Review Problems KEY

1) $CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(\ell)}$

45.0 g | 125 mL, 25.7 % (w/w), 1.13 g/mL

$$45.0\ g\ CaCO_3 \left| \frac{1\ mol\ CaCO_3}{100.09\ g} \right| \frac{2\ mol\ HCl}{1\ mol\ CaCO_3} = 0.899_{19}\ \text{moles HCl which reacts}$$

$$\frac{25.7\ g\ solute}{100\ g\ solution} \times \frac{1.13\ g\ solution}{1\ mL\ solution} \times \frac{1\ mol\ HCl}{36.45_8\ g\ solute} \times \frac{1000\ mL}{1\ L} \times 1.25\ L = 9.95_7\ \text{moles HCl total}$$

TOTAL − REACTS = REMAINING

$(9.95_7 - 0.899_{19})$ moles $= 9.05_{78}$ moles remaining

$$\frac{9.05_{78}}{1.25\ L} = \boxed{7.25\ M}$$

$M_1V_1 + M_2V_2 = M_3(V_1+V_2)$

2) $(0.335\ L)(0.186\ M) + X(0.248\ M)\left(\frac{2\ mol\ Cl^-}{1\ mol\ CaCl_2}\right) = (0.335\ L + X)(0.250\ M)$

moles of Cl^- from KCl + moles of Cl^- from $CaCl_2$ = TOTAL MOLES OF Cl^-

$X = 0.0872\ L$ or $\boxed{87.2\ mL}$

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3)

$$5\,C_2O_4^{2-} \longrightarrow 10\,CO_2 + 10\,e^-$$

$$10\,e^- + 16\,H^+ + 2\,MnO_4^- \longrightarrow 2\,Mn^{2+} + 8\,H_2O$$

$$5C_2O_4^{2-} + 16H^+ + 2MnO_4^- \longrightarrow 10\,CO_2 + 2Mn^{2+} + 8\,H_2O$$

$$25.8\ mL \times \frac{1\ L}{1000\ mL} \times \frac{0.02140\ moles\ MnO_4^-}{1\ L} = 5.52_{12} \times 10^{-4}\ moles\ MnO_4^-$$

$$\frac{5.52_{12} \times 10^{-4}\ \cancel{moles\ MnO_4^-}}{} \left| \frac{5\ \cancel{moles\ C_2O_4^{2-}}}{2\ \cancel{moles\ MnO_4^-}} \right| \frac{1\ mol\ \cancel{Na_2C_2O_4}}{1\ mol\ \cancel{C_2O_4^{2-}}} \left| \frac{134.00\ g}{1\ mol\ \cancel{Na_2C_2O_4}} \right.$$

$$= 0.184_{96}\ g\ Na_2C_2O_4$$

$$\frac{0.184_{96}\ g}{0.0500\ L} = 3.69_9 = \frac{3.70\ g}{1\ L}$$