

ATOMS AND NUCLEUS

1. Define activity of a radioactive substance. Give its practical and SI unit.
2. Explain the term mass defect and nuclear binding energy. Sketch a graph showing the variation of binding energy per nucleon with nucleon numbers (mass number) and show how both nuclear fission and fusion can be explained from the shape of the curve?
3. What is stable and unstable nucleus? What factors contribute towards the stability of nucleus?
4. Using Bohr's postulate derive an expression for the velocity of an electron in nth orbit of Hydrogen like atom and find the expression for total energy of electron in the nth orbit of H-atom.
5. Draw a graph showing the variation of P.E of a pair of nucleus as a function of their separation. Indicate the region in which nuclear force is- i) attractive ii) Repulsive. State and explain two properties of nuclear forces.
6. A) How β rays emitted from a nucleus when it does not contain electron.
B) Why is energy distribution of β rays continuous?
7. State the limitation of Bohr's theory.
8. Consider the so called deuterium-tritium reaction future thermo nuclear fusion reaction.
 $1\text{H}^2 + 1\text{H}^3 \longrightarrow 2\text{He}^4 + 0\text{n}^1 + Q(\text{Energy})$
Determine the value of Q in Mev released in the reaction from the data.
 $m(1\text{H}^2) = 2.014102 \text{ amu}$
 $m(1\text{H}^3) = 3.016049 \text{ amu}$
 $m(4\text{He}^4) = 4.002603 \text{ amu}$
 $m(0\text{n}^1) = 1.008665 \text{ amu}$

9. Find the BE/nucleon of α particle.

$$m_{\alpha}=4.002775 \text{ amu}$$

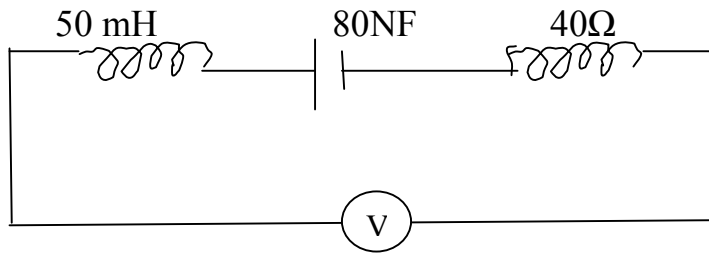
$$m_p=1.0075934 \text{ amu}$$

$$m_n=1.008982 \text{ amu}$$

ELECTROMAGNETIC STATIC

1. State Lenz's rule. Show that it obeys conservation principle of energy. Two identical loops one of copper and another of aluminum are rotated with same speed in a uniform magnetic field acting normal to the plane of the loops. State with reason for which of the coil-
 - i) Induced e.m.f
 - ii) induced current will be more.
2. Define self inductance and give its S.I units. Derive an expression for self inductance of long air-cored solenoid of length 'l' and radius 'r' having 'N' no. of turns.
3. Define mutual inductance and give its S.I unit. Derive an expression for mutual inductance of two long solenoid of same length wound one over the other.
4. A circular coil of N turns and radius R is kept normal to a magnetic field given by $B = B_0 \sin \omega t$. Deduce an expression for e.m.f induced in the coil. State the rule which helps to detect the direction of current of induced current.
5. What are the eddy currents? How are these minimized? Mention two applications of eddy current.
6. What is power dissipation in a.c circuit. In which voltage and current are given by $V = 300 \sin(\omega t + \pi/2)$ and $I = 5 \sin \omega t$
7. Show graphically the variation of inductive and capacitive reactance with frequency. Show that in inductor 'L' voltage leads the current by $\pi/2$.
8. Give principle construction and working of an a.c generator?
9. Give principle construction and working of a transformer, why core is laminated?
10. Give the condition for a current carrying loop not to rotate in a magnetic field.
11. Show that in the free oscillation of an L-C circuit the sum of energies stored in the capacitor and the inductor is constant in time.
12. The instantaneous voltage from an a.c source is given by $E = 300 \sin 314 t$. What is the r.m.s value of voltage of the source?
13. Draw a graph between
 - i) Inductive reactance with frequency and
 - ii) Capacitive reactance with frequency.How does the value of inductive and capacitive reactance change, when the frequency of applied voltage is tripled?

14. i) determine the source frequency at which drives the circuit in resonance.
 ii) Calculate the impedance of the circuit and amplitude of current at resonance.



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16. An alternating voltage frequency ω is applied across a series LCR circuit. Let ω_0 be the resonance frequency for the circuit. Will the current in the circuit lag, lead ω remain in phase with applied voltage.

When

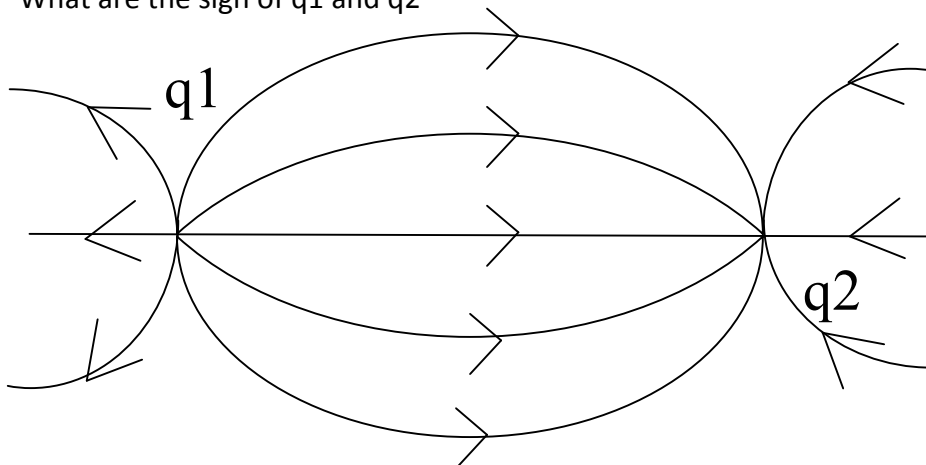
- i) $\omega > \omega_0$
 ii) $\omega < \omega_0$

Explain your answer in each case.

Electrostatics

For low achiever

1. Define the term 'dielectric constant' of a medium in the term of capacitance of a capacitor.
2. Define the term electric displacement. Is it a scalar or a vector quantity?
3. Define the term electric flux. Write its S.I unit.
4. What are the sign of q_1 and q_2



5. Write the statement of Gauss Law. Find the expression for the electric field at a point due to a uniformly charged infinite plane sheet of charge.
6. Derive an expression for the energy stored in a parallel plate capacitor with air between them. How does the energy change if air is replaced by a medium of dielectric constant K .
7. How can you charge a metal sphere without touching it?
8. An electric dipole is held in a uniform electric field-
 - i) Using the suitable diagram, show that it does not undergo any translational motion and
 - ii) Derive an expression for the torque acting on it and specify its direction.
9. Why does the electric field inside a dielectric decrease when it is placed in an external electric field?
10. Draw an equipotential surface due to
 - i) Point charge
 - ii) electric dipole.
11. Draw the graph showing the variation of electric field with distance for a uniformly charged metallic sphere.
12. What is an equipotential surface? Show that the electric field at a point on the surface of a charged conductor is perpendicular to the surface.
13. Show that the energy density in a parallel plate capacitor is given by $\frac{1}{2} \epsilon_0 E^2$.
14. A P.P.C with air as dielectric is connected to a power supply and charged to a potential difference V_0 . After a sheet of insulating material is inserted between the plates completely filling the space between them. How will its-
 - i) Capacity
 - ii) Electric field
 - iii) Energy change
 Giving that the capacity of capacitor with air as a medium is C_0 .
15. Draw the equipotential surface for an electric dipole and for an isolated charge. Write its properties and prove that the electric field is always perpendicular to the equipotential surface.
16. Define electrostatic potential. Give the dependence of electrostatic potential due to a small electric dipole at a far off point lying on-
 - i) The axial line
 - ii) Equatorial line.

Magnetic effect of current

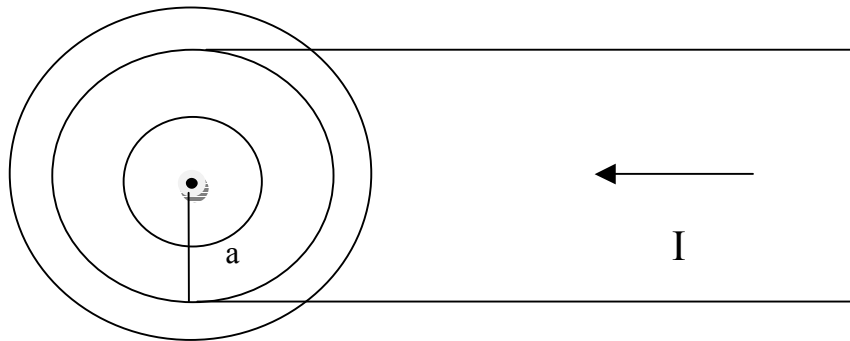
For low achiever

1. How will magnetic strength at the center of a circular coil carrying current change, if the current through the coil is doubled and the radius of the coil is halved?
2. Under what condition does an electron moving through a uniform magnetic field experience maximum force?
3. What is a cyclotron? Discuss its construction, work and theory. Explain why cyclotron frequency is independent of the speed of the particle.
4. Discuss the construction, principle and work of a moving coil galvanometer.
5. i. Write the two properties of a suspension fiber.

- ii. Why magnetic field is kept radial in the case of moving coil galvanometer?
 - iii. What is the function of soft iron core in such a device?
 - iv. Is voltage sensitivity depends upon current sensitivity?
6. Describe the path of a charge particle moving in-
 - a. Uniform electric field with initial velocity
 - i) Parallel to the field.
 - ii) Perpendicular to the field.
 - b. Uniform magnetic field with
 - i) Parallel to the field.
 - ii) Perpendicular to the field
 - iii) At the arbitrary angle with field direction.
 7. What is the role played by electric field and magnetic field in cyclotron?
 8. What are the S.I unit of –
 - i) Magnetic flux.
 - ii) Magnetic field strength

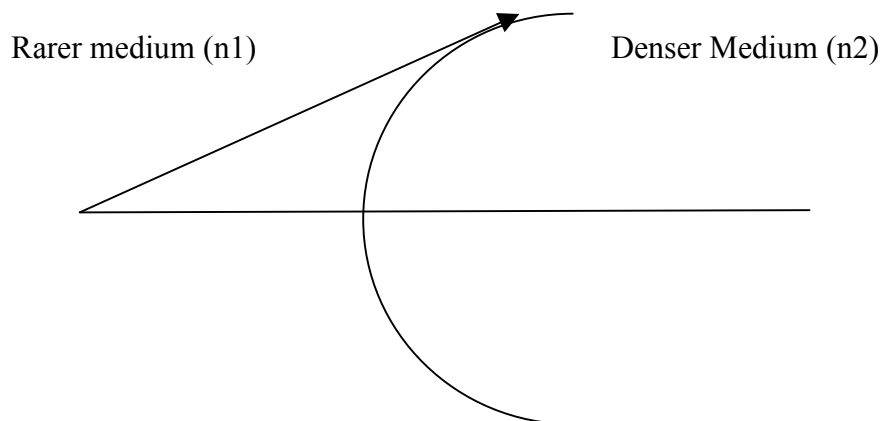
Define magnetic field in term of force experienced by moving charge and magnetic moment in term of torque.
 9. State Biot-savart law. Apply it to calculate the field at a point near a current carrying long straight wire.
 10. Using Amperci law, describe an expression for magnetic deu to i) Solenoid ii) toroid
 11. Find the force acting between two infinitely long current carrying straight conductor placed at a certain distance in vacuum. Also define amp.
 12. Find the expression for magnetic moment associated with revolving electron.
 13. Explain how will you convert galvanometer into voltmeter to read a maximum potential of V volts. Can one use a voltmeter to measure the e.m.f of a cell? Justify your answer.
 14. Electric force of line nor magnetic lines intersect. Then why can only magnetic lines forms loops?
 15. Derive an expression for torque acting on a loop of N turns, area A . Carrying current I . when held in uniform magnetic field B . with the help of circuit shows how a moving coil galvanometer can be converted into ammeter of a given range. Write the necessary mathematical formula.

16. Figure show a long straight wire of a circular cross-section (radius-‘a’) carrying steady current I the cross-section. Calculate the magnetic field in the region $r < a$ and $r > a$.



Ray Optics

1. A spherical surface of radius of curvature R, separates a rarer and denser medium complete the path of the incident ray of light showing the formation of real image. Hence derive the relation $n_2/v - n_1/u = (n_2 - n_1)/R$



2. Show by diagram the image formation of point by a thin double convex lens having radius of curvature R_1 and R_2 . Hence derive the formation

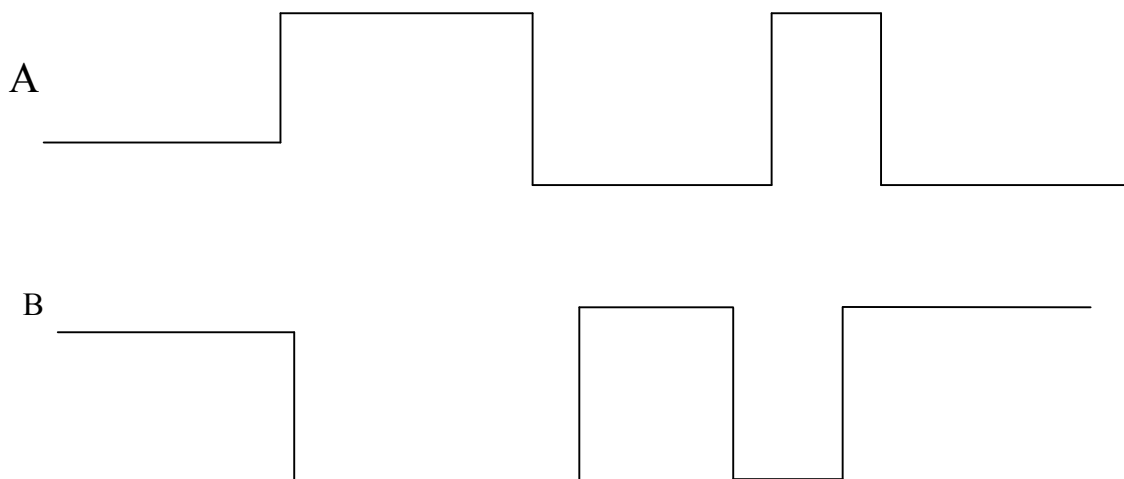
$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$
3. A ray of diagram to show the formation of image
 - i) At near point (Normal adjustment)
 - ii) At least distance of distinct vision.
4. Draw a ray diagram to show the formation of image-
 - i) Normal adjustment.
 - ii) At least distance of distinct vision.
5. Derive an expression for the refractive index of the material of prism in terms of its refracting angle and angle of minimum deviation. What is meant by dispersion of light?
6. Define resolving power of microscope and telescope. How resolving power if telescope changes when-
 - i) Size of the aperture of the objective lens change.
 - ii) Focal length of objective lens is increased
 - iii) Wavelength of light increase.
 How resolving power of microscope changes when-
 - i) When frequency of incident light on objective lens is increased?
 - ii) Focal length of the objective lens is increased.
 - iii) Aperture of objective lens is increased.
7. With the help of ray diagram, explain the phenomenon of total internal reflection obtain the relation between critical angle and refractive index of the medium. Draw ray diagram to show how a right angled isosceles prism can be used to deviate the ray through-
 - i) 108°
 - ii) 90°
 - iii) Invert the ray
8. You are given three lenses having power P and aperture A as follows:-

$P_1 = 6D$	$A_1 = 3cm$
$P_2 = 3D$	$A_2 = 15cm$
$P_3 = 12D$	$A_3 = 1.5cm$

 Which two of these will you select to construct a telescope and a microscope? State the basis for your answer in each case.

SOLID ANS SEMICONDUCTOR

1. Explain briefly with the help of circuit diagram, how V-I characteristics of p-n junction diode are obtained in
i) Forwarded bias ii) reverse bias.
Draw the shape of the curve obtain.
2. How p-n junction can be used a half wave and full wave rectifier.
3. Describe the principle working of transistor n-p-n and p-n-p.
4. Draw a labeled circuit diagram for common emitter amplifier using
i) n-p-n ii) p-n-p transistor and find its various types of gain.
5. Explain transistor acts as a switch.
6. Draw the energy band diagram of –
i) Intrinsic Semiconductor at a) OK and b) at room temperature.
ii) N-type and p-type semiconductor.
7. Explain the function of base region of transistor. Why is this region made thin and lightly doped? Draw a circuit diagram of study the input and output characteristics of n-p-n in a common emitter amplifier. Show these characteristics graphically. Explain hoe current amplification factor of the transistor is calculated using output characteristics.
8. Two signal A and B are shown in figure given below are used as two input of an AND gate obtained its output waveform. Draw the logic symbol of AND gate.



9. Give the construction principle and working of n-p-n transistor as an oscillator.
10. Problems of N.C.E.R.T: Q.no: 7, 9, 10, 11, 12, 15, 16, 17, 18. And solved examples.