MORE ABOUT PROTONS, NEUTRONS AND ELECTRONS

ISOTOPES

Dalton could not have dreamt of the existence of subatomic particles and he would have been suprised to discover that all atoms of the same element are exactly the same. Some atoms of carbon for instance, have a mass of 12 a.m.u. and some have a mass of 14 a.m.u. All carbon atoms have the same number of protons and electrons but the numbers of neutrons differ. Atoms of the same element but with different atomic masses are called ISOTOPES. Most elements have some naturally occuring isotopes including carbon, hydrogen and oxygen - which means that you have a few isoptopes in your body as you are reading this.

If you take a good look at the Periodic table you will find that the elements all have their mass (weight) recorded in a.m.u. The figure used is the RELATIVE ATOMIC MASS. A definition of this figure is - the weighted mean of naturally occuring atoms of that element. It is very important to refer to individually named isotopes as having atomic mass but a named element as having a RELATIVE atomic mass. It is also important to remember that weighted mean is not the same as the average. If we look at the two naturally occuring isotopes of chlorine, they are ^{35}Cl and ^{37}Cl, having masses of 35 a.m.u. and 37 a.m.u. respectively. The average of 35 and 37 is 36, but the relative atomic mass (A_r) of chlorine is in fact 35.5. Not only the mass of the isopes but their abundance must be taken into account when calculating their relative atomic mass. 75% of all chlorine atoms are ^{35}Cl, and 25% are ^{37}Cl. Thus the following calculation shows how the relative atomic mass is calculated.

A_r Cl =	$\frac{(35 \times 75) + (37 \times 25)}{100} = 35.5$

If you check the periodic table above you will find a few elements have relative atomic masses that reflect some common isotopes; other elements have few or rare isotopes so the Ar is very close to the atomic mass.

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Using the periodic table again, we can see what makes elements of different atoms unique - it is not the mass (note that cobalt and nickel both have the same Ar, rather it is the number of protons that they have. Atoms are arranged in the periodic table according to the number of protons present. The number of protons in an atom is called the ATOMIC NUMBER. Note also that the number of protons is always equal to the number of electrons - this is because the overall charge on any atom is zero, thus the proton and electron charges cancel each other out. You can calculate the number using these rules;

The number of PROTONS in an atom is equal to the ATOMIC NUMBER
The number of ELECTRONS in an atom is equal to the ATOMIC NUMBER
The number of NEUTRONS in an atom is equal to the MASS NUMBER minus the ATOMIC NUMBER

Using these rules, the following table can be constructed; the pattern for protons and electrons is obvious, but neutrons show only a vague increase in numbers as the proton number increases.

ELEMENT	PROTONS	ELECTRONS	NEUTRONS
H	1	1	0
He	2	2	2
Li	3	3	4
Be	4	4	5
B	5	5	6
C	6	6	6

N	7	7	7
O	8	8	8
F	9	9	10
Ne	10	10	10
Na	11	11	12
Mg	12	12	12
Al	13	13	14
Si	14	14	14
P	15	15	16
S	16	16	16

ATOMIC STRUCTURE AND THE ELECTRON [3i 3ii 3iii 3iv 3v]

In 1913 Niels Bohr proposed a model of hydrogen atom, which retained earlier nuclear model of Rutherford and Thomson but made further progress towards the behaviour of the electrons. A dramatic explanation for Rydberg spectral expression resulted.

In 1900s Max Planck and Albert Einstein united two descriptions of the nature of light. Bohr then approached the problem, aware of Planck's (quantum theory of radiation) success and further success of Einstein, with Planck's $\Delta E = h\nu$ relation; where ΔE is the energy change of the oscillator of the black body, ν is the frequency of the radiation and h is Planck's constant (6.6256×10^{-27} Js). Modern ideas (Quantum description of atom) about atomic and molecular structure stem from Bohr's theory.

Bohr's model of H atom postulates:

1. The electron revolves about the nucleus in a circular orbit.
2. Only orbits in which the electron has a angular momentum that is an integral multiple of $\frac{h}{2\pi}$ are allowed.
3. The electron (e^-) does not radiate energy when it is in an allowed orbit. It can gain or lose energy only by jumping from one allowed orbit to another.

Louis de Broglie in 1923 suggested that particles like electrons could be associated with wave properties. De Broglie recognised that integers introduces by Bohr (to explain behaviour of electron in the hydrogen atom), enter naturally in problems dealing with the waves.

Source : http://www.peoi.org/Courses/Coursesen/chem/fram1.html