Essential SCIENCE

Chapter 25 – Structure of the atom

THE CHEMICAL WORLD – Building Blocks

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Objectives:

- To help students appreciate that all matter is made up of atoms
- To make students familiar with the particles inside atoms
- To help students understand the structure of the atom

Keywords:

Atom

Proton

Neutron

Subatomic

Electron

Planetary model

25.1 The atom

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The atom

- Scientists have discovered that all materials are made of millions of tiny particles called atoms.
- An **atom** is the smallest particle of an element that still has the properties of that element.
- Each element has its own unique type of atom.

25.2 Particles inside atoms

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Particles inside atoms

- A **subatomic particle** is a particle found inside an atom.
- There are three types of subatomic particle:

Name of particle	Where situated in atom	Relative mass	Relative charge
Proton	Nucleus	1 unit	+1
Neutron	Nucleus	1 unit	0
Electron	Outside the nucleus (electron cloud)	$\frac{1}{1{,}840}$ unit	−1

25.3 Atomic structure of the first 20 elements

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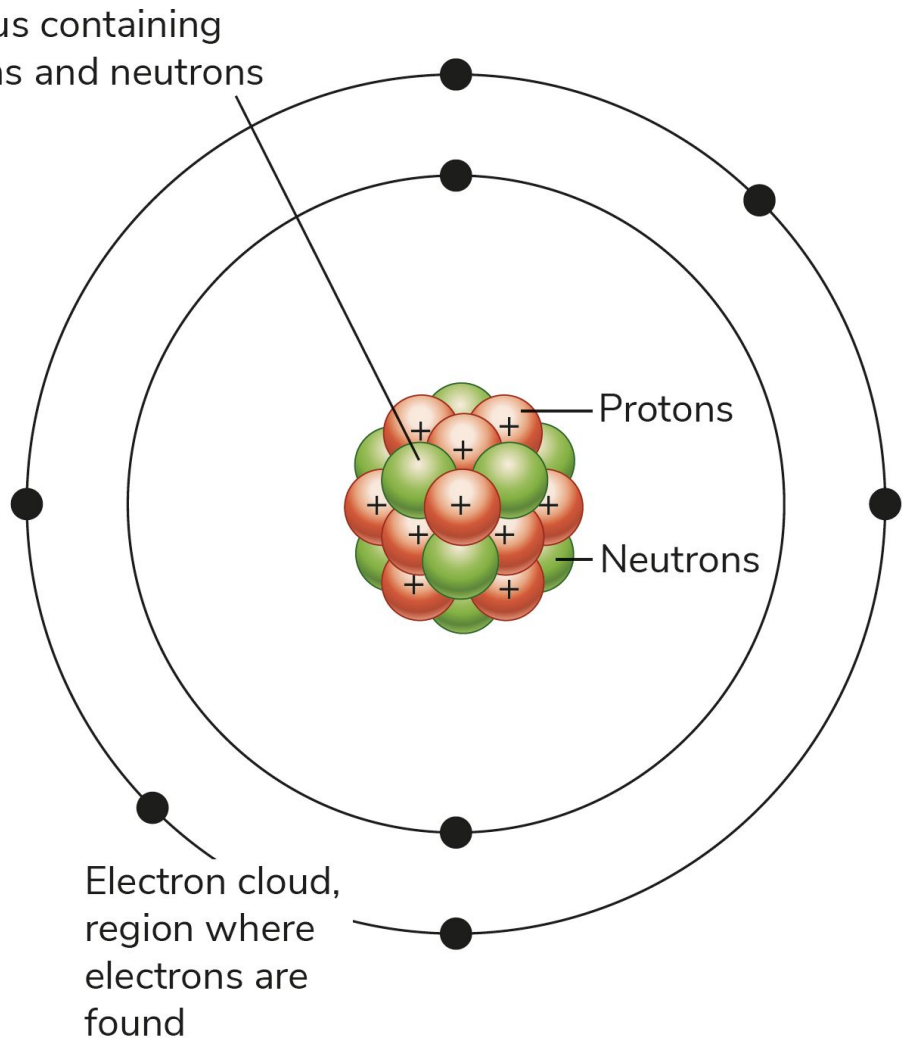
The structure of an atom

- A Danish scientist, Niels Bohr, proposed that electrons move around the centre, or nucleus, of an atom, in fixed paths called **orbits**. These orbits are also called **shells**.
- The region in which the shells are located is called the **electron cloud**.

The planetary model

- Bohr's model is often called the **planetary model**. The electrons move around the nucleus like planets moving around the sun.



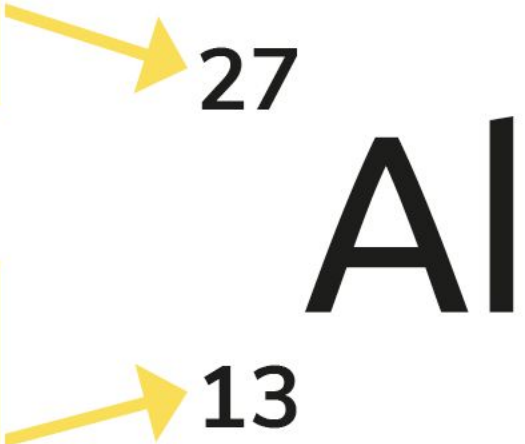
Important points about atoms

1. All atoms are neutral – this means that there must be an equal number of protons (positively charged) and electrons (negatively charged).
2. The **atomic number** of an atom is the number of protons in the nucleus of that atom.
3. Each element has its own atomic number.
4. The **mass number** of an atom = number of protons + number of neutrons.

Important points about atoms

This is the **mass number**. It is the sum of the number of protons and neutrons in the nucleus.

This is the **atomic number**. It tells you the number of protons in the nucleus.



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Atomic structure of the first 10 elements

Element	Atomic number	Number of protons	Number of electrons	Mass number	Number of neutrons (= mass no. – atomic no.)
$^{1}_{1}H$	1	1	1	1	1 – 1 = 0
$^{4}_{2}He$	2	2	2	4	4 – 2 = 2
$^{7}_{3}Li$	3	3	3	7	7 – 3 = 4
$^{9}_{4}Be$	4	4	4	9	9 – 4 = 5
$^{11}_{5}B$	5	5	5	11	11 – 5 = 6
$^{12}_{6}C$	6	6	6	12	12 – 6 = 6
$^{14}_{7}N$	7	7	7	14	14 – 7 = 7
$^{16}_{8}O$	8	8	8	16	16 – 8 = 8
$^{19}_{9}F$	9	9	9	19	19 – 9 = 10
$^{20}_{10}Ne$	10	10	10	20	20 – 10 = 10

Learning outcomes: *Now I am able to…*

Tick

- Describe the structure of the atom. ☐
- State the location, relative charge and relative mass of each of the subatomic particles. ☐
- Define atomic number and mass number. ☐
- Write down the number of protons, neutrons and electrons in the atoms of the first 20 elements given their nuclear formulas. ☐

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