Analytical chemistry (5th Edition)

LuMg

February 2023

1 Chapter 1

1.

$$c_{Zn^{2+}} = \frac{m_{Zn}}{M_{Zn} * V} = 0.01988 mol/L \tag{1}$$

2.

$$0.0982 mol/L * 0.480 L + 0.5000 mol/L * x = 0.1000 mol/L * (0.480 + x) L, x = 0.20 mL \tag{2}$$

3.

$$\begin{aligned} c_{K_4Fe(CN)_6} &= \frac{m}{M * V} = 0.050 mol/L \\ D &= M_{Zn^{2+}} * \frac{3}{2} * c * 0.001 L/mL = 4.90 mg/mL \end{aligned} \tag{3}$$

4.

- $$\begin{aligned} &NaOH \sim KHC_8H_4O_4, \\ &m_{KHC_8H_4O_4} = M_{KHC_8H_4O_4} * c_{NaOH} * V_{NaOH} = 1.0 \sim 1.2 g \end{aligned} \tag{4}$$

- $$NaOH \sim \frac{1}{2} H_2C_2O_4 \cdot 2H_2O,$$
$$m_{H_2C_2O_4 \cdot 2H_2O} = M_{H_2C_2O_4 \cdot 2H_2O} * c_{NaOH} * V_{NaOH} * \frac{1}{2} = 0.3 \sim 0.4 g \tag{5}$$

5.

$$\begin{aligned} 2KMNO_4 &\sim 5Na_2C_2O_4 \\ c_{Na_2C_2O_4} &= 0.05 mol/L \\ m_{Na_2C_2O_4} &= c_{Na_2C_2O_4} * V * M_{Na_2C_2O_4} = 0.7 g \end{aligned} \tag{6}$$

6.

$$\begin{aligned} S \sim SO_2 \sim H_2O_2 \sim SO_4^{2-} &\sim 2KOH \\ P_S &= \frac{c_{KOH} * V_{KOH} * \frac{1}{2} * M_S}{m_{sample}} * 100\% = 10.3\% \end{aligned} \tag{7}$$

7.

$$
\begin{gathered}
Ca\left(NO_3\right)_2 \sim 2NaF \\
Ca^{2+} \sim EDTA \\
P_NaF = \frac{c_{Ca(NO_3)_2} * V_{Ca(NO_3) - c_{EDTA} * V_{EDTA}}}{m_{sample}} * 2 = 31.8\%
\end{gathered} \tag{8}
$$

8.

$$
\begin{gathered}
CaCO_3 \sim 2HCl \\
HCL \sim OH^- \\
P_{CaCO_3} = \frac{c_{HCl} * V_{HCl} - c_{NAOH} * VNaOH * \frac{1}{2} * M_{CaCO_3}}{m_{sample}} = 98.4\%
\end{gathered} \tag{9}
$$

9.

$$
\begin{gathered}
suppose the percentage of MgSO_4 \cdot 7H_2O is x \\
\frac{M_{MgSO_4 \cdot 7H_2O}}{x * M_{MgSO_4 \cdot 7H_2O} + (1-x) * M_{MgSO_4 \cdot 6H_2O}} = 100.94\% \\
x = 87.8\% \\
P_{MgSO_4 \cdot 6H_2O} = 12.2\%
\end{gathered} \tag{10}
$$

10.

$$
\begin{gathered}
Sb_2S_3 \sim 3SO_2 \sim 6FeCl_3 \sim \frac{6}{5} KMnO_4 \\
P_{Sb_2S_3} = \frac{c_{KMnO_4} * V_{KMnO_4} * \frac{5}{6} * M_{Sb_2S_3}}{m_{sample}} = 71.6\% \\
in terms of Sb: \\
P_{Sb} = \frac{c_{KMnO_4} * V_{KMnO_4} * \frac{5}{6} * M_{Sb_2}}{m_{sample}} = 51.3\%
\end{gathered} \tag{11}
$$

11.

$$
\begin{gathered}
MnO_4^- \sim 5Fe^{2+} \\
c_{KMnO_4} = \frac{\frac{m_{Fe}}{M_{Fe}} * \frac{1}{5}}{V_{KMnO_4}} = 0.42 mol/L \\
5KHC_2O_42C_2O_4 \sim 4MnO_4^- \\
c_{KHC_2O_42C_2O_4} = \frac{\frac{5}{4} * V_{KMnO_4} * C_{KMnO_4}}{V_{KHC_2O_42C_2O_4}} = 0.105 mol/L \\
3NaOH \sim KHC_2O_42C_2O_4 \\
V_{NaOH} = \frac{3 * V_{KHC_2O_42C_2O_4} * c_{KHC_2O_42C_2O_4}}{V_{NaOH}} = 1.57 mL
\end{gathered} \tag{12}
$$

12.

$$
\begin{gathered}
5As_2O_3 \sim 4KMnO_4 \\
c_{KMnO_4} = \frac{\frac{4}{5} * m_{As_2O_3} / M_{As_2O_3}}{V_{KMnO_4}} = 0.0234 mol/L
\end{gathered} \tag{13}
$$

13.

$$CaCO_3 \sim CaC_2O_4 \sim H_2C_2O_4 \sim \frac{2}{5}KMnO_4$$
$$P_{CaCO_3} = \frac{\frac{5}{2} * \frac{1}{5} * c_{\frac{1}{5}KMnO_4} * V_{KMnO_4} * M_{CaCO_3}}{m_{sample}} = 97.4\% \tag{14}$$

14.

$$H_2C_2O_4 \sim 2NaOH$$
$$V_{NaOH} = \frac{m_sample/M_{H_2C_2O_4} * 2}{c_{NaOH}} = 111mL$$
$$H_2C_2O_4 \sim \frac{2}{5}KMnO_4 \tag{15}$$
$$V_{KMnO_4} = \frac{m_sample/M_{H_2C_2O_4} * \frac{2}{5}}{c_{KMnO_4}} = 22.2mL$$

15.

$$P_{CrCl_3} = \frac{M_{CrCl_3} * (c_{EDTA} * V_{EDTA} - c_{back} * V_{back})}{m_sample} = 0.21\% \tag{16}$$

16.

$$c_{K_2Cr_2O_7} = \frac{5.442g/L}{M_{K_2Cr_2O_7}} = 0.0185mol/L$$
$$6Fe_3O_4 \sim K_2Cr_2O_7 \tag{17}$$
$$D = M_{Fe_3O_4} * 6 * c_{K_2Cr_2O_7} = 231.54 * 6 * 0.0185 = 25.7mg/mL$$

17.

$$MnO_2 \sim 2Fe^{2+}$$
$$5Fe^{2+} \sim MnO_4^-$$
$$P_{Mn_3O_4} = \frac{\frac{1}{2} * \left(c_{Fe^{2+}} * V_{Fe^{2+}} - 5 * c_{MnO_4^-} * V_{MnO_4^-}\right) * \frac{1}{3} * M_{Mn_3O_4}}{m_sample} = 66.7\% \tag{18}$$

18.

$$5FeSO_4 \cdot 7H_2O \sim KMnO_4$$
$$P_{FeSO_4 \cdot 7H_2O} = \frac{5 * c_{KMnO_4} * V_{KMnO_4} * M_{FeSO_4 \cdot 7H_2O}}{m_sample} = 99.75\% \tag{19}$$
$$which mean sit is GR$$

19.

$$H_2C_2O_4 \sim 2Ce^{4+}$$
$$\frac{m_{H_2C_2O_4 \cdot 2H_2O}}{M_{H_2C_2O_4 \cdot 2H_2O}} = \frac{1}{2} * c_{Ce^{4+}} * V_{Ce^{4+}} \tag{20}$$
$$then we get m_{H_2C_2O_4 \cdot 2H_2O} = 1.72mg$$

20.

$$
\begin{aligned}
c_{Ni^{2+}} &= \frac{c_{EDTA} * V_{EDTA}}{V_{Ni^{2+}}} = 0.017 mol/L \\
& Ni^{2+} \sim 4CN^{-} \\
c_{CN^{-}} &= \frac{4 * (C_{Ni^{2+}} * V_{Ni^{2+}} - c_{back} * V_{back})}{V_{CN^{-}}} = 0.092 mol/L
\end{aligned}
\tag{21}
$$