	C	H
% composition	85.7 %	14.3 %
mass of element in 100 g of compound	85.7 g	14.3 g
amount of element in 100 g of compound	$85.7\text{ g} / 12\text{ g mol}^{-1} = 7.14$ mol	$14.3\text{ g} / 1\text{ g mol}^{-1} = 14.3$ mol
lowest whole number ratio of element's amounts	$7.14\text{ mol} / 7.14\text{ mol} = 1$	$14.3\text{ mol} / 7.14\text{ mol} = 2$

The empirical formula for the compound is CH_2.

Molecular formula of a compound

- The molecular formula for a compound is simply the empirical formulae multiplied by some whole number (1, 2, 3, etc...).
- Knowing the molar mass of the compound enables the molecular formula of it to be found.

Finding Molecular Formulas (when molar mass is known)

- calculate the empirical formula
- use the equation : (empirical formula mass)x n = molar mass
- find value for n: n = molar mass/empirical formula mass
- multiply each subscript in empirical formula by value for n

Example1. The actual molar mass of the compound in the previous example is 42 g mol^{-1}. What is the molecular formula for this compound?

Solution: The molar mass of CH_2 = (12+(2×1)) g mol-1 = 14 g mol-1

The molecular formula of this compound is $(CH_2)_n$, where n is a positive whole number.

The value of n = 42 g mol-1 / 14 g mol-1 = 3

The molecular formula is $(CH_2)_3$ or more properly C_3H_6.

Examples of where the empirical formula is the same as the molecular formula

Water H2O, methane CH4, propane C_3H_8 (these molecular formula cannot be 'simplified')

Examples of where the molecular formula is different from the empirical formula

Ethane C_2H_6 (CH_3), phosphorus (V) oxide P_4O_{10} (P_2O_5), benzene C_6H_6 (CH)

Three examples are set out below to illustrate all the situations. The relative atomic masses of the elements (Ar) are given in the tabular format method of solving the problem.

Example 2: 1.35g of aluminium was heated in oxygen until there was no further gain in weight. The white oxide ash formed weighed 2.55g. Deduce the empirical formula of aluminium oxide. Note: to get the mass of oxygen reacting, all you have to do is to subtract the mass of metal from the mass of the oxide formed.

Volumetric Analysis (Titrations)

- A titration is a laboratory procedure where a measured volume of one solution is added to a known volume of another reagent until the reaction is complete.
- The operation is an example of volumetric (titrimetric) analysis. The equivalence point is usually shown by the colour change of an indicator and is known as the end-point.
- Volumetric analysis is a powerful technique, which is used in a variety of ways by chemists in many different fields.

Practical Aspects

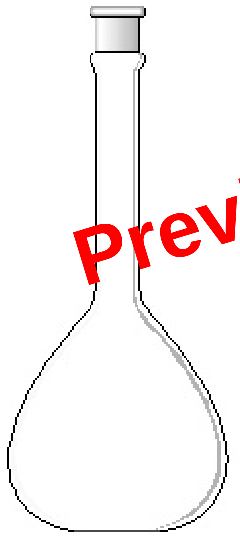
- The practical aspects of titrations are required in the assessment of practical skills
- Knowledge of the techniques of titrations is expected but it would be normal to assume that all apparatus would have been washed with distilled/deionised water. The description should include which reagent is placed in the burette, name of indicator (but no reason for choice of indicator), detection of endpoint and what should be observed, and repetition for accuracy.

When you have finished this section you should be able to

- Perform titrations
- Record titration results in the form of a table

Use of a Volumetric Flask

- To prepare a solution of precisely known concentration (a standard solution), a definite amount of solute must be dissolved in a solvent to give a definite volume of solution.



- The definite amount of material is measured by weighing, and the definite volume of solution prepared in a volumetric flask.
- A volumetric flask contains a definite volume when correctly filled to the calibration mark at the temperature stated on the flask.
- Tip the solid from a weighing bottle into a large (250 cm^3) beaker and add about 50 cm^3 of distilled water from a wash bottle.
- Stir well with a glass rod to dissolve.
- Take great care not to lose any of the solution and remember to wash the solution off the stirring rod back into the beaker.
- Rinse out the volumetric flask with distilled water and pour the cold solution into the flask through a clean filter funnel.

FA	Final answer with unit	(1 mark)
Total		(5 marks)

CT	1 mark
D	1 mark
AC	1 mark
PA	1 mark
FA	1 mark
Total	5 marks

Specimen titration Table II

Titration no.		Trial	1	2	3
Burette readings	Final	33.10	32.70	32.70	42.80
	Initial	0.00	0.00	0.00	10.00
Volume used (titre) /cm^3		33.10	32.70	32.70	32.80
Mean titre /cm^3		32.73			

Average volume used of soln

$$\frac{32.70 + 32.70 + 32.80}{3}$$

$= 32.73\ cm^3$

Calculating the Concentration of a Solution from Titration Data

- When you have finished this section you should be able to:
    - Calculate the concentration of a solution from titration data and the balanced equation.
    - Calculate the volume of solution required for titration from titration data and the balanced equation.