(NO_3)_2$$

$$Mg(NO_3)_2 \rightarrow Mg^{2+} + 2NO_3^-$$
$$0.120\text{M} \qquad 0.120\text{M} \qquad 0.240\text{M}$$

5. What volume of 0.250M $NaNO_3$ solution needs to be evaporated in order to produce 68.0 grams of solid $NaNO_3$?

$$68.0\text{g } NaNO_3 \times \frac{1\text{mol } NaNO_3}{85.0\text{g}} \times \frac{1\text{L}}{0.250\text{mol}} = 3.2\text{L } NaNO_3$$

6. The concentration of chloride ion, $[Cl^-]$ in a solution of aluminum chloride is 0.99M. Calculate the $[Al^{3+}]$ in the same solution.

$$AlCl_3 \rightarrow Al^{3+} + 3Cl^-$$
$$0.33\text{M} \qquad 0.33\text{M} \qquad 0.99\text{M}$$
$$\div 3$$

7. 400.0 mL of 0.200 M Li_3PO_4 is mixed with 200.0 mL of 0.250 M Na_2CO_3. Calculate the final concentration of all four ions in the final mixture.

$[Li_3PO_4]$

$(0.200M)(400.0mL) = (C_2)(600.0mL)$

$C_2 = 0.133M$

$Li_3PO_4 \rightarrow 3Li^+ + PO_4^{3-}$

$0.133M \quad 0.400M \quad 0.133M$

x3

$[Na_2CO_3]$ $(0.250M)(200.0mL) = (C_2)(600.0mL)$

$C_2 = 0.0833M$

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

$0.0833M \quad 0.167M \quad 0.0833M$

x2

8. 300.0 mL of 0.100M Li_3PO_4 is mixed with 500.0 mL of 0.050M Li_2CO_3. Calculate the final concentration of all three ions in the final mixture.

$[Li_3PO_4]$

$(0.100M)(300.0mL) = (C_2)(800.0mL)$

$C_2 = 0.0375M$

$Li_3PO_4 \rightarrow 3Li^+ + PO_4^{3-}$

$0.0375M \quad 0.1125M \quad 0.0375M$

x3

$[Li_2CO_3]$

$(0.050M)(500.0mL) = (C_2)(800.0mL)$

$C_2 = 0.03125$

$Li_2CO_3 \rightarrow 2Li^+ + CO_3^{2-}$

$0.03125M \quad 0.0625M \quad 0.03125M$

x2

$[PO_4^{3-}] = 0.038M$

$[CO_3^{2-}] = 0.031M$

$[Li^+] = 0.1125 + 0.0625 = 0.18M$

9. Calculate the volume of 12.0 M Na_2SO_3 which needs to be added to 500.0 mL of water in order to produce a solution in which $[Na^+] = 0.200M$

$Na_2SO_3 \rightarrow 2Na^+ + SO_3^{2-}$

$[Na_2SO_3] = 0.200M\ Na^+ \times \frac{1mol\ Na_2SO_3}{2mol\ Na^+} = 0.100M\ Na_2SO_3$

$C_1V_1 = C_2V_2$

$(12.0M)(V_1) = (0.100)(500.0 + V_1)$

$V_1 = 4.20mL$

10. The molar solubility of calcium sulphate is 8.43×10^{-3} M. Calculate the mass of solid calcium sulphate which can be evaporated from 250.0 mL solution of calcium sulphate.

$250.0mL\ CaSO_4 \times \frac{1L}{1000mL} \times \frac{8.43 \cdot 10^{-3}mol}{1L} \times \frac{136.2g}{1mol} = 0.287g\ CaSO_4$

11. It is found that 13.01g is the maximum mass of $PbCl_2$ which will dissolve in 3.0L of solution. Use this information to calculate the concentration of $PbCl_2$.

$\frac{13.01g\ PbCl_2}{3.0L} \times \frac{1mol\ PbCl_2}{278.2g} = 0.016M\ PbCl_2$

12. The concentration of silver iodate ($AgIO_3$) is 1.79×10^{-4}M. Calculate the mass of silver iodate that can be dissolved in 650 mL of water.

$650.0mL \times \frac{1L}{1000mL} \times \frac{1.79 \cdot 10^{-4}mol}{1L} \times \frac{282.8g}{1mol\ AgIO_3} = 0.0329g\ AgIO_3$