Atomic Structure Notes for AQA GCSE Physics

The structure of an atom

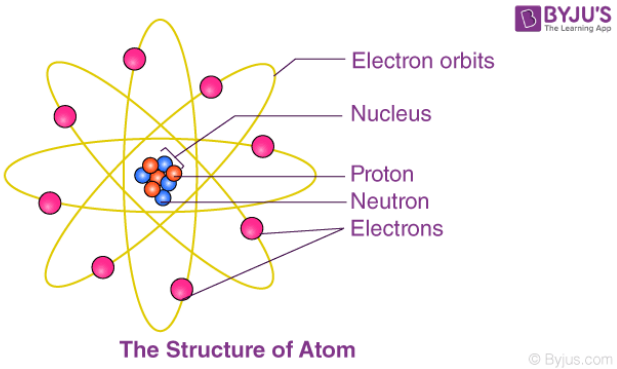
Atoms are the fundamental building blocks of matter, and they are incredibly small, with a radius of about 1×10^{-10} meters.

This means that they are too small to be seen by the naked eye or even by conventional microscopes.

Atoms are composed of three types of particles: protons, neutrons, and electrons.

The basic structure of an atom is a positively charged nucleus composed of both protons and neutrons, surrounded by negatively charged electrons.

The nucleus is at the center of the atom and is extremely dense compared to the rest of the atom.

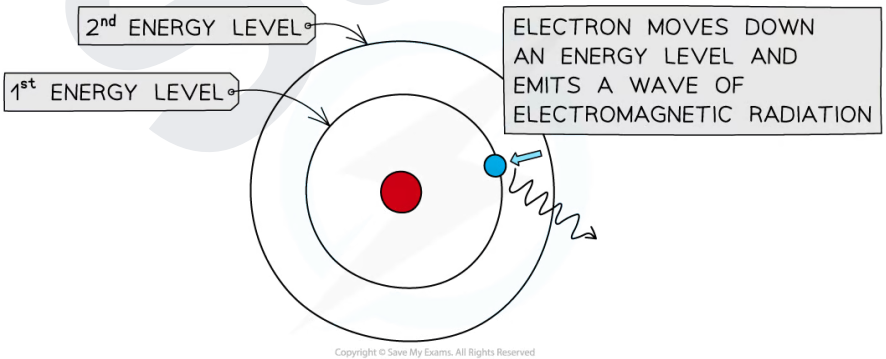


The radius of a nucleus is less than 1/10,000 of the radius of an atom, indicating how small the nucleus is compared to the overall size of the atom.

Most of the mass of an atom is concentrated in the nucleus because both protons and neutrons are much heavier than electrons.

The electrons are arranged in different energy levels, which determine their distance from the nucleus.

The electron arrangements may change with the absorption of electromagnetic radiation, which causes them to move further from the nucleus and occupy a higher energy level.



Conversely, the emission of electromagnetic radiation causes the electrons to move closer to the nucleus and occupy a lower energy level.

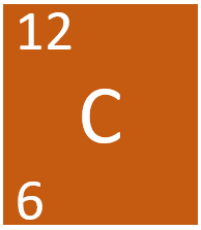
Mass number, atomic number and isotopes

An atom is the basic unit of matter that consists of a small, dense, positively charged nucleus at its center and negatively charged electrons orbiting around the nucleus. The number of electrons in an atom is equal to the number of protons in the nucleus, and this balance ensures that atoms are electrically neutral.

The number of protons in the nucleus of an atom is referred to as the atomic number and determines the identity of the element.

All atoms of the same element have the same number of protons, and this number is unique to each element.

For example, carbon atoms have six protons, and this is what makes them carbon atoms.



The total number of protons and neutrons in the nucleus of an atom is referred to as the mass number.

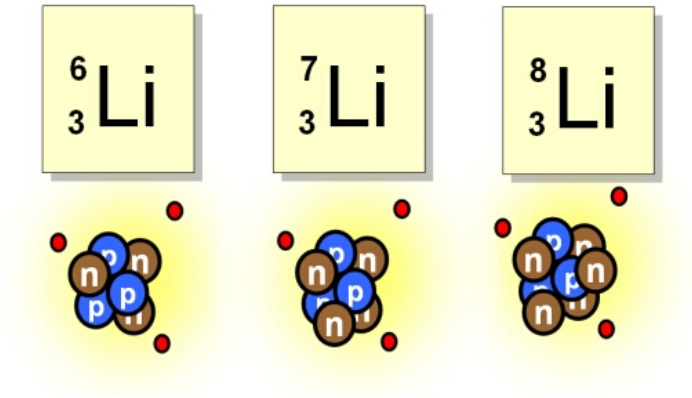
Atoms can be represented as shown in this example:

(Mass number) 23
(Atomic number) 11 Na

Isotopes

Atoms of the same element can have different numbers of neutrons, resulting in isotopes of that element. Isotopes have the same number of protons but different numbers of neutrons. This means that they have the same atomic number (i.e., they are the same element), but they have different mass numbers. Isotopes can be stable or unstable (radioactive), and some isotopes are more common than others.

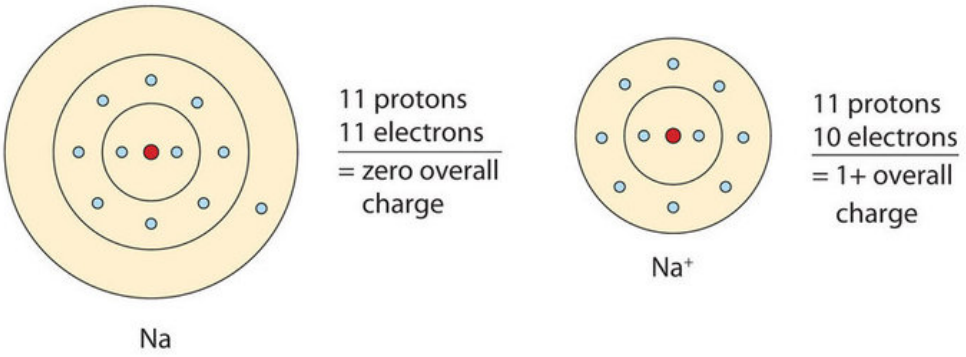
Examples of Isotopes of Lithium



Making Ions

When an atom loses one or more outer electrons, it becomes a positive ion. Outer electrons are the electrons in the outermost shell of the atom, which are held more loosely than the inner electrons.

When an outer electron is removed, the atom becomes positively charged because the number of protons in the nucleus now exceeds the number of electrons.



Choose 5 elements from the periodic table and work out the number of protons, neutrons and electrons.

The development of the model of the atom (common content with chemistry)

Before the discovery of the electron, atoms were thought to be tiny spheres that could not be divided. However, the discovery of the electron in 1897 by J.J. Thomson led to the development of the plum pudding model of the atom.

The plum pudding model suggested that the atom is a ball of positive charge with negative electrons embedded in it.