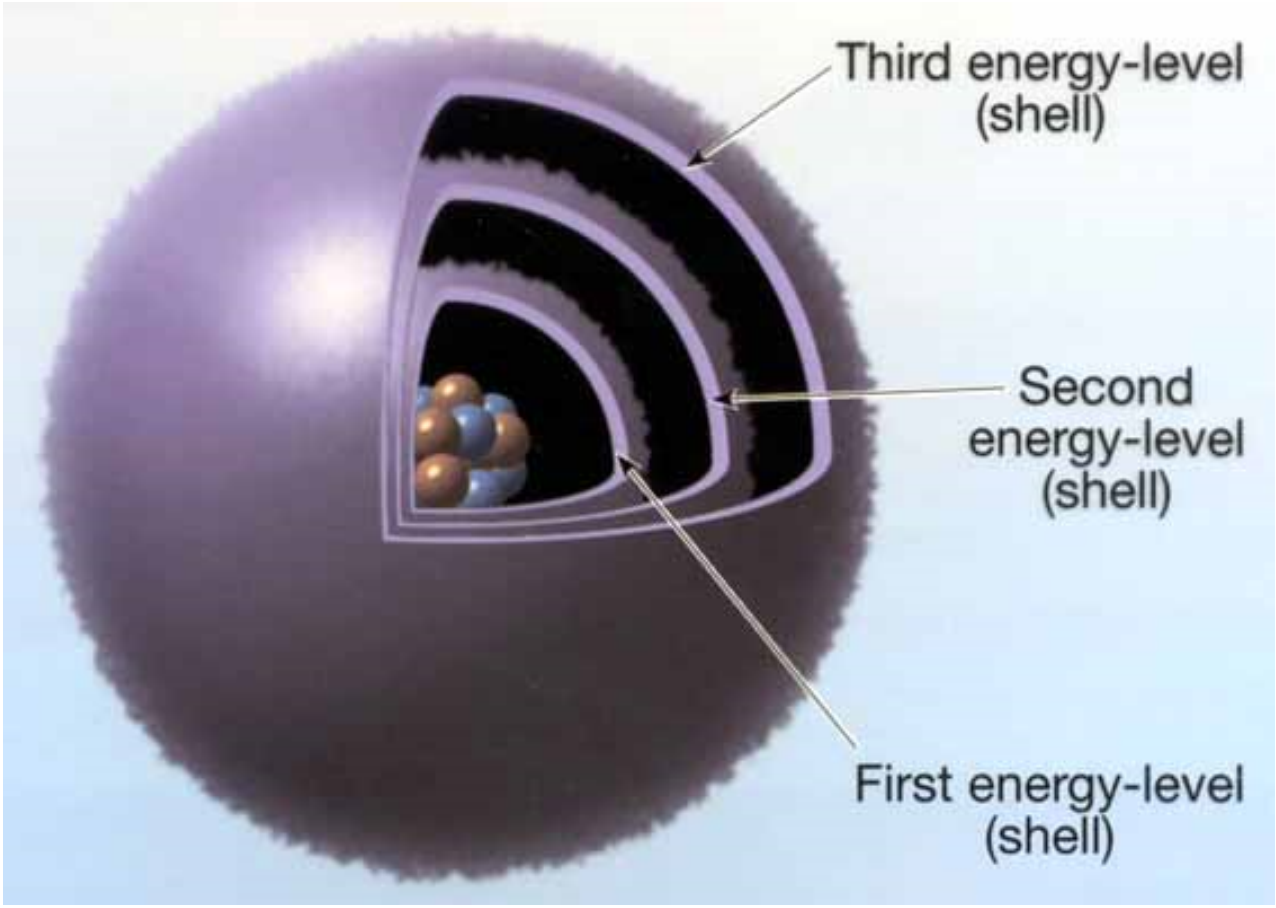
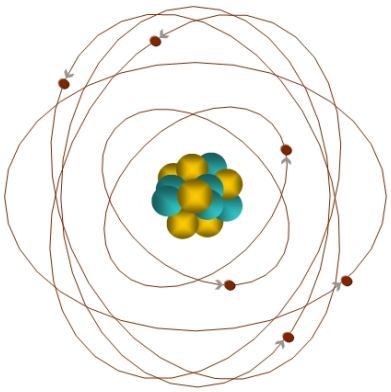
Structure of an Atom



The Atom



The atom consists of 3 subatomic particles.

- The Proton
- The Electron
- The Neutron

Protons and neutrons are located inside the nucleus of the atom. The electrons surround the nucleus

	Charge	Relative Mass	Location	Actual Mass (g)
Proton	+1	1	nucleus	1.67×10^{-24}
Electron	-1	1/1840	orbit or shell	9.11×10^{-28}
Neutron	no charge	1	nucleus	1.67×10^{-24}

Elements

Elements are made up of one type of atom.

The type of atom depends on the number of protons.

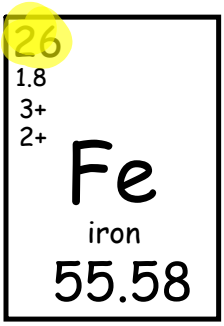
(the number of electrons and neutrons in an atom can change, but not the number of protons)

For example.
The atom with the 6 protons is called carbon

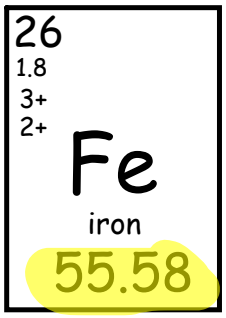
The atom with 15 protons is called phosphorus

The number of protons an atom has is called the "atomic number" "Z" (must be a whole number)

The atomic number of an element is the number of protons in the nucleus of an atom of that element.



The total number of protons and neutons in an atom is called the mass number.

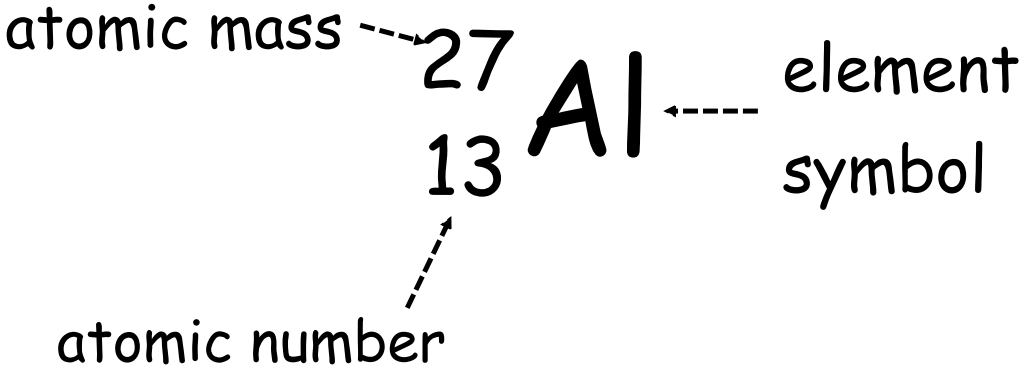


When you know the atomic number and the mass number, these can be used to find the amount of electrons, neutrons, and protons there are in a given atom.

protons = electrons = atomic #

neutrons = mass # - atomic number

Standard Atomic Notation



Worksheet on subatomic particles

Ion Charges

When atoms form compounds, they will either want to take on extra electrons or give them away.

The charge of an atom is determined by adding the number of protons to the number of electrons.

If there are more electrons, like in the case of the oxygen ion, then the number is shown by showing the symbol and charge with a negative sign.

O^{2-}

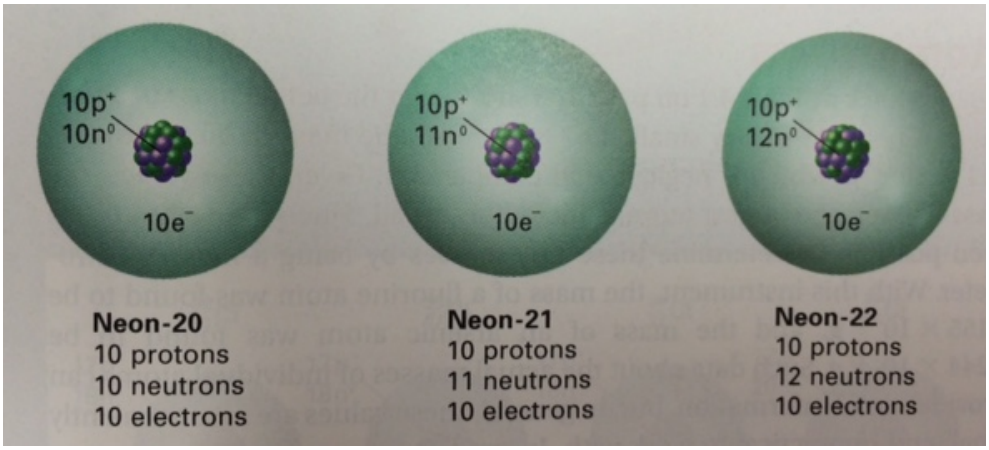
If there are more protons then the same steps are followed with a plus sign instead

Al^{3+}

Isotopes

It is possible for the same element to have different amounts of neutrons in its nucleus.

Isotopes are atoms that have the same number of protons but different numbers of neutrons.



Copy and complete the following table

atom/ion symbol	atomic number (Z) Z = p	mass number (A) A = p + n	protons p (+)	electrons e(-)	neutrons n	charge (compare p + e)
	9	19				0
			20	18	21	
Fe^{3+}		56				3+
	35			36	45	
C		12				0
		14		2	8	
Zn^{2+}		64				2+
	30			30	42	

Copy and complete the following table

atom/ion symbol	atomic number (Z) Z = p	mass number (A) A = p + n	protons p (+)	electrons e(-)	neutrons n	charge (compare p + e)
F	9	19	9	9	10	0
Ca^{2+}	20	41	20	18	21	2+
Fe^{3+}	26	56	26	23	30	3+
Br^{-}	35	80	35	36	45	1-
C	6	12	6	6	6	0
$^{14}C^{4+}$	6	14	6	2	8	4+
Zn^{2+}	30	64	30	28	34	2+
^{72}Zn	30	72	30	30	42	0

Which are isotopes, which are ions?

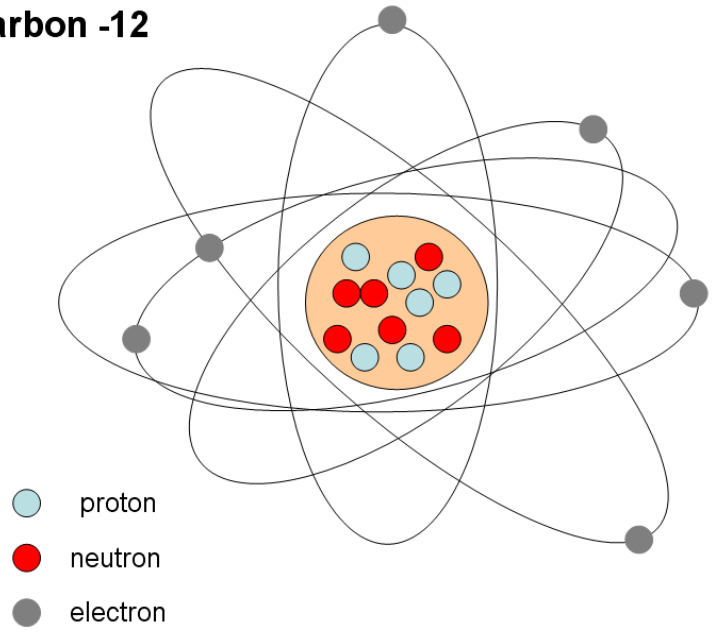
Atomic Mass

The mass of an electron, neutron, and proton are quite small which means that atoms of elements are also quite light.

Because this is inconvenient to report such small numbers, scientists used carbon-12 as a base to assign units.

An *atomic mass unit (amu)* is defined as one twelfth the mass of a carbon-12 atom.

Since carbon-12 has 6 protons and 6 neutrons, the amu of a proton and neutron was given a value of 1.



Because elements exist in nature in different abundances, a weighted average is used to find the average atomic mass of elements.

For example, chlorine has two isotopes, chlorine-35 and chlorine-37. The average atomic mass of a chlorine atom has been calulated to be 35.453. What does that tell you about the abundance of the two chlorine isotopes?

To calculate the atomic mass of an element, multiply the mass of each isotope by its natural abundance, expressed as a decimal, and then add the products.

Example

Element X has two natural isotopes. The isotope with a mass of 10.012 amu has a relative abundance of 19.91%. The isotope with a mass of 11.009 amu has a relative abundance of 80.09%. Calculate the atomic mass of this element.