Review Set Chapter 4

Michael Brodskiy
Instructor: Mr. Morgan

October 15, 2020

1. What volume of .08[M] solution of copper (II) sulfate is needed to react with .02[L] of .2[M] solution of sodium hydroxide? (1)

$$\begin{gathered} CuSO_4 + 2\,NaOH \longrightarrow Cu(OH)_2 + Na_2SO_4 \\ .2 \cdot .02 = .004 \\ \frac{.004}{.08} \cdot .5 = .025[L] \end{gathered} \tag{1}$$

2. Give the oxidation number of each atom in the following:

   (a) $N_2H_4 \rightarrow N = -2,\ H = 1$

   (b) $NOF \rightarrow N = 3,\ F = -1,\ O = -2$

   (c) $Sb_4O_{10} \rightarrow O = -2,\ Sb = 5$

   (d) $CaC_2O_4 \rightarrow Ca = 2,\ O = -2,\ C = 3$

   (e) $HSO_4 \rightarrow S = 6,\ H = 1,\ O = -2$

   (f) $Sn^{4+} \rightarrow Sn = 4$

3. State which reactant is oxidized and which is reduced:

   (a) $CrO_4{}^{2-} + NO_2{}^- + H_2O \longrightarrow Cr(OH)_3 + NO_3{}^- + OH^-$

   Chromium is reduced because it gained electrons, while nitrogen is oxidized because it lost electrons

   (b) $ClO_3{}^{2-} + S^{2-} + H_2O \longrightarrow Cl^- + S + OH^-$

   Chlorine is reduced because it gains electrons, and sulfur is oxidized because it loses electrons.

   (c) $Cl_2 + OH^- \longrightarrow ClO^- + Cl^- + H_2O$

Chlorine is both reduced and oxidized.

(d) $NO_3^- + H^+ + I_2 \longrightarrow NO_2 + H_2O + IO_3$

Nitrogen is reduced because it gains electrons, and Iodine is oxidized because it loses electrons.

4. How many grams of solid is produced when 13[mL] of .164[M] zinc (II) sulfate is mixed with excess ammonium sulfide:

$$\begin{aligned} ZnSO_4(aq) + (NH_4)_2S(aq) &\longrightarrow (NH_4)_2SO_4(aq) + ZnS(s) \\ 13[mL] &\rightarrow .013[L] \\ .164 \cdot .013 &= .00213 \\ .00213 \cdot 97 &= .207[g] \end{aligned} \tag{2}$$

5. Complete each of the following, indicate the physical state of each product:

(a) $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow 2\,NaCl(aq) + BaSO_4(s)$

(b) $3\,KOH(aq) + Fe(NO_3)_3(aq) \longrightarrow 3\,KNO_3(aq) + FeOH(s)$

(c) $Ca(C_2H_3O_2)_2(aq) + K_2SO_4(aq) \longrightarrow 2\,KC_2H_3O_2(aq) + CaSO_4(s)$

6. Given the following reactants, write the corresponding balanced complete ionic equation. Include physical states and any charges:

(a) $Co^{2+}(aq) + 2\,NO_3^-(aq) + 2\,NH_4^+(aq) + S^{2-}(aq) \longrightarrow 2\,NH_4^+(aq) + 2\,NO_3^-(aq) + CoS(s)$

(b) $2\,Na^+(aq) + CO_3^{2-}(aq) + Co^{2+}(aq) + 2\,Cl^-(aq) \longrightarrow 2\,Na^+(aq) + 2\,Cl^-(aq) + CoCO_3(s)$

7. How many grams of solid is produced when 50[mL] of .2[M] Na_2CO_3 is mixed with 50[mL] of .158[M] of $BaCl_2$

$$\begin{aligned} Na_2CO_3 + BaCl_2 &\longrightarrow BaCO_3(s) + 2\,NaCl \\ .05 \cdot .2 &= .01[mol_{Na_2CO_3}] \\ .05 \cdot .158 &= .0079[mol_{BaCl_2}] \\ .0079 \cdot 197 &= .156[g_{BaCO_3}] \end{aligned} \tag{3}$$

8. Balance the following Redox equations:

9. $Se + NO_3^- \longrightarrow SeO_2 + NO$

$$\begin{aligned} Se + 2\,H_2O &\longrightarrow SeO_2 + 4\,H^+ + 4\,e^- \\ NO_3^- + 4\,H^+ + 3\,e^- &\longrightarrow NO + 2\,H_2O \\ 3\,Se + 4\,NO_3^- + 4\,H^+ &\longrightarrow 3\,SeO_2 + 4\,NO + 2\,H_2O \end{aligned} \tag{4}$$

10. $\mathrm{MnO_4^-} + \mathrm{Cl^-} \longrightarrow \mathrm{Mn^{2+}} + \mathrm{ClO^-}$

$$\begin{aligned} \mathrm{MnO_4^-} + 8\,\mathrm{H^+} + 5\,\mathrm{e^-} &\longrightarrow \mathrm{Mn^{2+}} + 4\,\mathrm{H_2O} \\ \mathrm{Cl^-} + \mathrm{H_2O} &\longrightarrow \mathrm{ClO^-} + 2\,\mathrm{H^+} + 2\,\mathrm{e^-} \\ 2\,\mathrm{MnO_4^-} + 3\,\mathrm{H_2O} + 5\,\mathrm{Cl^-} &\longrightarrow 2\,\mathrm{Mn^{2+}} + 5\,\mathrm{ClO^-} + 6\,\mathrm{OH^-} \end{aligned} \tag{5}$$