

Unit 1, Lesson 01: Review of Atomic Structure (page xv)

An **atom** is the smallest particle of an element that has the identity and properties of that element. Atoms are made up of protons, neutrons and electrons.

In our current model of the atom, the protons and neutrons are found in the **nucleus**, a small, dense, positively charged region at the centre of the atom. Electrons move in the space around the nucleus.

Sub-atomic Particle	Where it's Found	Relative Mass (atomic mass units, amu or u)	Relative Charge
proton	nucleus	1 amu (u)	1+
neutron	nucleus	1 amu (u)	0 (neutral)
electron	space around nucleus	1/1837 amu (u) or almost zero	1-

The **atomic number** (Z) tells us the number of protons in the nucleus of the atom. The atomic number defines the identity of the atom.

eg. Z= 12, the atom is magnesium

Z= 47, the atom is silver

The **mass number** (A) tells us the number of protons and neutrons in the nucleus of the atom. It is a counted value that has no units. The protons and neutrons give an atom almost all of its mass.

Isotopes are atoms of the same element (ie. atoms with the same atomic number) that have different numbers of neutrons, so they have different mass numbers and slightly different masses.

Isotopes can be indicated using the format U-238, where 238 is the mass number of the atom.

eg. Pb – 206

Pb – 207

Pb – 208

atomic #: 82 (lead)
mass #: 206
neutrons (206 – 82): 124

atomic #: 82 (lead)
mass #: 207
neutrons (207 – 82): 125

atomic #: 82 (lead)
mass #: 208
neutrons (208 – 82): 126

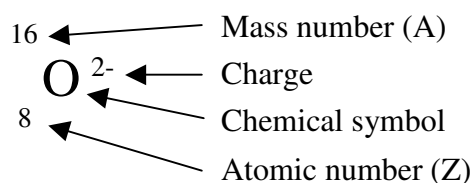
Elements contain a mixture of all of the different isotopes of that element. The **average atomic mass** is the weighted average of the masses of all of the isotopes of an element (the most abundant isotope is weighted more). The average atomic mass for each element is reported on the Periodic Table. Its units are a.m.u. (atomic mass units, or u).

eg. the average atomic mass of carbon is 12.011 u (from the Periodic Table). This is the weighted average mass of C – 12, C – 13 and C – 14. Because the average atomic mass is close to 12, we know that most carbon atoms have a mass number of 12; that is, C-12 is the most common isotope.

The charge on the atom tells us the number of electrons in the atom:

- if the atom is uncharged (neutral) then the # of electrons is equal to the # of protons
- if the atom has a positive charge, then there are fewer electrons than protons and the atom has a positive charge. It is called a **cation** (a positively charged ion)
- if the atom has a negative charge, then there are more electrons than protons and the atom has a negative charge. It is called an **anion** (a negatively charged ion)

This information can be written using the standard format:



protons (atomic number) = 8 p+ # neutrons (mass number – atomic number) = 8 n ⁰ # electrons (2 more electrons than protons) = 10 e-
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