Chem 1100 Chapter Four Study Guide Answers

Outline

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IV. Oxidation Reduction (redox) reactions
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Practice Problems
1. Write the ionic equation and net ionic equation for the following molecular equation.
   \[ \text{H}_2\text{SO}_4 \text{(aq)} + 2 \text{NaOH (aq)} \rightarrow \text{Na}_2\text{SO}_4 \text{(aq)} + 2 \text{H}_2\text{O (l)} \]

   Ionic: \[ 2 \text{H}^+ \text{(aq)} + \text{SO}_4^{2-} \text{(aq)} + 2 \text{Na}^+ \text{(aq)} + 2 \text{OH}^- \text{(aq)} \rightarrow 2 \text{Na}^+ \text{(aq)} + \text{SO}_4^{2-} \text{(aq)} + \text{H}_2\text{O (l)} \]

   Net Ionic: \[ 2 \text{H}^+ \text{(aq)} + 2 \text{OH}^- \text{(aq)} \rightarrow \text{H}_2\text{O (l)} \]

2. Give the type of reaction for each of the following as either an acid-base, combustion, gas evolution, or precipitation reaction.
   a. \[ 2 \text{C}_4\text{H}_{10} \text{(g)} + 13 \text{O}_2 \text{(g)} \rightarrow 8 \text{CO}_2 \text{(g)} + 10 \text{H}_2\text{O (l)} \]
      combustion

   b. \[ \text{Cu(NO}_3)_2 \text{(aq)} + 2 \text{NaOH (aq)} \rightarrow \text{Cu(OH)_2 (s)} + 2 \text{NaNO}_3 \]
      precipitation

   c. \[ \text{H}_2\text{SO}_3 \text{(aq)} \rightarrow \text{SO}_2 \text{(g)} + \text{H}_2\text{O (l)} \]
      gas evolution

   d. \[ \text{H}_2\text{SO}_4 \text{(aq)} + 2 \text{NaOH (aq)} \rightarrow \text{Na}_2\text{SO}_4 \text{(aq)} + 2 \text{H}_2\text{O (l)} \]
      acid-base

3. Salts, acids and bases are all examples of **electrolytes**, compounds that when added to water enable it to conduct electricity.

4. An excess of AgNO₃ was added to 100.0 mL of a MgCl₂ solution and 1.215 g of AgCl precipitate was formed. What is the concentration of the original MgCl₂ solution?
   \[ 0.04238 \text{ mol/L} \]

5. A 0.100 molar solution of NaOH was used to titrate 25.00 mL of a H₂SO₄ solution of unknown concentration. If it takes 12.50 mL of NaOH to titrate the H₂SO₄, what is the concentration of the H₂SO₄ solution?
   \[ 0.02500 \text{ mol/L} \]
6. Underline the element or compound that is oxidized in the following reactions.
   a. \(2 \text{Cu} (s) + \text{O}_2 \rightarrow \text{CuO} (s)\)
   b. \(\text{C}_6\text{H}_6 (l) + \text{O}_2 \rightarrow \text{C}_6\text{H}_6\text{O}_2\)

7. Underline the element or compound that is being reduced in the following reactions.
   a. \(\text{Zn} (s) + \text{CuCl}_2 (s) \rightarrow \text{ZnCl}_2 (s) + \text{Cu} (s)\)
   b. \(4 \text{CuO} (s) + \text{CH}_4 \rightarrow 4 \text{Cu} (s) + \text{CO}_2 (g) + 2 \text{H}_2\text{O} (l)\)

8. In an oxidation-reduction reaction the compound that causes another compound to be oxidized is known as a(n) \underline{oxidizing agent}.

9. What is the oxidation state of the carbon in the following compounds?
   a. \(\text{CO}_2 : +4\)
   b. \(\text{CH}_4 : -4\)
   c. \(\text{CO} : +2\)

10. When dissolved in water, of \(\text{HClO}_4\), \(\text{Ca(OH)}_2\), \(\text{KOH}\), and \(\text{HI}\), which are acids?
    a. only HI
    b. only KOH
    c. \(\text{HClO}_4\) and HI
    d. \(\text{Ca(OH)}_2\) and KOH

11. What is the concentration of HCl in the final solution when 65mL of a 12 M HCl solution is diluted with pure water to a total volume of 0.15 L?
    a. 28 M
    b. \(5.2 \times 10^3\) M
    c. \(5.2\) M
    d. \(2.8 \times 10^0\) M

12. How many milliliters of 0.260 M \(\text{Na}_2\text{S}\) are needed to react with 25.00 mL of 0.315 M \(\text{AgNO}_3\)?
    \(\text{Na}_2\text{S} (\text{aq}) + 2 \text{AgNO}_3 (\text{aq}) \rightarrow 2 \text{NaNO}_3 (\text{aq}) + \text{Ag}_2\text{S} (\text{s})\)
    a. 41.3 mL
    b. 60.6 mL
    c. \textbf{15.1 mL}
    d. 30.3 mL

13. The reaction \(\text{HNO}_3 (\text{aq}) + \text{KOH} (\text{aq}) \rightarrow \text{KNO}_3 (\text{aq}) + \text{H}_2\text{O} (\text{l})\) is best classified as a(n)
    a. precipitation reaction
    b. oxidation-reduction reaction
    c. \textbf{acid-base neutralization reaction}
    d. single replacement reaction
14. HCl, NaOH, and NaCl are all classified as
   a. bases
   b. nonelectrolytes
   c. acids
   d. electrolytes

15. Which is the balanced net ionic equation for the reaction of CdCl$_2$ (aq) with Na$_2$S (aq)?
   a. Cd$^{2+}$ (aq) + 2 Cl$^-$ (aq) + 2 Na$^+$ (aq) + S$^{2-}$ (aq) $\rightarrow$ CdS (s) + 2 NaCl (aq)
   b. CdCl$_2$ (aq) + Na$_2$S (aq) $\rightarrow$ CdS (aq) + 2 NaCl (aq)
   c. Cd$^{2+}$ (aq) + 2 Cl$^-$ (aq) + 2 Na$^+$ (aq) + S$^{2-}$ (aq) $\rightarrow$ CdS (s) + Na$^+$ (aq)
   d. Cd$^{2+}$ (aq) + S$^{2-}$ (aq) $\rightarrow$ CdS (aq)

16. Which of the following compounds is insoluble in water?
   a. Rb$_2$CO$_3$
   b. NaNO$_3$
   c. K$_2$SO$_4$
   d. PbSO$_4$

17. What is the oxidation number of the sulfur atom in H$_2$SO$_4$?
   a. +2
   b. +4
   c. -2
   d. +6

18. Which species functions as the oxidizing agent in the following redox reaction:
   Zn (s) + Cu$^{2+}$ (aq) $\rightarrow$ Cu (s) + Zn$^{2+}$ (aq)
   a. Cu$^{2+}$ (aq)
   b. Zn$^{2+}$ (aq)
   c. Cu (s)
   d. Zn (s)