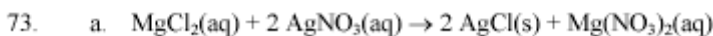


Stoichiometry Workshop 2 - Solutions

Question 1:



$$0.641 \text{ g AgCl} \times \frac{1 \text{ mol AgCl}}{143.4 \text{ g AgCl}} \times \frac{1 \text{ mol MgCl}_2}{2 \text{ mol AgCl}} \times \frac{95.21 \text{ g}}{\text{mol MgCl}_2} = 0.213 \text{ g MgCl}_2$$

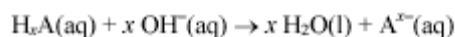
$$\frac{0.213 \text{ g MgCl}_2}{1.50 \text{ g mixture}} \times 100 = 14.2\% \text{ MgCl}_2$$

b. $0.213 \text{ g MgCl}_2 \times \frac{1 \text{ mol MgCl}_2}{95.21 \text{ g}} \times \frac{2 \text{ mol AgNO}_3}{\text{mol MgCl}_2} \times \frac{1 \text{ L}}{0.500 \text{ mol AgNO}_3} \times \frac{1000 \text{ mL}}{1 \text{ L}}$
 $= 8.95 \text{ mL AgNO}_3$

Question 2:

83. $\text{Mol C}_6\text{H}_8\text{O}_7 = 0.250 \text{ g C}_6\text{H}_8\text{O}_7 \times \frac{1 \text{ mol C}_6\text{H}_8\text{O}_7}{192.1 \text{ g C}_6\text{H}_8\text{O}_7} = 1.30 \times 10^{-3} \text{ mol C}_6\text{H}_8\text{O}_7$

Let H_xA represent citric acid, where x is the number of acidic hydrogens. The balanced neutralization reaction is:



$$\text{Mol OH}^- \text{ reacted} = 0.0372 \text{ L} \times \frac{0.105 \text{ mol OH}^-}{\text{L}} = 3.91 \times 10^{-3} \text{ mol OH}^-$$

$$x = \frac{\text{mol OH}^-}{\text{mol citric acid}} = \frac{3.91 \times 10^{-3} \text{ mol}}{1.30 \times 10^{-3} \text{ mol}} = 3.01$$

Therefore, the general acid formula for citric acid is H_3A , meaning that citric acid has three acidic hydrogens per citric acid molecule (citric acid is a triprotic acid).

Question 3: (Chapter 4 #71) Answer = 173 ml evaporated

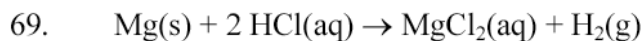
71. $\text{Mol CaCl}_2 \text{ present} = 0.230 \text{ L CaCl}_2 \times \frac{0.275 \text{ mol CaCl}_2}{\text{L CaCl}_2} = 6.33 \times 10^{-2} \text{ mol CaCl}_2$

The volume of CaCl_2 solution after evaporation is:

$$6.33 \times 10^{-2} \text{ mol CaCl}_2 \times \frac{1 \text{ L CaCl}_2}{1.10 \text{ mol CaCl}_2} = 5.75 \times 10^{-2} \text{ L} = 57.5 \text{ mL CaCl}_2$$

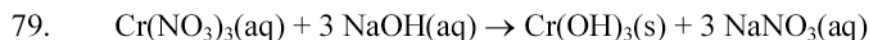
$$\text{Volume H}_2\text{O evaporated} = 230. \text{ mL} - 57.5 \text{ mL} = 173 \text{ mL H}_2\text{O evaporated}$$

Question 4: (Chapter 4 #69, with modifications) Answers: Part b = 49.4 ml; Part c = 2.5 M $[\text{Mg}^{2+}]$



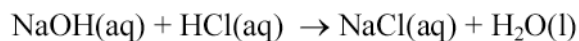
$$3.00 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} \times \frac{2 \text{ mol HCl}}{\text{mol Mg}} \times \frac{1 \text{ L HCl}}{5.0 \text{ mol HCl}} = 0.0494 \text{ L} = 49.4 \text{ mL HCl}$$

Question 5: (Chapter 4 #79) Answer = 2.00 M



$$\text{Mol NaOH used} = 2.06 \text{ g Cr(OH)}_3 \times \frac{1 \text{ mol Cr(OH)}_3}{103.02 \text{ g}} \times \frac{3 \text{ mol NaOH}}{\text{mol Cr(OH)}_3} = 6.00 \times 10^{-2} \text{ mol}$$

to form precipitate



$$\text{Mol NaOH used} = 0.1000 \text{ L} \times \frac{0.400 \text{ mol HCl}}{\text{L}} \times \frac{1 \text{ mol NaOH}}{\text{mol HCl}} = 4.00 \times 10^{-2} \text{ mol}$$

to react with HCl

$$M_{\text{NaOH}} = \frac{\text{total mol NaOH}}{\text{volume}} = \frac{6.00 \times 10^{-2} \text{ mol} + 4.00 \times 10^{-2} \text{ mol}}{0.0500 \text{ L}} = 2.00 \text{ M NaOH}$$