

KENDRIYA VIDYALAYA SANGATHAN, CHENNAI REGION

SECOND PRE – BOARD EXAMINATION 2025 – 2026

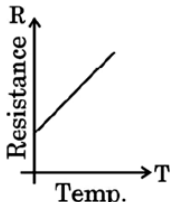
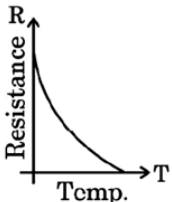
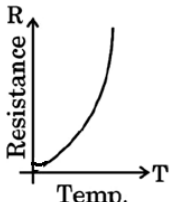
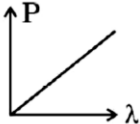
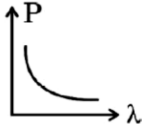
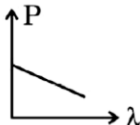
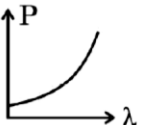
CLASS : XII SUBJECT : PHYSICS (042)

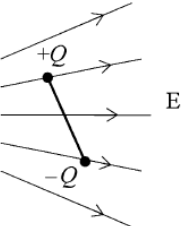
Time Allowed : 3 hours

Maximum Marks : 70

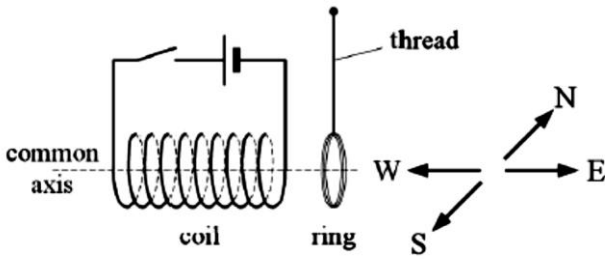
General Instructions

- (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 where ever necessary
 - (i) $c = 3 \times 10^8 \text{ m/s}$
 - (ii) $m_e = 9.1 \times 10^{-31} \text{ kg}$
 - (iii) $m_p = 1.7 \times 10^{-27} \text{ kg}$
 - (iv) $e = 1.6 \times 10^{-19} \text{ C}$
 - (v) $\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$
 - (vi) $h = 6.63 \times 10^{-34} \text{ J s}$
 - (vii) $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
 - (viii) Avogadro's number = 6.023×10^{23} per gram mole

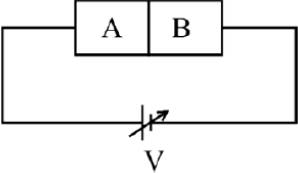
	SECTION – A	
1	In the process of charging of a capacitor, the current produced between the plates of the capacitor is : (a) $\mu_0 \frac{d\phi_E}{dt}$ (b) $\frac{1}{\mu_0} \frac{d\phi_E}{dt}$ (c) $\epsilon_0 \frac{d\phi_E}{dt}$ (d) $\frac{1}{\epsilon_0} \frac{d\phi_E}{dt}$	1
2	A point charge situated at a distance ‘ r ‘ from a short dipole on its axis, experiences a force $\vec{F}$. If the distance of the charge is ‘ 2r ‘, the force on the charge will be : (a) $\frac{\vec{F}}{16}$ (b) $\frac{\vec{F}}{8}$ (c) $\frac{\vec{F}}{4}$ (d) $\frac{\vec{F}}{2}$	1
3	For a metallic conductor, the correct representation of variation of resistance R with temperature T is :  (a)  (b)  (c)  (d)	1
4	Which of the following represents variation of particle's momentum with the de Broglie wavelength associated with it ?  (a)  (b)  (c)  (d)	1

5	Two equal and opposite charges are situated a fixed distance apart in a non – uniform electric field as shown. The pair of charges experience:  (a) A resultant force in the plane of the paper and a couple. (b) A resultant force in the plane of the paper, but no couple (c) A resultant force normal to the plane of the paper, but no couple (d) A resultant force normal to the plane of the paper and a couple	1
6	A point object is placed in air at a distance of $4R$ on the principal axis of a convex spherical surface of radius of curvature R separating two mediums, air and glass. As the object is moved towards the surface, the image formed is : (a) always real (b) always virtual (c) first virtual and then real (d) first real and then virtual	1
7	In a series LC circuit connected to an ac source, with the increase in the frequency of the source, the net reactance: (a) increases linearly (b) decreases linearly (c) first increases to become maximum and then decreases to zero (d) first decreases to become zero and then increases	1
8	For a glass prism, the angle of minimum deviation will be smallest for the light of (a) red colour. (b) blue colour. (c) yellow colour. (d) green colour.	1

9	The given diagram shows a long straight wire P situated along the axis of a flat circular coil Q. Both the wire and the coil carry a current. Which of the following correctly describes the force acting on each part of Q due to the current in P? (a) There is no force in any direction (b) The force is away from P (c) The force is towards P (d) The force is perpendicular to the plane of the diagram	1
10	The given diagram illustrates the upper energy bands of a typical semiconductor. Which of the following is a typical value for E_g ? (a) 0.1 eV (b) 1 eV (c) 10 eV (d) 1 MeV	1
11	The diagram shows a coil fixed coaxially with and near to an aluminium ring which hangs vertically from a fine string with its axis pointing east – west. Which of the following correctly describes the initial motion of the aluminium ring when the current in the coil is switched on?	1

	 (a) Moves towards S (b) Moves towards W (c) Moves towards N (d) Moves towards E	
12	Two coherent light waves, each having amplitude 'A', superpose to produce an interference pattern on a screen. The intensity of light as seen on the screen varies between : (a) 0 and $2A^2$ (b) 0 and $4A^2$ (c) A^2 and $2A^2$ (d) $2A^2$ and $4A^2$	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) : The phase difference between any two points on a wavefront is zero. Reason (R) : All points on a wavefront are at the same optical path length from the source and thus oscillate in the same phase.	1
14	Assertion (A) : During formation of a nucleus, the mass defect produced is the source of the binding energy of the nucleus.	1

	Reason (R) : For all nuclei, the value of binding energy per nucleon increases with mass number	
15	Assertion(A) : The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies. Reason(R) : The energy of electrons emitted from inside the metal surface, is lost in collision with the other atoms in the metal.	1
16	Assertion (A) : In Bohr model of hydrogen atom the angular momentum of electron in the n^{th} orbit is proportional to the square root of its orbit radius r_n . Reason (R) : According to Bohr atom model, electron can jump to its nearest orbit only.	1
	SECTION – B	
17	Two point charges $+q$ and $-q$ are located at points $(3a, 0)$ and $(0, 4a)$ respectively in x-y plane. A third charge 'Q' is kept at the origin. Find the value of 'Q', in terms of 'q' and 'a', so that the electrostatic potential energy of the system is zero. OR The electric potential (in volt) in a region varies with x according to the relation: $V(x) = 5 + 4x^2$, where x is in m. (a) Is the electric field in the given region uniform? (b) Find the magnitude of the force experienced by a charge of $1C$ placed at $x = -1 m$.	2
18	A solenoid has a core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry a current of $2A$. If the number of turns is 1000 per metre, calculate the magnetisation and magnetic intensity.	2
19	Explain how one 'observes an inconsistency' when Ampere's circuital law is applied to the process of charging a capacitor. How this 'contradiction' gets removed by introducing the concept of an 'additional current', known as the 'displacement current'?	2
20	A proton and an α-particle are accelerated, using the same potential difference. How are the de Broglie wavelengths λ_p and λ_α related to each other? OR	2

	Consider a metal exposed to light of wavelength 600 nm. The maximum energy of the electron doubles when light of wavelength 400 nm is used. Find the work function of the metal.	
21	Draw a diagram to show the variation of binding energy per nucleon with mass number for different nuclei. Mention its two features.	2
	SECTION – C	
22	An electric dipole is held in uniform electric field ' E ' such that the dipole moment makes an angle ' θ ' with the electric field. Using suitable diagram, show that it does not undergo any translatory motion and hence derive an expression for the torque acting on this dipole.	3
23	Two halves of a silicon crystal (A and B) are doped with arsenic and boron respectively, forming a p-n junction in it. A battery is connected across it as shown in the figure.  (a) Will the junction be forward biased or reverse biased? Give reason. (b) Draw V-I graph for this arrangement. (c) Explain how the applied voltage affects the width of depletion region at the p – n junction	3
24	A parallel-plate capacitor has plates of area 500 cm^2 and is connected across the terminals of a battery. After some time has passed, the capacitor is disconnected from the battery. When the plates are then moved 0.4 cm farther apart, the charge on each plate remains constant but the potential difference between the plates increases by 100 V. (a) What is the magnitude of the charge on each plate? (b) What happens to the energy stored in the capacitor? Justify your answer.	3
25	A square shaped current carrying loop MNOP is placed near a straight long current carrying wire AB as shown in the figure. The wire and the loop lie in the same plane. Find the magnitude and direction of the force acting on the loop.	3

26	What is the effect on the interference fringes in a Young's double-slit experiment due to each of the following operations: (a) the screen is moved away from the plane of the slits; (b) the (monochromatic) source is replaced by another (monochromatic) source of shorter wavelength; (c) the separation between the two slits is increased; In each operation, take all parameters, other than the one specified, to remain unchanged.	3
27	What do you mean by potential barrier? Explain the formation of p-n junction mentioning the two important processes involved.	3
28	A person with a normal near point (25cm) using a compound microscope with objective of focal length 8.0 mm and an eyepiece of focal length 2.5cm can bring an object placed at 9.0 mm from the objective in sharp focus. What is the separation between the two lenses? Calculate the magnifying power of the microscope. OR (a) State the conditions for total internal reflection to occur. (b) A small bulb is placed at the bottom of a tank containing water to a depth of 80 cm. What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 1.33.	3
	SECTION -D	
29	The Aurora Borealis (Northern Lights) and Aurora Australis (Southern Lights) are brilliant light displays near the polar regions, created when charged (mainly protons and electrons) particles from the Sun interact with Earth's magnetic field and atmosphere. During Coronal Mass Ejections (CMEs), the Sun releases billions of tons of charged particles that travel as solar wind. When these particles encounter Earth's magnetic field, they become trapped	

	and move in a spiral path along the magnetic field lines toward the poles. In the upper atmosphere (100–400 km), they collide with oxygen and nitrogen atoms, exciting them. As the atoms return to their ground state, they emit light: oxygen produces green and red, while nitrogen produces blue and purple.	
I	Why do charged particles from the Sun follow a spiral (helical) path when they enter Earth's magnetic field instead of moving in a straight line?	1
II	Calculate the radius of the helical path followed by an electron from solar wind if it enters the Earth's Magnetic field with velocity 5×10^5 m/s at an angle of 30° to the field lines. Earth's magnetic field near the polar region = 5×10^{-5} T	2
III	What happens to the speed of the electron as it spirals along the magnetic field lines? Explain.	1
30	A research team is investigating the hydrogen atom emission spectrum to verify Bohr's atomic model. When they excite hydrogen gas in a discharge tube, they observe several distinct spectral lines in the visible region. The most prominent line appears at 656 nm (red), which corresponds to an electron transition from $n=3$ to $n=2$ energy level. The team calculates that the energy of the electron in the ground state is -13.6 eV. They also observe that as electrons transition from higher energy levels ($n=5, 6, 7\dots$) to $n=2$, the spectral lines get closer together and converge toward a series limit at 364.6 nm.	
I	An electron in the ground state of a Hydrogen atom absorbs energy and jumps to the third orbit. The ratio of kinetic energies of electron in third orbit to ground state is : (a) 9 : 1 (b) 1 : 3 (c) 3 : 1 (d) 1 : 9	1
II	Which one of the following phenomena did the Bohr model successfully explain, thereby becoming a significant step towards modern quantum theory? (a) The continuous spectrum of white light. (b) The line emission spectra of the hydrogen atom. (c) The chemical bonding and molecular structure of H_2O (d) The splitting of spectral lines in the presence of an electric field	1

III	The radius of the ground state of a hydrogen atom is r_0. What is the radius of the fourth orbit in terms of r_0 (a) $16 r_0$ (b) $4 r_0$ (c) $64 r_0$ (d) $8 r_0$	1
IV	When an electron in the hydrogen atom jumps from second excited state ($n = 3$) to first excited state ($n = 2$), the emitted radiation belongs to which spectral series? (a) Lyman series (b) Balmer series (c) Paschen series (d) Brackett series	1
SECTION – E		
31 (I)	(i) Two cells of emf E_1 and E_2 have their internal resistances r_1 and r_2, respectively. Deduce an expression for the equivalent emf and internal resistance of their parallel combination when connected across an external resistance R. Assume that the two cells are supporting each other. (ii) In case the two cells are identical, each of emf $E = 5 \text{ V}$ and internal resistance $r = 2 \Omega$, calculate the voltage across the external resistance $R = 10 \Omega$ OR	3 + 2
(II)	(i) Explain how free electrons in a metal at constant temperature attain an average velocity under the action of electric field. Hence obtain the expression for it. (ii) Consider two conducting wires A and B of the same diameter but made of different materials joined in series across a battery. The number density of electrons in A is 1.5 times that in B. Find the ratio of drift velocity of electrons in wire A to that in wire B.	3 + 2
32 (I)	(i) Draw a ray diagram for the formation of image of a point object by a thin double convex lens having radii of curvature R_1 and R_2. Hence derive lens maker's formula.	3 + 2

	(ii) A converging lens has a focal length of 10 cm in air. It is made of a material of refractive index 1.6. If it is immersed in a liquid of refractive index 1.3, find its new focal length. OR	
(II)	(i) What do you mean by diffraction of light and state the condition for the diffraction? Obtain the conditions for secondary maxima using Huygens's construction of secondary wavelets (ii) Two wavelengths of sodium light 590 nm and 596 nm are used in turn to study the diffraction at a single slit of size 4 mm. The distance between the slit and screen is 2 m. Calculate the separation between the positions of the first secondary maximum of the diffraction pattern obtained in the two cases.	3 + 2
33 (I)	(i) Describe the construction and working of a transformer and hence obtain the relation for V_P / V_S in terms of number of turns of primary and secondary. Write any two main causes of energy loss in a real transformer. (ii) A transformer on a utility pole operates at 8.5 kV on the primary side and supplies electrical energy to a number of nearby houses at 120 V, both quantities being rms values. Assume the transformer to be ideal and the load purely resistive. (a) What is the turns ratio N_P/N_S of the transformer? (b) The average rate of energy consumption (or dissipation) in the houses served by the transformer is 78 kW. What are the rms currents in the primary and secondary of the transformer? OR	3+2
(II)	(i) A voltage $v = V_0 \sin \omega t$ applied to a series LCR circuit drives a current $i = I_0 \sin (\omega t + \phi)$ in the circuit. Deduce the expression for the average power dissipated in the circuit. (ii) For circuits used for transporting electric power, a low power factor implies large power loss in transmission. Explain. (iii) In a series LR circuit, $X_L = R$ and the power factor of the circuit is P_1. When a capacitor of capacitance C such that $X_L = X_C$ is put in series, the power factor becomes P_2. Find P_1/P_2.	3 + 2
