Elements and compounds

Isotopes of Hydrogen

$_1^1H\rightarrow$Deuterium ($_1^2H$)$\rightarrow$Tritium ($_1^3H$)

Mol: amount of substance SI

N_a=6,022*10^{23}entities/mol

mass of 1 mol of substance=its atomic mass (uma), taken as grams

Atomic spectra

High voltage through a gas at low pressure

⬇

Electromagnetic radiation

⬇

Dispersion of light through the prism

⬇

Atomic spectra
only some wavelengths are observed
(line spectrum)

Gas lamp

Photographic film

Slit

prism

The position of the lines (the wavelength, the energy) depends exclusively on the gas inside the lamp

Changes in the energy of the atoms occurs only at certain energy values

The electron can only have certain values of energy

Rydberg relation

$$\bar{v}=\frac{1}{\lambda}=R_y\left(\frac{1}{n_i^2}-\frac{1}{n_j^2}\right)$$

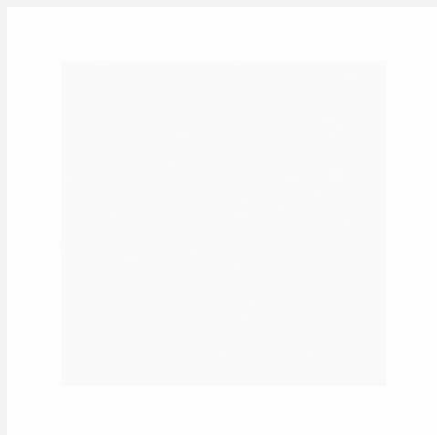only a limited number of energy values are available to excited gaseous atoms

The Bohr Atom

First postulate

atom= nucleus(positivecharge and miuch of the system mass) +e$^-$ moving in circular orbits around it

Fe=Fc⟶r= $(Ze^2)/(4\pi\varepsilon_0mv^2)$

Second postulate

The e$^-$ has only a fixed set of stationary states, as long as it remains in the same orbit, its energy is constant and no energy is emitted

Third postulate

An e$^-$can pass only from one allowed orbit to another emitting or absorvig quanta(fixed discrete quantities of energy)

Heisenberg's uncertainty principle

$$\Delta x\Delta p\geq\frac{h}{4\pi}$$

De Broglie's wave-particle duality

$$\lambda=\frac{h}{mc}$$

Particle in a box

Law of conservation of mass

Matter cannot be created nor destroyed

mass reactants=mass products

Law of definite proportions

A chemical compound always contains exactly the same proportion of elements by mass

The modern atom

	Electric Charge		Mass	
	SI (C)	Atomic	SI (g)	Atomic (u)[a]
Proton	$+1.6022\times10^{-19}$	+1	1.6726×10^{-24}	1.0073
Neutron	0	0	1.6749×10^{-24}	1.0087
Electron	-1.6022×10^{-19}	−1	9.1094×10^{-28}	0.00054858

[a]u is the SI symbol for atomic mass unit (abbreviated as amu).
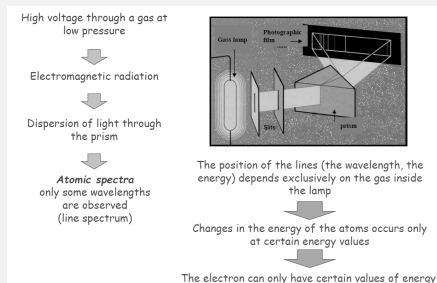
Atomic Number=Z=protons
Mass number=A=protons+neutrons

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Page 1 of 2.

Electromagnetic spectrum

$c=\lambda * v$

γ rays	$[10^{-15},10^{-11}]$m
X rays	$[10^{-13},10^{-9}]$m
U.V.	$[10^{-9},390*10^{-6}]$m
Visible	$[390,760]$nm
Infrarred	$[760*10^{-6},10^{-3}]$m
Microwave	$[10^{-3},10^{-1}]$m
Radio	$[10^{-2},10^{4}]$m

the given values are for λ

Atomic spectrum of Hydrogen

Balmer experimentally found a frequency formula to define H spectral lines

$v=3,2881 \cdot 10^{15}(1/2-1/n^2)$ s^{-1}

The photoelectric effect

$$E_{photon} = h\bar{v} \rightarrow h\bar{v} = \frac{1}{2}(mv^2) + eV_0$$

Einstein postulated that light is not a wave but a collection of discrete wave packets (photons)

The Zeeman effect

spectral lines are split in the presence of a magnetic fild	the split was proportional to the applied magnetic field

Quantum number

n (principal quantum number)	1,2,...,n
l (angular momentum number)	[0,...,n-1]
m (magnetic quantum number)	[-l,...,l]
s (spin number)	[-1/2,1/2]

Pauli Exclusion Principle

In an atom two electrons cannot have the same quantum numbers

Planck's formula

$$E = nh\nu$$

the quantum energy is proportional to the frequency of the emitted radiation, the energy of a system changes in specific quanta.
$h=6,626*10^{-34}$

Orbitals

Description of the probability of finding the electron in the space

high electronic charge density

Multielectron atoms

Different penetrating and shielding properties of the orbitals	$Z_{eff}=Z-\sigma$