KENDRIYA VIDYALAYA SANGATHAN, TINSUKIA REGION

PRE BOARD EXAM (2024– 2025)

SUBJECT: PHYSICS (042)

CLASS: XII **MAX- MARKS:70**

TIME: 3 HOURS

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 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.

(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

$me = 9.1 \times 10^{-31}$ kg

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

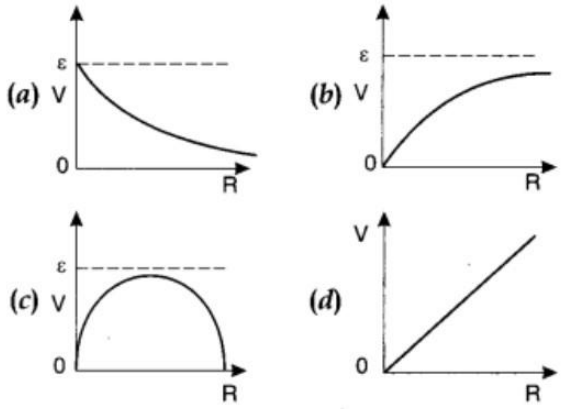
$\mu 0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$

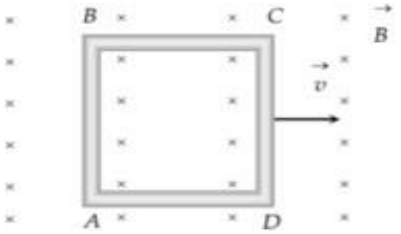
$h = 6.63 \times 10^{-34}$Js

$\varepsilon 0 = 8.854 \times 10^{-12}\boldsymbol{C^2N^{-1}m^{-2}}$

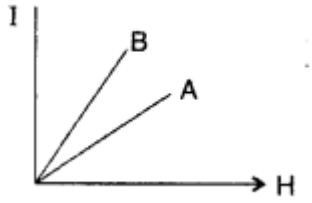
Avogadro's number = 6.023 X $\mathbf{10^{23}}$per gram mole

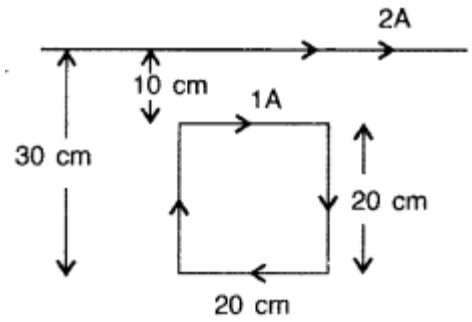
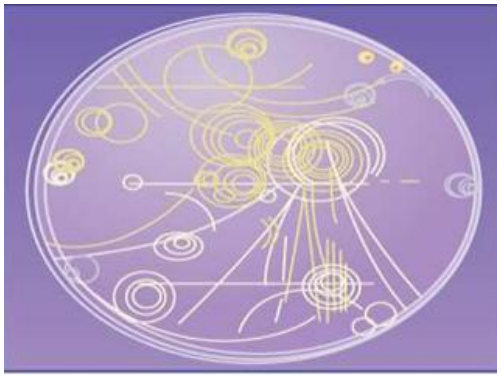
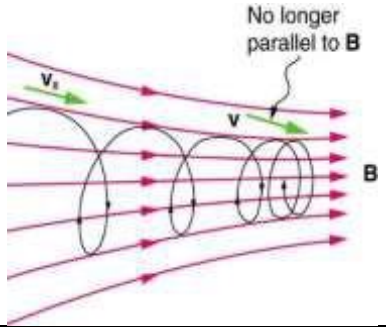
Q. No.	QUESTION	Marks
	SECTION A	
1	A point P lies at distance x from the midpoint of an electric dipole on its axis. The electric potential at point P is proportional to (a) $\frac{1}{x^2}$ (b) $\frac{1}{x3}$ (c) $\frac{1}{x^4}$ (d) $\frac{1}{x^{1/2}}$	1
2	Four charges +8Q, -3Q, +5Q and -10Q are kept inside a closed surface. What will be the out going electric flux through the surface. (a) 26 V-m (b) 0 V-m (c) 10 V-m (d) 8 V-m	1
3	A cell having an emf E and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by	1

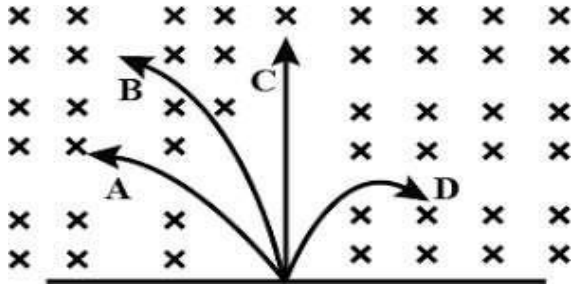
<table>
<tr><td></td><td> 
</td><td></td></tr>
<tr><td>4</td><td>A long straight wire of circular cross section of radius 'a' carries a steady current I. The current is uniformly distributed across its cross section. The ratio of magnitudes of the magnetic field at a point a/2 above the surface of wire to that of a point a/2 below its surface is

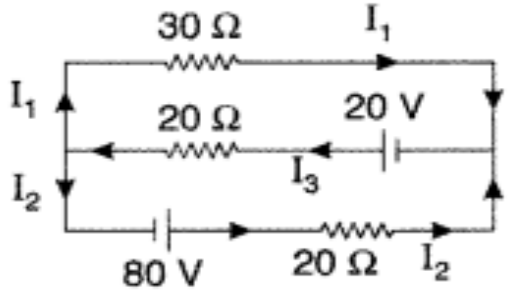
(a) 4:1 (b) 1:1 (c) 4: 3 (d) 3 :4</td><td>1</td></tr>
<tr><td>5</td><td>A conducting square loop of side 'L' and resistance 'R' moves in its plane with the uniform velocity 'v' perpendicular to one of its sides. A magnetic induction 'B' constant in time and space pointing perpendicular and into the plane of the loop exists everywhere as shown in the figure. The current induced in the loop is
(a) BLv/R Clockwise
(b) BLv/R Anticlockwise
(c) 2BLv/R Anticlockwise
(d) Zero
 
</td><td>1</td></tr>
<tr><td>6</td><td>An astronomical refractive telescope has an objective of focal length 20 m and an eyepiece of focal length 2 cm. Then
(a) the magnification is 1000 (b) the length of the telescope tube is 20.02 m
(c) the image formed is inverted (d) all of these</td><td>1</td></tr>
<tr><td>7</td><td>Correct match of column I with column II is
<table><tr><td>E.M waves C-I</td><td>Uses of E.M waves C-II</td></tr><tr><td>(1) Infra-red</td><td>(P). sterilization, killing bacteria and germs in food stuff, detection of invisible writing</td></tr><tr><td>(2)Microwaves</td><td>(Q). night vision device, green house, revealing secret writings on ancient walls</td></tr><tr><td>(3) X-rays</td><td>(R). Radar, analysis of fine details of atomic and molecular structures</td></tr><tr><td>(4) U.V rays</td><td>(S). locating cracks and flaws in finished metallic objects, detection of smuggled goods in bags of a person, study of crystal structure, etc.</td></tr></table></td><td>1</td></tr>
</table>

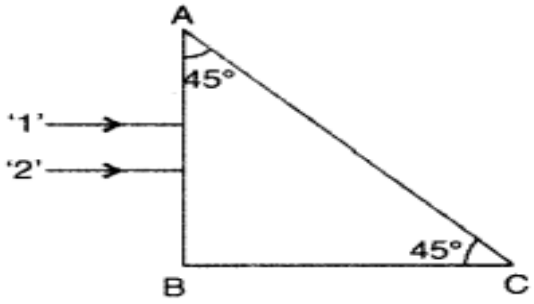
	(a) 1-P, 2-R, 3-S, 4-Q (b) 1-S, 2-P, 3-O, 4-R (c) 1-Q, 2-R, 3-S, 4-P (d) 1-S. 2-R, 3-P, 4-Q	
8	De- Broglie wavelength associated with an electron associated through a potential difference V is λ .What will be the new wavelength when the accelerating potential is increase to 4V? (a) λ/2 (b) 2λ (c) 4 λ (d) λ/4	1
9	The distance of closest approach of an alpha particle is d when it moves with a speed V towards a nucleus. Another alpha particle is projected with higher energy such that the new distance of the closest approach is d/2. What is the speed of projection of the alpha particle in this case? (a) V /2 (b) √2 V (c) 2 V (d) 4 V	1
10	A plane wave passes through a convex lens. The geometrical shape of the wave front that emerges is (a) plane (b) diverging spherical (c) converging spherical (d) None of these	1
11	The binding energy per nucleon of a nucleus is a measure of its (a) Stability (b) Instability (c) Radioactivity (d) Mass defect	1
12	When p-n junction diode is forward biased then (a) both the depletion region and barrier height are reduced (b) the depletion region is widened and barrier height is reduced (c) the depletion region is reduced and barrier height is increased (d) Both the depletion region and barrier height are increased	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) If both Assertion and Reason are true and Reason is the correct explanation of Assertion (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (c) If Assertion is true but Reason is false. (d) If both Assertion and Reason are false.	
13	Assertion (A): On increasing the current sensitivity of a galvanometer by increasing the number of turns may not necessarily increase its voltage sensitivity. Reason(R): The resistance of the coil of the galvanometer increases on increasing the number of turns	1
14	Assertion (A) : Infrared radiation plays an important role in maintaining the average temperature of earth. Reason (R): Infrared radiations are sometimes referred to as heat waves	1
15	Assertion (A): If the objective and eye lenses of a microscope are interchanged, then it can work as telescope. Reason (R): The objective lens of telescope has small focal length.	1
16	Assertion(A) : In Lyman series, the ratio of minimum and maximum wavelength is 3/4. Reason(R) : Lyman series constitute spectral lines corresponding to transition from higher energy to ground state of hydrogen atom.	1
	SECTION -B	
17	How does the resistivity of conductor changes when (i) relaxation time of electron increases (ii) electron density decreases ?. Draw the graph showing variation of	2

	resistivity with temperature for copper.	
18	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) Write two characteristic point of difference between this two magnetic material?	2
19	(i) A beam of light consisting of two wavelengths, 4000 Å and 6000 Å, is used to obtain interference fringes in a Young's double-slit experiment. What is the least distance from the central maximum where the dark fringe is obtained? **OR** (ii) In Young's double-slit experiment using monochromatic light of wavelength λ, the intensities of two sources are I. What is the intensity of light at a point where path difference between wave fronts is λ/4?	2
20	Sketch the graph showing the variation of stopping potential with frequency of incident radiation for two photosensitive metals A and B having threshold frequencies f_A and f_B respectively ($f_A > f_B$) (i)Which of the two metals, A and B has higher work function ? (ii)What information do you get from the slope of the graphs ?	2
21	A nucleus with mass no. A = 240 and $\frac{B.E}{A}$ =7.6MeV breaks into two fragments each of A =120 and $\frac{B.E}{A}$ = 8.5 MeV. Calculate the energy released.	2
	SECTION-C	
22	Find the expression for the capacitance of a parallel plate capacitor of plate area 'A' and plate separation ' d ' when a dielectric slab of thickness ' t' (t < d) is introduced between the plates of the capacitor. Net capacitance of three identical capacitors in series is 1pF. What will be their net capacitance when connected in parallel?	3
23	(a) State Gauss's theorem in electrostatics. Write down its mathematical form. (b) Using this theorem, derive an expression for the electric field due to an infinitely long straight wire of linear charge density λ. OR (a) Define electric flux and write its SI unit. (b) Use Gauss's law to obtain the expression for the electric field due to a uniformly charged infinite plane sheet of charge density σ .	3
24	**(a)**Write down the expression for force per unit length between two long straight parallel current carrying conductors. Using it define 1 ampere of current. (b)A square loop of side 20 cm carrying current of 1A is kept near an infinite long straight wire carrying a current of 2A in the same plane as shown in the figure.	3

	 Calculate the magnitude and direction of the net force exerted on the loop due to the current carrying conductor.	
25	Can a convex lens diverges a beam of light falling on it? If so how? Two lenses of power 10D and -5D are placed in contact. (i) Calculate the power of the new lens (ii) Where should an object be placed from the lens so as to obtain a virtual image of magnification 2?	3
26	Draw the ray diagram for formation of image by a compound Microscope. An astronomical telescope uses two lenses of power 10D and 1D for its construction. (i) State with reason, which lens is preferred as objective and eyepiece. (ii) Calculate the magnifying power of telescope so form.	3
27	Draw the energy band diagram for P-type semiconductor at (a) T=0K and (b) room temperature. A semiconductor has equal electron and hole concentrations of $6x10^{8}$/m3. On doping with a certain impurity, the electron concentration increases to $9x10^{12}$/m3. (i) Identify the new semiconductor obtained after doping (ii) Calculate the new hole concentrations.	3
28	With the help of level diagram, explain the working of a full wave rectifier. Also draw its input and output wave form	3
	SECTION-D	
29	**Case Study Based Question: Motion of Charge in Magnetic Field** Bubble Chamber: Trails of bubbles are produced by high-energy charged particles moving through the superheated liquid hydrogen in this artist's rendition of a bubble chamber. There is a strong magnetic field perpendicular to the page that causes the curved paths of the particles. The radius of the path can be used to find the mass, charge, and energy of the particle.   Magnetic forces can cause charged particles to move in circular or spiral paths. Particle	4

	accelerators keep protons following circular paths with magnetic force. Cosmic rays will follow spiral paths when encountering the magnetic field of astrophysical objects or planets (one example being Earth's magnetic field). The bubble chamber photograph in the figure below shows charged particles moving in such curved paths. The curved paths of charged particles in magnetic fields are the basis of a number of phenomena and can even be used analytically, such as in a mass spectrometer shows the path traced by particles in a bubble chamber. (i) When a charged particle moves perpendicular to a uniform electric field, it follows- (a) circular path (b) parabolic path (c) translational path (d) helical path (ii) A charged particle moving with velocity v in X direction is subjected to a magnetic field B in negative X direction. As a result, the charge will (a) retard along X-axis (b) start moving in a circular path in YZ plane (c) remains unaffected (d) move in a helical path around X-axis (iii)) An α- particle and proton having same momentum enter into a region of uniform magnetic field and move in a circular path. The ratio of the radii of curvature of their paths is (a)1 (b)1/4 (c)1/2 (d)4 (iv)) A neutron, a proton, an electron and an α- particle enter in a region of uniform magnetic field with equal velocities. The magnetic field is perpendicular and directed into the paper. The tracks of the particles are shown in figure. The electron will follow the track  (a) A (b) B (c) C (d) D **OR** If magnetic force experienced by the charged particle is perpendicular to the velocity of the particle, then work done is- (a) zero (b) maximum (c) minimum (d) none of these	
30	**Case Study Based Question: Photoelectric effect** In 1887, German physicist Heinrich Hertz noticed that shining a beam of ultraviolet light onto a metal plate could cause it to shoot sparks. It is due to the emission of negatively charged particles called electrons from the metal surface into the surrounding space. Hallwachs and Lenard also observed that when ultraviolet light fell on the emitter plate, no electrons were emitted at all when the frequency of the incident light was smaller than a certain minimum frequency. Experimental study shows that different metals required different minimum frequencies of light for the emission of electron. When brightness of the incident light increases, more electrons were produced, without increasing their energy, and increasing the frequency of 172 the light produced electrons with higher energies, but without increasing the number produced. This is known as the photoelectric effect, and it would be understood in 1905 by a	4

	young scientist named Albert Einstein. (i) In photoelectric effect, the kinetic energy of emitted electrons from the metal surface depends upon (a) frequency of incident light (b) velocity of incident light (c) intensity of light (d) angular momentum of emitted electron . (ii). When monochromatic radiation of intensity I falls on a metal surface, the number of photoelectron and their maximum kinetic energy are n and K respectively. If the intensity of radiation is 2I, the number of emitted photoelectron and their maximum kinetic energy will be (a) n and 2K (b) 2n and 2K (c) 2n and K (d) n and K (iii) According to Einstein's picture of photoelectric equation, , the photo electric emission does not takes place by (a) continuous emission of energy from radiation (b) continuous absorbtion of energy from radiation (c) discrete absorption of energy from radiation (d) discrete emission of energy from radiation (iv) The minimum energy required to remove an electron from a substance is called its (a) work function (b) kinetic energy (c) stopping potential (d) potential energy OR Which of the following property does not support wave theory of light? (a) Light waves get polarised (b) Light obeys Laws of refraction and reflection (c) Light shows phenomenon of diffraction (d) Light shows photoelectric effect.	
	SECTION E	
31	(a) State Kirchoff's law for network of conductor. Using it deduce the Wheatstone's Bridge balance condition. **(b)** Use Kirchhoff's rules to determine the value of the current I_1 flowing in the circuit shown in the figure.  **OR** (a) What is drift velocity? Derive expression for drift velocity of electrons in a good	5

	conductor in terms of relaxation time of electrons? (b) Potential difference V is applied across the ends of copper wire of length l and diameter D. What is the effect on drift velocity of electrons if (i) V is doubled (ii) l is doubled? (c) At room temperature 27.0∘C the resistance of a heating element is 100Ω. What is the temperature of the element if the resistance is found to be 117Ω, given that the temperature coefficient of the material of the resistor is 1.70×10^{-4}∘C−1 ?	
32	(a) With the help of a diagram, explain the principle of a device which changes a low ac voltage into a high voltage . Deduce the expression for the ratio of secondary voltage to the primary voltage in terms of the ratio of the number of turns of primary and secondary winding. For an ideal transformer, obtain the ratio of primary and secondary currents in terms of the ratio of the voltages in the secondary and primary coils. (b) Write any two sources of the energy losses which occur in actual transformers. (c) A step-up transformer converts a low input voltage into a high output voltage. Does it violate law of conservation of energy? Explain. **OR** (a) In an AC circuit containing a prime inductor, show that the voltage is ahead of current by $\pi/2$ in phase. (b) Draw the phasor diagram for the circuit. (c) Why does an inductor blocks a.c and easily bypass d.c?	5
33	(a) Deduce the lens maker's formula (b) How will the focal length of a convex lens change when (i) when the lens is immersed in water (ii) When red light which is incident on it is replaced by blue light ? (c) Use the mirror equation to show that a convex mirror always produces a virtual image independent of the location of the object. **OR** (a) Draw a ray diagram to show refraction of a ray of monochromatic light passing through a glass prism..Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. (b) Two monochromatic rays of light are incident normally on the face AB of an isosceles right angled prism ABC. The refractive indices of the glass prism for the two rays '1' and '2' are respectively 1.35 and 1.45. Trace the path of these rays entering through the prism.  	5