

Chemistry

Leaving Certificate

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Subject: Leaving Certificate Chemistry

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Week: Lesson 1

Learning Intentions

- Dalton's Atomic Theory
- Contribution by scientists
- Discovery of: the electron, neutron and proton
- Properties of subatomic particles
- Mass spectrometer: how it works!

Dalton: elements are composed of tiny particles and all particles are identical in an element.

Element: an element is a simple substance that cannot be divided into simpler particles

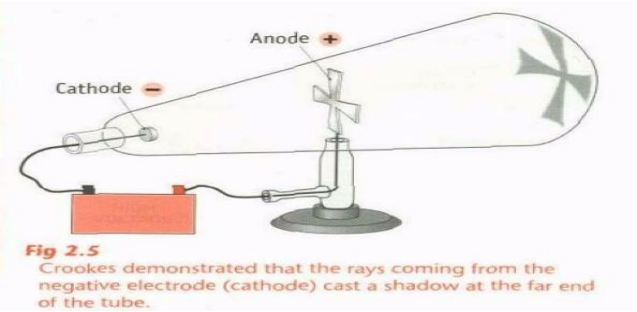
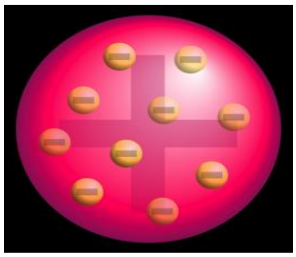


Fig 2.5
Crookes demonstrated that the rays coming from the negative electrode (cathode) cast a shadow at the far end of the tube.

Crookes

Hot negative cathode produces rays causing a glow
to form in a vacuum tube.
Ray were blocked by a cross (anode)



Thompson

Determined that cathode rays must be negative as they could be deflected by charged plates. Called these negative particles electrons

Determined the ratio between the charge and mass of an electron

Stated that an atom consisted of a large positive sphere
with negative particles embedded in it (plum pudding model)

Milikan

Discovered the mass of an electron by charging oil drops
Used xrays to knock electrons from aid and placed this charge onto oil drops
Measure the charge needed to stop them falling
Used this to calculate the mass of an electron using Thompson's ratio.

Rutherfod

Used the gold foil experiment to discover the nucleus.
Fired alpha particles (+ charge) at a thing gold leaf.
Almost all passed through (atom mainly consisted of space)
Some deflected at angles (nucleus is positively charged)
Some completed reflected back (nucleus is small, dense and has mass)

Moselely

Named atomic number (positive charge)
Element: substance that has atoms with the same atomic number.

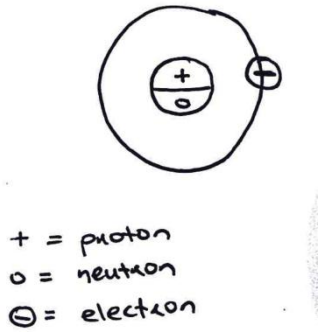
Rutherford

Discovered protons using lighter elements than gold.
Bombarded elements with alpha particles and a positive charge was emitted.
Named them protons

Chadwick

Discovered neutrons (neutral particles) when he bombarded beryllium with alpha particles.

New structure of the atom



Particle	Charge	Mass	Position
Electron	-1	1/1838	Outside the nucleus
Proton	+1	1	Inside the nucleus
Neutron	0	1	Inside the nucleus

Atomic number
Is the number of protons in an atom (small number on the periodic table)

Mass number
Is the number of protons & neutrons in an atom (large number on the periodic table)

N.B as long as the number of protons and electrons are the same the element is neutral (it has no charge). If there are more electrons than protons the element becomes negatively charged (anion). If there are more protons than electrons the element becomes positively charged (cation)

Atom: is the smallest part of an element/tiny particle of an element

Molecule: a group of atoms combined that together make up the smallest part of an element that can exist on it's own.

Isotope
Atom which has the same atomic number but different mass number due to a different number of neutrons in the atom.

Example

C_{12},	C_{13},	C_{14}	→ all carbon isotope
N = 6	N = 7	N = 8	

Relative atomic mass:

The average mass of an element as it occurs in nature compared to one twelfth of the mass of a C_{12} isotope (when the isotopes and their abundance are taken into account)

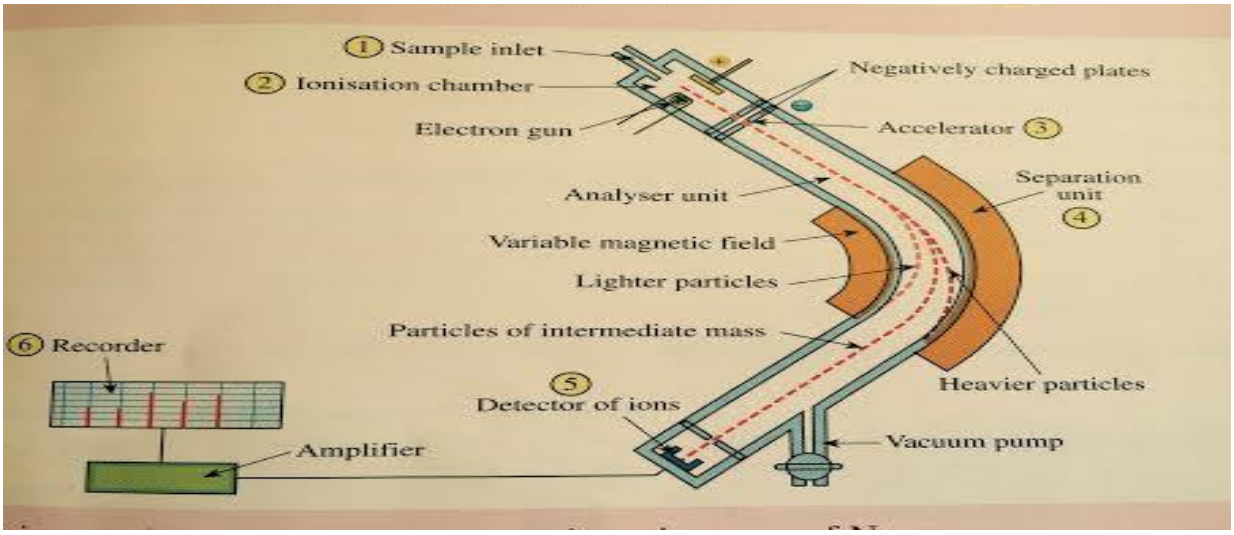
Example:

What is the relative atomic mass of chlorine if 75% of it's isotopes weigh 35 and 25% of it's isotopes weigh 37?

$$\frac{(35 \times 75) + (37 \times 25)}{100} = 35.5$$

relative atomic mass of chlorine = 35.5

Mass spectrometer
Used to measure the mass and quantity of isotopes of elements
Used to analyse gases from waste dumps and organic pollutants in water samples.



Stages:

1. Vaporisation: heat & pressure vaporize the sample
2. Ionisation: sample bombarded with high energy electrons (become + charged)
3. Acceleration: all particles need to have the same kinetic energy so that they only way there are different from each other is by their mass.
4. Separation: ions are deflected by a magnetic field & separated based on their mass.
5. Detection: ions are detected by an electronic plate at the end of their spectrometer

Homework (Week 1)

2012 Q 5 OL

(*b*) Atoms are made up of the subatomic particles protons, neutrons and electrons.

Copy the following table into your answer book and fill in the missing information. (21)

PARTICLE	RELATIVE MASS	RELATIVE CHARGE	LOCATION
		–1	
	1	**0**	
proton			**nucleus**

(*c*) The values of the *atomic number* and of the *mass number* for the most abundant isotope of the element hydrogen, **H**, are both 1.

What does this fact tell us about the composition of the **H** nuclei? (6)

(*d*) Naturally-occurring carbon consists mainly of carbon-12 atoms but it also contains a small percentage of carbon-14 atoms.

In terms of their subatomic particles, state **two** ways in which these carbon atoms are similar, and **one** way in which they differ. (9)

(*e*) The scientist who discovered the atomic nucleus is shown in the photograph on the right. What was his name? (6)

