केन्द्रीय विद्यालय संगठन, बेंगलुरु क्षेत्र

KENDRIYA VIDYALAYA SANGATHAN, BENGALURU REGION

प्री-बोर्ड परीक्षा – 2024-2025

FIRST PRE-BOARD EXAMINATION – 2024-2025

Class: XII Maximum marks:70

Subject: PHYSICS 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 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 where ever necessary

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

ii. $m_e = 9.1 \times 10^{-31}$ kg

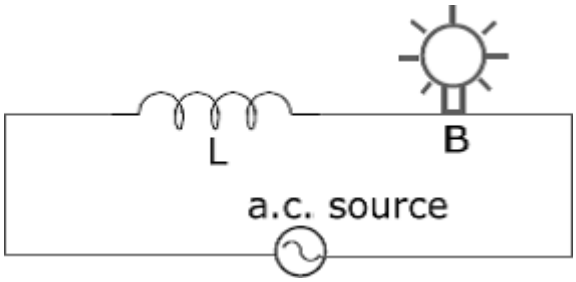
iii. $e = 1.6 \times 10^{-19}$ C

iv. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$

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

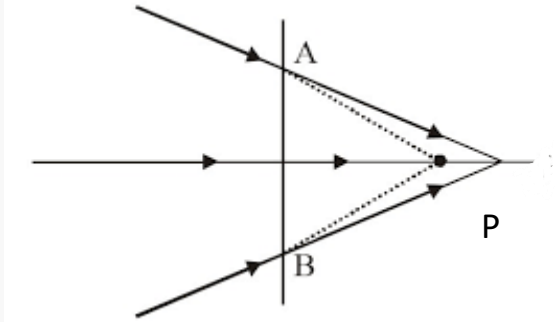
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$

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

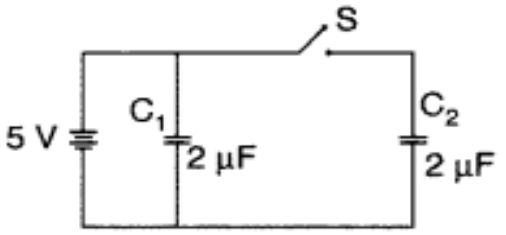
	SECTION A (16x1=16 marks)	
1	A point charge q is kept at a distance r from an infinitely long straight wire with charge density λ. The magnitude of the electrostatic force experienced by charge q is (a) Zero (b) $\frac{q\lambda}{2\pi\epsilon_0 r}$ (c) $\frac{q\lambda}{4\pi\epsilon_0 r}$ (d) $\frac{q\lambda}{\epsilon_0 r}$	1
2	An inductor L of reactance X_L is connected in series with a bulb B to an ac source as shown in the figure.  How does the brightness of the bulb change when number of turns of the inductor is increased? (a) Increases (b) Decreases (c) Remains same (d) none of these	1
3	Shape of equipotential surfaces in uniform electric field will be : (a) Spherical normal to electric field (b) Random (c) Circular normal to electric field (d) Equidistant Planes normal to electric field.	1
4	The electric resistance of a certain wire of iron is R. If its length and radius are both doubled, then (a) the resistance and the specific resistance, will both remain unchanged (b) the resistance will be doubled and the specific resistance will be halved (c) the resistance will be halved and the specific resistance will remain unchanged (d) the resistance will be halved and the specific resistance will be doubled	1
5	Magnetic field lines inside an ideal solenoid are: (a) Circular (b) Straight and parallel (c) Random (d) Perpendicular to the axis	1
6	Identify the property which is not characteristic for a semiconductor? (a) at a very low temperatures, it behaves like an insulator (b) at higher temperatures two types of charge carriers will cause conductivity (c) the charge carriers are electrons and holes in the valence band at higher temperatures (d) the semiconductor is electrically neutral.	1

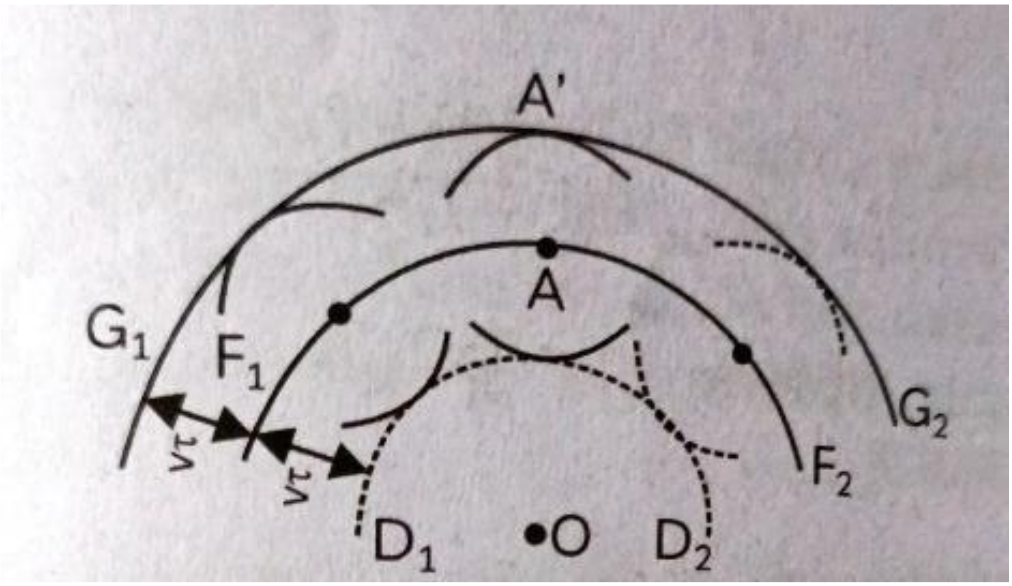
7	Correct match of column I with column II is (a) 1-P, 2-R, 3-S, 4-Q (b) 1-S, 2-P, 3- Q, 4-R (c) 1-Q, 2-P, 3-S, 4-R (d) 1-S. 2-R, 3-P, 4-Q	1

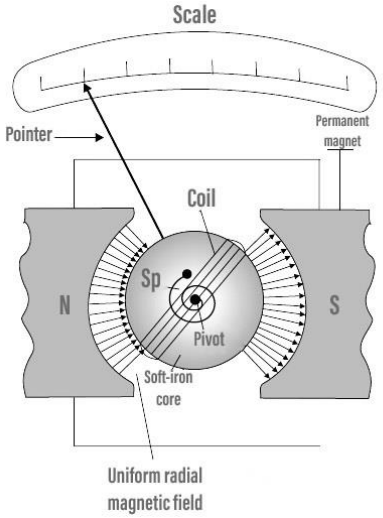
Column-I (waves)	Column-II (Production)
1) Infra-red	P. Rapid vibration of electrons in aerials
(2) Radio	Q . Electrons in atoms emit light when they move from higher to lower energy level
(3) Light	R . Klystron valve
(4) Microwaves	S . Vibration of atoms and molecules

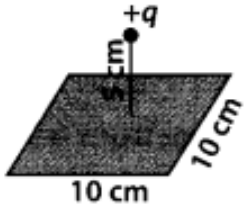
8	The line AB in the ray diagram of figure represents a lens. On keeping AB the rays get converged at P. The lens represented by AB is  (a) Concave lens (b) convex lens (c) can't say (d) Both A & B	1
9	Two thin lenses are in contact and the focal length of the combination is 80 cm. If the focal length of one lens is 20 cm, then the power of the other lens will be (a) 1.66 D (b) 4.00 D (c) – 100 D (d) – 3.75 D	1
10	The ratio of the intensities of two light waves from two coherent sources is 9:1. The ratio of the intensities of interference maxima and minima when above two waves interfere is (a)3:1 (b) 81:1 (c) 4:1 (d) 1:4	1
11	When radiation of given frequency is incident upon different metals, the maximum kinetic energy of the electrons emitted electrons (a) decreases with increase of work function	1

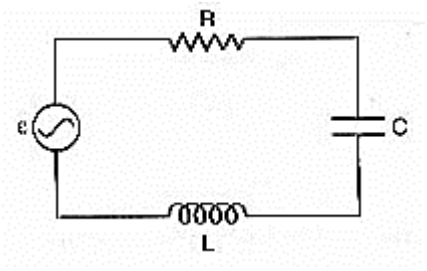
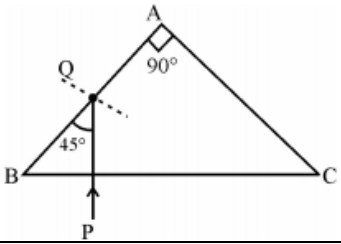
	(b) increases with increase of work function (c) remains same with the increase of work function (d) does not depend upon work function	
12	The radius of $_{13}Al^{27}$ nucleus ($R_0 = 1.2\times 10^{-15}$ m) will be (a) 3.6×10^{-15} m (b) 2.7×10^{-15} m (c) 10.8×10^{-15} m (d) 4×10^{-15} m	1
	For Questions 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:** Kinetic energy of photoelectrons emitted by a photosensitive surface depends upon the frequency of incident photon. **Reason:** The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency.	1
14	**Assertion:** Nuclear force between neutron – neutron, proton – neutron and proton -proton is approximately the same. **Reason**: The nuclear force does not depend on the electric charge.	1
15	**Assertion :** An *N*-type semiconductor has a large number of electrons but still it is electrically neutral. **Reason :** An *N*-type semiconductor is obtained by doping an intrinsic semiconductor with a pentavalent impurity	1
16	**Assertion:** When number of turns in a coil is doubled, coefficient of self-inductance of the coil becomes 4 times. **Reason:** This is because self-inductance is directly proportional to the square of number of turns in a coil.	1
	SECTION B (05x2=10 marks)	
17	Using Huygens's construction draw a figure showing the propagation of a plane wavefront getting reflected from a plane reflecting surface. Show that the angle of incidence is equal to the angle of reflection.	2
18	(a) Define 'drift velocity' and obtain an expression for the current flowing in a conducting wire in terms of drift velocity of the free electrons. **OR** (b) Define relaxation time. Obtain relation between relaxation time and resistivity?	2
19	A closely wound solenoid of 800 turns and an area of cross-section 2.5×10^{-4} m^2 carries a	2

	current of 3.0 A. Explain the sense in which the solenoid acts like a bar magnet. What is its associated magnetic moment?	
20	The energy of the electron in the nth orbit is given by $E_n = -13.6/n^2$ eV. Calculate the energy required to excite an electron from ground state to the second excited state	2
21	a)Name the two processes responsible for the formation of depletion region in a p-n junction diode. b) Explain the formation of potential barrier with the help of a diagram.	2
	SECTION C : (07x3=21 marks)	
22	(a) Define mass defect and binding energy? (b) Calculate the energy required to dissociate a deuteron into its constituent particles (a proton and a neutron). Given: mass of deuteron = 2.014102 u, mass of proton = 1.007825 u, mass of neutron = 1.008665 u.	3
23	Draw a plot showing the variation of photoelectric current with collector plate potential for two different frequencies, $\nu_1 > \nu_2$, of the incident radiation having the same intensity. In which case will the stopping potential be higher? Justify your answer.	3
24	With the help of a ray diagram, explain the working of a reflecting telescope. Mention two advantages of a reflecting telescope over a refracting telescope? **OR** With the help of a ray diagram, explain the formation of image in a compound microscope when the final image is formed at the near point. Obtain the expression for the magnifying power in this case.	3
25	(a)Two thin, long, straight, parallel current carrying conductors carrying currents I_1 and I_2 are kept 'd' distance apart in air. The directions of currents in both the conductors are the same. Obtain the expression for the magnitude of force per unit length acting on each other and nature of the force between them. (b) Hence define one ampere.	3
26	Figure shows two identical capacitors C_1 and C_2, each of 2 μF capacitance, connected to a battery of 5 V. Initially switch 'S' is closed. Now the switch "S" is opened and dielectric slabs of dielectric constant K = 5 are inserted to fill completely the space between the plates of the two capacitors.  a) How will the charge and potential difference between the plates of the capacitors be affected after the slabs are inserted? b) Find the ratio of energy stored in both the capacitors after introducing dielectric slabs?	3

27	(a) Can potential difference across a cell be greater than its emf? Explain? (b) A battery of emf 10 V and internal resistance 3 Ω is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed? OR (a) State Kirchhoff's rules used in the analysis of electric circuits. (b) Derive the equation for balanced state of a Wheatstone bridge, using Kirchhoff's laws.	3
28	(a) A student wants to use two p-n junction diodes to convert alternating current into direct current. Draw the labeled circuit diagram she would use and explain how it works. (b) Show graphically the input and output Wave forms.	3
	SECTION D: CASE STUDY BASED QUESTIONS (02x4=08 marks)	
29	Wave Optics: According to Huygens principle, each point of the wave front is the source of a secondary disturbance and the wavelets emanating from these points spread out in all directions with the speed of the wave. These wavelets emanating from the wave front are usually referred to as secondary wavelets and if we draw a common tangent to all these spheres, we obtain the new position of the wave front at a later time.  (i) Using Huygens's principle we can prove the law of (a) Reflection only (b) Refraction only (c) Both the reflection and refraction (d) None of these (ii) Huygens's wave theory allows us to know (a) The wavelength of the wave (b)The velocity of the wave (c) The amplitude of the wave (d)The propagation of wave fronts	4

	(iii) A 'wave front' is the surface of constant (a)Phase (b)Frequency (c)Wavelength (d)Amplitude (iv) The wave front due to a source situated at infinity is (a)Spherical (b)Cylindrical (c) Planar (d) Rectilinear (OR) When monochromatic light travels from a rarer to a denser medium, which quantity will not vary (a) wavelength (b) speed (c) frequency (d) all the above.	
30	Case Study Based Question: Moving coil galvanometer  Moving coil galvanometer operates on Permanent Magnet -Moving Coil mechanism and was designed by the scientist D'Arsonval. It is of two types.(i) Suspended coil and (ii) Pivoted coil type. Its working is based on the fact that when a current carrying coil is placed in a uniform magnetic field , it experiences the torque. This torque tends to rotate the coil about its axis of suspension or pivot in such a way that magnetic flux passing through the coil is maximum. 1. A moving coil galvanometer is an instrument which (a) to measure emf of a cell (b) to measure potential difference (c) to measure resistance (d) is a deflection type instrument that gives deflection when current passes through the coil. 2. To make the field radial in moving coil galvanometer (a) Number of turns of the coil is kept small (b) Horse shoe shaped magnet (OR) set of concave shaped magnetic poles is taken (c) Poles are very strong magnets	4

	(d) Poles are cylindrically cut 3. The deflection in moving coil galvanometer is (a) Directly proportional to torsional constant of spring (b) Directly proportional to number of turns in the coil (c) Inversely proportional to the area of cross section (d) Inversely proportional to the current in the coil 4. In a moving coil galvanometer, a coil of N number of turns, area of cross section A and carrying current I Is placed in radial magnetic field B, then the torque on the coil is (a) $NA^2 B^2 I$ (b) $NABI^2$ (c) N^2ABI (d) NIAB (OR) Current sensitivity of a moving coil galvanometer increases if (a) Magnetic field strength increases (b) Area of the coil decreases (c) Number of turns increases. (d) Both (a) and (c)	
	SECTION E (03X5=15)	
31	(I) (a) Define electric dipole moment. Derive the expression for the electric field of a dipole at a point on the equatorial plane of the dipole. (b) Two charges +5μC and +20μC are placed 2m apart. At what point on the line joining the two charges is the electric field zero? OR (II) (a) Using Gauss's law, show that the electric field E at a point due to a uniformly charged infinite plane sheet is given by $E = \sigma / 2\epsilon_0$, where symbols have their usual meanings. (b) A point charge +10 μC is at a distance of 5 cm directly above the centre of a square of side 10 cm, as shown in figure. What is the magnitude of the electric flux through the square? 	5
32	(a) With the help of a diagram, explain the principle of the device which changes a low alternating voltage into a high alternating 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	5

	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 series of LCR circuit is connected to a variable frequency 230 V source, L = 5.0 H, $C = 80\mu F$, $R = 40\Omega$  i. Determine the source frequency which drives the circuit in resonance. ii. Obtain the impedance of the circuit and the amplitude of current at the resonating frequency. iii. Determine the rms potential drops across the three elements of the circuit. Show that the potential drop across the LC combination is zero at the resonating frequency.	
33	(i)Write the two conditions for total internal reflection to occur? (ii) Obtain a relation between critical angle and refractive index of a medium. (iii) Write any two applications of total internal reflection. (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. (Consider the bulb to be a point source) OR a) Draw the ray diagram showing refraction of ray of light through a glass prism. Derive the expression for the refractive index n of the material of prism in terms of the angle of prism A and angle of minimum deviation Dm. (b)A ray of light PQ enters an isosceles right angled prism ABC of refractive index 1.5 as shown in figure. (i)Trace the path of the ray through the prism. (ii) What will be the effect on the path of the ray if the refractive index of the prism is 1.4?  	5

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