BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

PRE BOARD - 2 EXAMINATION 2024-25

Class : XII
Date : 09/12/2024
Admission No.:

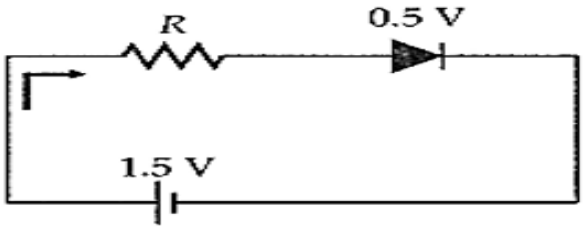
Duration: 3 Hrs
Max. Marks: 70
Roll No.:

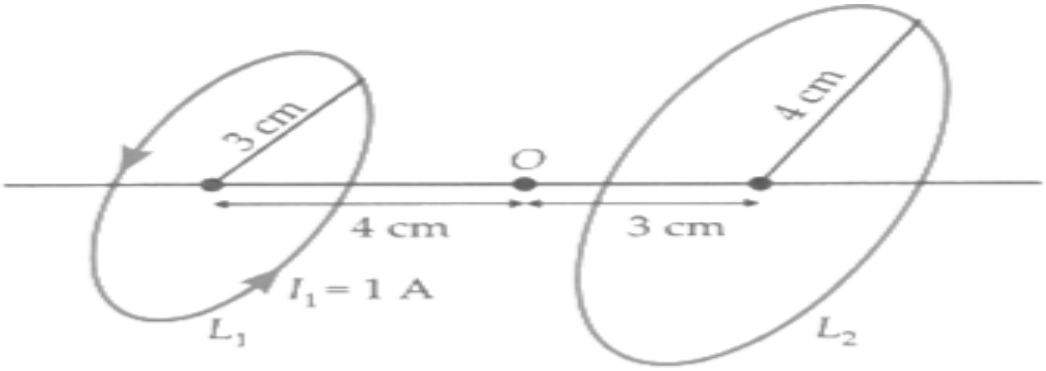
General Instructions:

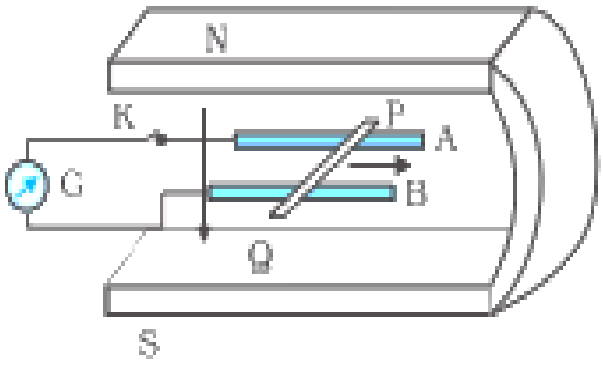
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of one mark each.
(5) Section B contains five questions of two marks each.
(6) Section C contains seven questions of three marks each.
(7) Section D contains two case study-based questions of four marks each.
(8) Section E contains three long answer questions of five marks each.
(9) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(10) Use of calculators is not allowed.
(11) You may use the following values of physical constants where ever necessary:
(i) $c = 3 \times 10^8$ m/s (ii) $m_e = 9.1 \times 10^{-31}$ kg (iii) $e = 1.6 \times 10^{-19}$ C (iv) $\mu_0 = 4\pi \times 10\text{-}7$ $Tm\boldsymbol{A}^{-1}$
(v) $m_p = 1.67 \times 10^{-27}$ kg (vi) $m_n = 1.675 \times 10^{-27}$ kg (vii) h = 6.63 x10-34 Js
(vii) $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$ (viii) Avogadro's number = 6.023×10^{23} per gram mole

	Section A	
1	Number of electrons to be transfer for 1μC. a) 6.25×10^{-6} b) 6.25×10^{6} c) 6.25×10^{12} d) 6.25×10^{18}	**[1]**
2	The potential difference across a cell in an open circuit is 8 V. It falls to 4 V when a current of 4 A is drawn from it. The internal resistance of the cell is: a) 4Ω b) 1Ω c) 2Ω d) 3Ω	**[1]**
3	How will the image formed by a convex lens be affected if the central portion of the lens is wrapped in a black paper? a) No image is formed by the remaining portion of the lens	**[1]**

	b) Full image will be formed but will be less bright c) Two images will be formed d) Central portion of the image will be absent	
4	Magnetic field at any point inside the straight solenoid is given as————- a) AB = μ_0+nI b) B = μ_0+nI^2 c) B = μ_0/nI d) B = μ_0nI	**[1]**
5	A thin plastic rod is bent into a circular ring of radius R. It is uniformly charged with charge density λ . The magnitude of the electric field at its centre is: a) $\frac{\lambda}{4\varepsilon_0 R}$ b) Zero c) $\frac{\lambda}{2\varepsilon_0 R}$ d) $\frac{\lambda}{4\pi\varepsilon_0 R}$	**[1]**
6	The sensitivity of a moving coil galvanometer increases with the decrease in: a) magnetic field b) torsional rigidity c) area of coil d) number of turns	**[1]**
7	A magnet is dropped with its north pole towards a closed circular coil placed on a table then a) no current will be induced in the coil. b) looking from above, the induced current in the coil will be anti - clockwise. c) the magnet will fall with uniform acceleration. d) as the magnet falls, its acceleration will be reduced.	**[1]**
8	A bar magnet of pole strength (m) and magnetic moment (M) is cut perpendicular to its axis in two equal halves. The new pole strength (m') and magnetic moment (M') of each part are respectively: a) 2m and $\frac{M}{2}$ b) m and $\frac{M}{2}$ c) $\frac{m}{2}$ and 2M d) m and M	**[1]**
9	Two sources of light are said to be coherent when they give light waves of the same: a) phase and speed b) wavelength and constant phase difference c) intensity and wavelength d) amplitude and phase	**[1]**
10	A body can be negatively charged by a) Giving some protons to it b) Giving excess of electrons to it c) removing some electrons from it d) Removing some neutrons from it	**[1]**
11	The diode used in the circuit shown in the figure has a constant voltage drop at 0.5 V at all currents and a maximum power rating of 100 milliwatts. What should be the value of the resistor R, connected in series with diode for obtaining maximum current?	**[1]**

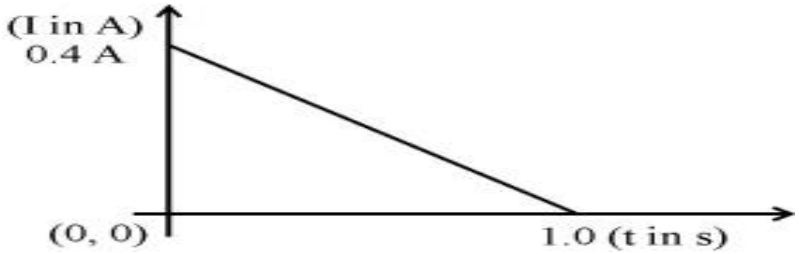
	 a) 20Ω b) 6.76Ω c) 5Ω d) 5.6Ω	
12	If the focal length of objective lens is increased then magnifying power of a) Microscope will decrease but that of telescope will increase. b) Microscope and telescope both will decrease. c) Microscope and telescope both will increase. d) Microscope will increase but that of telescope decrease.	**[1]**
13	**Assertion (A):** The de Broglie wavelength of a molecule varies inversely as the square root of temperature. **Reason (R):** The root mean square velocity of the molecule depends on the temperature. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
14	**Assertion (A):** If the distance between parallel plates of a capacitor is halved and dielectric constant is three times, then the capacitor becomes 6 times. **Reason (R):** Capacity of a capacitor does not depend upon the nature of the material. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
15	**Assertion (A):** The images formed by total internal reflections are much brighter than those formed by mirrors or lenses. **Reason (R):** There is no loss of intensity in total internal reflection. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**

16	**Assertion (A):** Transformers are used only in alternating current sources, not in direct current. **Reasons (R):** Only a.c. can be stepped up or down by means of transformers. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
	Section B	
17	Considering the case of a parallel plate capacitor being charged, show how one is required to generalize Ampere's circuital law to includethe term due to displacement current.	**[2]**
18	A long straight wire carries a current of 35 A. What is the magnitude of the field B at a point 20 cm from the wire?	**[2]**
19	Explain the variation of resistivity with temperature in pure - semiconductors.	**[2]**
20	1. The radius of the innermost electron orbit of a hydrogen atom is 5.3×10^{-11} m. Calculate its radius in n = 3 orbit. 2. The total energy of an electron in the first excited state of the hydrogen atom is - 3.4 e V. Find out its (a) kinetic energy and (b) potential energy in this state.	**[2]**
21	Two coaxial circular loops L_1 and L_2 of radii 3 cm and 4 cm are placed as shown. What should be the magnitude and direction of the current in the loop L_2 so that the net magnetic field at the point O be zero?  **OR** An electron entering a magnetic field of 10^{-2} T with a velocity of 10^{7} ms $^{-1}$ describes a circle of radius 6×10^{-3} m. Calculate $\frac{e}{m}$ of the electron.	**[2]**
	Section C	
22	Two wires X, Y have the same resistivity, but their cross - sectional areas are in the ratio 2 : 3 and lengths in the ratio 1 : 2. They are first connected in series and then in parallel to a d.c. source. Find out theratio of the drift speeds of the electrons in the two wires for the two cases.	**[3]**
23	What is biasing in semiconductor diodes. Write its types and briefly explain all the types.	**[3]**

24	If the frequency of the incident radiation on the cathode of a photo - cell is doubled, how will the following change: 1. The kinetic energy of the electrons? 2. Photoelectric current? 3. Stopping potential? Justify your answer.	**[3]**
25	A 1000 MW fission reactor consumes half of its fuel in 5.00 y. How much $^{235}_{92}U$ did it contain initially? Assume that the reactor operates 80% of the time, that all the energy generated arises from the fission of $^{235}_{92}U$ and that this nuclide is consumed only by the fission process.	**[3]**
26	Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.	**[3]**
27	A slit of width 0.6 mmis illuminated by a beam of light consisting of two wavelengths 600 nmand 480 nm. The diffraction pattern is observed on a screen 1.0 mfrom the slit. Find: 1. The distance of the second bright fringe from the central maximum pertaining to light of 600 nm. 2. The least distance from the central maximum at which bright fringes due to both the wavelengths coincide.	**[3]**
28	Figure shows a metallic rod PQ of length l, resting on the smooth horizontal rails AB positioned between the poles of a permanent magnet. The rails, the rod, and the magnetic field are in three mutually perpendicular directions. A galvanometer G connects the rails through a switch K. Assume the magnetic field to be uniform. Given the resistance of the closed - loop containing the rod is R.  1. Suppose K is open and the rod is moved with a speed v in the direction shown. Find the polarity and magnitude of induced emf. 2. With K open and the rod moving uniformly, there is no net force on the electrons in the rod PQ even though they do experience a magnetic force due to the motion of the rod. Explain. 3. What is the induced emf in the moving rod if the magnetic field is parallel to the rails instead of being perpendicular?	**[3]**

OR

When a conducting loop of resistance 10Ω and area 10 cm ^{2} is removed from an external magnetic field acting normally, the variation of induced current in the loop with time is shown in the figure.



Find the

1. total charge passed through the loop.
2. change in magnetic flux through the loop.
3. magnitude of the magnetic field applied.

Section D

29 **Read the text carefully and answer the questions:** An electromagnetic wave transports linear momentum as it travels through space. If an electromagnetic wave transfers a total energy Uto a surface in time t, then total linear momentum delivered to the surface is p =$\frac{U}{c}$. When an electromagnetic wave falls on a surface, it exerts pressure on the surface. In 1903, the American scientists Nichols and Hull succeeded in measuring radiation pressures of visible light where other had failed, by making a detailed empirical analysis of the ubiquitous gas heating and ballistic effects. **[4]**

1. The pressure exerted by an electromagnetic wave of intensity I(W m^{-2}) on a non - reflecting surface is (c is the velocity of light)

   a) $\frac{I}{c}$ b) $\frac{I}{c^2}$ c) Ic^2 d) Ic

2. Light with an energy flux of 18 W/cm^2 falls on a non - reflecting surface at normal incidence. The pressure exerted on the surface is:

   a) 2 N/m^2 b) 6× 10^{-4} N/m^2 c) 2× 10^{-4} N/m^2 d) 6 N/m^2

3. Radiation of intensity 0.5 W m^{-2} are striking a metal plate. The pressure on the plate is

   a) 0.212× 10^{-8} N m^{-2} b) 0.132× 10^{-8} N m^{-2}

   c) 0.166× 10^{-8} N m^{-2} d) 0.083× 10^{-8} N m^{-2}

   OR

4. The radiation pressure of the visible light is of the order of

   a) 10^{-4} N/m b) 10^{-6} N/m^2 c) 10^{-8} N d) 10^{-2} N m^2

	5. A point source of electromagnetic radiation has an average power output of 1500 W. The maximum value of electric field at a distance of 3 m from this source (in V m^{-1}) is a) 500 b) $\frac{500}{3}$ c) $\frac{250}{3}$ d) 100	
30	**Read the text carefully and answer the questions:** The triboelectric series is a list that ranks materials according to their tendency to gain or lose electrons. The process of electron transfer as a result of two objects coming into contact with one another and then separating is called triboelectric charging. During such an interaction, one of the two objects will always gain electrons (becoming negatively charged) and the other object will lose electrons (becoming positively charged). The relative position of the two objects on the triboelectric series will define which object gains electrons and which object loses electrons. In triboelectric series, materials are ranked from high to low in terms of the tendency for the material to lose electron. If an object high up on this list (Glass, for example) is rubbed with an object low down on the list (Teflon, for example), the glass will lose electrons to the teflon. The glass will, in this case, become positively charged and the teflon will become negatively charged. Materials in the middle of the list (steel and wood, for example) are items those do not have a strong tendency to give up or accept electrons.  1. Materials in the upper position have _____tendency to become positively charged. a) no b) medium c) high d) low 2. Name two materials which do not have a strong tendency to give up or accept electrons. a) Steel, wood b) Plastic wrap, Teflon c) Ebonite, Nylon d) Nylon, cat fur 3. If human hair is rubbed with amber, how those will be charged? a) Hair will be negatively charged, Amber will be positively charged.	**[4]**

	b) Both positive c) Hair will be positively charged, Amber will be negatively charged. d) Both negative 4. Triboelectric charging is the process of electron transfer between two objects a) By contact b) Without contact c) By anyone of these d) By none of these **OR** 5. The object which loses electron becomes _____charged and the object gains electron becomes _____charged. a) positively, positively b) negatively, positively c) negatively, negatively d) positively, negatively	
	Section E	
31	1. State two main considerations taken into account while choosing the objective of astronomical telescope. 2. Draw a ray diagram of reflecting type telescope. State its magnifying power. 3. State the advantages of reflecting type telescope over the refracting type? **OR** 1. Derive an expression for path difference in Young's double - slit experiment and obtain the condition for constructive and destructive interference at a point on the screen. 2. The intensity at the central maxima in Young's double - slit experiment is IQ. Find out the intensity at a point where the path difference is $\frac{\lambda}{6}$, $\frac{\lambda}{4}$ and $\frac{\lambda}{3}$.	**[5]**
32	1. In a quark model of elementary particles, a neutron is made of one up quarks [charge ($\frac{2}{3}$) e] and two down quarks [charges –($\frac{1}{3}$) e] . Assume that they have a triangle configuration with side length of the order of 10^{-15} m. Calculate the electrostatic potential energy of neutron and compare it with its mass 939 MeV. 2. Repeat above exercise for a proton which is made of two up and one down quark. **OR** Two tiny spheres carrying charges $1.5\mu C$ and $2.5\mu C$ are located 30 cm apart. Find the potential and electric field: 1. at the mid point of the line joining the two charges, and 2. at a point 10 cm from this mid point in a plane normal to the line and passing through the mid point.	**[5]**

33	1. Derive an expression for the impedance of a series L - C - R circuit connected to an AC supply of variable frequency. 2. Explain briefly how the phenomenon of resonance in the circuit can be used in the tuning mechanism of a radio or a TV set? **OR** 1. When an AC source is connected to an ideal capacitor, then show that the average power supplied by the source over a complete cycle is zero. 2. A lamp is connected in series with a capacitor. Predict your observations when the system is connected first across a DC and then an AC source. What happens in each case if the capacitance of the capacitor is reduced?	**[5]**

----------ALL THE BEST----------