KENDRIYA VIDYALAYA SANGATHAN, JABALPUR REGION
SECOND PRE-BOARD EXAMINATION - 2025- 2026
PHYSICS (THEORY) - 042
CLASS – XII

Time : 3.00 Hrs **M.M. : 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 question 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.

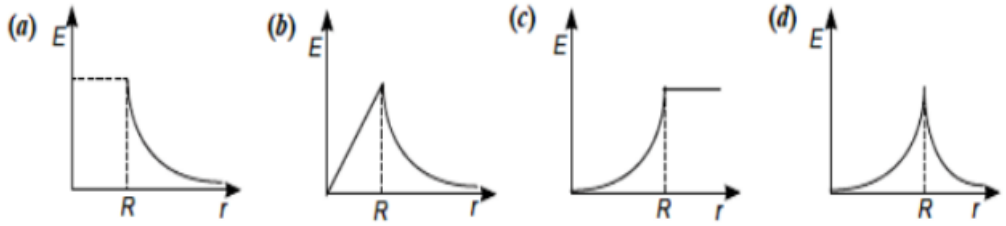
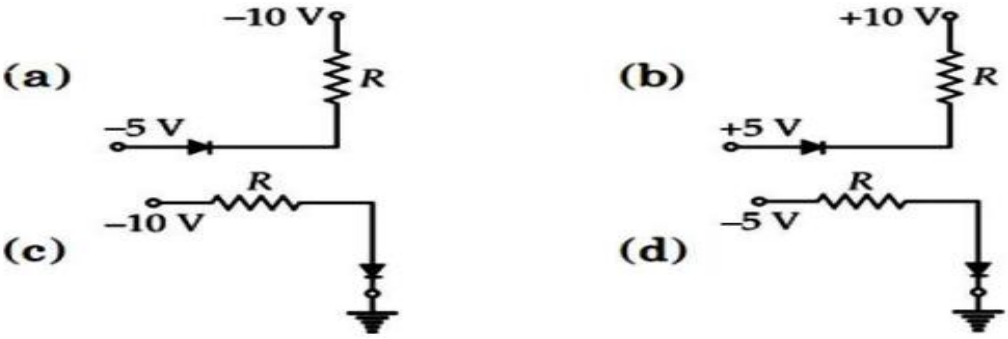
(6) Use of calculators is not allowed.

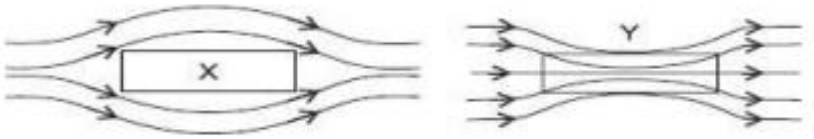
(7) You may use the following values of physical constants where ever necessary

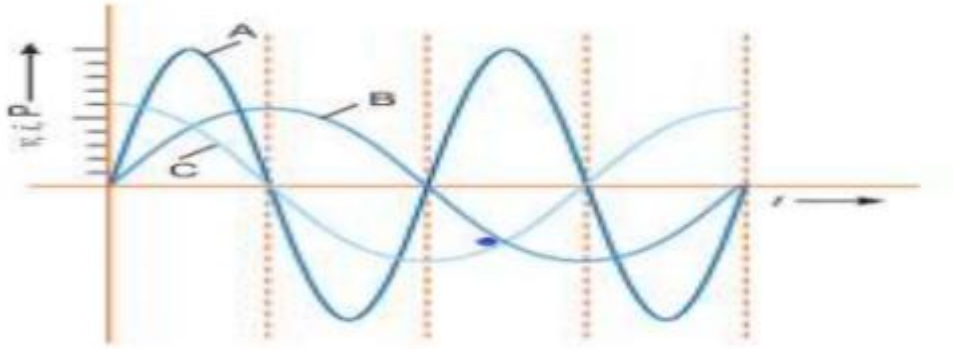
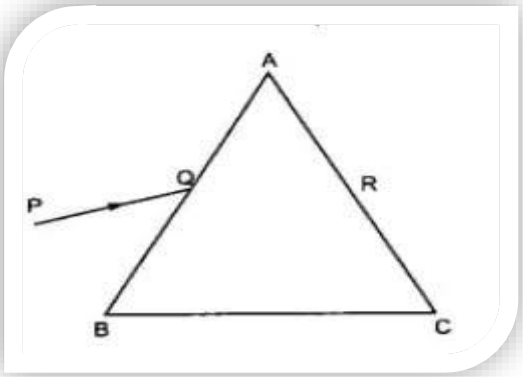
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$ C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m $\boldsymbol{A^{-1}}$
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
viii. Avogadro's number = 6.023 X $\boldsymbol{10^{23}}$ per gram mole

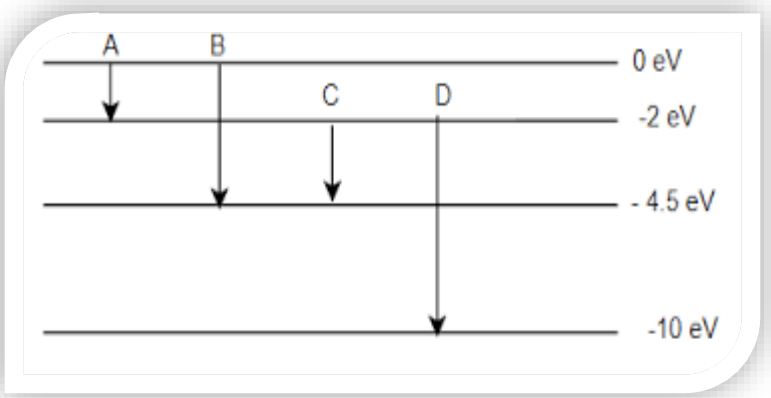
SECTION A

Q.N.	Questions	Mark
1.	A point charge is kept at a distance r from an infinitely long straight wire with charge density λ. The magnitude of the electrostatic force experience by charge q is (a) Zero (b) $q\lambda/2\pi\varepsilon_0 r$ (c) $q\lambda/4\pi\varepsilon_0 r$ (d) $q\lambda/\varepsilon_0 r$	**1**
2.	A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of the combination is (a)-1.5 D (b) -6.5 D (c) 6.5 D (d) -6.67 D	1
3.	The ratio of the intensities of two light waves from two coherent sources is 9 : 1. The ratio of interference maxima and minima when above two waves interference (a) 3 : 1 (b) 81 : 1 (c) 4 : 1 (d) 1 : 4	1
4.	A beam of electrons particles projected along +X-axis, experiences a force due to magnetic field along the +Y-axis. What is the direction of the magnetic field? (a) + X-axis (b) +y-axis (c) +z-axis (d) –z-axis	1

5.	A welder wears special glasses to protect his eyes mostly from the harmful effect of (a) very intense visible light (b) infrared radiation (c) Ultraviolet rays (d) microwaves	1
6.	Which of the following is not true for EM waves (a) They transport energy (b) They travel at same speed in air (c) They have momentum (d) They travel at different speed in a medium	1
7.	The mass density of nuclei varies with mass number as (a) A^o (b) A^1 (c) A^3 (d) $A^{1/3}$	1
8.	For ionising an excited hydrogen atom, the minimum energy required (in eV) will be (a) 13.6 eV (b) -13.6 eV (c) -3.4 eV (d) 3.4 eV or less	1
9.	In an AC circuit V and I are given by V = 50 sin 50t Volts and I = 100 sin (50t + π/3) A.The power dissipated in the circuit is (a) 2.5 kW (b) 1.25 kW (c) 5.0 kW (d) 500 W	1
10	Which of the following graph shows the variation of electric field E due to a hollow spherical conductor of radius R as a function of distance from the centre of the sphere 	1
11	Which of the junction diode shown below is forward biased? 	1
12	An electron is projected with uniform velocity along the axis of a current carrying long solenoid.which of the following is true (a) The electron will accelerated along the axis. (b) The electron path will be circular about the axis. (c) The electron will experience a force 45° to the axis and hence execute a helical path (d) The electron will continue to move with uniform velocity along the axis of the solenoid	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)** Air bubble inside the water behave like a diverging lens. **Reason(R)** Refractive index of water is more than air.	1
14	**Assertion(A) I**n series LCR resonance circuit, impedance is equal to the resistance. **Reason(R)** In resonance condition capacitive reactance is equal to inductive reactance.	1
15	**Assertion(A)** According to Bohr's atomic model the ratio of angular momenta of an electron in second excited state to that in ground state is 2 : 1. **Reason(R)** According to Bohr's theory the angular momentum of electron is directly proportional to the square of principal quantum number.	1
16	**Assertion(A)** The depletion layer in p-n junction under forward bias decreases **Reason(R)** The electric field due to external voltage support the electric field due to potential barrier.	1
	SECTION B	
17	(i) what is the mean by equipotential surface? (ii) What is the work done in moving a charge of +1 nC in between two points located on equipotential surface and are separated by a distance of 4 cm. (iii) Draw the equipotential surface for an electric dipole.	2
18	Calculate the binding energy per nucleon of an alpha particle in MeV given Mass of proton = 1.007825 u, mass of neutron = 1.008665 Mass of $_2He^4$ nucleus = 4.002800 u	2
19	(a) A uniform magnetic field get modified as shown below when two specimens X and Y are placed in it. Identify whether the specimens X and Y are diamagnetic, paramagnetic or ferromagnetic.  (b) How is the magnetic permeability of specimen X different from that of specimen Y.	2
20	Arrange the following E.M. waves, in increasing order of frequency and among these waves, which have greatest penetration and ionization power? (a) X-ray (b) Gamma ray (c) Radio wave (d) visible light OR The oscillating magnetic field in a plane electromagnetic wave is given by $B_y = (8 \times 10^{-6}) \sin[2 \times 10^{11} t + 300 \pi x]$ T i. Calculate the wavelength of the electromagnetic wave. Ii Write down the expression for the oscillating electric field.	2
21	Draw the energy band diagram when intrinsic semiconductor (Ge) is doped with impurity of Antimony (Sb). Name extrinsic semiconductor so obtain and majority charge carriers in it.	2
	SECTION C	
22.	A parallel plate capacitor is charged by a battery. After some time the battery is disconnected and a dielectric slab of dielectric constant K with its thickness equal to the plate separation is inserted between the plates. How it will affected? (i) The capacitance of the capacitor (ii) potential difference between the plates (iii) energy store in the capacitor Justify your answer in each case.	3

23.	A device X is connected to an ac source. The variation of voltage, current and power in one complete cycle is shown in the figure  (i) Identify the device X. (ii) Which of the curves A, B and C represent the voltage, current and the power consumed in the circuit? Justify the answer. (iii) How does its impedance vary with frequency of the AC source? Show graphically	3
24.	(a) Write the necessary conditions of total internal reflection. (b) A ray PQ incident on the face AB of a prism ABC, as shown in the figure, emerges from the face AC such that AQ = AR.  Draw the ray diagram showing the passage of the ray through the prism. If the angle of the prism is 60^0 and the refractive index of the material of the prism is √3, determine the values of angle of incidence and angle of deviation.	3
25.	The energy levels of an atom of an element are shown in the following diagram. Which one of the level transition will result in the emission of photons of wavelength 5000 A^0? Support your answer with mathematical calculations. Which of these transitions correspond to the emission of of radiation of (i) maximum (ii) minimum wavelength.	3



26. (a) State Huygen's postulates of wave theory.
(b) Hence, Using Huygen's postulates verify the the laws of reflection.

27. A circular ring of diameter 0.2 m is placed in the uniform magnetic field of 0.4 T. The ring is rotated around its diameter which is perpendicular to the magnetic field at a frequency of 60 Hz. 3

(a) If the ring has 50 turns, then what is the maximum induced emf in the ring.
(b) State one condition under which the induced emf in the circular ring will be zero?

OR

Given below are a few characteristic of solenoids p and q

Characteristics	Solenoid p	Solenoid q
Length of the solenoid	L (m)	L (m)
Number of turns	200	50
Cross-section area of the solenoid	A (m^2)	A (m^2)
Relative permeability of the core material	1	500
Self inductance	2 (mH)	?

What is the self inductance of the solenoid q?

28. Write the two process that take place in the formation of p-n junction. Explain with the help of a diagram, formation of depletion layer and potential barrier in p-n junction, 3

SECTION D

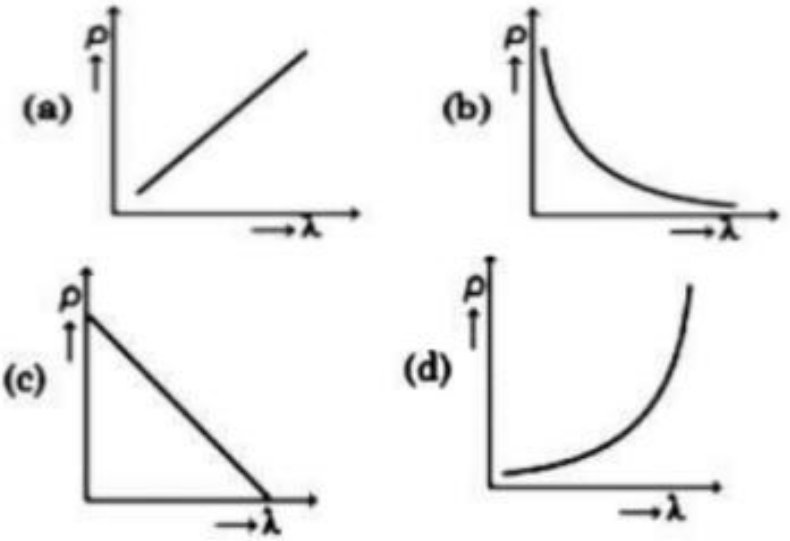
29. **CASE STUDY I (de-Broglie wavelength)** 4

Matter can not exist both as a particle and as a wave simultaneously. At a particular instant of time, it is either the one of the aspect. i.e. the two aspect are complementary to each other. According to de-Broblie, a wave is associated with moving material particle which controls the particle in every respect . The wave associated with moving material particle is called matter wave or de-Broglie wave whose wavelength is called de-Broglie wavelength.

(i) De-Broglie wavelength of moving material particle does not depends on
(a) mass (b) charge (c) velocity (d) momentum

(ii) The de-Broglie wavelength of a particle of kinetic energy K is λ. What will be the wavelength of the particle, if the kinetic energy is K/9 ?
(a) 9λ (b) λ/9 (c) 3λ (d) λ/3

(iii) Which of the following figures represent the variation of particle momentum and associated de-Broblie wavelength?



(iv) De-Broglie wavelength associated with an electron, accelerating through a potential difference 100 V in the region of

(a) Visible light (b) Gamma rays (c) UV (d) X rays

OR

A proton and a alpha particle are accelerated through a same potential difference. The ratio of de-Broglie wavelength λ_p that of $\lambda\alpha$ is

(a) $\sqrt{2} : 1$ (b) $\sqrt{4} : 1$ (c) $\sqrt{6} : 1$ (d) $\sqrt{8} : 1$

30. **CASE STUDY II (emf and internal resistance)** 4

The electrolytic cell is a simple device that maintain steady current in an eletric circuit. A cell has two electrode positive (P) and negative (N). They are emerged in an electrolyte solution. Dipped in the solution, the electrodes exchange charges with the electrolyte. When a source of emf E is connected to an external resistance, the voltage V_{out} across R is given by $V_{out} = IR = ER/(R+r)$, where r is the internal resistance of the source.

(i) A current 2 A flows through a 2 Ω resistor when connected across a battery. The same battery supply current 0.5 A when connected across a 9 Ω resistor. The internal resistance of the battery is

(A) 1/3 Ω (B) 3 Ω (C) 0.5 Ω (D) 1 Ω

(ii) maximum current drawn from the cell when

(A) R = infinity (B) R = 0 (C) R = r (D)r = 0

OR

The maximum current that can be drawn from the cell is

(A) E/(r+R) (B) E/r (C)E/R (D) V/(R+r)

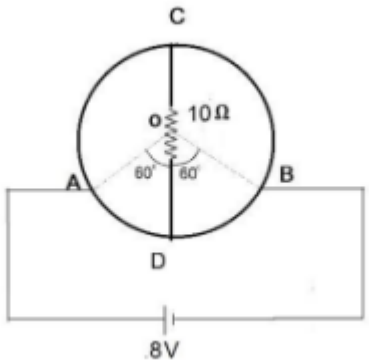
(iii) A battery has an emf 4 V and internal resistance r. When the battery is connected to resistance 2 Ω a current of 1 A flows through the circuit. How much current will flows, if terminals are directly connected?

(A) Zero (B) 1 A (c) infinite (D) 2 A

(iv) for an open circuit which of the following statement is true

(A) V = E (B) V = E- ir (c)V < E (D) V > E

SECTION E

31.	(a) Using Biot-Savert law obtain the expression for magnetic field on an axial point at a distance x from centre of a circular loop of radius a carrying a current I. (b) Hence, find the ratio of the magnetic field of this coil at the centre and at an axial point for which $x = a\sqrt{3}$ OR (a) With the help of a labelled diagram explain the principal and working theory of moving coil galvanometer. (b) If a galvanometer of resistance 49.5 Ω has range of 0.05 A. what will be value of resistance needed to convert it in ammeter of range 5 A.	5
32.	(a) A Young's double slit setup is illuminated with monochromatic light. If the intensity of light passing through one of the slits is reduced, explain the changes that can be seen in the appearance of the bright and dark fringes? (b) (i) A single slit diffraction setup is illuminated with green light of wavelength 500 nm. If the with of the slit is 1 mm and screen is 2 m away from the slit, calculate the with of the central maxima.. (ii) What will happen to the width of the central maxima, if the green light is replaced with the red light? Give a reason for your answer. OR (a) Draw a ray diagram for formation of image of a point object by a thin double convex lens having radii of curvature R_1 and R_2 and hence derive lens maker's formula. (b) A converging lens has a focal length of 20 cm in air. It is made of material of refractive index 1.6 .If it is immersed in a liquid of refractive index 1.3. Calculate its new focal length in the liquid.	5
33.	(a) Derive an expression for drift velocity of electrons in a conductor. Hence deduce Ohm's law. (b) A wire whose cross-section area is increasing linearly from its one end to the other, is connected a battery of V volts. Which of the following quantities remains constant in the wire (i) drift speed (ii) current density (iii) electric current (iv) electric field Justify your answer. OR (a) Using Kirchhoff's laws obtain the equation of the balanced state in Wheatstone bridge' (b) A wire of uniform cross-section and resistance of 12 ohm is bent in the shape of circle as shown in figure. A resistance of 10 ohm is connected to diametrically opposite ends C and D. A battery of emf 8V and negligible internal resistance is connected between A and B. Determine the current flowing through arm AD.  	5