Answer Key

10/01/25

Chapter 4 Review

Determine if each is a strong electrolyte, weak electrolyte, or nonelectrolyte.

strong acid

HNO_3 strong

covalent → CH_3OH Non

weak base → $Zn(OH)_2$ weak

weak acid

HF weak

Ionic → K_2SO_4 strong

$C_6H_{12}O_6$ Non ← covalent

Write the net ionic equation for potassium iodide and silver nitrate in a precipitation reaction. What are the spectator ions?

Molecular: $KI_{(aq)} + AgNO_{3(aq)} \rightarrow AgI_{(s)} + KNO_{3(aq)}$

$K^+ I^-$ $Ag^+ NO_3^-$

Complete ionic: $K^+_{(aq)} + I^-_{(aq)} + Ag^+_{(aq)} + NO_3^-{}_{(aq)} \rightarrow AgI_{(s)} + K^+_{(aq)} + NO_3^-{}_{(aq)}$

Net: $Ag^+_{(aq)} + I^-_{(aq)} \rightarrow AgI_{(s)}$

Spectator ions: $K^+_{(aq)} + NO_3^-{}_{(aq)}$

Write the net ionic equation for the following.

Molecular: $FeCl_3 \cdot 6H_2O\,(aq) + 3NaOH\,(aq) \rightarrow 3\,NaCl_{(aq)} + Fe(OH)_{3(s)} + 6H_2O_{(l)}$

Complete ionic: $Fe^{3+}_{(aq)} + 3Cl^-_{(aq)} + 6H_2O_{(l)} + 3Na^+_{(aq)} + 3OH^-_{(aq)} \rightarrow 3Na^+_{(aq)} + 3Cl^-_{(aq)} + Fe(OH)_{3(s)} + 6H_2O_{(l)}$

Net: $Fe^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Fe(OH)_{3(s)}$

SKIP

Write the net ionic equation for the following.

H_2SO_3 (aq) + LiOH (aq) →

Write the net ionic equation for sulfuric acid and potassium hydroxide.

Molecular: $H_2SO_4(aq) + 2\,KOH(aq) \rightarrow K_2SO_4(aq) + 2\,H_2O(l)$

Complete: $2H^+(aq) + SO_4^{2-}(aq) + 2K^+(aq) + 2OH^-(aq) \rightarrow 2K^+(aq) + SO_4^{2-}(aq) + 2H_2O(l)$

Net: $2H^+(aq) + 2OH^-(aq) \rightarrow 2\,H_2O(l)$ ← Need to simplify

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

Write the net ionic equation for the following:

K_2CO_3 (aq) + 2 HCl (aq) → $2\,KCl(aq) + CO_2(g) + H_2O(l)$

Complete: $2K^+(aq) + CO_3^{2-}(aq) + 2H^+(aq) + 2Cl^-(aq) \rightarrow 2K^+(aq) + 2Cl^-(aq) + CO_2(g) + H_2O(l)$

Net: $CO_3^{2-}(aq) + 2H^+(aq) \rightarrow CO_2(g) + H_2O(l)$

Find the oxidation number of the indicated atoms:

N_2O_3 N = +3 (+3, -2; +6 -6 = 0)

HSO_4^- S = +6 (+1 +6 -8 = -1; +7 -8)

P_4 P = 0

HCl H = +1 (+ -)

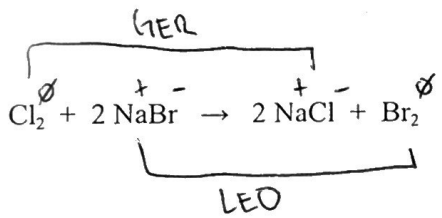
ScH_3 H = -3 (+3 -3)

$LiBF_4$ B = +3 (+ -; +1 +3 -4 = 0; +4 -4)

Determine what is oxidized and reduced. Identify the oxidizing agent and the reducing agent.

Cl_2 = Oxidizing Agent

NaBr = Reducing Agent



$Cl_2^0 \rightarrow Cl^-$ more - → gain e⁻ Reduced

$Br^- \rightarrow Br^0$ more + → lose e⁻ Oxidized

$2Ag(s) + Pb(NO_3)_2(aq) \rightarrow 2AgNO_3(aq) + Pb(s)$

(0; +2 +10 -12; +12 -12) (+ +5 -2; +1 +5 -6; +6 -6) (0)

Ag = Reducing Agent

$Pb(NO_3)_2$ = Oxidizing Agent

$Ag^0 \rightarrow Ag^+$ lost e⁻ = oxidized

$Pb^{2+} \rightarrow Pb^0$ gain e⁻ = Reduced

$\frac{mol}{L}$

M

What is the concentration of an aqueous solution with a volume of 450 mL that contains 200. grams of iron (II) chloride (MW = 126.751 g)?

$$\frac{200\text{ g } FeCl_2}{126.751\text{ g } FeCl_2} \left| \frac{1\text{ mol } FeCl_2}{} \right. = 1.58\text{ mol } FeCl_2$$

$$\frac{1.58\text{ mol}}{0.450\text{ L}} = \boxed{3.5\text{ M}}$$

$$\frac{450\text{ mL}}{1000\text{ mL}} \left| \frac{1\text{ L}}{} \right. = 0.450\text{ L}$$

How many grams of copper (II) fluoride are needed to make 6.7 liters of a 1.2 M solution?

$\uparrow \frac{mol}{L}$

$$\frac{1.2\text{ mol}}{\text{L}} \times 6.7\text{ L} = 8.0\text{ moles } CuF_2$$

$$\frac{8.0\text{ moles } CuF_2}{1\text{ mol } CuF_2} \left| \frac{101.542\text{ g } CuF_2}{} \right. = \boxed{8.2 \times 10^2\text{ g } CuF_2}$$

If you dilute 175 mL of a 1.6 M solution of LiCl to 1.0 L, determine the new concentration of the solution.

$$M_1V_1 = M_2V_2$$

$$\frac{1.0\text{ L}}{1\text{ L}} \left| \frac{1000\text{ mL}}{} \right. = 1000\text{ mL}$$

$$\frac{(1.6\text{ M})(175\text{ mL})}{1000\text{ mL}} = \frac{(M_2)(1000\text{ mL})}{1000\text{ mL}}$$

$$M_2 = \boxed{0.28\text{ M}}$$

$10.0\,mL \mid \frac{1\ L}{1000\ mL} = 0.0100\,L$ $\qquad$ $30.0\,mL \mid \frac{1\ L}{1000\ mL} = 0.0300\,L$

If it takes 10.0 mL of 2.0 M H_2SO_4 to neutralize 30.0 mL of KOH, what is the molar concentration of the KOH?

$$H_2SO_4 + 2\,KOH \rightarrow K_2SO_4 + 2\,H_2O$$

$$\frac{2.0\,mol\ H_2SO_4}{L} \times 0.0100\,L = 0.020\,mol\ H_2SO_4$$

$$0.020\,mol\ H_2SO_4 \mid \frac{2\,mol\ KOH}{1\,mol\ H_2SO_4} = 0.040\,mol\ KOH$$

$$\frac{0.040\,mol}{0.0300\,L} = \boxed{1.3\,M\ KOH}$$

What is the concentration of NO_3^- in a 0.65 M solution of barium nitrate?

$$Ba(NO_3)_2$$

$$\frac{0.65\,\cancel{mol}\ Ba(NO_3)_2}{L} \mid \frac{2\,mol\ NO_3^-}{1\,mol\ \cancel{Ba(NO_3)_2}} = \boxed{1.3\,M\ NO_3^-}$$