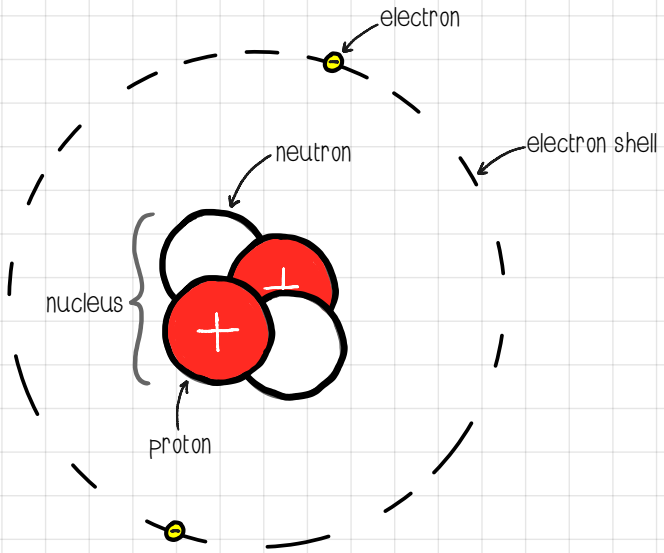
Atomic (proton) number and mass number

Atomic structure

The structure of an atom consists of a central **nucleus** containing **protons** and neutrons. It is surrounded by electrons which are found in shells around the nucleus.

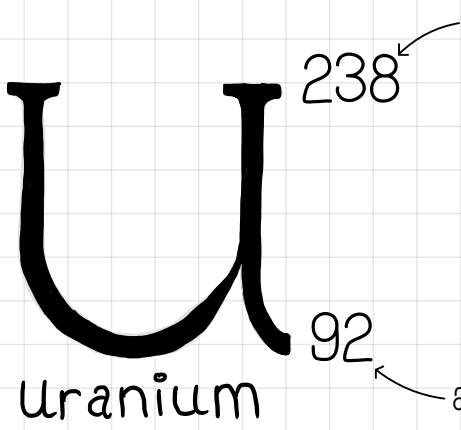


	mass	charge
proton	1	+1
neutron	1	neutral
electron	0 (0.0005)	-1

Protons have a **positive** charge and **electrons** have a **negative** charge. Neutrons are neutral and have no charge.

Atoms have no overall charge because the number of electrons (negative) is equal to the number of protons (positive). So the positive charge on the protons is cancelled out by the negative charges on the electrons.

The **periodic table** can be used to calculate the numbers of protons, electrons and neutrons in the atoms of an element.



mass number (neutrons + protons)

On the periodic table each element has 2 numbers. The **top** number is called the **mass** number and the **bottom** number is called the **atomic** number.

atomic number (protons)

number of neutrons = top - bottom

Atomic (proton) number and mass number...

The size of an atom

- Atoms are very small, having a radius of about 1×10^{-10} metres.
- The radius of a nucleus is over 10 000 times smaller than the radius of an atom. Most of the mass of an atom is concentrated in the nucleus.
- If the atom was the size of the Earth then the nucleus would only be 260 metres in diameter. So most of an atom is space.

Isotopes

- Isotopes are atoms of elements with different numbers of neutrons. All the atoms of an element will have the same number of protons.
- Here are some examples of isotopes of carbon.

$^{12}_{6}C$	$^{13}_{6}C$	$^{14}_{6}C$
6 protons 6 neutrons	6 protons 7 neutrons	6 protons 8 neutrons

Ions

- Ions are atoms which have a positive or negative charge. This is because they lost or gained electrons.
- The electrons are lost from the outer shell.
- Examples of positive ions are shown below:

$^{23}_{11}Na^{+}$	$^{24}_{12}Mg^{2+}$	$^{27}_{13}Al^{3+}$
11 protons 12 neutrons 10 electrons	12 protons 12 neutrons 12 electrons	13 protons 14 neutrons 10 electrons

- Alpha particles (a helium nucleus) are positively charged ions (+2).