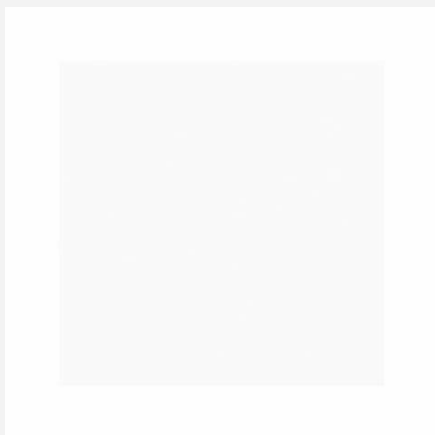


Elements and compounds



Isotopes of Hydrogen

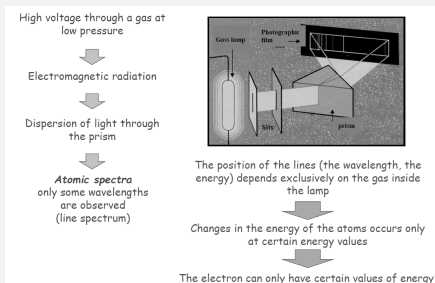
${}^1_1\text{H} \rightarrow \text{Deuterium } ({}^2_1\text{H}) \rightarrow \text{Tritium } ({}^3_1\text{H})$

Mol: amount of substance SI

$N_A = 6,022 \times 10^{23}$ entities/mol

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

Atomic spectra



Rydberg relation

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_i^2} - \frac{1}{n_f^2} \right)$$

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

The Bohr Atom

First postulate

atom = nucleus (positive charge and much of the system mass) + e^- moving in circular orbits around it

$$F_e = F_c \rightarrow r = \frac{(Ze^2)/(4\pi\epsilon_0 m v^2)}{v}$$

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 absorbing 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

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

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	$+1.6022 \times 10^{-19}$	+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

^au is the SI symbol for atomic mass unit (abbreviated as amu).

Atomic Number = Z = protons

Mass number = A = protons + neutrons

Electromagnetic spectrum

$$c = \lambda \cdot \nu$$

γ rays	$[10^{-16}, 10^{-11}]m$
X rays	$[10^{-13}, 10^{-9}]m$
U.V.	$[10^{-9}, 390 \cdot 10^{-6}]m$
Visible	$[390, 760]nm$
Infrared	$[760 \cdot 10^{-6}, 10^{-3}]m$
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

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

The photoelectric effect

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

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 field	the split was proportional to the applied magnetic field
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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.
 $h = 6,626 \cdot 10^{-34}$

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	$Z_{\text{eff}} = Z - \sigma$
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