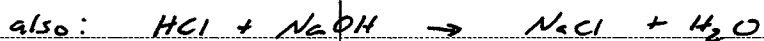


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project	AP Chem
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Chem Ch. 4 Problems



total mol HCl - excess mol HCl = mol HCl reacted

mol CaCO_3 = mol HCl / 2 because of balanced chem. eq.

g CaCO_3 = mol CaCO_3 x molar mass (x 100 for percent by mass)

$$\frac{1.035 \text{ mol HCl}}{1 \text{ L soln}} \times .03 \text{ L} = .031050 \text{ mol HCl total}$$

$$\frac{1.012 \text{ mol NaOH}}{1 \text{ L soln}} \times .01156 \text{ L} = .011676 \text{ mol HCl excess}$$

$$.031050 \text{ total} - .011676 \text{ excess} = .019374 \text{ mol HCl reacted}$$

$$\frac{.019374 \text{ mol HCl}}{2 \text{ mol HCl}} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaCO}_3} \times \frac{100.09 \text{ g CaCO}_3}{1 \text{ mol CaCO}_3} = .96959 \text{ g CaCO}_3$$

$$\text{mass } \% \text{ CaCO}_3 = \frac{\text{g CaCO}_3}{\text{g rock}} \times 100 = \frac{.96959}{1.245} \times 100 = \boxed{77.69\% \text{ CaCO}_3}$$

task list:

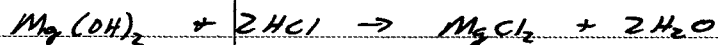
date

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4.89

Give mass impure $\text{Mg}(\text{OH})_2$; M and vol excess HCl; M and vol NaOH
Find mass % $\text{Mg}(\text{OH})_2$ in sample.



Calculate total moles of HCl = $M_{\text{HCl}} \times L_{\text{HCl}}$

$$\frac{.2050 \text{ mol HCl}}{1 \text{ L soln}} \times .100 \text{ L} = .02050 \text{ mol HCl total}$$

$$\text{mol excess HCl} = \text{mol NaOH used} = M_{\text{NaOH}} \times L_{\text{NaOH}}$$

$$\frac{.1020 \text{ mol NaOH}}{1 \text{ L soln}} \times .01985 \text{ L} = .0020247 = .002025 \text{ mol NaOH}$$

$$\text{mol HCl reacted w/ } \text{Mg}(\text{OH})_2 = \text{total mol HCl} - \text{excess mol HCl}$$

$$.02050 \text{ mol total} - .0020247 \text{ mol excess} = .0184753 =$$

.01848 mol HCl

Use mol ratio to get mol $\text{Mg}(\text{OH})_2$ in sample, then molar mass
of $\text{Mg}(\text{OH})_2$ to get g pure $\text{Mg}(\text{OH})_2$

$$\frac{.0184753 \text{ mol HCl}}{2 \text{ mol HCl}} \times \frac{1 \text{ mol } \text{Mg}(\text{OH})_2}{1 \text{ mol } \text{Mg}(\text{OH})_2} \times \frac{58.32 \text{ g } \text{Mg}(\text{OH})_2}{1 \text{ mol } \text{Mg}(\text{OH})_2} = .5387 \text{ g } \text{Mg}(\text{OH})_2$$

$$\frac{.5387 \text{ g } \text{Mg}(\text{OH})_2}{.5895 \text{ g sample}} \times 100 = 91.40\% \text{ } \text{Mg}(\text{OH})_2$$

task list:

date 10-6-11

project 4.113 & 4.115

page

4.113

a) As^{+5}

b) Ag_3PO_4 is silver phosphate, so Ag_3AsO_4 is silver arsenate

c)

$$\frac{.250 \text{ L soln}}{1 \text{ L soln}} \times \frac{.102 \text{ mol Ag}^+}{3 \text{ mol Ag}^+} \times \frac{1 \text{ mol Ag}_3\text{AsO}_4}{1 \text{ mol Ag}_3\text{AsO}_4} \times \frac{1 \text{ mol As}}{1 \text{ mol As}} \times \frac{74.92 \text{ g As}}{1 \text{ mol As}} = .06367 \text{ g As}$$

$$\frac{.06367 \text{ g As}}{1.22 \text{ g sample}} \times 100 = \boxed{5.22\% \text{ As}}$$

4.115

a) $\text{mol initial HCl} - \text{mol NH}_3 \text{ from air} = \text{mol HCl remaining (also mol NaOH required for titration)}$

$$\text{mol NaOH} = .0588 \text{ M} \times .0131 \text{ L} = 7.703 \times 10^{-4} \text{ mol NaOH}$$

$$= 7.70 \times 10^{-4} \text{ mol HCl remain}$$

$\text{mol initial} - \text{mol HCl remaining} = \text{mol NH}_3 \text{ from air}$

$$(.0105 \text{ M HCl} \times .100 \text{ L}) - 7.703 \times 10^{-4} \text{ mol HCl} = 2.80 \times 10^{-4} \text{ mol NH}_3$$

$$\frac{2.8 \times 10^{-4} \text{ mol NH}_3}{1 \text{ mol NH}_3} \times \frac{17.03 \text{ g NH}_3}{1 \text{ mol NH}_3} = 4.77 \times 10^{-3} \text{ g NH}_3 = \boxed{4.8 \times 10^{-3} \text{ g NH}_3}$$

b) Calculate molecules NH_3 from mol NH_3

$$\frac{2.80 \times 10^{-4} \text{ mol NH}_3}{1 \text{ mol NH}_3} \times \frac{6.022 \times 10^{23} \text{ molecules NH}_3}{1 \text{ mol NH}_3} = 1.686 \times 10^{20}$$

Calculate total volume of air processed, then g of air using density,
then molecules of air using molar mass.

$$= 1.7 \times 10^{20} \text{ molecules}$$

$$\frac{10 \text{ L}}{1 \text{ min}} \times 10 \text{ min} \times \frac{1.20 \text{ g air}}{1 \text{ L air}} \times \frac{1 \text{ mol air}}{29 \text{ g air}} \times \frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = \boxed{2.5 \times 10^{24} \text{ air molecules}}$$

task list:

c) 68 ppm > 50 ppm. The manufacturer is not in compliance