## **Relative Atomic Mass**

➢ Atoms are too small to be weighted, therefore isotopes <sup>12</sup>C has been assigned, a mass of exactly 12 g for comparison purpose.

- Relative atomic mass is the weighted average mass of naturally occurring atoms of an element on a scale where an atom of carbon-12 has a mass exactly 12 units.
- A<sub>r</sub> = average mass of one atom of element Y x 12 mass of one atom of carbon-12

## Amount of Substance A mole of any substances has a stars in grams numerically equal to its A<sub>r</sub> or M<sub>r</sub> Mass of those of 200 ft of 5

mass of 1 mole of  $H_2O$  molecules = [2(1) + 16] g = 18 g

mass of 1 mole of  $CO_3^{2-}$  ions = [12 + 3(16)]g = 60g



Use of the Data Booklet is relevant to this question. Q2: Analytical chemists can detect very small amounts of amino acids down to  $3x10^{-21}$ mol. Have many molecules of an amino acid (M<sub>r</sub> = 200) would his be? Previous 26

- A. 9
- B. 200
- C. 1800
- D. 360 000
- [AS Nov 2003 Paper I Q1]



Example 3.

Calculate the percentage by mass of caebon in ethanol,  $C_2H_5OH$ .



2. Divide the mass of each element by its respective atomic mass to get the number of moles of each.

3. Divide the number of moles of each element by the smallest number of moles.

Example 5 10 cm<sup>3</sup> of a 3 moldm<sup>-3</sup> suitanc acid is diluted with water to give a volume of 250 cm<sup>3</sup>, what is the concentration of the diluted solution? Q1:  $N_2O_4$  is a poisonous gas. It can be disposed of safely by reaction with sodium hydroxide.

•  $N_2O_4$  (g) + 2NaOH (aq)  $\rightarrow$  NaNO<sub>2</sub>(sq) + NaNO<sub>2</sub> (aq) + H<sub>2</sub>O (l) What is the minimum volume of 0.5mol dm<sup>-3</sup> NaOH (aq) needed to dispose of 0.02mol of  $N_2O_4$ ?

- A.  $8 \text{ cm}^3$
- B. 12.5cm<sup>3</sup>
- C. 40cm<sup>3</sup>
- D. 80cm<sup>3</sup>
- [AS June 2006 Paper I Q1]

Calculation using Combustion Data The molecular formula of hydrocaraon can be determined by combustion in excessorygen (to form carbon dioxide and steam). A gaseous hydrocarbon,  $C_xH_y$ , explodes with excess  $O_2$ according to the general equation.

$$C_xH_y + (x + \frac{y}{4}) O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

Example 3:

20 cm<sup>3</sup> of an unknown hydrocarbon,  $C_x H_y$  was mixed with 80 cm<sup>3</sup> of oxygen (ancexcess) intagraduated tube. A spark was passagethrough the mixture, and the resulting gases were allowed to cool back to room temperature. 60 cm<sup>3</sup> of gas was left. When this gas was exposed to sodium hydroxide solution, the volume fell to 40 cm<sup>3</sup>. Write the equation for the combustion, and so find the formula of the hydrocarbon

- Q2: 0.200 mol of a hydrocarbon undergo complete combustion to give 35.2g of carbon dioxide and 14.4g of water as the only products. What is the molecular formula of the hydrocarbon?
- A.  $C_2H_4$
- B.  $C_2H_6$
- C.  $C_4H_4$
- D.  $C_4 H_8$
- [AS Nov 2009 Paper 12 Q1]