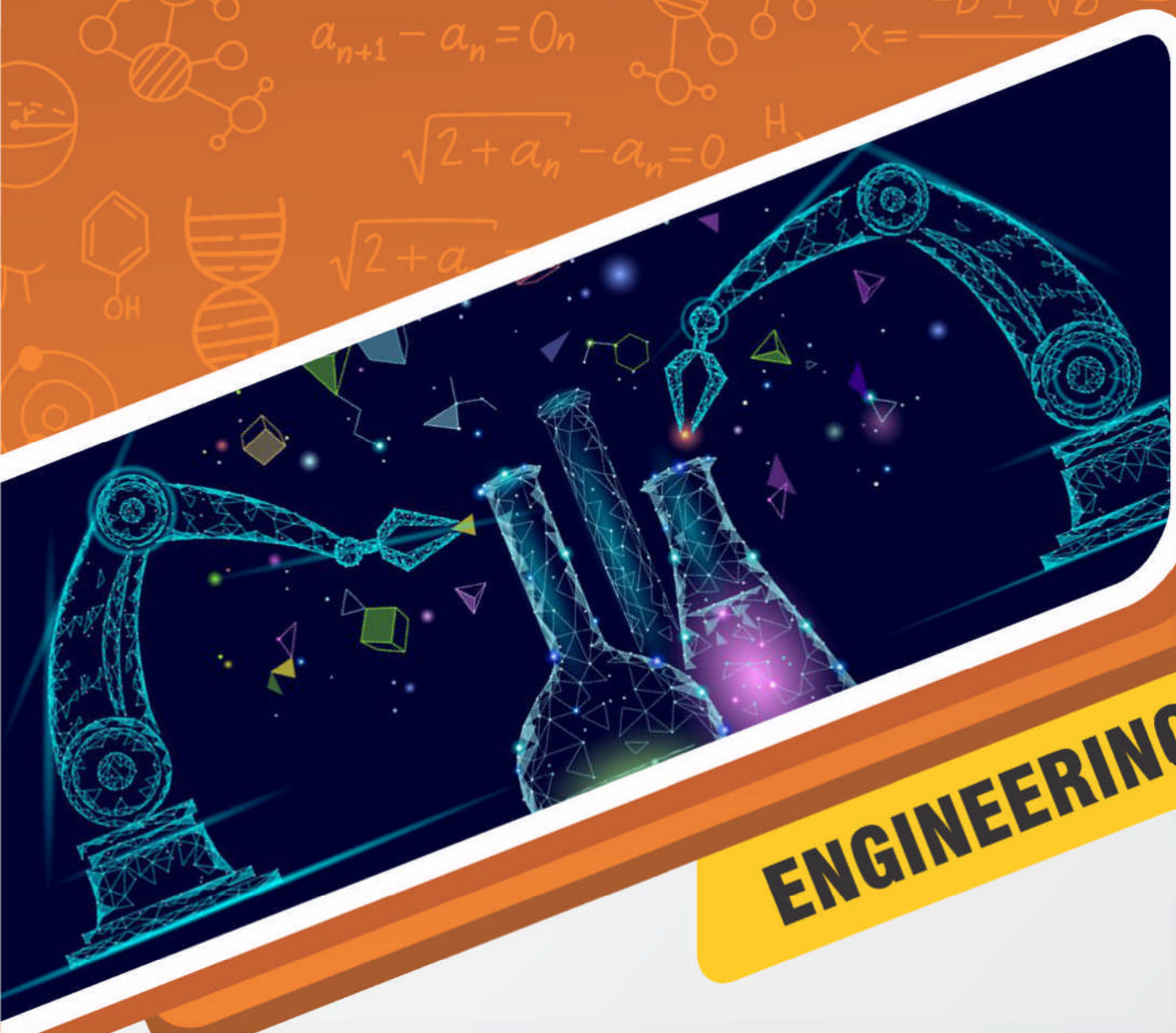
CHEMISTRY



ENGINEERING

ATOMIC STRUCTURE

BANSAL CLASSES
PRIVATE LIMITED
Ideal for Scholars

ATOMIC STRUCTURE

CONTENT

TENTATIVE LECTURE SCHEDULE

Lec-1: Dalton's Atomic theory, Cathode rays-Properties & Experiments for charge and specific charge determination.

Lec-2: Anode rays, Thomson's model.

Lec-3: Rutherford model, Mosley experiment, Atomic terms.

Lec-4: Wave, EM Wave, Spectrum, Planck's Quantum theory.

Lec-5: Photoelectric effect, Bohr's Atomic Model.

Lec-6: Numericals portion of Bohr theory & hydrogen spectrum.

Lec-7: De-Broglie theory & Heisenberg uncertainity principle.

Lec-8: Wave mechanical model & Radial probability graphs.

Lec-9: Angular probability of orbitals & applications based on quantum number & pending discussion.

* The above schedule is tentative & can be modified as per the batch.

* Tutorial sheet discussion should be done along with completion of theory.

Special Highlights

BRAIN TEASERS: 

GENERAL MISTAKE: 

TO BE REMEMBERED: 

TEACHER'S ADVICE: 

ATOMIC STRUCTURE

1. PRE - REQUISITES

"In order to have a clear understanding of some of the concepts of Atomic Structure, an elementary knowledge of concepts from other topics is required. The following section gives an overview of such concepts which would be used during the chapters. Students are advised to get acquainted to these terms and formulae as these would be frequently used in the chapters. An in-depth knowledge in the following areas at this level is not required and these would be covered in detail later as a part of course curriculum in Physics."

1.1 Concepts of Electrostatics from physics [Elementary level]

(a) Electrostatic force, $F = \frac{K}{D}.\frac{q_1 q_2}{r^2}$

D = Dielectric constant (1 for vacuum)
q_1 q_2 are charge on particles & r is distance between them.

$K = \frac{1}{4\pi \in_0} = 9 \times 10^9$ (S.I. units)

Force is along the line joining center and is attractive when q_1 & q_2 are of opposite sign.

(b) Potential Energy [Due to Electrostatic force] $= \frac{k.q_1 q_2}{r}$

P.E. + ve for forces of repulsion & P.E. -ve for forces of attraction.

(c) Electric force on charged particle in an electric field E, F_{EF} = q. E
E - Electric field strength, q – Charge on electron

(d) Increase in energy of a charged particle (q) accelerated from rest by a potential difference of V volts = qV

(e) Magnitude of magnetic force on a moving charge under specific arrangement.*
F_{MF} = q v B
q = Charge on Body, v = velocity of Body, B = Magnetic field strength.

* For the above expression to be applicable velocity should be $\perp$ to the magnetic field vector.

1.2 Elementary knowledge of waves [To be discussed later in chapter]

1.3 Expertise in unit conversion from one system to another.

2. DALTON'S ATOMIC THEORY

John Dalton 1808, believed that matter is made up of extremely minute indivisible particles, called **atom** which takes part in chemical reactions. These particles can neither be created nor be destroyed. However, modern researchers have conclusively proved that atom is no longer an indivisible particle. Modern structure of atom is based on Rutherford's scattering experiment, quantization of energy and wave mechanical model.

Can you guess how and into what an atom can be divided ?

3. COMPOSITION OF ATOM

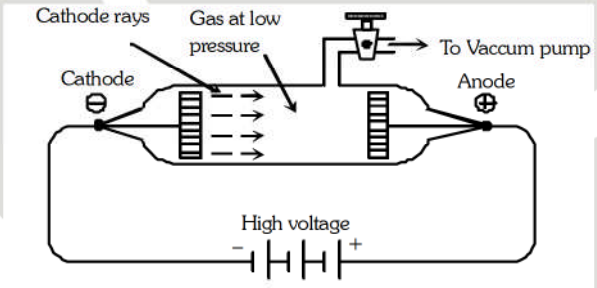
The works of J.J. Thomson and Ernst Rutherford actually laid the foundation of the modern picture of the atom. It is now verified that the atom consists of several sub-atomic particles like electron, proton, neutron, positron, neutrino, meson etc. Out of these particles, the electron, proton and the neutron are called fundamental subatomic particles.

Does all the atoms contain all the three fundamental subatomic particles

4. ELECTRON ($_{-1}e^0$, e)

4.1 Electron was discovered by **J.J. Thomson (1897)** and it is a negatively charged particle.

4.2 Cathode rays were discovered by **William Crooke** & **J.J. Thomson** using a cylindrical hard glass tube fitted with two metallic electrodes. This tube was known as discharge tube. They passed electricity (10,000V) through a discharge tube at very low pressure. Blue rays emerged from the cathode. These rays were termed as Cathode rays.



Discharge tube experiment for production of cathode ray

4.3 Properties of Cathode rays

(i) Cathode rays travel in straight line.
(ii) Cathode rays produce mechanical effect, as they can rotate the wheel placed in their path.
(iii) Cathode rays consist of negatively charged particles known as electron.
(iv) Cathode rays travel with high speed.
(v) Cathode rays can cause fluorescence.
(vi) Cathode rays heat the object on which they fall due to transfer of kinetic energy to the object.
(vii) When cathode rays fall on heavy metals, X-rays are produced.
(viii) Cathode rays possess ionizing power i.e., they ionize the gas through which they pass.