Extra Solutions Review Questions

1. What mass of calcium carbonate can be precipitated by reacting 80.0 mL of a 0.100 mol/L solution of sodium carbonate with 50.0 mL of a 0.100 mol/L solution of calcium chloride?
2. Which solution has the greater concentration of chloride ions: 0.10 mol/L magnesium chloride or 0.15 mol/L sodium chloride? Show your work.
3. Oxalic acid in 10.0 mL samples were titrated with a solution of sodium hydroxide (0.0161 mol/L). Determine the oxalic acid concentration using the following data for the volume of sodium hydroxide.

Trial	1	2	3	4
Initial Reading	0.0 mL	14.1 mL	27.6	1.2 mL
Final Reading	14.1 mL	27.6 mL	40.9 mL	14.6 mL
Total Volume				

Answers on the next page

Extra Solutions Review Questions

1. Line Equation

$Na_2CO_3\,(aq) + CaCl_2\,(aq) \rightarrow 2NaCl\,(aq) + CaCO_3\,(s)$

$V = 0.08\,L$ $\quad V = 0.05\,L$ $\quad m = ?$

$c = 0.100\,\frac{mol}{L}$ $\quad c = 0.100\,\frac{mol}{L}$ $\quad M = \frac{100.086\,g}{mol}$

LR Problem

Using Na_2CO_3

$$m_{CaCO_3} = 0.08\,L\,Na_2CO_3 \times \frac{0.100\,mol\,Na_2CO_3}{L\,Na_2CO_3} \times \frac{1\,mol\,CaCO_3}{1\,mol\,Na_2CO_3} \times \frac{100.086\,g\,CaCO_3}{1\,mol\,CaCO_3}$$

$$= 0.801\,g$$

Using $CaCl_2$

$$m_{CaCO_3} = 0.05\,L\,CaCl_2 \times \frac{0.100\,mol\,CaCl_2}{L\,CaCl_2} \times \frac{1\,mol\,CaCO_3}{1\,mol\,CaCl_2} \times \frac{100.086\,g\,CaCO_3}{1\,mol\,CaCO_3}$$

$$= 0.500\,g$$

↑ LR is $CaCl_2$

∴ the mass of $CaCO_3$ expected is 0.500g and the limiting reactant is $CaCl_2$.

Part 5

$Na_2CO_3(aq) + CaCl_2(aq) \longrightarrow 2\,NaCl(aq) + CaCO_3(s)$

$V = 0.08\ L$ $\quad c = 0.100\ \frac{mol}{L}$

$V = 0.05\ L$ $\quad c = 0.100\ \frac{mol}{L}$

$m = ?$ $\quad M = 100.086\ \frac{g}{mol}$

$n = V \times C$

$= 0.08\ L \times 0.100\ \frac{mol}{L}$

$= 0.008\ mol$

$\frac{0.008}{1}$ ← coefficient

$n = V \times C$

$= 0.05\ L \times 0.100\ \frac{mol}{L}$

$= \boxed{0.005\ mol}$

$\frac{0.005}{1}$

↑ LR

$n_{CaCO_3} = 0.005\ mol\ CaCl_2 \times \frac{1\ mol\ CaCO_3}{1\ mol\ CaCl_2}$

$= 0.005\ mol\ CaCO_3$

$m_{CaCO_3} = 0.005\ mol \times \frac{100.086\ g}{mol}$

$= 0.500\ g$

∴ the LR was $CaCl_2$ and the mass of $CaCO_3$ expected is $0.500\ g$

Question # 2

$MgCl_2$ $\quad 0.10\ mol/L$

↓

$Mg^{2+}_{(aq)} + \underline{\underline{2}}\,Cl^-(aq)$

$[Cl^-] = 2 \times 0.10\ \frac{mol}{L}$

$= 0.20\ \frac{mol}{L}$ ← larger concentration

$NaCl$ $\quad 0.15\ \frac{mol}{L}$

↓

$Na^+(aq) + Cl^-(aq)$

$[Cl^-] = 1 \times 0.15\ \frac{mol}{L}$

$= 0.15\ \frac{mol}{L}$

∴ $MgCl_2$ has the greater ~~concentration~~ of Cl^- ions

Question # 3

Trial	#1	#2	#3	#4
Volume NaOH	14.1 mL	27.6 − 14.1 = 13.5 mL	40.9 − 27.6 = 13.3 mL	14.6 − 1.2 = 13.4 mL

off ↑

$$\text{average} = \frac{13.5 + 13.3 + 13.4}{3}$$

$$= \frac{40.2}{3}$$

$$= 13.4\ \text{mL}$$

$$H_2C_2O_4(aq) + 2NaOH(aq) \longrightarrow 2H_2O(\ell) + Na_2C_2O_4(aq)$$

$V = 0.0100\ L$ $\quad$ $V = 0.0134\ L$

$c = ?$ $\quad$ $c = 0.0161\ \frac{mol}{L}$

$$C_{H_2C_2O_4} = 0.0134\ \text{L NaOH} \times \frac{0.0161\ \text{mol NaOH}}{\text{L NaOH}} \times \frac{1\ \text{mol } H_2C_2O_4}{2\ \text{mol NaOH}} \times \frac{}{0.0100\ \text{L } H_2C_2O_4}$$

$$= 0.0108\ \frac{mol}{L}.$$

∴ the concentration of oxalic acid is

$$0.0108\ \frac{mol}{L}$$