PROBLEMS

1. Identify the following ionic compounds as soluble or insoluble.

   a) Calcium Carbonate ($CaCO_3$)

   b) Barium Sulfate ($BaSO_4$)

   c) Calcium Phosphate ($Ca_3(PO_4)_2$)

2. Predict what happens when a potassium phosphate (K_3PO_4) solution is mixed with a Calcium carbonate ($CaCO_3$) solution.

   a) balanced molecular equation

   b) ionic equation

   c) net ionic equation

3. Predict what happens when sodium sulfide and zinc chloride solutions are mixed.

   a) balanced molecular equation

   b) ionic equation

   c) net ionic equation

4. Identify the following as a weak or strong acid or base.

   a) H_2SO_4 b) HF c) NH_3 d) $Ba(OH)_2$

5. In the redox reaction given below, write the half-reaction and identify the oxidising and reducing agents.

   $$H_2 + Cl_2 \longrightarrow 2HCl$$

6. Calculate the mass of KCl in grams required to prepare 5×10^2 mL of a 3.6M solution.

7. Calculate the molarity of the following solution: 14.4 g of calcium chloride in 2.4×10^2 mL of solution.

8. If you have 240 mL of a .6M HCl solution and you want to dilute it to exactly .24M, how much water should be added?

9. How many grams of KCl are required to precipitate most of the Ag^+ ions from 5×10^2 mL of .012 M $AgNO_3$ solution? Write the net ionic equation also.

10. Iodate ion, IO_3^- oxidizes SO_3^{2-} in acidic solution.
Half reaction: $SO_3^{2-} + H_2O \longrightarrow SO_4^{2-} + 2H^+ + 2e^-$
A 50mL sample of solution containing 2g of KIO_3 reacts with 36mL of .3M Na_2SO_3. What is the final oxidation state of the iodine after the reaction has occurred?

11. What is the oxidation number of I in IF_7?

ANSWERS

1a) soluble

b) insoluble

c) insoluble

2a) $2K_3PO_4 + 3CaCO_3 \rightarrow 3K_2CO_3 + Ca_3(PO_4)_{2\,(s)}$

b) $6K^+ + 2PO_4^{3-} + 3Ca^{2+} + 3CO_3^{2-} \rightarrow 6K^+ + 3CO_3 + Ca_3(PO_4)_{2\,(s)}$

c) $3Ca^{2+} + 2PO_4^{3-} \rightarrow Ca_3(PO_4)_{2\,(s)}$

3a) $Na_2S + ZnCl_2 \rightarrow ZnS_{(s)} + 2NaCl$

b) $2Na^+ + S^{2-} + Zn^{2+} + 2Cl^- \rightarrow ZnS_{(s)} + 2Na^+ + 2Cl^-$

c) $S^{2-} + Zn^{2+} \rightarrow ZnS_{(s)}$

4a) strong acid b) weak acid c) weak base d) strong base

5. $H_2 + Cl_2 \rightarrow 2HCl$

Oxidation: $H_2 \rightarrow 2H^+ + 2e^-$ Reduction: $Cl_2 + 2e^- \rightarrow 2Cl^-$

Oxidizing Agent: Cl_2 Reducing Agent: H_2

6. Volume of solution = 5×10^2 mL

Molarity = 3.6M molar mass of KCl = 74.5g

Moles of KCl = $500\ mL \times \frac{3.6\ mol\ KCl}{1000\ mL\ solution}$

= 1.8 moles of KCl

Mass of KCl = $1.8 \times 74.5g = \boxed{134.1\ g}$

7. 14.4 g $CaCl_2$ in 2.4×10^2 mL of solution

Molar mass $CaCl_2$ = 108.98

Moles $CaCl_2 = \frac{14.4g}{108.98\ mol/g} = .132$ moles $CaCl_2$

Molarity = $\frac{.132\ mol}{.24L} = \boxed{.55M}$

8. $M_1V_1 = M_2V_2$

$V_2 = \frac{M_1V_1}{M_2} = \frac{(.6)(.04)}{.24} = .1\,L = 100\,mL$

100 mL is the final volume of the solution

Volume of water that should be added is $100 - 40 = \boxed{60\,mL}$

9. $KCl + AgNO_3 \longrightarrow AgCl_{(s)} + KNO_3$

Moles of $AgNO_3 = .012\,M \times \frac{5 \times 10^2\,mL}{1000\,mL} = .006\,mol$

Moles of $KCl = .006\,mol$

Mass of $KCl = .006\,mol \times 74.5\,g/mol = \boxed{.447\,g}$

Net ionic equation: $Ag^+ + Cl^- \longrightarrow AgCl_{(s)}$

10. $SO_3^{2-} + H_2O \longrightarrow SO_4^{2-} + 2H^+ + 2e^-$

Moles $KIO_3 = \frac{2\,g}{214\,g/mol} = .009\,mol$

Moles $Na_2SO_3 = .3\,M \times \frac{36\,mL}{1000\,mL} = .0108\,moles$

To find oxidation state

$SO_3^{2-} = x + 3(-2) = -2$

$\Rightarrow x = -2 + 6 = 4$

$SO_4^{2-} = x + 4(-2) = -2$

$\Rightarrow x = -2 + 8 = 6$

There is a loss of $2e^-$ gained by I

$IO_3^- = x + 3(-2) = -1$

$\Rightarrow x = -1 + 6 = 5$

Final oxidation state = $\boxed{+5}$

11. IF_7

$x + 7(-1) = 0$

$x = \boxed{7}$