

CALCULATE CONCENTRATION

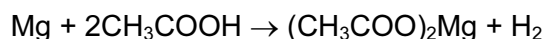
4.10.1

Chemists use the concept of the mole to calculate the amounts of chemicals involved in a reaction.

(a) Define *mole*.

..... [1]

(b) 3.0 g of magnesium was added to 12.0 g of ethanoic acid.



The mass of one mole of Mg is 24 g.

The mass of one mole of CH₃COOH is 60 g.

(i) Which one, magnesium or ethanoic acid, is in excess? You must show your reasoning.

..... [3]

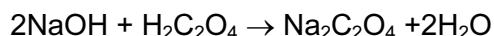
(ii) How many moles of hydrogen were formed?

..... [1]

(iii) Calculate the volume of hydrogen formed, measured at r.t.p.

..... [2]

(c) In an experiment, 25.0 cm³ of aqueous sodium hydroxide, 0.4 mol/dm³, was neutralised by 20.0 cm³ of aqueous oxalic acid, H₂C₂O₄.



Calculate the concentration of the oxalic acid in mol/dm³.

(i) Calculate the number of moles of NaOH in 25.0 cm³ of 0.4 mol/dm³ solution.

..... [1]

(ii) Use your answer to (i) and the mole ratio in the equation to find out the number of moles of H₂C₂O₄ in 20 cm³ of solution.

..... [1]

(iii) Calculate the concentration, mol/dm³, of the aqueous oxalic acid.

..... [2]

- (a) Avogadro's Number of particles
or formula mass in grams
or 6×10^{23} particles accept atoms, ions and molecules
or as many particles as there are carbon atoms in 12.00g of ^{12}Ca
ANY one [1]
- (b) (i) moles of Mg = $3/24 = 0.125$
moles of $\text{CH}_3\text{COOH} = 12/60 = 0.200$
magnesium is in excess

OR 3.0g of magnesium react with 15g of acid
only 12.0 g of acid present
magnesium is in excess [3]
- (ii) Mark conseq to (i) but NOT to any simple integer
moles of $\text{H}_2 = 0.1$ [1]
- (iii) Mark conseq to (ii) but NOT to any simple integer
Volume of hydrogen = 0.1×24
= 2.4 dm^3 [2]
- (c) (i) moles of NaOH = $25/1000 \times 0.4 = 0.01$ [1]
- (ii) Mark conseq to (i) but NOT to any simple integer
moles of acid = $0.01/2 = 0.005$ [1]
- (iii) Mark conseq to (ii) max 10M
concentration of acid = $0.005 \times 1000/20$ [1]
= 0.25 mol/dm^3 [1]

4.10.2

In the first experiment, the maximum volume of oxygen produced was 96 cm³ measured at r.t.p. Calculate the concentration of the aqueous hydrogen peroxide in mol/dm³.



number of moles of O₂ formed = [1]

number of moles of H₂O₂ in 40 cm³ of solution = [1]

concentration of the aqueous hydrogen peroxide in mol/dm³ =

..... [1]

-----Marking Scheme-----

number of moles of O_2 formed = $0.096/24 = 0.004$ (1)

number of moles of H_2O_2 in 40 cm^3 of solution = $0.004 \times 2 = 0.008$ (1)

concentration of the hydrogen peroxide in $\text{mol/dm}^3 = 0.008/0.04 = 0.2$ (1) [3]