Indian School Al Wadi Al Kabir

Second Rehearsal Examination (2025-2026)

Class: XII **Subject: Physics (042)** **Max. Marks: 70**

Date: 01-02-2026 **Set-1** **Time : 3hours**

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

(3) All the sections are compulsory.

(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each, and Section E contains three long answer questions of five marks each.

(5) There is no overall choice. However, an internal choice has been provided in two questions in Section B, one question in Section C and all three questions in Section E. You have to attempt only one of the choices in such questions.

(6) Use of calculators is not allowed.

(7) You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^8$ m/s

$h = 6.63 \times 10^{-34}$ Js

$e = 1.6 \times 10^{-19}$ C

$\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ C^2 N^{-1} m^{-2}

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N m^2 C^{-2}

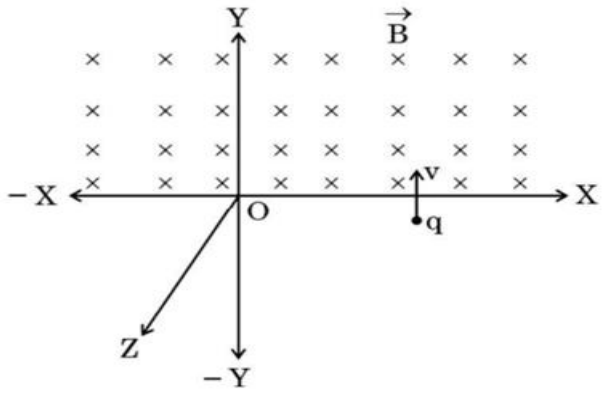
Mass of electron (m_e) = 9.1×10^{-31} kg.

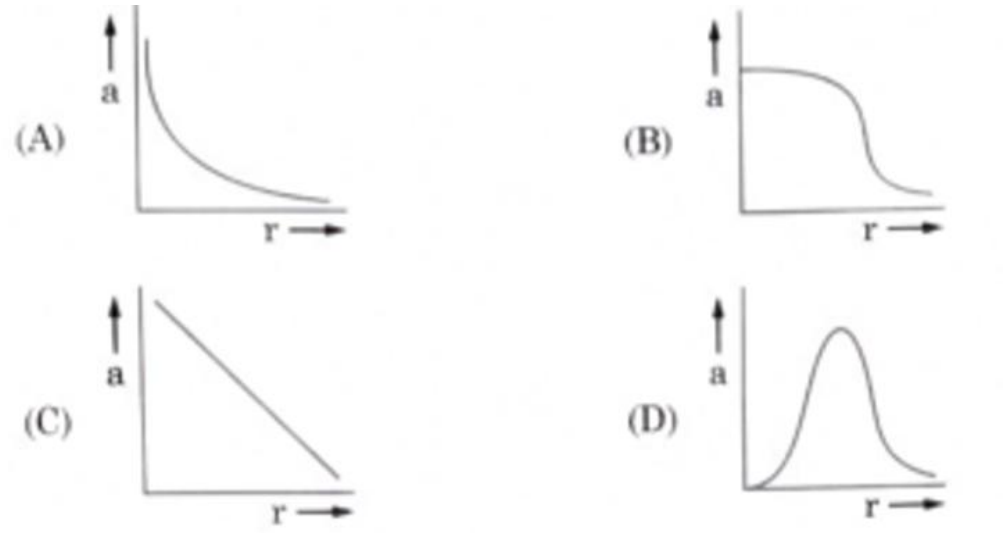
Mass of neutron = 1.675×10^{-27} kg.

Mass of proton = 1.673×10^{-27} kg.

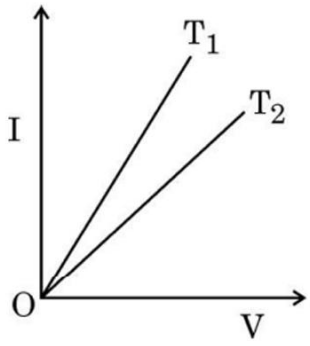
Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann's constant = 1.38×10^{-23} JK^{-1}

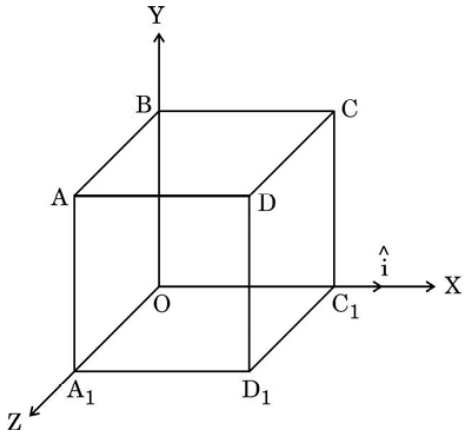
Q. No.	SECTION A	Marks
1.	An AC source is connected to a resistor and an inductor in series. The voltage across the resistor and inductor is 8 V and 6 V, respectively. The voltage of the source is: (A) 10 V (B) 12 V (C) 14 V (D) 16 V	1
2.	The radius $r_n of\ the\ n^{th}$ orbit in the Bohr model of the hydrogen atom varies with n as: (A) $r_n \propto$ n (B) $r_n \propto \frac{1}{n^2}$ (C) $r_n \propto n^2$ (D) $r_n \propto \frac{1}{n}$	1
3.	A proton and an α-particle enter with the same velocity $\vec{V}$ in a uniform magnetic Field $\vec{B}$ such that $\vec{V} \perp \vec{B}$. The ratio of the radii of their paths is (A) 1/2 (B) 1/ 4 (C) 1/ 3 (D) 1	1
4.	A particle having charge +q enters a uniform magnetic field $\vec{B}$ as shown in the figure. The particle will describe:  (A) a circular path in XZ plane (B) a semicircular path in XY plane	1

	(C) a helical path with its axis parallel to Y-axis (D) a semicircular path in YZ plane	
5.	The magnetic flux linked with a coil changes with time t as $\phi = (8t^2+5t+7)$, where t is in seconds and ϕ is in Wb. The value of emf induced in the coil at t = 4 s is (A) 32 V (B) 37 V (C) 64 V (D) 69 V	1
6.	A charge Q is fixed in position. Another charge q is brought near charge Q and released from rest. Which of the following graphs is the correct representation of the acceleration of the charge q as a function of its distance r from charge Q?  (A) Fig.A (B) Fig.B (C) Fig.C (D) Fig.D	1

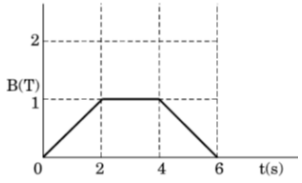
7.	A transformer is connected to a 200 V AC source. The transformer supplies 3000 V to a device. If the number of turns in the primary coil is 450, then the number of turns in its secondary coil is (A) 30 (B) 450 (C) 4500 (D) 6750	1
8.	X-rays are more harmful to human beings than ultraviolet radiations because X-rays (A) have frequency lower than that of ultraviolet radiations. (B) have wavelength smaller than that of ultraviolet radiations. (C) move faster than ultraviolet radiations in air. (D) are mechanical waves but ultraviolet radiations are electromagnetic waves	1
9.	The magnification produced by a spherical mirror is 2·0. The mirror used and the nature of the image formed will be (A) Convex and virtual (B) Concave and real (C) Concave and virtual (D) Convex and real	1
10.	What will be the effect on fringe width in Young's double slit experiment if the wavelength of light be increased (A) Band width increases (B) Band width decreases (C) Band width remains the same (D) Band width increases and then decreases	1
11.	The transition of an electron that gives rise to the formation of the second spectral line of the Balmer series in the spectrum of hydrogen atom corresponds to: (A) nf = 2 and ni = 3 (B) nf = 3 and ni = 4 (C) nf = 1 and ni = ∞ (D) nf = 2 and ni = ∞	1

12.	The figure shows the voltage (V) versus the current (I) graphs for a wire at two temperatures T1 and T2. One can conclude that  (A) T2 = 2T1 (B) T1 > T2 (C) T1 = T2 (D) T1 < T2	1

	For Questions 13 to 16, two statements are given one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. (A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. (B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (C) Assertion is true but Reason is false. (D) Both Assertion and Reason are false.	
13.	Assertion (A): When a conductor is placed in an external electrostatic field, the net electric field inside the conductor becomes zero after a small instant of time. Reason (R): It is not possible to set up an electric field inside a conductor.	1
14.	Assertion (A): In a reflecting telescope, the image does not have chromatic aberration. Reason (R): Chromatic aberration occurs only due to refraction of light through an optical medium.	1

15.	Assertion (A): In interference and diffraction of light, light energy reduces in one region producing a dark fringe. It increases in another region and produces a bright fringe. Reason (R): This happens because energy is not conserved in the phenomena of interference and diffraction.	1
16.	Assertion (A): The potential energy of an electron revolving in any stationary orbit in a hydrogen atom is positive. Reason (R): The total energy of a charged particle is always positive.	1
	SECTION B	
17	An electric field $\vec{E}$ = [10 x + 5] $\hat{\imath}$ N/C exists in a region in which a cube of side L is kept as shown in the figure. Here x and L are in metres. Calculate the net flux through the cube  	2
18.	A cell of emf E and internal resistance 'r' is connected with a variable external resistance R and a voltmeter showing potential drop V across R. Obtain the relationship between potential drop V ,E,R and r Draw the shape of the graph showing the variation of terminal voltage V of the cell as s function of current I drawn from it. How can one determine its internal resistance from this graph?	2
19[I]	State Ampere's circuital law Derive an expression to find the magnetic field produced by a straight current-carrying conductor of infinite length at a point outside the conductor **OR**	2
19.[II]	Derive an expression to find the force between two parallel infinite conductors carrying currents I1 and I2 when they are separated by a distance 'r'	2

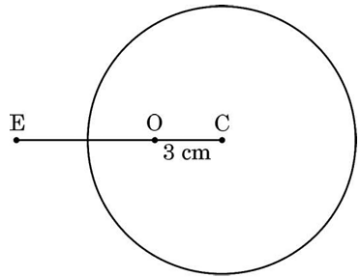
20	What is displacement current? What is the source of displacement current? Write the expression for displacement current	2
21[I]	Derive an expression for the total energy of an electron moving in an orbit of radius 'r' in hydrogen atom **OR**	2
21[II]	Using Bohr's theory of hydrogen atom, prove that ,for an electron revolving in the nth orbit, the radius of the orbit is proportional to n^2.	2

SECTION C		
22.	Define electron mobility. Derive the relation between electron mobility [μ]and drift velocity	3
23.[I]	With the help of a labelled diagram, explain the working of a moving coil galvanometer and hence derive the relationship between the current and the deflection produced **OR**	3
23[II]	[i] A rectangular loop of sides ℓ and b carries a current I clockwise. Write the magnetic moment $\overrightarrow{m}$ of the loop and show its direction in a diagram. [ii] The loop is placed in a uniform magnetic field $\overrightarrow{B}$ and is free to rotate about an axis which is perpendicular to $\overrightarrow{B}$. Prove that the loop experiences no net force, but a torque = $\vec{\tau} = \overrightarrow{m} \times \overrightarrow{B}$.	3
24.	The magnetic field through a circular loop of wire 12cm in radius and 8.5 ohm resistance changes with time as shown in the figure. The magnetic field is perpendicular to the plane of the loop. Calculate the induced current in the loop and plot it as a function of time 	3
25.	A ray of light is incident normally on one face of an equilateral glass prism of refractive index 'P'. When the prism is completely immersed in a transparent medium of refractive index 'μ', it is observed that the emergent	3

	ray just grazes the adjacent face. Find the refractive index of the medium in terms of 'P'.	
26.	State Huygen's principle and verify laws of reflection using Wave theory of light	3

27	Calculate the energy released during the reaction, $_3Li^6 + _0n^1 \rightarrow _2He^4 + _1H^3$ Given: mass of $_3Li^6$ = 6.015126amu, mass of $_1H^3$ = 3.01604amu, mass of $_2He^4$ = 4.002604amu, mass of neutron = 1.008655amu	3
28.	[a] What are majority and minority charge carriers of P type and N type semiconductors? [b] Explain briefly the formation of diffusion current and drift current in a PN junction diode	3
	SECTION - D Question numbers 29 and 30 are case study based questions. Read the following paragraphs and answer the questions that follow	
29	According to wave theory of light, the light of any frequency can emit electrons from metallic surface provided the intensity of light be sufficient to provide necessary energy for emission of electrons, but according to experimental observations, the light of frequency less than threshold frequency cannot emit electrons; whatever be the intensity of incident light. Einstein also proposed that electromagnetic radiation is quantized. [i] A photon has energy 3.3 $x10^{-19}$J.Its momentum is (A) 9.9 $x10^{-11}$ Kgm/s (B) 9.9 $x10^{-26}$ Kgm/s (C) 5.5 $x10^{-14}$ Kgm/s (D) 1.1 $x10^{-26}$ Kgm/s. [ii] Monochromatic light of frequency 5 $x10^{14}$Hz is produced by a source.The power emitted is 3.315mW.The number of photons emitted per sec,on an average ,by the source is (A) 1 $x10^{16}$ (B) 4 $x10^{11}$ (C) 8 $x10^{6}$	1 Mark each

	(D) 12 x10^{18} [iii] The work function of the metal is 2.14 eV. When light of frequency 6 x10^{14}Hz is incident on the metal surface, photo emission of electrons takes place.The maximum kinetic energy of the emitted electrons is [a] 0.25 x10^{-15}J [b] 0.75 x10^{-17}J [c] 0.15 x10^{-16}J [d] 0.55 x10^{-19}J [iv] The work function of a metal is 2.21 eV. The threshold frequency for the metal is [a] 4.1 x10^{11}Hz [b] 5.3 x10^{14}Hz [c] 3 x10^{17}Hz [d] 3.3 x10^{13}Hz **OR** Two monochromatic beams A and B of equal intensity I, hit a screen. The number of photons hitting the screen by beam A is twice that by beam B. Then what inference can you make about their frequencies? [a] $f_B = 2\ f_A$ [b] $f_B = 3\ f_A$ [c] $f_B = \frac{f_A}{3}$ [d] $f_B = \frac{f_A}{2}$	
30.	A pure semiconductor like Ge or Si, when doped with a small amount of suitable impurity, becomes an extrinsic semiconductor. In thermal equilibrium, the electron and hole concentration in it are related to the concentration of intrinsic charge carriers. A semiconductor diode is basically a p-n junction with metallic contacts provided at the ends for the application of an external voltage	

	[i] Explain the process of formation of depletion layer and potential barrier in a PN junction diode [ii] Which feature of junction diode makes it suitable for its use as rectifier [iii] Draw a circuit diagram that can be used to produce half wave rectification using a pn junction diode	2 1 1
	SECTION E	
31(I)	[i]A spherical surface of radius of curvature R separates two media of refractive indices n1 and n2 . A point object is placed in front of the surface at distance u in medium of refractive index n1 and its image is formed by the surface at distance v, in the medium of refractive index n2 . Derive a relation between u , v & R [ii]A solid glass sphere of radius 6cm has a small air bubble trapped at a distance 3 cm from its centre C as shown in the figure. The refractive index of the material of the sphere is 1.5. Find the apparent position of this bubble when seen through the surface of the sphere from an outside point E in air.  **OR**	5
31(II)	[i]Explain with the help of a labelled ray diagram the formation of final image by an astronomical telescope at infinity. Write the expression for its magnifying power. [ii]The total magnification produced by a compound microscope is 20. The magnification produced by the eyepiece is 5. When the microscope is focused on a certain object, the distance between the objective and eyepiece is observed to be 14 cm. Calculate the focal lengths of the objective and the eyepiece. (Given that the least distance of distinct vision = 25 cm)	5

32(I)	[i] With the help of phasor diagram, derive an expression for impedance in LCR circuit and hence derive the expression for resonant frequency. [ii] An alternating current from a source is represented by I = 10 sin3l4t .Write the corresponding values of (i) its 'effective value' of current and (ii) frequency of the source. **OR**	5
32(II)	With the help of a diagram, briefly explain the construction and working of ac generator. [ii]An electron is revolving around a proton in an orbit of radius r with a speed V. Obtain an expression for magnetic dipole moment associated with the electron	5
33(I)	(i) A parallel plate capacitor with plate area A and plate separation d has a capacitance C0 . A slab of dielectric constant K having area A and thickness $\frac{d}{4}$ is inserted in the capacitor, parallel to the plates. Find the new value of its capacitance. (ii) You are provided with a large number of 1μF identical capacitors and a power supply of 1200 V. The dielectric medium used in each capacitor can withstand up to 200 V only. Find the minimum number of capacitors and their arrangement, required to build a capacitor system of equivalent capacitance of $2\mu F$ for use with this supply. **OR**	5
33(II)	(i) An electric dipole of dipole moment p consists of point charges q and -q, separated by 2a. Derive an expression for electric potential in terms of its dipole moment at a point at a distance x (>> a) from its centre and lying (a) along its axis[axial line], and (b) along its bisector line[perpendicular to the axial line]. (ii) An electric dipole of dipole moment $\overrightarrow{p}$ = $(0.8\,\hat{\imath} + 0.6\,\hat{\jmath})10^{-29}$Cm is placed in an electric field $\overrightarrow{E}$ = 1 x $10^7\,\hat{k}\,\frac{V}{m}$ .Calculate the magnitude of the torque acting on it and the angle it makes with the x-axis, at this instant.	5