Atoms and Elements

All matter is made up of atoms. Atoms are made up of any combination of protons (which have a positive charge), neutrons (which have no charge), and electrons (which have a negative charge). Atoms are classified by the number of protons they have, so the number of protons is called the atomic number. Atoms with the same number of protons are the same element.

Electrons travel around the nucleus of an atom in shells. Elements are organised down the periodic table (each row is a period) by their number of electron shells. These shells are also known as energy levels, and each has a maximum number of electrons it can hold. If it is the outermost (valence) shell, it usually will not contain more than 8 electrons. Atoms try to have stable shells – there is a rule called the octet rule which states that any atom is most stable when it has 8 valence electrons (except for the first shell which is stable at 2 electrons).
Elements are organised across the periodic table (each column is a group) by the number of valence electrons.

When calculating the electron configuration of an element, remember that:
- the innermost shells are filled first
- the valence shell must not have more than 8 electrons
- atoms try to have stable shells

(periodic table diagram with the following groups to memorise:)
- alkali metals (Group I)
- alkaline earth metals (Group II)
- transition metals (between Groups II and III)
- halogens (Group VII)
- noble gases (Group VIII)

Isotopes

Atoms of the same element can have different numbers of neutrons. Each atom with a different number of neutrons for a particular element is called an isotope of that element.
Atoms have a very small mass, so they are given a mass number. Protons and neutrons weigh 1840 times more than electrons, so the mass number of an atom is effectively the number of protons plus the number of neutrons.
The amount of each isotope found naturally varies for each element. Since the mass number for each isotope will be different, the mass number shown on the periodic table is based on the abundance of that element's isotopes.

Example:
$^{35}_{17}$Cl makes up 75.77%
$^{37}_{17}$Cl makes up 24.23%
So $75.77\% \times 35 + 24.23\% \times 37$
$= 0.7577 \times 35 + 0.2423 \times 37$
$= 35.48$