DEHRADUN PUBLIC SCHOOL
ASSIGNMENT (2023-24)
SUBJECT - PHYSICS (042)
CLASS - XII

CHAPTER- 1 (ELECTRIC CHARGES AND FIELDS)

Multiple choice questions:

Q1. In the process of charging, the mass of the negatively charged body
a. increases b. decreases
c. remains constant d. become half

Q2. If the sizes of charged bodies are very small compared to the distances between them, we treat them as
a. Zero charges b. Point charges
c. Single charge d. No charges

Q3. The force per unit charge is known as
a. Electric current b. Electric potential
c. Electric field d. Electric space

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

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c. If **Assertion (A)** is true and **Reason (R)** is false.

d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: Electrostatic experiments do not work well on humid days.
Reason: Water is a good conductor of electricity.

Q5. Assertion: Excess charge on a conductor resides entirely on the outer surface.
Reason: Like charges repel each other.

Subjective type questions:

Q6. Derive an expression for the torque experienced by an electric dipole kept in a uniform electric field.

Q7. Derive the expression for electric field at a point on the equatorial line of an electric dipole. Depict the orientation of the dipole in
a. stable
b. unstable equilibrium in a uniform electric field.

Q8. Obtain the expression for the torque $\vec{\tau}$ experienced by an electric dipole of dipole moment $\vec{p}$ in a uniform electric **E** ? What will happen if the field were not uniform?

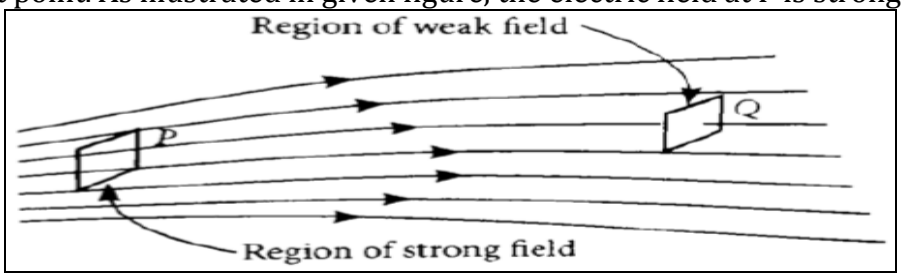
Q9. a. Using Gauss law, derive an expression for the electric field intensity at any point outside a uniformly charged thin spherical shell of radius R and charge density 'σ' C/m^2. Draw the field lines when the charge density of the sphere is
i. positive ii. negative

b. A uniformly charged conducting sphere of 2.5 m in diameter has a surface charge density of 100 μC/m^2. Calculate the
i. charge on the sphere
ii. total electric flux passing through the sphere

CASE STUDY

Read the following passage and answer the questions that follow:

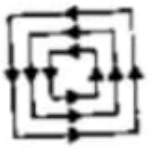
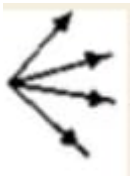
Q10. Electric field strength is proportional to the density of lines of force i.e., electric field strength at a point is proportional to the number of lines of force cutting a unit area element placed normal to the field at that point. As illustrated in given figure, the electric field at P is stronger than at Q.



i. Electric lines of force about a positive point charge are
   a. radially outwards
   b. circular clockwise
   c. radially inwards
   d. parallel straight lines

ii. Which of the following is false for electric lines of force?
   a. They always start from positive charge and terminate on negative charges.
   b. They are always perpendicular to the surface of a charged conductor.
   c. They always form closed loops.
   d. They are parallel and equally spaced in a region of uniform electric field.

iii. Which one of the following patterns of electric line of force is not possible in field due to stationary charges?

a.  b.  c.  d. 

iv. Electric field lines are curved
   a. in the field of a single positive or negative charge
   b. in the field of two equal and opposite charges.
   c. in the field of two like charges.
   d. both b. and c.

CHAPTER-2 (ELECTROSTATICS POTENTIAL AND CAPACITANCE)

Multiple choice questions:

Q1. Three capacitors of capacitances 1μf, 2μF & 3μF are connected in series and a potential difference of 11V is applied across the combination them the potential difference across the plates of 1μF capacitor is
   a. 2V b. 4V c. 1V d. 6V

Q2. Work done to bring a unit positive charge un-accelerated from infinity to a point inside electric field is called:
   a. Electric field
   b. Electric potential
   c. Capacitance
   d. Electric flux

Q3. Dielectrics are
   a. Conducting substances
   b. Non-conducting substances
   c. Semi-conducting substances
   d. None of the option

Assertion - Reason type questions:

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d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: A charged capacitor is disconnected from a battery. Now if its plates are separated further, the potential energy will fall.

Reason: Energy stored in a capacitor is equal to the work done in charging it.

Q5. Assertion: Any charge will move from electric potential V_1 to V_2 by its own; when $V_1 > V_2$.

Reason: Electron moves from $V_1 = 2V$ towards $V_2 = 4V$.

Subjective type questions:

Q6. i. Can two equipotential surfaces intersect each other? Give reasons.

ii. Two charges -q and + q are located at points A (0, 0, – a) and B (0, 0, +a) respectively. How much work is done in moving a test charge from point P(7, 0, 0) to Q (-3,0,0)?

Q7. Define an equipotential surface. Draw equipotential surfaces :

i. in the case of a single point charge and

ii. in a constant electric field in Z-direction. Why the equipotential surfaces about a single charge are not equidistant?

iii. Can electric field exist tangential to an equipotential surface? Give reason.

Q8. Derive an expression for the capacitance of a parallel plate capacitor.

On charging a parallel plate capacitor to a potential V, the spacing between the plates is halved, and a dieletric medium of $\varepsilon_r = 10$ is introduced between the plates, without disconnecting the d.c. source. Explain, using suitable expressions, how the

i. capacitance, ii. electric field and iii. energy density of the capacitor change.

Q9. If two similar large plates, each of area A having surface charge densities $+\sigma$ and $-\sigma$ are separated by a distance 'd' in air, find the expressions for

i. field at points between the two plates and on outer side of the plates. Specify the direction of the field in each case.

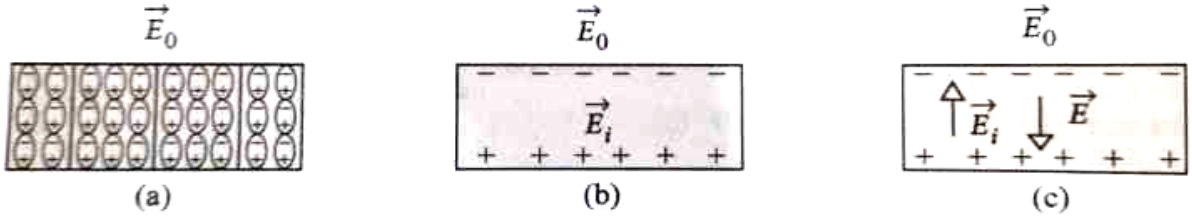
ii. the potential difference between the plates.

iii. the capacitance of the capacitor so formed.

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. When an insulator is placed in an external field, the dipoles become aligned. Induced surface charges on the insulator establish a polarization field $\bar{E}_i$ in its interior. The net field $\bar{E}$ in the insulator is the vector sum of $\bar{E}$, and $\bar{E}_i$ as shown in the figure.



On the application of external electric field, the effect of aligning the electric dipoles in the insulator is called polarisation and the field $\bar{E}$; is known as the polarisation field.

The dipole moment per unit volume of the dielectric is known as *polarisation P*..

For linear isotropic dielectrics, $P = \chi E$, where χ = electrical susceptibility of the dielectric medium.

i. Which among the following is an example of polar molecule?

a. O_2 b. H

c. N_2 d. HCI

ii. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance

a. increases K times
b. remains unchanged
c. decreases 1/K times
d. increases 2K times.

iii. Which of the following is a dielectric?

a. Copper
b. Glass
c. Antimony Sb.
d. None of these

iv. For a polar molecule, which of the following statements is true ?

a. The centre of gravity of electrons and protons coincide.
b. The centre of gravity of electrons and protons do not coincide.
c. The charge distribution is always symmetrical.
d. The dipole moment is always zero.

CHAPTER-3 (CURRENT ELECTRICITY)

Multiple choice questions:

Q1. Kirchhoff's II law for the electric network is based on:

a. Law of conservation of charge
b. Law of conservation of energy
c. Law of conservation of angular momentum
d. Law of conservation of mass

Q2. For a cell of e.m.f. 2 V, and internal resistance 0.1Ω, when connected to an external resistor of 10 Ω, the current flows. The value of current is

a. 20.2 A
b. 2.02 A
c. 0.198 A
d. 0 A

Q3. Current density is a

a. scalar
b. vector
c. dimensionless quantity
d. constant quantity

Assertion - Reason type questions:

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Q4. Assertion: A voltmeter is a high resistance instrument.
Reason: A voltmeter is always connected in parallel in a circuit.

Q5. Assertion: Internal resistance of battery is drawn parallel to battery in electrical circuit.
Reason: Heat generated in battery is due to internal resistance.

Subjective type questions:

Q6. Derive an expression for the resistivity of a good conductor, in terms of the relaxation time of electrons.

Q7. A wire of 20 Ω resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in parallel across a 4.0 volt battery. Find the current drawn from the battery.

Q8. A battery of emf 10 V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5 A, find a. the resistance of the resistor; b. the terminal voltage of the battery. Draw a graph showing variation of resistivity with temperature for nichrome. Which property of nichrome is used to make standard resistance coils?

Q9. Define the terms, drift velocity and relaxation time.

A conductor of length L is connected to a dc source of emf E. If this conductor is replaced by another conductor of same material and same area of cross-section but of length 3L, how will the drift velocity change?

i. Why do the 'free electrons', in a metal wire, 'flowing by themselves', not cause any current flow in the wire? Obtain an expression for the current flowing in a wire, in terms of the 'drift velocity' of the free electrons.

ii. Use the above expression to show that the 'resistivity', of the material of a wire, is' inversely proportional to the 'relaxation time' for the 'free electrons' in the metal.

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. Whenever an electric current is passed through a conductor, it becomes hot after some time. The phenomenon of the production of heat in a resistor by the flow of an electric current through it is called heating effect of current or Joule heating. Thus, the electrical energy supplied by the source of emf is converted into heat. In purely resistive circuit, the energy expended by the source entirely appears as heat. But if the circuit has an active element like a motor, then a part of energy supplied by the source goes to do useful work and the rest appears as heat. Joule's law of heating forms the basis of various electrical appliances such as electric bulb, electric furnace, electric press etc.

i. Which of the following is correct statement?

a. Heat produced in a conductor is independent of the current flowing.
b. Heat produced in a conductor varies inversely as the current flowing.
c. Heat produced in a conductor varies directly as the square of the current flowing.
d. Heat produced in a conductor varies inversely as the square of the current flowing.

ii. If the coil of a heater is cut to half, what would happen to heat produced?

a. Doubled
b. Halved
c. Remains same
d. Becomes four times.

iii. A 25 W and 100 W are joined in series and connected to the mains. Which bulb will glow brighter?

a. 100 W
b. 25 W
c. Both bulbs will glow brighter
d. None will glow brighter

iv. A rigid container with thermally insulated wall contains a coil of resistance 100 Ω, carrying 1 A. Change in its internal energy after 5 min will be

a. 0 kJ
b. 10 kJ
c. 20 kJ
d. 30 kJ

CHAPTER- 4 (MOVING CHARGES AND MAGNETISM)

Multiple choice questions:

Q1. To convert a galvanometer into on ammeter of given range, we must connect:

a. A suitable low resistance in series
b. A suitable low resistance in parallel
c. A suitable high resistance in parallel
d. A suitable high resistance in series

Q2. Current sensitivity of a galvanometer can be increased by decreasing:

a. Magnetic field B
b. number of turns N
c. torsional constant K
d. Area A

Q3. A current carrying loop is placed in a uniform magnetic field. The torqe acting on it does not depend upon

a. area of loop
b. value of current
c. magnetic field
d. None of these

Assertion - Reason type questions:

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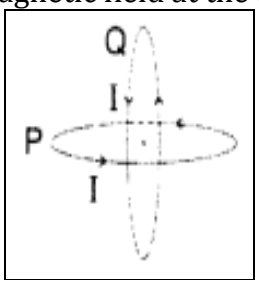
Q4. Assertion: Acceleration of a moving charged particle in a magnetic field is non-zero.
Reason: Inside magnetic field region, the particle may be moving on curved path.

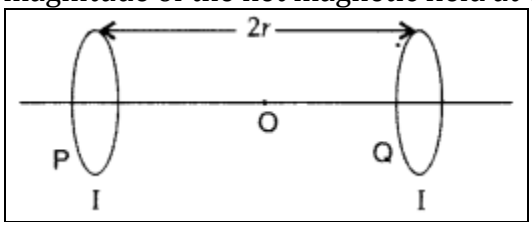
Q5. Assertion: The Lorentz force, is a non- conservative force.
Reason: The work done by the Lorentz force is always zero.

Subjective type questions:

Q6. Two identical circular wires P and Q each of radius R and carrying current 'I' are kept in perpendicular planes such that they have a common centre as shown in the figure. Find the magnitude and direction of the net magnetic field at the common centre of the two coils.



Q7. Two identical circular loops, P and Q, each of radius r and carrying equal currents are kept in the parallel planes having a common axis passing through O. The direction of current in P is clockwise and in Q is anti-clockwise as seen from O which is equidistant from the loops P and Q. Find the magnitude of the net magnetic field at O.



Q8. State Biot-Savart law, giving the mathematical expression for it. Use this law to derive the expression for the magnetic field due to a circular coil carrying current at its centre. How does a circular loop carrying current behave as a magnet?

Q9. i. Derive the expression for the torque on a rectangular current carrying loop suspended in a uniform magnetic field.

ii. A proton and a deutron having equal momenta enter in a region of uniform magnetic field at right angle to the direction of the field. Depict their trajectories in the field.

CASE STUDY

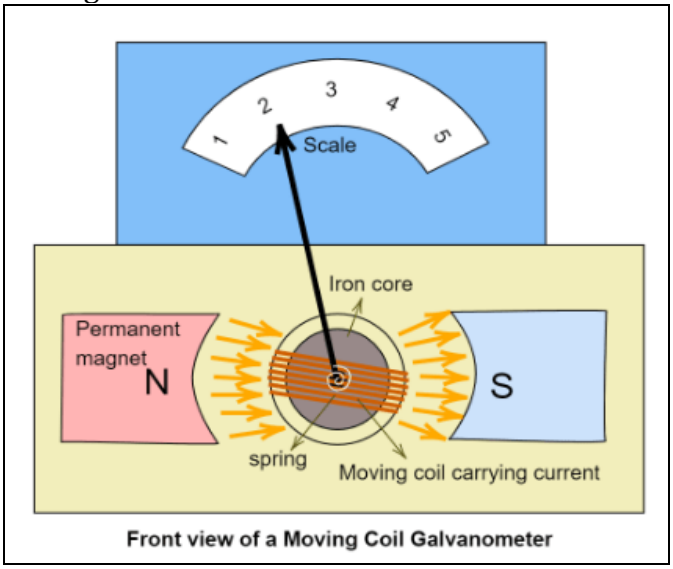
Read the following passage and answer the questions that follow:

Q10. Moving coil galvanometer operates on Permanent Magnet Moving Coil (PMMC) mechanism and was designed by the scientist D'Arsonval.

Moving coil galvanometers are of two types

i. Suspended coil ii. Pivoted coil type or tangent galvanometer, Its working is based on the fact that when a current carrying coil is placed in a magnetic field, it experiences a torque. This torque tends to rotate the coil about its axis of suspension in such a way that the

magnetic flux passing through the coil is maximum.



Front view of a Moving Coil Galvanometer

i. A moving coil galvanometer is an instrument which
   a. is used to measure emf
   b. is used to measure potential difference
   c. is used to measure resistance
   d. is a deflection instrument which gives a deflection when a current flows through its coil

ii. To make the field radial in a moving coil galvanometer.
   a. number of turns of coil is kept small
   b. magnet is taken in the form of horse-shoe
   c. poles are of very strong magnets
   d. poles are cylindrically cut

iii. The deflection in a moving coil galvanometer is
   a. directly proportional to torsional constant of spring
   b. directly proportional to the number of turns in the coil
   c. inversely proportional to the area of the coil
   d. inversely proportional to the current in the coil

iv. In a moving coil galvanometer, having a coil of N-turns of area A and carrying current I is placed in a radial field of strength B. The torque acting on the coil is
   a. NA^2B^2I b. $NABI^2$ c. N^2ABI d. NABI

CHAPTER-5 (MAGNETISM AND MATTER)

Multiple choice questions:

Q1. S.I. unit of magnetic pole strength is
   a. Ampere/meter b. Ampere-meter
   c. volt/meter d. $Ampere/meter^2$

Q2. Which of the following is an example for diamagnetic substances?
   a. copper b. nickel
   c. aluminum d. iron

Q3. Magnetic moment for current carrying solenoid and corresponding bar magnet is
   a. equal for both
   b. more for solenoid
   c. more for bar magnet
   d. none of these

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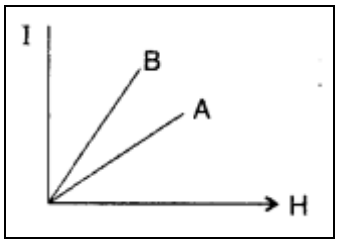
Q4. Assertion: The poles of magnet cannot be separated by breaking into two pieces.
Reason: The magnetic moment will be reduced to half when a magnet is broken into two equal pieces.

Q5. Assertion: Magnetic monopoles do not exist.
Reason: Magnetic field lines are continuous and closed.

Subjective type questions:

Q6. Define magnetic susceptibility of a material. Name two elements, one having positive susceptibility and the other having negative susceptibility. What does negative susceptibility signify?
The figure shows the variation of intensity of magnetisation versus the applied magnetic field intensity, H, for two magnetic materials A and B :
a. Identify the materials A and B.
b. Why does the material B, has a larger susceptibility than A, for a given field at constant temperature?



Q7. A bar magnet of magnetic moment **M** is aligned parallel to the direction of a uniform magnetic field B. What is the work done to turn the magnet, so as the align its magnetic moment? a. Opposite to the field direction b. Normal to the field direction?

Q8. Draw magnetic field lines when a a. diamagnetic, b. paramagnetic substance is placed in an external magnetic field. Which magnetic property distinguishes this behaviour of the field lines due to the two substances?

Q9. A short bar magnet has a magnetic moment of 0.48 J/T . Give the direction and magnitude of the magnetic field produced by the magnet at a distance of 10 cm from the centre of the magnet on a. the axis, b. the equatorial lines normal bisector. of the magnet.

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. In terms of the susceptibility χ , a material is diamagnetic if χ is negative, para- if χ is positive and small, and ferro- if χ is large and positive. Electrons in an atom orbiting around nucleus possess orbital angular momentum. These orbiting electrons are equivalent to current-carrying loop and thus possess orbital magnetic moment. Diamagnetic substances are the ones in which resultant magnetic moment in an atom is zero. Paramagnetic substances are those which get weakly magnetised when placed in an external magnetic field. The individual atoms (or ions or molecules) of a paramagnetic material possess a permanent magnetic dipole moment of their own. Ferromagnetic substances are those which gets strongly magnetised when placed in an external magnetic field. The individual atoms (or ions or molecules) in a ferromagnetic material possess a dipole moment as in a paramagnetic material. However, they interact with one another in such a way that they spontaneously align themselves in a common direction over a macroscopic volume called domain.
i. The universal property among all substances is

a. Diamagnetism
b. Paramagnetism
c. Ferromagnetism
d. Both a. & b.

ii. When a bar is placed near a strong magnetic field and it is repelled, then the material of bar is
a. Diamagnetic
b. Paramagnetic
c. Ferromagnetic
d. Anti-Ferromagnetic

iii. Magnetic susceptibility of a diamagnetic substance
a. Decrease with temperature
b. Is not affected by temperature
c. Increases with temperature
d. First increases then decreases with temperature

iv. The value of the magnetic susceptibility for a superconductors is
a. zero
b. infinity
c. +1
d. -1

CHAPTER-6 (ELECTROMAGNETIC INDUCTION)

Multiple choice questions:

Q1. What will be the self inductance of a coil, in which a magnetic flux of 40 Wb. is produced, when 2 A current flows through it?
a. 0.002 H
b. 0.001 H
c. 1 H
d. 20 H

Q2. The role of inductance is equivalent to
a. inertia
b. force
c. energy
d. momentum

Q3. Whenever the magnetic flux linked with an electric circuit changes, an emf is induced in the circuit. This is called
a. electromagnetic induction
b. lenz's law
c. hysteresis loss
d. kirchhoff's laws

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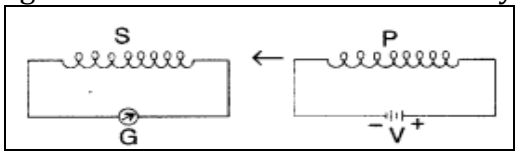
Q4. Assertion: Eddy currents are undesirable.
Reason: Eddy currents produces lot of heating effect.

Q5. Assertion: An emf is induced in the coil whenever flux linked with it changes.
Reason: Induced emf opposes flux change .

Subjective type questions:

Q6. Derive an expression for the self-inductance of a long air-cored solenoid of length l and number of turns N. When primary coil P is moved towards secondary coil S as shown in the figure. the galvanometer shows momentary deflection. What can be done to have larger deflection in the galvanometer with the same battery? State the related law.



Q7. State Lenz's Law. A metallic rod held horizontally along east-west direction, is allowed to

fall under gravity. Will there be an emf induced at its ends? Justify your answer.

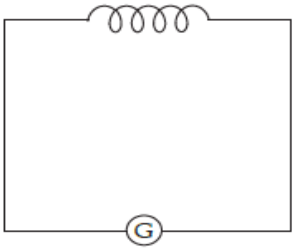
Q8. Define the term 'mutual inductance' between the two coils.
Obtain the expression for mutual inductance of a pair of long coaxial solenoids each of length l and radii r_1 and r_2 $r_2 >> r_1$.Total number of turns in the two solenoids are N_1 and N_2 respectively.

Q9. The current through two inductors of self-inductance 12 mH and 30 mH is increasing with time at the same rate. Draw graphs showing the variation of the
a. emf induced with the rate of change of current in each inductor
b. energy stored in each inductor with the current flowing through it.
Compare the energy stored in the coils, if the power dissipated in the coils is the same.

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. When a current I flows through a coil, flux linked with it is $\varphi = LI$, where L is a constant known as self inductance of the coil.



Any charge in current sets up an induced emf in the coil. Thus, self inductance of a coil is the induced emf set up in it when the current passing through it changes at the unit rate. It is a measure of the opposition to the growth or the decay of current flowing through the coil. Also, value of self inductance depends on the number of turns in the solenoid, its area of cross-section and the permeability of its core material.

i. The inductance in a coil plays the same role as
a. inertia in mechanics
b. energy in mechanics
c. momentum in mechanics
d. force in mechanics

ii. A current of 2.5 A flows through a coil of inductance 5 H. The magnetic flux linked with the coil is
a. 0.5 Wb
b. 12.5 Wb
c. zero
d. 2 Wb

iii. The inductance L of a solenoid depends upon its radius R as
a. $L \propto R$
b. $L \propto 1/R$
c. $L \propto R^2$
d. $L \propto R^3$

iv. The unit of self-inductance is
a. Weber ampere
b. Weber^{-1} ampere
c. Ohm second
d. Farad

CHAPTER-7 (ALTERNATING CURRENT)

Multiple choice questions:

Q1. An acceptor circuit is :
a. series resonant circuit
b. parallel resonant circuit
c. LCR circuit
d. None of these

Q2. The no. of turns in the primary coil of a transformer is 200 and the no. of turns in the

secondary is 10. If 240 V a.c. is applied to primary, the output from the secondary

a. 6 V
b. 12 V
c. 24 V
d. 48 V

Q3. In general in an alternating current circuit

a. the average value of current is zero
b. the average value of square of the current is zero
c. average power dissipation is zero
d. the phase difference between voltage and current is zero

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

a. If both **Assertion (A)** and **Reason (R)** are true **and Reason (R)** is the correct explanation of **Assertion (A).**
b. If both **Assertion (A)** and **Reason (R)** are true but **Reason (R)** is not the correct explanation of the **Assertion (A)**.
c. If **Assertion (A)** is true and **Reason (R)** is false.
d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: The alternating current cannot be used to conduct electrolysis.
Reason: AC is unidirectional.

Q5. Assertion: In series LCR circuit resonance can take place.
Reason: Resonance occurs if inductive and capacitive reactance are equal.

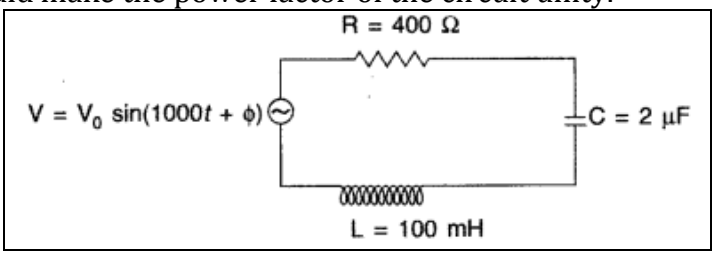
Subjective type questions:

Q6. A voltage $V = V_0 \sin\omega t$ is applied to a series LCR circuit. Under what condition is

i. no power dissipated even though the current flows through the circuit,
ii. maximum power dissipated in the circuit?

Q7. a. Determine the value of phase difference between the current and the voltage in the given series LCR circuit.

b. Calculate the value of the additional capacitor which may be joined suitably to the capacitor C that would make the power factor of the circuit unity.



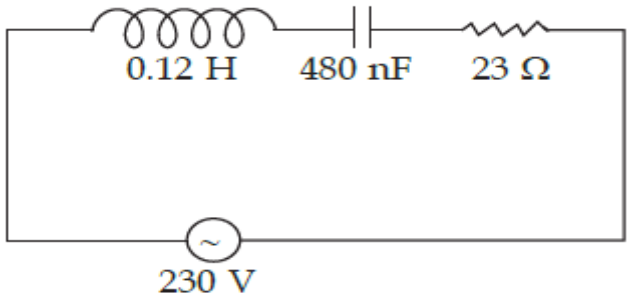
Q8. An a.c. source generating a voltage $v = v_m \sin \omega t$ is connected to a capacitor of capacitance C. Find the expression for the current, i, flowing through it. Plot a graph of v and i versus tat to show that the current is $\pi/2$ ahead of the voltage. A resistor of 200Ω and a capacitor of 15.0 μF are connected in series to a 220 V, 50 Hz a.c. source. Calculate the current in the circuit and the rms voltage across the resistor and the capacitor. Is the algebraic sum of these voltages more than the source voltage? If yes, resolve the paradox.

Q9. Explain briefly, with the help of a labelled diagram, the basic principle of the working of an a.c. generator. In an a.c. generator, coil of N turns and area A is rotated at v revolutions per second in a uniform magnetic field B. Write the expression for the emf produced.
A 100-turn coil of area 0.1 m^2 rotates at half a revolution per second. It is placed in a magnetic field 0.01 T perpendicular to the axis of rotation of the coil. Calculate the maximum voltage generated in the coil.

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. When the frequency of ac supply is such that the inductive reactance and capacitive reactance become equal, the impedance of the series LCR circuit is equal to the ohmic resistance in the circuit. Such a series LCR circuit is known as resonant series LCR circuit and the frequency of the ac supply is known as resonant frequency. Resonance phenomenon is exhibited by a circuit only if both L and C are present in the circuit. We cannot have resonance in a RL or RC circuit. A series LCR circuit with L = 0.12 H, C = 480 nF, R = 23 Ω is Connect to a 230 V variable frequency supply.



i. Find the value of source for which current amplitude is maximum.

a. 222.32 Hz b. 550.52 Hz

c. 663.48 Hz d. 770 Hz

ii. The value of maximum current is

a. 14.14 A b. 22.52 A

c. 50.25 A d. 47.41 A

iii. The value of maximum power is

a. 2200 W b. 2299.3 W

c. 5500 W d. 4700 W

iv. What is the impedance of the given circuit at resonance?

a. 23 Ω b. 20 Ω

c. 0 Ω d. 1 Ω

CHAPTER - 8 (ELECTROMAGNETIC WAVES)

Multiple choice questions:

Q1. Out of the following options which one can be used to produce a propagating electromagnetic wave?

a. A stationary charge

b. A charge less particle

c. An accelerating charge

d. A charge moving at constant velocity

Q2. In the following waves, which is not electromagnetic wave?

a. α –rays b. γ – rays

c. Infrared rays d. X – rays

Q3. The largest wavelength of electromagnetic wave is

a. X–rays b. radio waves

c. Ultraviolet rays d. infrared rays

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

a. If both **Assertion (A)** and **Reason (R)** are true **and Reason (R)** is the correct explanation of **Assertion (A).**

b. If both **Assertion (A)** and **Reason (R)** are true but **Reason (R)** is not the correct explanation of the **Assertion (A)**.

c. If **Assertion (A)** is true and **Reason (R)** is false.

d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: Electromagnetic waves travel with speed of light in vacuum.
Reason: Electromagnetic waves are transverse in nature.

Q5. Assertion: Infrared waves maintains earth's temperature by keeping it warm.
Reason: Infrared waves are called heat waves.

Subjective type questions:

Q6. Name the electromagnetic radiation to which waves of wavelength in the range of 10^{-2} m belong. Give one use of this part of electromagnetic spectrum.

Q7. Find the wavelength of electromagnetic wave of frequency 5 x 10^{10} Hz in free space. Give its two applications.

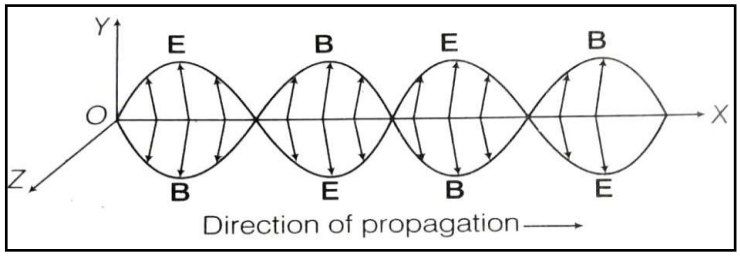
Q8. Name the constituent radiation of electromagnetic spectrum which
a. is used in satellite communication.
b. is used for studying crystal structure.
c. is emitted during decay of radioactive nuclei.
d. Write two more uses of each.

Q9. How will you show that EMW carry energy and momentum?

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. Electromagnetic waves are transverse in nature. i.e., electric and magnetic fields are perpendicular to each other and to the direction of wave propagation. Electromagnetic waves are not deflected by electric and magnetic fields.
The magnetic field in a plane electromagnetic wave is given by



$$B_y = 2\times10^{-7}\sin(0.5\times10^{3}x + 1.5\times10^{11}t)T$$

i. What is the angular frequency of wave?
a. 0.5 x 10^{3} rad s^{-1} b. 1.5 x 10^{11} rad s^{-1}
c. 3 x 10^{8} rad s^{-1} d. 2 x 10^{-7} rad s^{-1}

ii. What is the wavelength of the wave?
a.12.6 cm b. 1.26 cm c. 1.26 m d. 6.12 m

iii. What is the frequency of the wave?
a. 2.39 GHz b. 23.9 MHz c. 23.9 GHz d. 20.3 MHz

iv. The maximum value of electric field is
a. 6 x 10^{2} Vm^{-1} b. 6 x 10^{3} Vm^{-1}
c. 6 x 10^{1} Vm^{-1} d. 6 Vm^{-1}

CHAPTER - 9 (RAY OPTICS AND OPTICAL INSTRUMENTS)

Multiple choice questions:-

Q1. A ray passing through or directed towards centre of curvature of a spherical mirror is reflected such that it trace back of its path, because
a. It does not follow law of reflection
b. angle of incidence is 0^{0}
c. centre of curvature is midway between object and pole
d. distance of centre of curvature from focus is equal to its distance from pole

Q2. If lower half of a concave mirror is blackened, then

a. image distance increases
b. image distance decreases
c. image intensity increases
d. image intensity decreases

Q3. Two lenses of focal lengths 20 cm and – 40 cm are held in contact. The image of an object at infinity will be formed by the combination at

a. 10 cm
b. 20 cm
c. 40 cm
d. infinity

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

a. If both **Assertion (A)** and **Reason (R)** are true **and Reason (R)** is the correct explanation of **Assertion (A).**
b. If both **Assertion (A)** and **Reason (R)** are true but **Reason (R)** is not the correct explanation of the **Assertion (A)**.
c. If **Assertion (A)** is true and **Reason (R)** is false.
d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: In refraction of light, the frequency of light in both medium do not changes.
Reason: Frequency is the characteristic property of the source..

Q5. Assertion: Diamond glitters a lot.
Reason: Diamond is very expensive**.**

Subjective type questions:

Q6. Use the mirror equation to show that an object placed between f and $2f$ of a concave mirror produces a real image beyond $2f$.

Q7. State and derive mirror formula for a concave mirror. State the sign convention used.

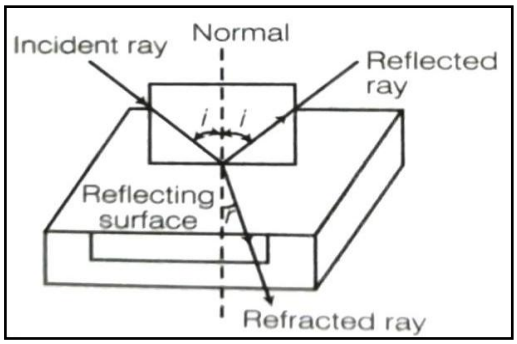
Q8. Derive lens maker formula for convex lens.

Q9. Draw a well labeled diagram of compound microsope when final image is formed at a distance of least distinct vision. Deduce the expression for its magnifying power.

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. Refraction involves change in the path of light due to change in the medium.



When a beam of light encounters another transparent medium, a part of light gets reflected back into the first medium while the rest enters the other. The direction of propagation of an obliquely incident ray of light, that enters the other medium, changes at the interface of two media. This phenomenon is called refraction of light.

i. Which of the following quantity remains unchanged after refraction?
a. Speed of light
b. Intensity of light
c. Wavelength of light
d. Frequency of light

ii. A ray of light strikes an air-glass interface at an angle of incidence $i = 60^0$. and gets refracted at an angle of refraction r. On increasing the angle of incidence $i > 60^0$., the angle of refraction r

a. Decreases b. remains same
c. is equal to 60^0 d. increases

iii. When an object lying in a denser medium is observed from rarer medium, then real depth of object is
a. More than that observed b. less than that observed
c. equals to observed depth d. depends on angle of vision

iv. For the same angle of incidence, the angles of refraction in media P, Q and R are 35^0, 25^0 and 15^0, respectively. Which of the following relation hold true for the velocity of light 'V' in the medium P, Q and R?
a. $V_\rho < V_Q < V_R$ b. $V_\rho < V_R < V_Q$
c. $V_\rho > V_Q > V_R$ d. $V_\rho > V_R > V_Q$

CHAPTER- 10 (WAVE OPTICS)

Multiple choice questions:

Q1. If a source is at infinity, then wavefronts reaching to observer are
a. cylindrical b. spherical c. plane d. conical

Q2. The shape of interference fringes is
a. parabolic b. hyperbolic
c. elliptical d. circular

Q3. For diffraction the wavelength of light should be comparable to
a. slit width b. frequency of light
c. distance between screen and slit d. none of the above

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

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c. If **Assertion (A)** is true and **Reason (R)** is false.
d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: There is no phase difference between two particles vibrating on a wavefront.
Reason: Wavefront is a surface of constant phase.

Q5. Assertion: Interference of light is based on energy conservation.
Reason: Interference of light is a surface phenomenon.

Subjective type questions:

Q6. In deriving the single slit diffraction pattern, it was stated that the intensity is zero at angles $\frac{n\lambda}{d}$. Justify this suitably dividing the slit to bring out the cancellation.

Q7. Define the following terms and give its source of origin.
a. Spherical wavefront
b. Plane wavefront
c. Cylindrical wavefront

Q8. Use Huygens' principle to verify the laws of refraction.

Q9. In Young's double slit experiment, derive the condition for
a. Constructive interference and
b. Destructive interference at a point on the screen.

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. In 1678, a Dutch scientist, Christian Huygens' propounded the wave theory of light. According to him, wave theory introduced the concepts of wvefront. Light travels in the form of waves. A wavefront is the locus of points (wavelets) having the same phase (a surface of constant phase) of oscillations. A wavelet is the point of disturbance due to propagation of light. Wavefront may also be defined as the hypothetical surface on which the light waves are in the same phase.

i. Huygens' original theory of light assumed that light propagates in the form of

a. Minute elastic particles b. transverse electromagnetic wave

c. transverse mechanical wave d. longitudinal mechanical wave

ii. A wave normal

a. Is parallel to a surface at the point of incidence of a wavefront

b. Is the line joining the source of light and an observer

c. Gives the direction of propagation of a wavefront at a given point

d. Is the envelope that is tangential to the secondary wavelets

iii. Ray diverging from a point source form a wavefront that is

a. Cylindrical b. Spherical

c. Plane d. Cubical

iv. According to Huygens' principle, a wavefront propagates through a medium by

a. Pushing medium particles

b. Propagating through medium with speed of light

c. Carrying particles of same phase along with it

d. Creating secondary wavelets which forms a new wavefront

CHAPTER- 11 (DUAL NATURE OF RADIATION AND MATTER)

Multiple choice questions:

Q1. The work function of platinum is 6.35 eV. The threshold frequency of platinum is

a.15.32×10^{14} Hz b. 15.32×10^{16} H

c. 15.32×10^{19} Hz d. 15.32×10^{18} Hz

Q2. With the increase in potential difference of emitter and collector, the photoelectric current

a. Increases b. Decreases

c. remains constant d. increase initially and then become constant

Q3. The waves associated with revolving electron around the nucleus are called

a. matter waves b. longitudinal waves

c. electromagnetic waves d. transverse waves

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

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c. If **Assertion (A)** is true and **Reason (R)** is false.

d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: The de Broglie waves are called matter waves.

Reason: Matter waves are associated with moving materialistic particles.

Q5. Assertion: Photoelectric effect is not an instantaneous process as given by wave theory.

Reason: In Photoelectric effect there is a time lag between striking of photons and ejection of electrons from a photosensitive surface as given by wave theory.

Subjective type questions:

Q6. The de-Broglie wavelength of a body moving with speed v is λ . On its way, it losses some of its mass and gains twice the speed. Kinetic energy also increases to twice of its initial value. What will be the new value of de-Broglie wavelength?

Q7. For what kinetic energy of a neutron, will the associated de-Broglie wavelength be 2.64 x 10^{-10} m?

Q8. Write Einstein's photoelectric equation relating the maximum kinetic energy of the emitted electron to the frequency of the radiation incident on a photosensitive surface. State clearly, the basic elementary process involved in photoelectric effect.

Q9. Define the terms threshold frequency and stopping potential in the study of photoelectric emission. Explain briefly the reasons, why wave theory of light is not able to explain the observed features in photoelectric effect?

CASE STUDY

Read the following passage and answer the questions that follow:

Q10. When a beam of 10.6 eV photons of intensity 2.0 Wm^{-2} falls on a surface of platinum of surface area 1.0 x 10^{-4} m^2 and the work-function of the material is 5.6 eV. Given that, 0.53% of the incident photons eject photoelectrons.

i. What is the energy of incident photon in joules?

a. 10.6 J
b. 16 x 10^{-19} J
c. 16.96 x 10^{-19} J
d. 2 x 10^{-21} J

ii. Find the number of photons incident on given area.

a. 1.18 x 10^{18}
b. 1.18 x 10^{14}
c. 2 x 10^{18}
d. 2.3 x 10^{18}

iii. Find number of photoelectrons emitted per second.

a. 7 x 10^{11}
b. 6.25 x 10^{11}
c. 9 x 10^{10}
d. 11 x 10^{11}

iv. Find maximum energy of photoelectrons emitted.

a. 5.0 eV
b. 6.0 eV
c. 2.5 eV
d. 0 eV

CHAPTER- 12 (ATOMS)

Multiple choice questions:

Q1. In hydrogen spectrum, longest wavelength lies in

a. Lyman series
b. Balmer series
c. Paschen series
d. Pfund series

Q2. The energy associated with first excited state of H atom is

a. -13.6Ev
b. -27.2eV
c. -8.5Ev
d. 0eV

Q3. The ratio of the shortest wavelength in Lyman and Balmer series of H atom is

a. 4:9
b. 9:4
c. 1:1
d. 3:2

Assertion - Reason type questions:

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c. If **Assertion (A)** is true and **Reason (R)** is false.

d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: Bohr's orbit are not equally spaced.

Reason: The radius of Bohr's orbit is given by r **α** n^2/Z, where n is the principal quantum number and Z is the atomic number**.**

Q5. Assertion: For a transition from high to low energy level by electrons in an atom, energy is liberated in form of electromagnetic radiations.

Reason: Electrons interact electromagnetically.

Subjective type questions:

Q6. Derive the Bohr's quantisation condition for angular momentum of the orbiting of electron in hydrogen atom, using de-Broglie's hypothesis.

Q7. Explain the significance of negative energy of an electron in an orbit. What is the energy possessed by an electron for n = ∞?

Q8. Draw energy levels for the hydrogen atom.

Q9. Derive the expression for the energy possessed by the electron in the nth level.

CASE STUDY

Read the following passage and answer the questions that follow:

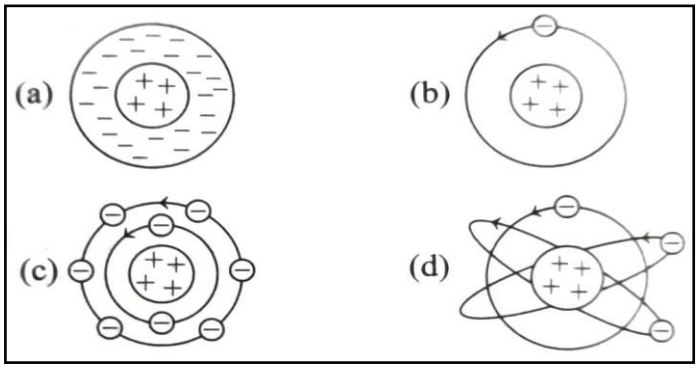
Q10. In this experiment, H. Geiger and E. Marsden took radioactive source ($^{214}_{83}Bi$) for α –particles. A collimated beam of α –particles of energy 5.5 MeV was allowed to fall on 2.1×10^{-7} m thick gold foil. The α –particles were observed through a rotatable detector consisting of a zinc sulphide screen & microscope and it was found that α –particles got scattered. These scattered α –particles produced scintillations on the zinc sulphide screen. Observation of this experiment are as follows

I. Many of the α –particles pass through the foil without deflection

II. Only about 0.14% of the incident α –particles scattered by more that 1^0.

III. Only about one α –particle in every 8000 α –particles deflected by more than 90^0.

i. Rutherford's atomic model can be visualised as



ii. Gold foil used in Geiger-Marsden experiment is about 10^{-8} m thick. This ensures
   a. Gold foil's gravitational pull is small or possible
   b. Gold foil is deflected when α –particle stream is not incident centrally over it
   c. Gold foil provides no resistance to passage of α –particles.
   d. Most α –particle will not suffer more than 10 scattering during passage through gold foil.

iii. In Geiger-Marsden experiment, detection of α –particles scattered at a particular angle is done by
   a. Counting flashes produces by α –particles on a ZnS coated screen
   b. Counting spots produced on a photographic film
   c. Using a galvanometer detector
   d. Using a Geiger-counter

iv. Atoms consist of a positively charged nucleus is obviously from the following observation of Geiger-Marsden experiment
   a. Most of α –particles pass straight through the gold foil
   b. Many of α –particles are scattered through the acute angles
   c. Very large number of α –particles are deflected by large angles
   d. None of the above

CHAPTER- 13 (NUCLEI)

Multiple choice questions:

Q1. The mass defect of helium nucleus is 0.0303 a.m.u. The binding energy per nucleon for

helium nucleus will be

a. 28 meV b. 7 MeV c. 14 MeV d. 1 MeV

Q2. Isotopes have

a. same atomic number but different mass number

b. same mass number but different atomic number

c. mass and atomic number are interconvertible

d. do not exist in nature

Q3. The ratio of nuclear densities of $Fe^{125}$and Al^{27} is

a. 1:1 b. 1:2 c. 125:27 d. 27:125

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

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c. If **Assertion (A)** is true and **Reason (R)** is false.

d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: Nuclear forces are short range order.

Reason: Nuclear forces are weak forces.

Q5. Assertion: In nuclear fusion reaction inside the sun hydrogen is constantly burning to give helium atom .

Reason: Nuclear fusion takes place at high pressure and temperature.

Subjective type questions:

Q6. i. Write two characteristic features of nuclear force.

ii. Draw a plot of potential energy of a pair of nucleons as a function of their separation.

Q7. Draw a plot of potential energy between a pair of nucleons as a function of their separation. Mark the regions, where potential energy is

i. Positive and ii. negative

Q8. Find the binding energy in MeV of a nitrogen nucleus (N^{14}) having atomic number 7.
Given m (N^{14})= 14.00307a.m.u.

Q9. Show that nuclear density in a given nucleus is independent of its mass number A.

CASE STIUDY

Read the following passage and answer the questions that follow:

Q10. The nucleus was first discovered in 1911 by Lord Rutherford and his associates by experiments on scattering of α –particles by atoms. He found that the scattering results could be explained, if atoms consist of a small, central, massive and positive core surrounded by orbiting electrons. The experimental results indicated that the size of the nucleus is of the order of 10^{-14} m and is thus 10000 times smaller than the size of atom.

i. Ratio of mass of nucleus with mass of atom is approximately

a. 1 b. 10 c. 10^3 d. 10^{10}

ii. Masses of nuclei of hydrogen, deuterium and tritium are in ratio

a. 1 : 2 : 3 b. 1 : 1 : 1 c. 1 : 1 : 2 d. 1 : 2 : 4

iii. Density of a nucleus is

a. More for lighter elements and less for heavier elements

b. More for heavier elements and less for lighter elements

c. Very less compared to ordinary matter

d. A constant

iv. If R is the radius and A is the mass number, then log R versus A graph will be

a. A straight line b. a parabola
c. an ellipse d. None of the above

CHAPTER- 14 (SEMICONDUCTOR ELECTRONICS: MATERIALS, DEVICES AND SIMPLE CIRCUITS)

Multiple choice questions:

Q1. In an unbiased *p*–*n* junction, holes diffuse from the *p*–region to *n*–region because
a. Free electrons in the *n*–region attract them
b. They moves across the junction by the potential difference
c. Hole concentration in *p*–region is more as compared to hole concentration in *n*–region
d. All of the above

Q2. The potential barrier of germanium diode is
a. 0.1 V b. 0.3 V c. 0.5 V d. 0.7 V

Q3. In n type semiconductors
a. $n_e >> n_h$ b. $n_h >> n_e$ c. $n_h = n_e$ d. none of the above

Assertion - Reason type questions:

Directions: In each of the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R).** While answering a question, choose the correct one and mark it as

a. If both **Assertion (A)** and **Reason (R)** are true **and Reason (R)** is the correct explanation of **Assertion (A).**
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c. If **Assertion (A)** is true and **Reason (R)** is false.
d. If both **Assertion (A)** and **Reason (R)** are false.

Q4. Assertion: N type semiconductors have electrons as majority charge carriers.
Reason: N type semiconductors are formed when a pure semiconductor is doped with pentavalent impurity.

Q5. Assertion: Rectifier converts ac into dc.
Reason: p-n junction diode can be used as full wave rectifier.

Subjective type questions:

Q6. Distinguish between an intrinsic semiconductor and *p*–type semiconductor. Give reason, why a *p*–type semiconductor crystal is electrically neutral, although $n_h >> n_e$?

Q7. Draw energy band diagram of *n*-type and *p*-type semiconductors at temperature T > 0K. Mark the donor and acceptor energy level with their energies.

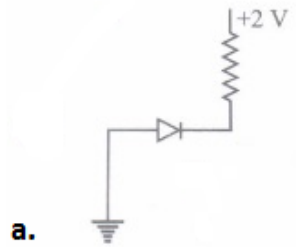
Q8. What is rectification? Explain half wave rectification of p-n junction diode.

Q9. What are the two main process in the formation of p-n junction diode. Explain

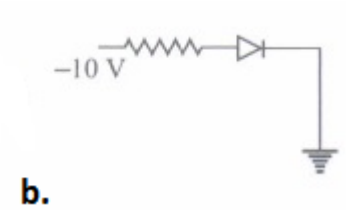
CASE STUDY

Read the following passage and answer the questions that follow:

Q10. When the diode is forward biased, it is found that beyond forward voltage V = V_k, called knee voltage, the conductivity is very high. At this value of battery biasing for p-n junction, the potential barrier is overcome and the current increases rapidly with increase in forward voltage. When the diode is reverse biased, the reverse bias voltage produces a very small current about a few microamperes which almost remains constant with bias. This small current is reverse saturation current.
i. In which of the following figures, the p-n diode is forward biased.



a.



b.

c.

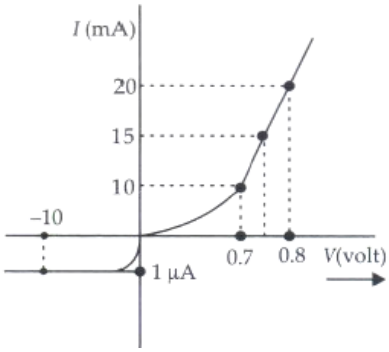
d.

ii. Based on the V-I characteristics of the diode, we can classify diode as

a. bi-directional device b. ohmic device

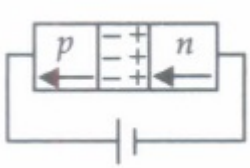
c. non-ohmic device d. passive element

iii. The V-I characteristic of a diode is shown in the figure. The ratio of forward to reverse bias resistance is

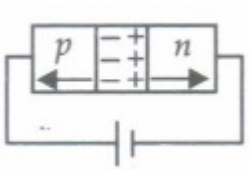


a. 100 b. 10^6 c. 10 d. 10^{-6}

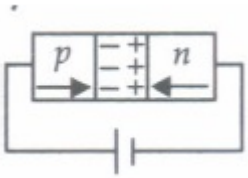
iv. In the case of forward biasing of a p-n junction diode, which one of the following figures correctly depicts the direction of conventional current indicated by an arrow mark.?



a.



b.



c.

d.