Ions:

When a chemical reaction take place, only the valence electrons are involved, while the number of protons and neutrons in an atom unchanged.

Types of ions: Cation and Anion

Cation: Ions with positively charged. The number of protons is more than number of electrons.

Cation is formed by losing electrons and become a positive ion.

Usually only metal elements can form cation.

Eg:

Ion	Na^+	Mg^{2+}	Al^{3+}
Number of protons	11	12	13
Number of electrons	10	10	10

Anions: Ions with negative charges. The number of electrons is more than the number of protons.

Anion is formed by receiving electrons and become a negative ion.

Usually only non-metal elements can form anion.

Eg:

Ion	N^{3-}	O^{2-}	F^-
Number of protons	7	8	9
Number of electrons	10	10	10

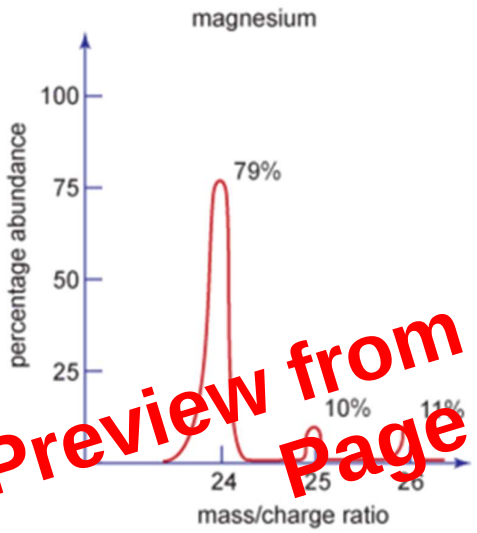
Isoelectronic species: Species with the same number of electrons. For example, all the ions from the table above.

- Mass Spectrum of Monoatomic Element

Use to determine:

- The number of isotopes of the element
- The relative isotopic mass of each isotope
- The percentage abundance of each isotope

Use magnesium as an example,



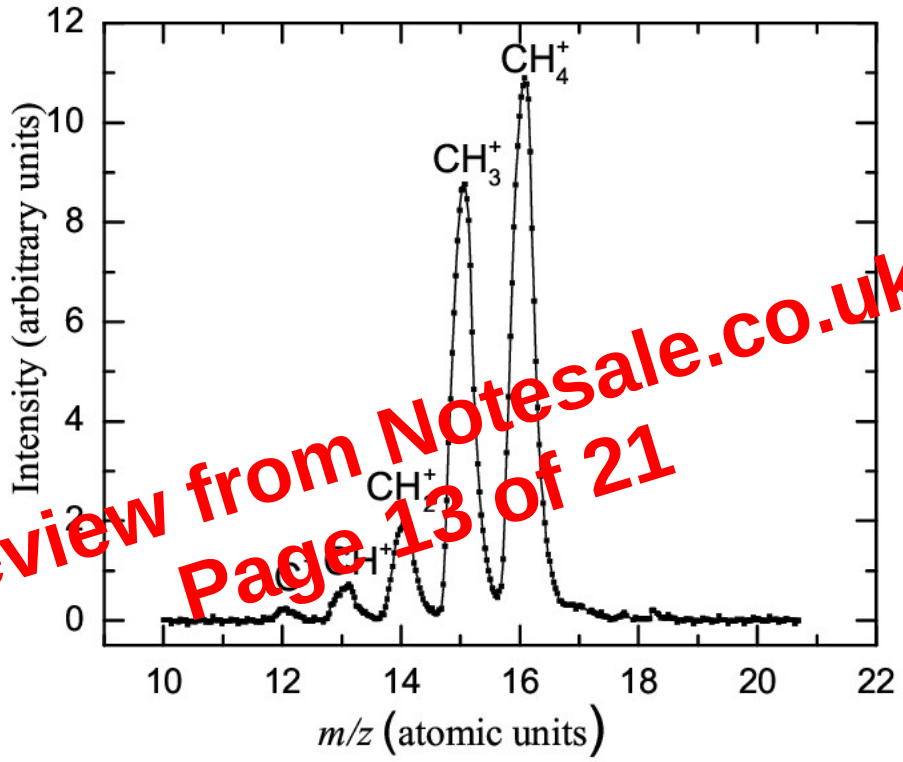
The relative atomic mass of magnesium

$$=\frac{(24X79)+(25X10)+(26X11)}{100} = 24.3$$

Sometimes the relative abundance of isotopes are given instead of percentage abundance. However, the method of calculation is still the same.

- Mass spectrum of a compound

  For example,
  The mass spectrum of methane, CH_4 with a relative molecular mass of 16.



When C—H bonds are broken, fragment ions are formed.

Extra notes:

Determination of the number of carbon atoms in a molecule

Formula:

$$\frac{\text{Relative abundance of } (M+1)^+ \text{ ion}}{\text{Relative abundance of } M^+ \text{ ion}} = \frac{1.1n}{100}$$