Stoichiometry - Calculations Involving Molar Concentration

Handout - Notes - Stoichiometry - Molar Concentrations

- In chemistry we want to be able to talk about how concentrated a liquid is. In chemistry we use units called Molarity (M). Molarity is a measure of how concentrated (strong) a liquid is in units of how many moles there is per litre $\frac{mol}{L}$. This ratio is a factor that can be used in the factor label method to go from moles to litres and litres to moles. Ex. - $0.5\ M = \frac{0.5\ mol}{1\ L}$ *or* $\frac{1\ L}{0.5\ mol}$

Demo – pHet - Concentration

Demo – pHet - Molarity

Ex. 1 – Tums™ is mostly $CaCO_3$ and in your stomach is HCl acid. When you eat Tums™ the following reaction occurs in your stomach $CaCO_{3\ (s)} + 2\ HCl_{(aq)} \rightarrow CaCl_{2\ (aq)} + CO_{2\ (g)} + H_2O_{(l)}$

A tablet of Tums™ is $0.750\ grams$ $CaCO_3$. What volume of stomach acid, [HCl] = $0.00100\ M$, is neutralized by the Tums™?

Answer - $0.750\ g\ CaCO_3 \times \frac{1\ mol\ CaCO_3}{100.09\ g\ CaCO_3} \times \frac{2\ mol\ HCl}{1\ mol\ CaCO_3} \times \frac{1\ L\ HCl}{0.00100\ mol\ HCl} = 15.0\ L\ HCl$

Ex. 2 – What volume of $CO_{2\ (g)}$ at STP is produced if $1.25\ L$ of $0.0055\ M$ HCl reacts with an excess of $CaCO_3$? ***Remember only use $\frac{22.4\ L}{1\ mol}$ when STP is stated!!!!***

Answer - $1.25\ L\ HCl \times \frac{0.0055\ mol\ HCl}{1\ L\ HCl} \times \frac{1\ mol\ CO_2}{2\ mol\ HCl} \times \frac{22.4\ L\ CO_2}{1\ mol\ CO_2} = 0.077\ L\ CO_2$

Ex. 3 – $19.8\ mL$ of H_3PO_4 with an unknown molarity reacts with $25.0\ mL$ of $0.500\ M$ KOH according to the following reaction below. What is the molarity of the H_3PO_4?

____ $H_3PO_{4\ (aq)}$ + _2_ $KOH_{(aq)} \rightarrow$ ____ $K_2HPO_{4\ (aq)}$ + _2_ $H_2O_{(l)}$

Answer – Is reaction balanced? $0.025\ L\ KOH \times \frac{0.500\ mol\ KOH}{1\ L\ KOH} \times \frac{1\ mol\ H_3PO_4}{2\ mol\ KOH} \times \frac{1}{0.0198\ L\ H_3PO_4} = 0.316\ M\ H_3PO_4$

Ex. 4 – What volume of $0.200\ M$ KOH is required to react with $125\ mL$ of $0.250\ M$ H_3PO_4 in order to produce a solution of K_2HPO_4?

Answer - $0.125\ L\ H_3PO_4 \times \frac{0.250\ mol\ H_3PO_4}{1\ L\ H_3PO_4} \times \frac{2\ mol\ KOH}{1\ mol\ H_3PO_4} \times \frac{1\ L\ KOH}{0.200\ mol\ KOH} = 0.313\ L\ KOH$

Practice – Worksheet – Stoichiometry - Molar Concentrations

Stoichiometry & Molar Concentrations - Answers

Practice – Lab – Double Replacement of Lead and Potassium

Double Replacement of Lead and Potassium – KEY

Practice – Quiz – Stoichiometry – Mass, Volume and Concentration

Stoichiometry – Mass, Volume and Concentration - KEY