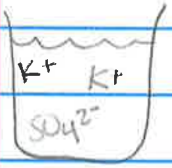
$$\boxed{M = \frac{n}{V_{sol'n}}} \qquad \boxed{V = \frac{n}{M}}$$

$$\boxed{\underset{(mol)}{n} = \underset{(\frac{mol}{L})}{M} \cdot \underset{(L)}{V}}$$

Suppose 24.307g K_2SO_4 is dissolved in water to make 250.00 mL sol'n. What is the molarity of K_2SO_4? (MM = 174.259 g mol^{-1}) September 23rd

$$[K_2SO_4] \equiv M_{K_2SO_4} = \frac{n}{V} \quad \frac{24.307 g\ A_2SO_4}{} \left| \frac{1\ mol}{174.259 g} \right| \frac{}{0.25000 L} = 0.55795 \frac{mol\ K_2SO_4}{L}$$



$[K^+] = 1.1159\ M\ K^+$

$[SO_4^{2-}] = 0.55795\ M\ SO_4^{2-}$

$[K_2SO_4] = 0.55795\ M\ K_2SO_4$

$$K_2SO_4(s) \xrightarrow{100\%} 2K^+(aq) + SO_4^{2-}(aq)$$

What volume of this solution is needed to make 500.00 mL of 2.0×10^{-2} M K_2SO_4?

$M_cV_c = M_dV_d$ = Dilution Formula $\qquad n_c = n_d \rightarrow M_cV_c = M_dV_d$

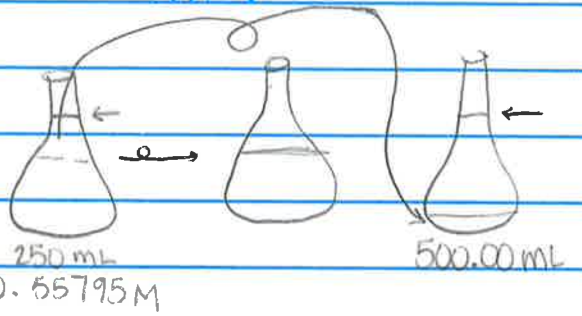
M_c: 0.55795 mol/L

V_c: ?

M_d: 2.0×10^{-2} M

V_d: 500.00 mL

↳ $V_c = 17.9$ mL



What volume of the original solution is needed to deliver 50.00 mmol K_2SO_4?

$$V = \frac{n}{M}$$

$$\frac{50.00\ mmol}{} \left| \frac{1 \times 10^{-3} mol}{1\ mmol} \right. = 0.05\ mol$$

$$V = \frac{0.05\ mol}{0.55795\ M}$$

↳ $\boxed{V = 0.0896 L \text{ or } 89.6 mL}$

Solubility Rules:

September 23rd

All NO_3^- are soluble. No exceptions.

ClO_4^-
$C_2H_3O_2^-$
Group I cations
NH_4^+

All halides (Cl^- Br^- I^-) are soluble (except for AgX, PbX_2 and Hg_2X_2)

All SO_4^{2-} are soluble except for $BaSO_4$ and $PbSO_4$ and Hg_2SO_4

O^{2-} S^{2-} CO_3^{2-} PO_4^{3-} are insoluble except for Group I and NH_4^+

Hydroxides (OH^-) are generally insoluble... except Group I hydroxides (LiOH, NaOH, KOH, RbOH)

$Ca(OH)_2$
$Sr(OH)_2$ } a little soluble
$Ba(OH)_2$
$Mg(OH)_2$ (s, aq)

(s) or (aq)

NH_4ClO_2 (aq)
$Ca_3(PO_4)_2$ (s)
$BaSO_4$ (s)
$ScClO_4$ (aq)

$Cr(NO_3)_3$ (aq)
K_3PO_4 (aq)
AgI (s)
K_2S (aq)

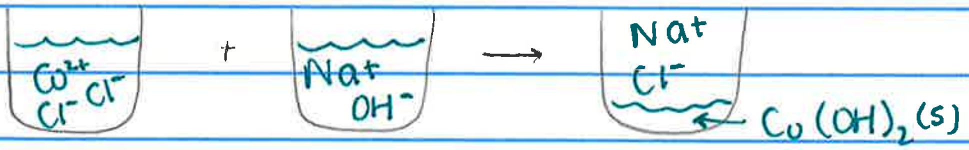
$Mg(C_2H_3O_2)_2$ (aq)
$Fe(OH)_3$ (s)
$FeSO_4$ (aq)
CuS (s)

overall equation: $CoCl_2(aq) + 2NaOH(aq) \longrightarrow Co(OH)_2(s) + 2NaCl(aq)$ September 23rd

Co^{2+} Cl^- Na^+ OH^- $Co(OH)_2(s)$ Na^+ Cl^-

Ionic equation: $Co^{2+}(aq) + \underbrace{2Cl^-(aq) + 2Na^+(aq)}_{\text{spectator ions}} + 2OH^-(aq) \rightarrow Co(OH)_2(s) + \underbrace{2Na^+(aq) + 2Cl^-(aq)}_{\text{spectator ions}}$

net ionic equation: $Co^{2+}(aq) + 2OH^-(aq) \longrightarrow Co(OH)_2(s)$

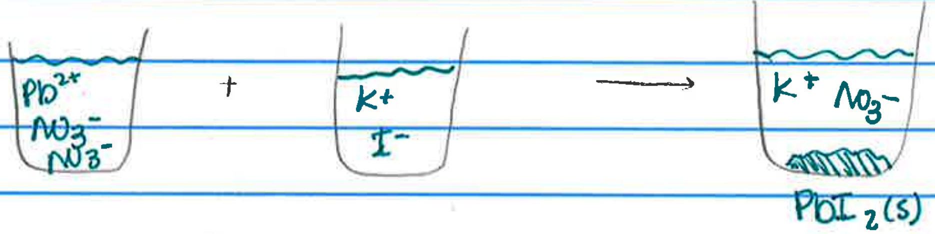


overall equation: $Pb(NO_3)_2(aq) + 2KI(aq) \longrightarrow PbI_2(s) + 2KNO_3(aq)$

Pb^{2+} NO_3^- K^+ I^- $PbI_2(s)$ K^+ NO_3^-

Ionic equation: $Pb^{2+}(aq) + \underbrace{2NO_3^-(aq) + 2K^+(aq)}_{\text{spectator ions}} + 2I^-(aq) \rightarrow PbI_2(s) + \underbrace{2K^+(aq) + 2NO_3^-(aq)}_{\text{spectator ions}}$

net ionic equation: $Pb^{2+}(aq) + 2I^-(aq) \longrightarrow PbI_2(s)$



$3NH_4Cl(aq) + Na_3PO_4(aq) \longrightarrow (NH_4)_3PO_4(aq) + 3NaCl(aq)$

NH_4^+ Cl^- Na^+ PO_4^{3-}

6 strong acids

hydrochloric acid	$HCl(aq) + H_2O \xrightarrow{100\%} H_3O^+(aq) + Cl^-(aq)$
hydrobromic acid	$HBr(aq)$
hydroiodic acid	$HI(aq)$
nitric acid	HNO_3
perchloric acid	$HClO_4$
sulfuric acid	H_2SO_4

sulfate H_2SO_4 → surfuric acid

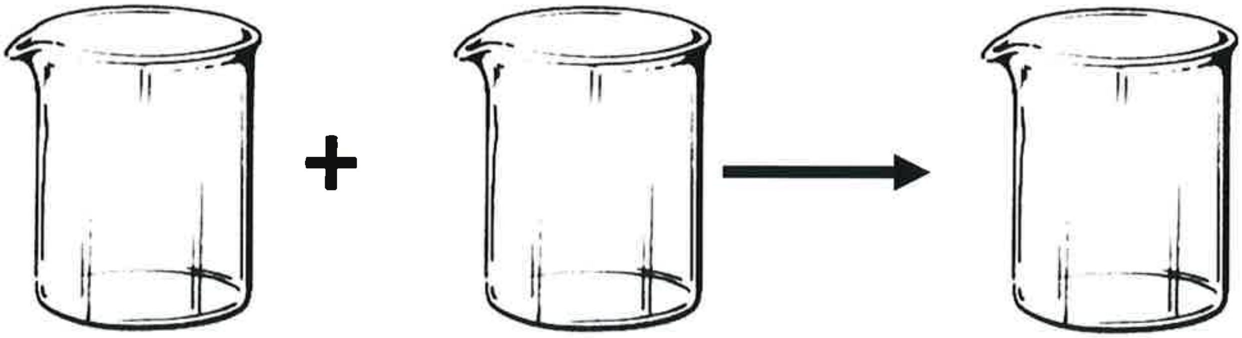
sulfite H_2SO_3 → sulfurous acid

nitrate HNO_3 → nitric acid

nitrite HNO_2 → nitrous acid

Chapter 4 Day 2 (Sections 4.6 – 4.9) (Unit 2) 23 September 2019

1. In the first beaker sketch aqueous sodium sulfate. In the second beaker sketch aqueous barium nitrate. In the third beaker sketch what happens when the two solutions are mixed. Write the overall reaction and the net ionic reaction below the beakers.



Balanced overall chemical equation:

Balanced net ionic equation:

2. Which of the following solutions would form a precipitate? Under each formula, write the ions in solution. Identify the precipitate and balance the overall reaction. If there is no reaction, only mixture-making, write "No reaction".

2a. $FeSO_4(aq)$ + $Na_2S(aq)$ →

2b. $AgNO_3(aq)$ + $KBr(aq)$ →

2c. $NiCl_2(aq)$ + $KOH(aq)$ →

2d. $NaClO_4(aq)$ + $NH_4Cl(aq)$ →

2e. $Ca(NO_3)_2(aq)$ + $Na_2CO_3(aq)$ →

3. Which of these form acids or bases when dissolved in water? Circle the acids. Box the bases.

$HClO_4$ NH_3 KOH HI CH_3OH

4. Write a net ionic equation for the neutralization reaction of HCN(aq) with NaOH(aq).

5. How many milliliters of 0.300 M Li_2S are needed to react with 25.00 mL of 0.315 M $AgNO_3$?

$Li_2S(aq) + 2\ AgNO_3(aq) \rightarrow 2\ LiNO_3(aq) + Ag_2S(s)$

Now try these problems from the book:

Section 4.6. (Precipitation and solubility) Problems 11, 12, 13, 14, 76 – 92 (even)

Section 4.7. (Acids, bases, neutralization) Problems 15, 16, 17, 18, 40, 94, 96, 98

Section 4.8. (Solution stoichiometry) Problems 19, 20, 100

Section 4.9. (Titrations) Problems 21, 22, 102, 104, 106

Practice Test (pg 151) 7 - 11