Problem Set 1

(110.981) (100.0869)

1) 0.1145 M HCl is used to titrate a sample of 0.3537 g of a sample containing $CaCO_3$ and $CaCl_2$. 15.32 mL of acid are required to titrate the sample. What is the percent composition of $CaCO_3$ in the sample.

$$(0.1145\ M)(15.32\ ml) = 1.754\ \text{mmoles HCl}$$

$$1.754\ \text{mmol HCl}\ \frac{1\ \text{mmol}\ CaCO_3}{2\ \text{mmol HCl}} = 0.8775\ \text{mmol}\ CaCO_3$$

$$= 87.626\ mg$$

$$\frac{87.626\ mg}{353.7\ mg\ \text{total}} \times 100 = \boxed{24.81\ \%}$$

2) 0.1523 grams of Silver Nitrate in solution is mixed with 0.1324 grams of calcium chloride which is also in solution to form an insoluble precipitate. What is the maximum quantity of precipitate in moles and grams which could be formed?

$$2AgNO_3 + CaCl_2 \rightarrow Ca(NO_3)_2 + \underline{2AgCl}$$

$$\frac{0.1523}{169.87} \qquad \frac{0.1324}{110.981}$$

$$0.8966\ \text{mmol}^* \qquad 1.193\ \text{mmol} \longrightarrow .8966\ \text{mmol} \times 143.32 = \boxed{0.1285 g}$$

3) What is the approximate Molarity of a 33% solution of Sulfuric Acid. To what volume should 100ml of the acid be diluted to prepare a1.80M solution. Using this 1.80M Solution, how much acid should be added to make up 1L of a 0.5 M H_2SO_4 Solution. How much of this final 0.5M solution would be needed to titrate to equivalence 45.21mL of 190 mM NaOH?

interpolate density from table

$$M = \frac{(10)(1.24355)(33)}{48.078} = 4.18\ M\ H_2SO_4$$

$$MV = MV \qquad (1.8M)V_1 = (4.18M)(.1L)$$

$$\boxed{V_1 = 0.232L}$$ "not practical"

$$M_1V_1 = M_1V_2 \qquad \boxed{V_1 = 277.8\ ml}$$

$$(1.8M)(V_1) = (0.5M)(1L)$$

$$H_2SO_4 + 2NaOH \longrightarrow 2H_2O + Na_2SO_4$$

$$.0085899\ \text{moles NaOH} \rightarrow .00429495\ \text{moles}\ H_2SO_4$$

$$\boxed{V = 8.6\ ml} \leftarrow MV = .05V = .004295$$

4) Consider the following experimental data:
Creatinine ($C_4H_7N_3O$) has a molar mass of 113.1201

Four weights in grams were taken:
0.3235
0.3245
0.3235
0.3238

$$\left.\begin{array}{l} \text{mean} = 0.32382 \text{ (round down)} \\ \text{std} = 0.00047 \end{array}\right\} \text{weight}$$

What are the **means** and **standard deviations** for both the mass AND for the moles collected? **Include proper sig figs!!!**

$$\begin{array}{l} .0028628 \text{ mol} \\ .0000042 \text{ mol} \end{array} \longrightarrow \left.\begin{array}{l} 2.8628 \text{ mmol} \\ 0.0042 \text{ mmol} \end{array}\right\} \text{moles}$$

5) 125.3 mg of **Ferric Chloride** is dissolved in a sufficient volume of water to fill to a 500ml Volumetric to the marker. What is the **Iron** concentration of this solution in ppm and mM?

$$\frac{125.3\text{mg}}{162.205} = \frac{0.7725 \text{ mmoles } Fe^{+3}}{0.5L} = \boxed{1.545\text{mM}} \times 55.845$$
$$= \boxed{86.28\text{ppm } Fe^{+3}}$$

6) 0.0465 grams of AgNO3 is weighed by difference and then transferred solid is dissolved 100 ml Volumetric

Using the fact the errors are

Volumetric Error is +/-	0.08	ml
Balance Error per measurement is +/-	0.3	mg

What is the Molarity of the solution and error?

$$\sqrt{(.3\text{mg})^2 + (.3\text{mg})^2} = .42\text{mg}$$

$$\sqrt{\left(\frac{.42}{46.5}\right)^2 + \left(\frac{.08}{100}\right)^2} = .0091 = .91\% \text{ Error}$$

$$\frac{\left(\frac{.0465}{169.87}\right)\text{moles}}{0.1L} = 0.00274M = 2.74\text{mM}$$
$$\pm .02\text{mM}$$