CIE Chemistry A-Level
Topic 1 - Atoms, Molecules and Stoichiometry

Flashcards

What is meant by the term relative atomic mass?

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The weighted mean mass of an atom of an element relative to an atom of carbon-12 having a mass of exactly 12 units.

What is meant by the term molecular mass?

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The weighted average of the mass of a molecule relative to an atom of carbon-12 having a mass of exactly 12 units.

What is meant by the term relative isotopic mass?

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The mass of an atom of an isotope on a scale relative to an atom of carbon-12 having a mass of exactly 12 units.

What is meant by the term relative formula mass?

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The weighted average of the masses of the formula units relative to an atom of carbon-12 having a mass of exactly 12 units.

What is meant by the term amount of substance?

What is meant by the term amount of substance?

- Measured in moles.
- Based upon the standard count of atoms called the Avogadro constant.
- Measures the number of atoms in a substance.

What is the Avogadro constant (N_A)?

What is the Avogadro constant (N_A)?

The number of atoms per mole of substance.

$N_A = 6.02 \times 10^{23}$ mol^{-1}
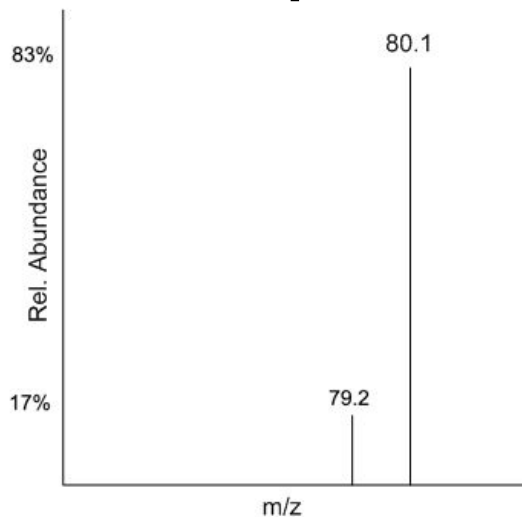
Define the mole

Define the mole

The amount of any substance containing as many particles as there are carbon atoms in exactly 12g of carbon-12.
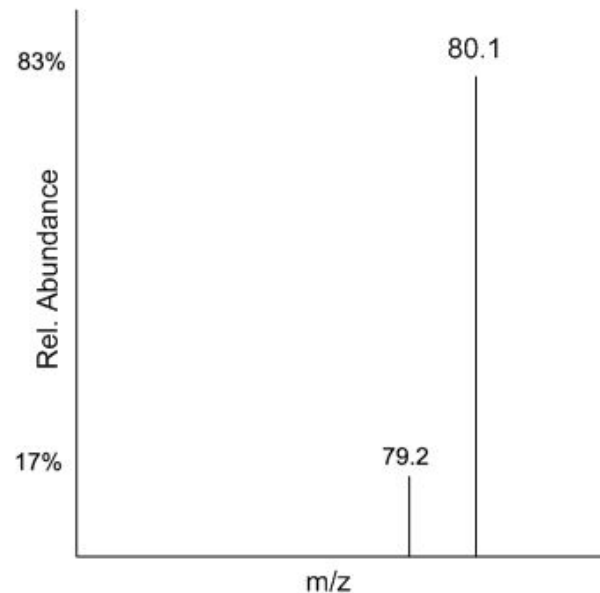
Using the mass spectrum below, what is the relative abundance of the isotope with a relative isotopic mass of 80.1?
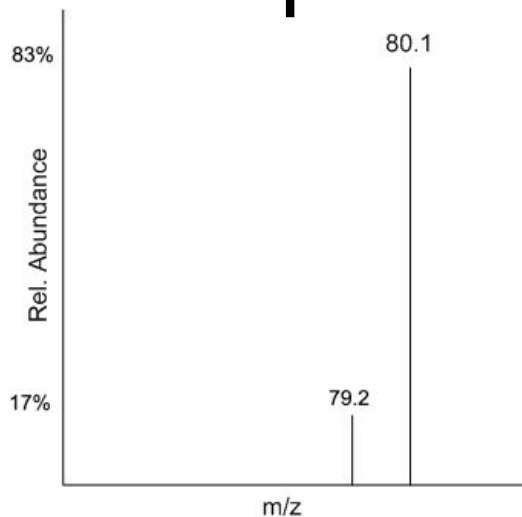
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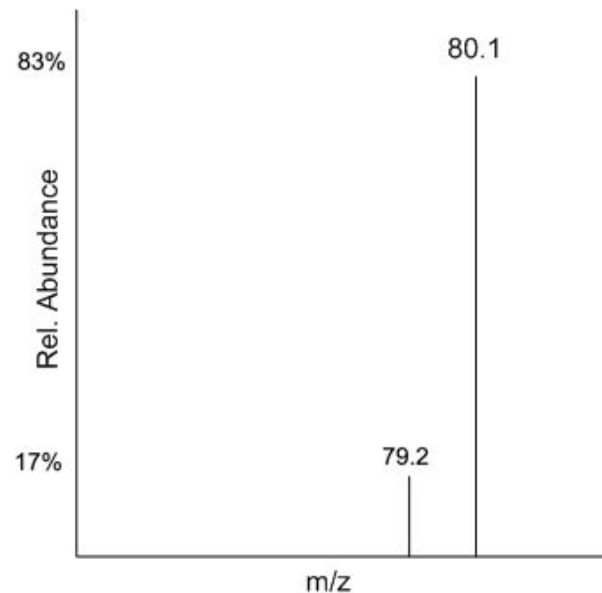
83%

Use the mass spectrum below to deduce the relative atomic mass of atoms in this sample

Use the mass spectrum below to deduce the relative atomic mass of atoms in this sample

[(79.2 x 17) + (80.1 x 83)] ÷ 100

= 79.95 g mol^{-1}

How can a mass spectrum be used to deduce the relative molecular mass?

How can a mass spectrum be used to deduce the relative molecular mass?

The peak with the highest m/z value (the molecular ion peak or M$^+$ peak) is caused by the whole molecule after one electron has been knocked off.

m/z value of M$^+$ peak = molecular mass

What is meant by the term empirical formula?

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The simplest whole number ratio of atoms of each element present in a compound.

What is meant by the term molecular formula?

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The actual number of atoms of each element present in a compound.

A compound has the following composition by mass:
C: 40% H: 6.67% O: 53.33%
Calculate empirical formula of this compound

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C: 40% H: 6.67% O: 53.33%
Calculate empirical formula of this compound

	C	**H**	**O**
Number of moles	40/12	6.67/1	53.33/16
	= 3.33	= 6.67	= 3.33
Ratio	3.33/3.33	6.67/3.33	3.33/3.33
		1 : 2 : 1	

1. Divide the percentage by the atomic mass.

2. Divide this by the smallest number.

3. This gives you the ratio of atoms in the molecule (or empirical formula): CH_2O.

A hydrocarbon is burnt in oxygen. 0.069 g of CO_2 and 0.0113 g of H_2O is produced. What is the empirical formula of the compound?

A hydrocarbon compound is burnt in oxygen. 0.069 g of CO_2 and 0.0113 g of H_2O is produced. What is the empirical formula of the compound?

Moles of carbon in the sample = (0.069/44) = 0.00157

Moles of hydrogen in the sample = (0.0113/18) x 2 = 0.00126

Ratio of carbon to hydrogen = 1.25 : 1

Empirical formula ratio = 5 : 4 so the empirical formula is C_5H_4

What is meant by the term concentration? What equation links concentration and number of moles?

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Concentration is the amount of solute (usually in moles) dissolved per dm^3 of solution.

$$c = \frac{n}{v}$$

How do you calculate the amount of a given substance (in moles) using mass and molecular mass?

How do you calculate the amount of a given substance (in moles) using mass and molecular mass?

Number of moles = mass ÷ molecular mass

$$n = \frac{m}{M_r}$$

What equation links volume and number of gaseous moles at room temperature and pressure?

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Number of moles = volume (dm^3) ÷ 24

n = V/24

How many significant figures should calculated results be given to?

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Unless otherwise stated, calculated results shouldn't be given to more significant figures than the least accurate numbers used in the calculation.

3 significant figures are typically used.

What is meant by the term stoichiometry?

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Stoichiometry is the proportions of reactants and products.

A balanced chemical equation can be used to find the stoichiometry of a reaction.