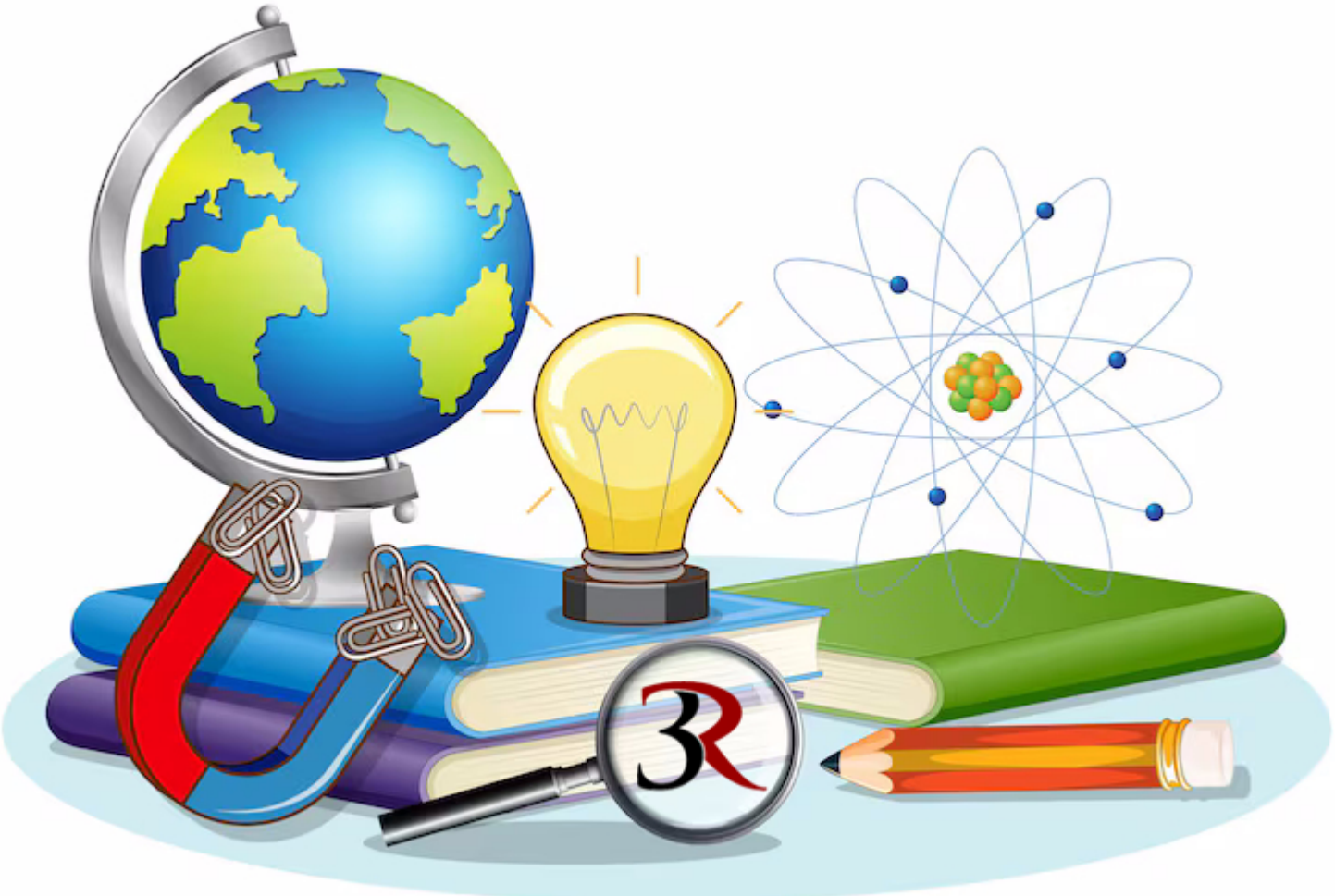
20 SAMPLE PAPERS

CBSE 2025-26

PHYSICS



INDEX

SAMPLE QUESTION PAPER-1: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

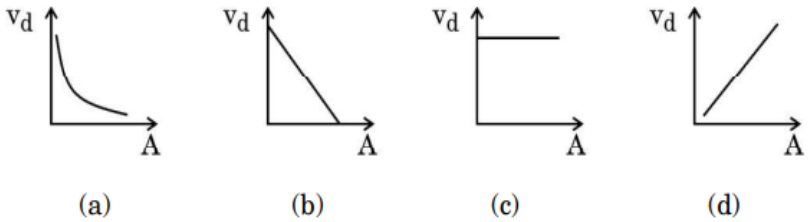
TIME:3Hrs **MAX MARKS:70**

General Instructions

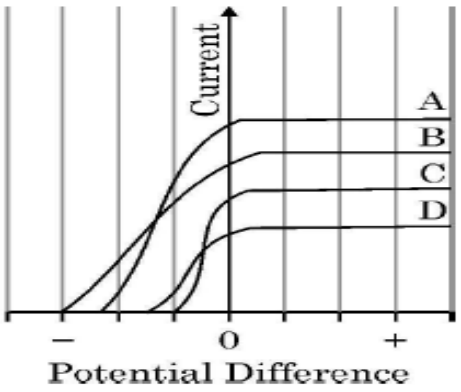
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark 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 wherever 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

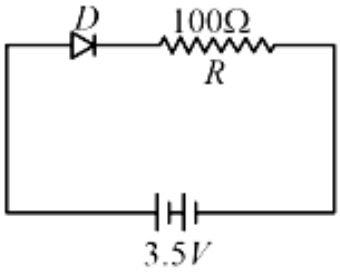
Q. No.	SECTION – A	Marks
1	What is the source of electromagnetic wave generation? a)constant electric field b)constant magnetic field c)changing electric and magnetic field d)constant electric and magnetic field	1
2	According to the wave theory of light, how does the intensity I depend on the amplitude A of the wave? a) I α $\sqrt{A}$ b) I α A c) I α A^2 d) I α $\frac{1}{A^2}$	1
3	Which SI unit is used to measure magnetic flux density (magnetic induction)? a) Weber b) Tesla c) Henry d) Coulomb	1
4	A cell with emf E and internal resistance r is connected to an external resistor R of value 2r. What will be the potential difference measured across the cell's terminals? a) E/4 b) E/2 c) (2/3)E d) E/3	1
5	A capacitor of 10 µF is charged using a 100 V power source. Calculate the energy stored in the capacitor. a) 0.05 J b) 0.1 J c) 1 J d) 0.5 J	1
6	An electron travels at 3×10^6 m/s perpendicular to a magnetic field of strength 0.02 T. What is the magnetic force acting on it? a) 9.6×10^{-15}N b) 1.6×10^{-15}N c) 4.8×10^{-15}N d) Zero	1
7	For a convex lens of focal length f, what is the least possible separation between an object and its real image? a) f b) 2f c) 3f d) 4f	1

8	Light passes from glass (refractive index = 1.5) into air (refractive index = 1). Given the critical angle is 42°, determine the deviation angle when the incident angle is 50°. a) 60.0° b) 22.0° c) 45.0° d) 80.0°	1
9	An ideal transformer has 100 turns in its primary coil and 500 turns in its secondary coil. If the input voltage is 240 V, what will be the output voltage? a) 48 V b) 1200 V c) 600 V d) 960 V	1
10	A solenoid of length 2 m contains 2000 turns and carries a current of 4 A. What is the magnetic field produced inside the solenoid? a) 5×10^{-3}T b) 5×10^{-4}T c) 4×10^{-3}T d) 4×10^{-4}T	1
11	In the energy band diagram of n-type silicon, what is the approximate order of energy gap between the bottom of conduction band E_C and the top of donor level E_D? a) 10 eV b) 1 eV c) 0.1 eV d) 0.01 eV	1
12	A uniform current flows through a metallic wire whose cross-sectional area A increases gradually along its length. How does the drift velocity v_d of electrons vary with A?  (a) (b) (c) (d)	1
	Assertion(A) and Reasoning(R) (1 Mark Each) For questions 13–16, choose the correct option: 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.	
13	**Assertion (A):** The electric field is zero inside a charged conductor in electrostatic equilibrium. **Reason (R):** All the charges in a conductor move to the surface to maintain equilibrium.	1
14	**Assertion (A):** The focal length of a concave mirror increases with an increase in the wavelength of light used. **Reason (R):** The refractive index of the material of the mirror decreases with the increase in wavelength of light.	1
15	**Assertion (A):** In a series LCR circuit, resonance occurs when the inductive reactance equals the capacitive reactance. **Reason (R):** At resonance, the impedance of the circuit is purely resistive, and the current is maximum.	1
16	**Assertion (A):** The phase difference between any two points on a wave front is zero**.** **Reason (R):** All points on a wave front are at the same distance from the source and thus oscillate in the same phase.	1

	SECTION B	
17	(a)Draw a graph showing the variation of binding energy per nucleon as a function of mass number A. The binding energy per nucleon for heavy nuclei (A 170) decreases with the increase in mass number. Explain. (OR) (b) Using Bohr's postulates, obtain the expression for radius of n^{th} stable orbit in a hydrogen atom.	2
18	Draw energy band diagram for an n-type and p-type semiconductor at T > 0 K.	2
19	The power of a thin lens is +5D. When it is immersed in a liquid, it behaves like a concave lens of focal length 100 cm. Calculate the refractive index of the liquid. Given refractive index of glass = 1.5.	2
20	(i). Depict the orientation of an electric dipole in (a) stable and (b) unstable equilibrium in an external uniform electric field. (ii). Write the potential energy of the dipole in each case.	2
21	A charge 'q' is placed at the centre of the line joining two equal charges Q. If the system of these charges will be in equilibrium, then find the value of 'q' in terms of Q.	2
	SECTION C	
22	Two circular loops A and B, each of radius 3 m, are placed coaxially at a distance of 4 m. They carry currents of 3 A and 2 A in opposite directions respectively. Find the net magnetic field at the centre of loop A.	3
23	(a) A resistor of 30 and a capacitor of 250/π μF are connected in series to a 200 V, 50 Hz ac source. Calculate (i) the current in the circuit, and (ii) voltage drops across the resistor and the capacitor. (iii) Is the algebraic sum of these voltages more than the source voltage ? If yes, solve the paradox. (OR) (b) A series LCR circuit with R = 20 , L = 2 H and C = 50 F is connected to a 200 volts ac source of variable frequency. What is (i) the amplitude of the current, and (ii) the average power transferred to the circuit in one complete cycle, at resonance ? (iii) Calculate the potential drop across the capacitor.	3
24	(i) How is the size of nucleus found experimentally? Write the relation between the radius and mass number of nuclei. (ii) Prove that the density of a nucleus is independent of its mass number.	3
25	A potential difference 'V' is applied across a load resistor of resistance R. V and R can be varied. If the current that flows in the circuit, is I, draw a plot showing the variation of power consumed by the resistor as a function of : (a) R, keeping V constant (b) I, keeping R constant (c) V, keeping R constant	3
26	(a)Arrange the following electromagnetic waves in the descending order of their wavelengths : Microwaves, Infra-red rays, Ultra-violet radiation, Gamma rays (b) Write one use each of any two of them	3

27	A ray of light is refracted by a glass prism. Obtain an expression for the refractive index of the glass in terms of the angle of the prism A and the angle of minimum deviation δ_m.	3
28	How does Einstein's photoelectric equation explain the emission of electrons from a metal surface ? Explain briefly. Plot the variation of photocurrent with : (a) collector plate potential for different intensity of incident radiation, and (b) intensity of incident radiation.	3
	SECTION D	
29	Figure shows the variation of photoelectric current measured in a photocell circuit as a function of the potential difference between the plates of the photo cell when light beams A, B, C and D of different wavelengths are incident on the photo cell. Examine the given figure and answer the following questions :  (i) Which light beam has the highest frequency ? (a)Curve A (b)Curve B (c)Curve C (d)Curve D (ii) Which light beam has the longest wavelength? (a)Curve A (b)Curve B (c)Curve C (d)Curve D (iii) Which light beam ejects photoelectrons with maximum momentum? (a)Curve A (b)Curve B (c)Curve C (d)Curve D (iv) Photo current increases with increase in (a)Intensity (b)Frequency (c) Potential (d)Wavelength (OR) (v) Stopping Potential increases with increase in (a)Intensity (b)Frequency (c) wavelength (d) Photo current	4
30	A semiconductor diode is basically a pn junction with metallic contacts provided at the ends for the application of an external voltage. It is a two-terminal device. When an external voltage is applied across a semiconductor diode such that the p-side is connected to the positive terminal of the battery and the n-side to the negative terminal, it is said that to be forward – biased. When an external voltage is applied across the diode such that the n-side is positive and the p-side is negative, it is said to be reverse – biased. An ideal diode is one whose resistance in forward biasing is zero and the resistance is infinite in reverse biasing. When the diode is forward biased, it is found that beyond forward voltage called knee voltage, the conductivity is very high. When the biasing voltage is more than the knee voltage the potential barrier is overcome and the current increases rapidly with an increase in forward voltage. When the	4

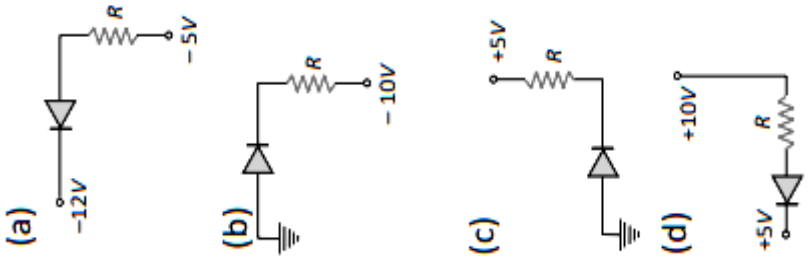
diode is reverse biased, the reverse bias voltage produces a very small current of about a few microamperes which almost remains constant with bias. This small current is a reverse saturation current.



i.In the given figure, a diode D is connected to an external resistance R = 100 Ω and an emf of 3.5 V. If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be

(a) 40 mA (b) 20 mA (c) 35 mA (d) 30 mA

ii. In which of the following figures, the pn diode is reverse biased?



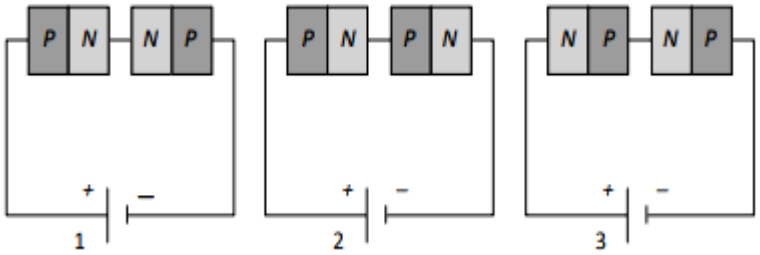
iii. Based on the V-I characteristics of the diode, we can classify diode as

(a)bilateral device (b) ohmic device

(c) non-ohmic device (d) passive element

(OR)

Two identical PN junctions can be connected in series by three different methods as shown in the figure. If the potential difference in the junctions is the same, then the correct connections will be



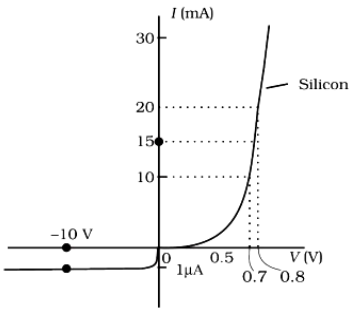
(a) in the circuits (1) and (2) (b) in the circuits (2) and (3)

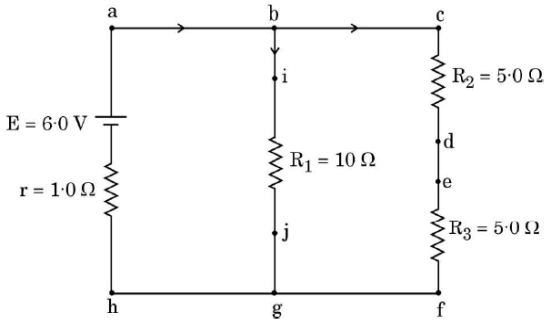
(c) in the circuits (1) and (3) (d) only in the circuit (1)

iv)The V-I characteristic of a diode is shown in the figure. The ratio of the resistance of the diode at I = 15 mA to the resistance at V = -10 V is

(a) 100 (b) 10^6

(c) 10 (d) 10^{-6}



	SECTION E	
31	(a) (i) Write the principle and explain the working of a moving coil galvanometer. A galvanometer as such cannot be used to measure the current in a circuit. Why ? (ii) Why is the magnetic field made radial in a moving coil galvanometer ? How is it achieved ? (OR) (b) (i) Derive an expression for magnetic field on the axis of a current carrying circular loop. (ii) Write any two points of difference between a diamagnetic and a paramagnetic substance.	5
32	The following figure shows a circuit diagram. We can find the currents through and potential differences across different resistors using Kirchhoff's rules.  (a) Which points are at the same potential in the circuit ? (b) What is the current through arm bg ? (c) Find the potential difference across resistance R_3. (d) What is the power dissipated in resistance R_2 ? (OR) (i) Define electric potential at a point and write its SI unit. (ii) Two capacitors are connected in series. Derive an expression of the equivalent capacitance of the combination. (iii) 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.	5
33	(a) (i) Draw a ray diagram to show how the final image is formed at infinity in an astronomical refracting telescope. Obtain an expression for its magnifying power. (ii) The magnifying power of an astronomical telescope is 8 and the distance between the two lenses is 54cm. Find the focal length of eye lens and objective lens. (OR) (b)(i)State Huygens principle. With the help of a diagram, show how a plane wave is refracted from a surface. Hence verify the law of refraction. (ii) Two coherent monochromatic light beams of intensities I and 4 I superpose each other. Find the ratio of maximum and minimum intensities in the resulting beam.	5

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SAMPLE QUESTION PAPER-2: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX MARKS:70**

General Instructions

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(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.
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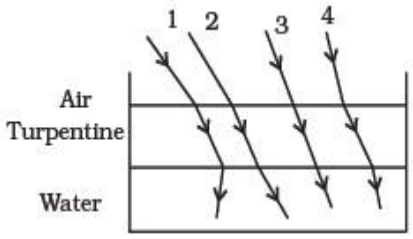
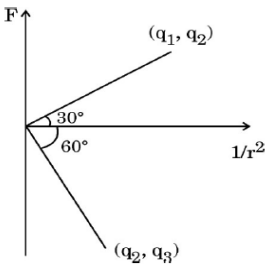
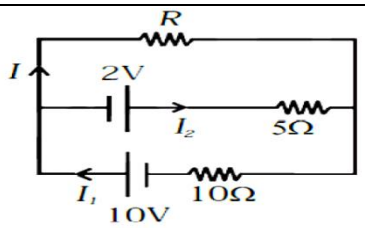
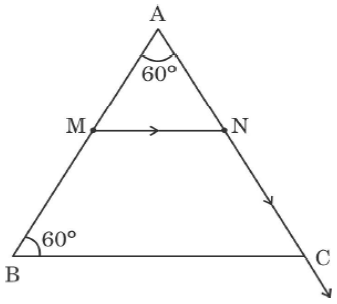
(7) You may use the following values of physical constants wherever necessary

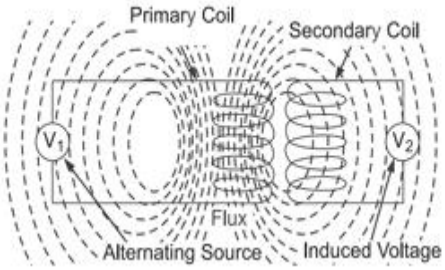
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$ C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
viii Avogadro's number = 6.023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

Q. No.	SECTION – A	Marks
1	The optical density of turpentine is higher than that of water while its mass density is lower shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in the path shown is correct?  a) 1 b) 2 c) 3 d) 4	1
2	Consider a group of charges q1, q2, q3 …… such that Σq ≠ 0. Then Equipotential surfaces at a large distance, due to this group are approximately : a) Plane b) Spherical surface c) Paraboloidal surface d) Ellipsoidal surface	1
3	A straight wire is kept horizontally along east-west direction. If a steady current flows in wire from east to west, the magnetic field at a point above the wire will point towards: a) East b) West c) North d) South	1
4	Two identical small conducting balls B_1 and B_2 are given -7 pC and +4 pC charges respectively. They are brought in contact with a third identical ball B_3 and then separated. If the final charge on each ball is -2 pC, the initial charge on B_3 was: a) -2 pC b) -3 pC c) -5 pC d) -15 pC	1

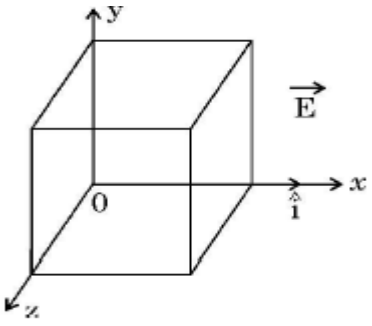
5	A galvanometer of resistance 100 Ω is converted into an ammeter of range (0-1 A) using a resistance of 0.1 Ω. The ammeter will show full scale deflection for a current of about a) 0.1 mA b) 1 mA c) 10 mA d) 0.1 A	1
6	The current in a coil of 15 mH increases uniformly from zero to 4 A in 0.004s. The emf induced in the coil will be a) 22.5 V b) 17.5 V c)15.0 V d) 12.5 V	1
7	Consider a solenoid of length l and area of cross-section A with fixed number of turns. The self-inductance of the solenoid will increase if : a) both l and A are increased b) l is decreased and A is increased c) l is increased and A is decreased d) both l and A are decreased	1
8	Coulomb force F versus $1/r^2$ graphs for two pairs of point charges (q_1 and q_2) and (q_2 and q_3) are shown in the figure. The ratio of charges $\frac{q_1}{q_3}$:  a)$\sqrt{3}$ b)$1/\sqrt{3}$ c)3 d)1/3	1
9	Electrons drift with speed vd in a conductor with potential difference V across its ends. If V is reduced to (V/2) their drift speed will become a)$\frac{v_d}{2}$ b)v_d c)$2v_d$ d) $4v_d$	1
10	In four regions I, II, III and IV, the magnetic field is given by : I. By = B0 sin kz II. By = B0 cos kz III. By = B0 sin (kz-ωt) IV. By = B0 sin kz + B0 cos kz The electromagnetic wave will exist in the region : a) IV b) I c) III d) II	1
11	In the phenomena of Diffraction of light when the violet light is used in the experiment is used instead of red light then, a) Fringe width increases b) No change in fridge width c) Fringe width decreases d) Colour pattern is formed	1
12	The path difference between two waves at the place of destructive interference is given by: a) multiple of λ b) multiple of λ /2 c) even multiple of λ /2 d) odd multiple of λ /2	1
	<u>Assertion and Reasoning (1 Mark Each)</u> For questions 13–16, choose the correct option: 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.	
13	**Assertion (A):** Electric potential (V) is a vector. **Reason (R):** In an electric field, a negative charge moves from lower potential to higher potential.	1

14	**Assertion (A):** A real object is placed on the optic axis of a lens so that an erect image of twice the size of the object is obtained. Then the lens must be a convex lens. **Reason (R):** Erect image of a real object can be formed by a concave lens as well as convex lens.	1
15	**Assertion (A):** Bohr said that the electrons in stationary orbits around the nucleus do not radiate. **Reason (R):** According to the classical physics, all moving electrons radiate.	1
16	**Assertion (A):** Two long parallel wires, freely suspended and connected in series to a battery, move apart. **Reason (R):** Two wires carrying current in opposite directions repel each other.	1
	SECTION B	
17	Two cells of E.M.F. 10 V and 2 V and internal resistances 10 Ω and 5 Ω respectively, are connected in parallel as shown. Find the effective voltage across R. 	2
18	Name the electromagnetic waves which are produced by the following : (i) Welding arcs (ii) Hot bodies. Write one use each of these waves.	2
19	Two crystals C_1 and C_2 made of pure silicon, are doped with arsenic and aluminium respectively. (i). Identify the extrinsic semiconductors so formed. (ii). Why is doping of an intrinsic semiconductor necessary?	2
20	Draw the circuit diagram for studying the V-I characteristics of a p-n junction diode in (i) forward bias and (ii) reverse bias. Draw the typical V-I characteristics of a silicon diode.	2
21	(a)(i)Define the terms :'impact parameter' and 'distance of closest approach' for an α -particle in Geiger-Marsden scattering experiment. (ii) What will be the value of the impact parameter for scattering angle (I) θ = 0 and (II) θ = 180 ? (OR) (b) Photoelectric emission occurs when a surface is irradiated with the radiation of frequency (i) v_1, and (ii) v_2. The maximum kinetic energy of the electrons emitted in the two cases are K and 2K respectively. Obtain the expression for the threshold frequency for the surface.	2
	SECTION C	
22	(a) What is meant by relaxation time of free electrons in a conductor ? Show that the resistance of a conductor can be expressed by R = $\frac{ml}{n\tau Ae^2}$, where symbols have their usual meanings. (OR) (b) Draw the circuit diagram of a Wheatstone bridge. Obtain the condition when no current flows through the galvanometer in it.	3

23	(a). What are the potential and kinetic energies of hydrogen atom at ground state? (b). Explain Bohr's second postulate of quantization of energy level, with suitable diagram using de-Broglie's hypotheses. (OR) State Bohr's first and second postulates. Use them to derive an expression for the radius of nth orbit in a hydrogen atom.	3
24	(a)(i)State Lenz's Law. In a closed circuit, the induced current opposes the change in magnetic flux that produced it as per the law of conservation of energy. Justify. (ii)A metal rod of length 2m is rotated with a frequency 60 rev/s about an axis passing through its centre and perpendicular to its length. A uniform magnetic field of 2T perpendicular to the plane of rotation is switched-on in the region. Calculate the e.m.f. induced between the centre and the end of the rod. (OR) (b)(i)State and explain Ampere's circuital law. (ii)Two long straight parallel wires separated by 20 cm, carry 5A and 10A current respectively, in the same direction. Find the magnitude and direction of the net magnetic field at a point midway between them.	3
25	With the help of a circuit diagram, explain the working of a p-n junction diode as a full-wave rectifier. Also draw its input and output waveforms.	3
26	A ray is incident on a prism of material of refractive index $\sqrt{2}$ at point M such that it grazes along NC after emerging from the prism, as shown in the figure.  Find : (a) the critical angle for the prism. (b) the angle of refraction at face AB.	3
27	(a)Define atomic mass unit (u). (b)When 4 hydrogen nuclei combine to form a helium nucleus, estimate the amount of energy(In MeV) released in this process of fusion. Neglect the masses of electrons and neutrons. Given, (i). Mass of Hydrogen atom = 1.087825 u (ii). Mass of helium nucleus= 4.002603 u (iii). 1 u =931.5 MeV/c^2.	3
28	A photosensitive surface of work function 2.1eV is irradiated by radiation of wavelength 150 nm. Calculate (i)the threshold wavelength (ii)energy (in eV) of an incident photon, and (iii)maximum kinetic energy of emitted photoelectron.	3

	SECTION D	
29	Mutual inductance between the two coils is defined as the property of the coil due to which it opposes the change of current in the other coil, or you can say in the neighbouring coil. When the current in the neighbouring coil changes, the flux sets up in the coil and because of this, changing flux emf is induced in the coil called mutually induced emf and the phenomenon is known as mutual inductance.  The value of mutual inductance (M) depends upon the following factors: 1.Number of turns in the secondary or neighbouring coil, 2.Cross-sectional area, 3.Closeness of the two coils. When on a magnetic core, two or more than two coils are wound, the coils are said to be mutually coupled. The current, when passed in any of the coils wound around the magnetic core, produces flux which links all the coils together and also the one in which current is passed. Hence, there will be both self-induced emf and mutual induced emf in each of the coils. The best example of the mutual inductance is the transformer, which works on the principle of Faraday's law of electromagnetic induction. Faraday's law of electromagnetic induction states that, "the magnitude of voltage is directly proportional to the rate of change of flux." Read the given passage carefully and give the answer of the following questions: 1. The phenomenon due to which there is an induced current in one coil due to current in a neighbouring coil is: (a). electromagnetism (b). susceptance (c). mutual inductance (d). steady current 2. Mutual inductance between two magnetically coupled coils depends on: (a). permeability of the core material (b). number of the turns of the coils (c). cross-sectional area of their common core (d). All of the above 3. Which of the following is a unit of inductance? (a). Ohm (b). Henry (c). Ampere (d). Weber/meter 4. Which of the following circuit elements will oppose the change in circuit current?	4

	(a). Capacitance (b). Inductance (c). Resistance (d). All of these 5. If in an iron cored coil, the iron core is removed so as to make the air cored coil, the inductance of the coil will be: (a). more (b). less (c). the same (d). None of these	
30	The British physicist Thomas Young explained the interference of light using the principle of superposition of waves. He observed the interference pattern on the screen, in his experimental set double slit experiment. The two slits S_1 and S_2 were illuminated by light from a slit S. The interference pattern consists of dark and bright bands of light. Such bands are called fringes. The distance between two consecutive bright and dark fringes is called fringe width. 1.If the screen is moved closer to the plane of slits S_1 and S_2, then the fringe width : (a) will decrease, but the intensity of bright fringe remains the same. (b) will increase, but the intensity of bright fringe decreases. (c) will decrease, but the intensity of bright fringe increases. (d) and the intensity both remain the same. 2. What will happen to the pattern on the screen, when the two slits S_1 and S_2 are replaced by two independent but identical sources ? (a) The intensity of pattern will increase (b) The intensity of pattern will decrease (c) The number of fringes will become double (d) No pattern will be observed on the screen 3. Two sources of light are said to be coherent, when both emit light waves of : (a) same amplitude and have a varying phase difference. (b) same wavelength and a constant phase difference. (c) different wavelengths and same intensity. (d) different wavelengths and a constant phase difference. 4. The fringe width in a Young's double slit experiment is β. If the whole set-up is immersed in a liquid of refractive index 'μ', then the new fringe width will be : (a) β (b) β μ (c) $\frac{\beta}{\mu}$ (d) $\frac{\beta}{\mu^2}$ 5. The total path difference between two waves meeting at points P_1 and P_2 on the screen are $\frac{3\lambda}{2}$ and 2 λ respectively. Then : (a) bright fringes are formed at both points. (b) dark fringes are formed at both points.	4

	(c) a bright fringe is formed at P_1 and a dark fringe is formed at P_2. (d) a bright fringe is formed at P_2 and a dark fringe is formed at P_1	
	SECTION E	
31	(i)You are given three circuit elements X, Y and Z. They are connected one by one across a given ac source. It is found that V and I are in phase for element X. V leads I by $(\frac{\pi}{4})$ for element Y while I leads V by $(\frac{\pi}{4})$ for element Z. Identify elements X, Y and Z. (ii)Establish the expression for impedance of circuit when elements X, Y and Z are connected in series to an ac source. Show the variation of current in the circuit with the frequency of the applied ac source. (iii)In a series LCR circuit, obtain the conditions under which (a)impedance is minimum and (b) wattles current flow in the circuit. (OR) (i)Explain with the help of a labelled diagram, the principle and working of an ac generator and obtain expression for the emf generated in the coil. (ii) Draw a schematic diagram showing the nature of the alternating emf generated by the rotating coil in the magnetic field during one cycle.	5
32	(i)A dielectric slab of dielectric constant 'K' and thickness 't' is inserted between plates of a parallel plate capacitor of plate separation d and plate area A. Obtain an expression for its capacitance. (ii)Two capacitors of different capacitances are connected first (1) in series and then (2) in parallel across a dc source of 100 V. If the total energy stored in the combination in the two cases are 40 mJ and 250 mJ respectively, find the capacitance of the capacitors. (OR) (i)Using Gauss's law, show that the electric field $\vec{E}$ at a point due to a uniformly charged infinite plane sheet, is given by $\vec{E} = \frac{\sigma}{2\epsilon_0}\hat{n}$ where symbols have their ususal meanings. (ii)Electric field $\vec{E}$ in a region is given by $\vec{E} = (5x^2 + 2)\,\hat{\imath}$ where E is in N/C and x is in metres. A cube of side 10 cm is placed in the region as shown in figure.  Calculate (1) the electric flux through the cube, and (2) the net charge enclosed by the cube.	5
33	(i)Draw a labelled ray diagram of a compound microscope when image is formed at least distance of distinct vision.	5

	(ii)Define its magnifying power and deduce the expression for the magnifying power of the microscope. (iii)A compound microscope has a magnifying power of 100 when the image is formed at infinity. The objective has a focal length of 0.5cm and the tube length is 6.5cm. Find the focal length of the eyepiece (OR) When a parallel beam of monochromatic source of light of wavelength λ is incident on a single slit of width , show how the diffraction pattern is formed at the screen by the interference of the wavelets from the slit. (i)Show that, besides the central maximum at θ = 0, secondary maxima are observed at $\theta_n = (n+\frac{1}{2})\lambda/a$ & minima at $\theta_n = n\lambda/a$. (ii) Show that angular width of central maximum is twice the angular width of secondary maximum and hence find the relation for linear width of central maximum.	

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SAMPLE QUESTION PAPER-3: 2025-26

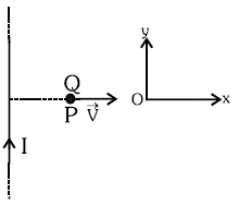
CLASS: XII **SUBJECT: PHYSICS**

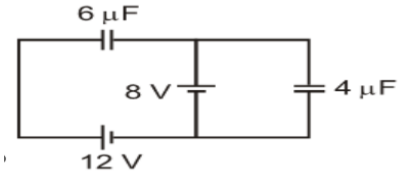
TIME:3Hrs **MAX MARKS:70**

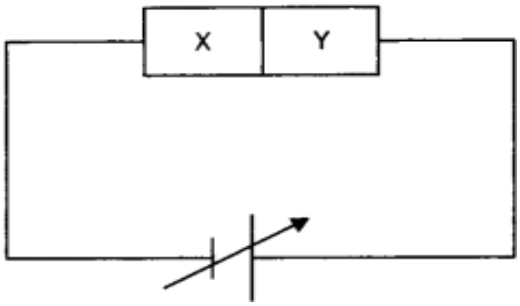
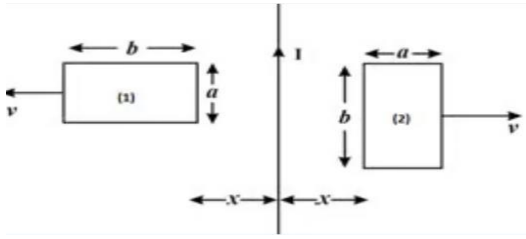
General Instructions

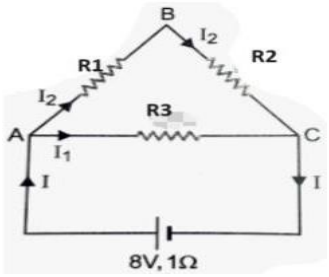
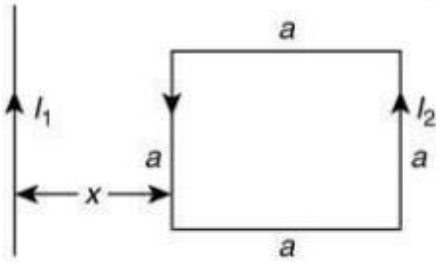
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark 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 wherever necessary

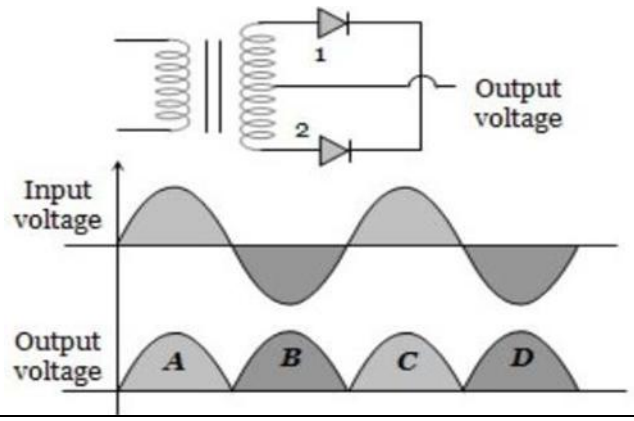
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$ C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m $\boldsymbol{A^{-1}}$
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
viii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

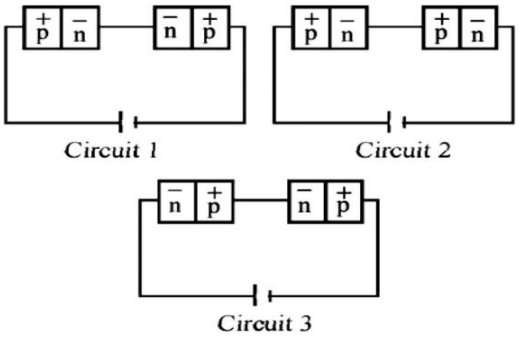
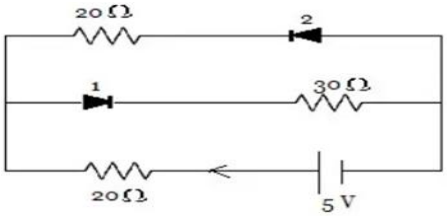
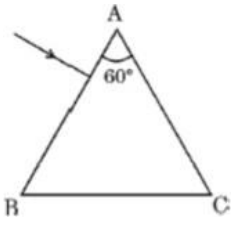
Q. No	Section A	Mark
1	When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential $\frac{V}{4}$ is the threshold wavelength for the metallic surface a) 3λ b) $\frac{5}{2}\lambda$ c) 4λ d) 5λ	1
2	A particle having a charge q_1 exerts F electrostatic force on the charge q_2 at rest. If a particle has a charge $\frac{q_1}{4}$ is placed midway between the line joining the two charges q_1 and q_2. Then electrostatic force on q_2 due to q_1 will become/remain a) 2F b) $\frac{F}{2}$ c) F d) zero.	1
3	An α-particle of energy 5 MeV is scattered through 180∘ by a fixed uranium nucleus. The distance of the closest approach is of the order of a) 10^{-10} m b) 10^{-13} m c) 10^{-14} m d) 10^{-16} m	1
4	A very long straight wire carries a current I. At the instant when a charge +Q at point P has velocity $\vec{v}$, as shown, the force on the charge is:- a) along OX b)along OY c)opposite to OX d)opposite to OY 	1
5	There are four lightweight rod samples A, B, C, and D separately suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted: i) A is feebly repelled ii) B is feebly attracted	1

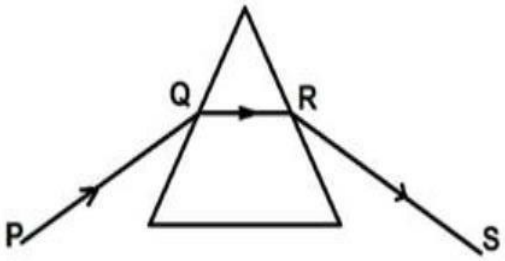
	iii) C is strongly attracted iv)D remains unaffected Which of the following is true? a) C is of a diamagnetic material b) D is of a ferromagnetic material c) A is of a non-magnetic material d) B is of a paramagnetic material	
6	In order to pass 10% of the main current through a moving coil galvanometer of 99 Ω, the resistance of the required shunt is: a) 9 Ω b) 9.9 Ω c) 10 Ω d) 11 Ω	1
7	In the circuit shown in the figure, energy stored in 6 μF capacitor will be:  a) 48 x 10^{-6}J b)32 x 10^{-6}J c)96 x 10^{-6}J d)24 x 10^{-6}J	1
8	The slope of stopping potential versus frequency of incident light graph for a given photo sensitive surface will be (h = Planck's constant) (a) h (b) h/e (c) eh (d) e	1
9	A transformer is used to light a 100W and 110V lamp from 220V mains. If the main current is 0.5A, the efficiency of the transformer is approximately: a) 90% b)50% c)30% d)10%	1
10	If E and B denote electric and magnetic fields respectively, which of the following is dimensionless? a) $\sqrt{\mu_o \epsilon_o}\ \frac{E}{B}$ b) $\mu_o \epsilon_o \frac{E}{B}$ c) $\mu_o \epsilon_o \left(\frac{E}{B}\right)^2$ d) $\frac{E}{\epsilon_o} X \frac{\mu_o}{B}$	1
11	The de-Broglie wavelength depends upon mass m and energy E according to the relation represented as (a) $m E^{1/2}$ (b) $E m^{1/2}$ (c) $m^{-1/2} E^{-1/2}$ (d) $m^{-1/2} E^{1/2}$	1
12	The ratio of the energies of the hydrogen atom in its first to second excited states is a) $\frac{1}{4}$ b) $\frac{4}{9}$ c) $\frac{9}{4}$ d) 4	1
	For Question 13 to 16, two statements are given – one labelled as Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options given below: A. Assertion and Reason are true and Reason is the correct explanation of Assertion. B. 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 electrical conductivity of a semiconductor increases on doping. Reason (R): Doping always increases the number of electrons in the semiconductor	1
14	Assertion(A): In Young's double slit experiment if the wavelength of incident monochromatic light is just doubled, the number of bright fringes on the screen will increase. Reason(R): The maximum number of bright fringes on the screen is directly proportional to the wavelength of light used.	1

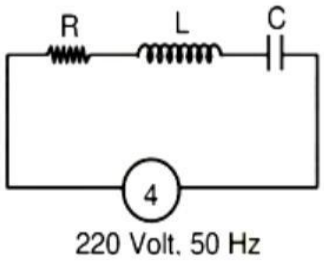
15	Assertion(A): If a convex lens is placed in water, its converging power decreases. Reason(R): The focal length of the convex lens relative to water is greater than that relative to air.	1
16	Assertion(A): The resistance of a given mass of copper wire is inversely proportional to the square of length. Reason(R): When a copper wire of a given mass is stressed to increase its length, its cross- sectional area also increases.	1
	Section B	
17	Two semiconductor materials X and Y, shown in the given figure, are made by doping a germanium crystal with indium and arsenic respectively. The two are joined end to end and connected to a battery as shown.  a) Will the junction be forward-biased or reverse-biased? b) Sketch a V-I graph for this arrangement.	2
18	a) Red light, however bright it is, cannot produce the emission of electrons from a clean zinc surface, but even weak ultraviolet radiation can do so, why? b) X-rays of wavelength λ fall on a photosensitive surface, emitting electrons. Assuming that the work function of the surface can be neglected, prove that the de Broglie wavelength of electrons emitted will be $\sqrt{\frac{h\lambda}{2mc}}$.	2
19	The figure shows two identical rectangular loops (1) and (2), placed on a table along with a straight long current carrying conductor between them.  a) What will be the directions of the induced currents in the loops when they are pulled away from the conductor with same velocity v? b) Will the emf induced in the two loops be equal? Justify your answer	2
20	A cell of emf E and internal resistance r is connected to two external resistances R_1 and R_2 and a perfect ammeter. The current in the circuit is measured in four different situations: (i) without any external resistance in the circuit. (ii) with resistance R_1 only (iii) with R_1 and R_2 in series combination (iv) with R_1 and R_2 in parallel combination. The currents measured in the four cases are 0.42 A, 1.05 A, 1.4 A and 4.2 A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above.	2

21	A figure divided into squares each of size $1mm^2$ is being viewed at a distance of 8 cm through a converging lens of focal length 12cm. a) What is the magnification produced by the lens? b) How much is the area of each square in the virtual image? OR Three immiscible liquids of densities d1 > d2 > d3 and refractive indices μ1 > μ2 > μ3 are put in a beaker. The height of each liquid column is h/3. A dot is made at the bottom of the beaker. For near normal vision, find the apparent depth of the dot.	2
	Section C	
22	a) What characteristic property of nuclear force explains the constancy of binding energy per nucleon (BE/A) in the range of mass number 'A' lying 30 < A < 170? b) Show that the density of a nucleus over a wide range of nuclei is constant, independent of mass number.	3
23	A molecule of a substance has a permanent electric dipole moment of magnitude equal to $10^{-29}\ Cm$. A mole of this substance is polarized (at low temperature) by applying a strong electrostatic field of magnitude (10^0 Vm^{-1}). The direction of the field is suddenly changed by an angle of 60∘. Estimate the heat released by the substance in aligning its dipole along the new direction of the field. For simplicity, assume 100% polarization of sample.	3
24	The uniform wire of resistance 12 Ω is cut into three pieces so that the ratio of the resistances $R_1 : R_2 : R_3 = 1 : 2 : 3$ and the three pieces are connected to form a triangle across which a cell of emf 8V and internal resistance 1 Ω is connected as shown. Calculate the current through each part of the circuit.  	3
25	Using de Broglie's hypothesis, explain with the help of a suitable diagram, Bohr's second postulate of quantization of energy levels in a hydrogen atom.	3
26	a) Write the expression for the magnetic moment ($\vec{M}$) due to a planar square loop of side 'l' carrying a steady current I in a vector form. b) A square loop of side 'a' carrying a current l2 is kept at a distance x from an infinitely long straight wire carrying a current l1 as shown in the figure. Obtain the expression for the resultant force acting on the loop.  OR Two long straight parallel conductors carry steady currents l1 and l2 separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field set up in one produces an attractive force on the other. Obtain the expression for this force. Hence define one ampere.	3

27	(a) Use Huygen's principle to verify the laws of refraction. (b) Draw the diagrams to show the behavior of plane wavefronts as they (i) pass through a thin convex lens and (ii) reflect by a concave mirror.	3
28	a) Define the term 'self-inductance' of a coil. Write its S.I. unit. b) Show that magnetic energy required to build up the current I in a coil of self-inductance L,is given by ½ LI^2.	3
	Section D	
29	**Read the following paragraph and answer the question that follows.** A diode is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance). It has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other. A semiconductor diode, the most commonly used type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals. It has an exponential current–voltage characteristic. Semiconductor diodes were the first semiconductor electronic devices. The discovery of asymmetric electrical conduction across the contact between a crystalline mineral and a metal was made by German physicist Ferdinand Braun in 1874. Today, most diodes are made of silicon, but other semiconducting materials such as gallium arsenide and germanium are also used. The obsolete thermionic diode is a vacuum tube with two electrodes, a heated cathode and a plate, in which electrons can flow in only one direction, from cathode to plate. Among many uses, diodes are found in rectifiers to convert alternating current (AC) power to direct current (DC), demodulation in radio receivers, and can even be used for logic or as temperature sensors. A common variant of a diode is a light-emitting diode, which is used as electric lighting and status indicators on electronic devices. i. A full wave rectifier circuit along with the input and output voltages is shown in the figure The contribution to output voltage from diode-2 is a). A,C b). B,D c) B,C d). A,D 	4

	ii. Two identical p-n junction may be connected in series with a battery in three ways as shown in the adjoining figure. The potential drop across the p-n junctions are equal in  a) First and second circuits b)Second and third circuits c) Third and first circuits d) All of these iii) Current in the circuit will be  a)5/40 A b) 5/50A c) 5/10 A d) 5/20A iv) In half wave rectification, if the input frequency is 60 Hz, then the output frequency would be: a) 30 Hz b)60 Hz c) 120 Hz d) Zero OR The breakdown in a reverse biased p-n junction is more likely to occur due to : a) Large velocity of the majority charge carriers if the doping concentration is small. b) Large velocity of the minority charge carriers if the doping concentration is small. c) Strong electric field in a depletion region if the doping concentration is small. d) Strong electric field in a depletion region if the doping concentration is large	
30	**Read the following paragraph and answer the question that follows**. Strontium titanate is a rare oxide – a natural mineral found in Siberia. It is used as a substitute for diamonds because its refractive index and critical angle are 2.41 and 24.5, respectively, which are approximately equal to the refractive index and critical angle of diamond. It has all the properties of diamond. Even an expert jeweler is unable to differentiate between diamond and strontium titanate. A ray of light is incident normally on one face of an equilateral triangular prism ABC made of strontium titanate.  	4

	i. A ray of light is incident on an equilateral glass prism placed on a horizontal table. For minimum deviation, which of the following is true?  a). RS is horizontal b)either PQ or RS is horizontal c) QR is horizontal d)PQ is horizontal (ii) The refractive index of an equilateral triangular prism kept in air is $\sqrt{2}$. Calculate the angle of minimum deviation a) 30^0 b)45^0 c)60^0 d) 90^0 iii. 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 iv. A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is 5^o and the prism is made of a material of refractive index 1.5, the angle of incidence is a) 7.5^0 b)5^0 c)15^0 d) 2.5^0 **OR** The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is 30^o.One of the two refracting surfaces of the prism is made a mirror inwards, by silver coating. A beam of monochromatic light entering the prism from the other face will retrace its path (after reflection from the silvered surface) if its angle of incidence of the prism is (a) 60^o b)45^o c) 30^o d) zero	
	Section E	
31	(a) Draw a labelled ray diagram of a compound microscope and write an expression for its magnifying power. (b) The focal length of the objective and eye-lens of a compound microscope are 2 cm and 6.25 cm respectively. The distance between the lenses is 15 cm. (i) How far from the objective lens, will the object be kept, so as to obtain the final image at the near point of the eye? (ii) Also calculate its magnifying power. **OR** (a) State the importance of coherent sources in the phenomenon of interference. (b) In Young's double slit experiment, the two slits 0.12 mm apart are illuminated by monochromatic light of wavelength 420 nm. The screen is 1.0 m away from this slits. Find the distance of the second (a) bright fringe, (b) dark fringe from the central	5

	maximum. (c) Show that the angular width of the first diffraction fringe is half of that of the central fringe. (d) If a monochromatic source of light is replaced by white light, what change would you observe in the diffraction pattern?	
32	a) Draw the diagram of a device which is used to decrease high ac voltage into a low ac voltage and state its working principle. Write four sources of energy loss in this device. b) A small town with a demand of 1200 kW of electric power at 220 V is situated 20 km away from an electric plant generating power at 440 V. The resistance of the two-wire line carrying power is 0.5 Ω per km. The town gets the power from the line through a 4000 – 220 V step-down transformer at a substation in the town. Estimate the line power loss in the form of heat. **OR** A voltage $V=V_0 \sin \omega t$ is applied to a series LCR circuit. Derive the expression for the average power dissipated over a cycle. a) Under what condition is no power dissipated even though the current flows through the circuit. b) In LCR ac circuit $V_L = V_C = 2 V_R$ and R = 5 , if $L = \frac{1}{K\Pi}$ then find K. 	5
33	a) Derive an expression for the electric field E due to a dipole of length ′2a′ at a point distant r from the centre of the dipole on the axial line. b) Draw a graph of E versus r for r >>a. c)If this dipole were kept in a uniform external electric field E_0, diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both cases. **OR** a) Using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it. b) An infinitely large thin plane sheet has a uniform surface charge density +σ. Obtain the expression for the amount of work done in bringing a point charge q from infinity to a point, distant r, in front of the charged plane sheet.	5

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SAMPLE QUESTION PAPER-4: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

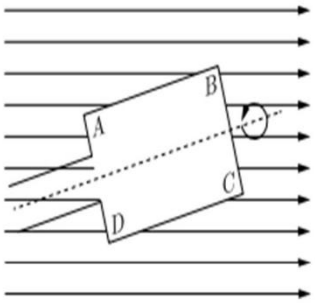
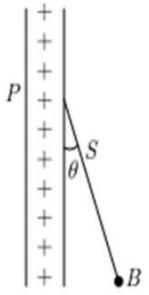
TIME:3Hrs **MAX MARKS:70**

General Instructions

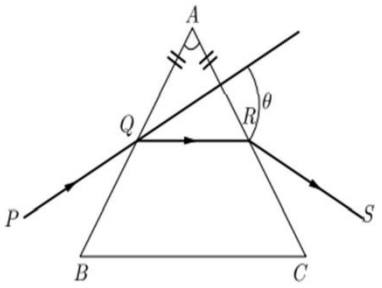
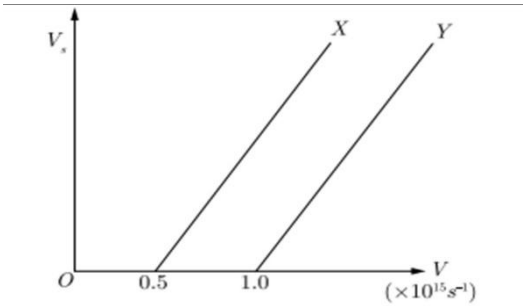
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark 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 wherever necessary

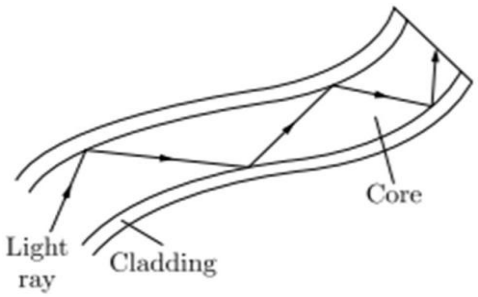
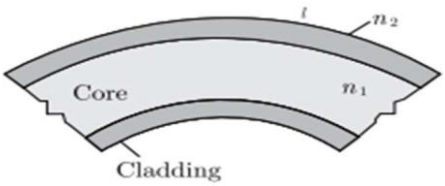
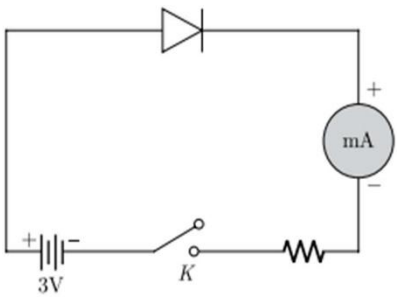
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$ C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m $\boldsymbol{A^{-1}}$
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
viii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

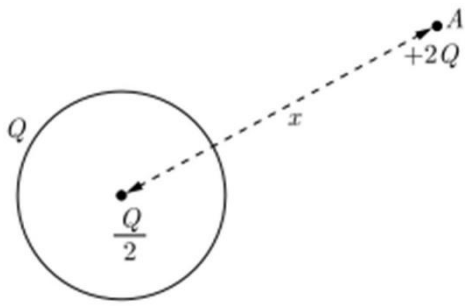
Q.No.	Section A	Mark
1	The ratio of no. of turns of primary coil to secondary coil in a transformer is 2:3. If a cell of 6 V is connected across the primary coil, then voltage across the secondary coil will be (a) 3 V (b) 6 V (c) 9 V (d) 12 V	1
2	When paramagnetic placed in external uniform magnetic field, it tends to move (a) From stronger to weaker part of the field (b) From weaker to stronger part of the field (c) remains stationary (d) First move from stronger to weaker and after some time it reverses its direction.	1
3	An electromagnetic wave of frequency 3 MHz passes from vacuum into a medium with dielectric constant k = 4. Then (a) both wavelength and frequency remain unchanged (b) wavelength is doubled, and frequency becomes half (c) wavelength is halved, and frequency remains unchanged (d) wavelength is doubled, and the frequency remains unchanged	1
4	Two charged spheres separated by a distance d exert some force F on each other. If they are immersed in a liquid of dielectric constant 4, then what is the force exerted, if all other conditions are same? (a) 2F (b) 4F (c) F/2 (d) F/4	1
5	In a LCR-circuit, the potential difference between the terminals of the inductance is 60 V, between terminals of the capacitor is 30 V and between the terminals of the resistance is 40 V. The supply voltage will be (a) 25 V (b) 50 V (c) 100 V (d) 200 V	1

6	A rectangular coil ABCD is rotated anticlockwise with a uniform angular velocity about the axis shown in the figure. Initially, the axis of rotation of the coil as well as the magnetic field B were horizontal. The induced E.M.F. in the coil would be maximum when plane of the coil:-  (a) Is horizontal (b) Is at right angle to the magnetic field (c) Makes an angle of 30^o with the horizontal (d) Makes an angle of 45^o with the direction of magnetic field.	1
7	The value of current, flowing through an inductor of inductance 1 H and having negligible resistance when connected to an AC source of 200 V and 50 Hz, is (a) 0.64 A (b) 1.64 A (c) 2.64 A (d) 3.64 A	1
8	When a ray of light enters a glass slab its wavelength (a) decreases (b) increases (c) remains unchanged (d) data are not complete	1
9	A charged particle moving in a magnetic field experiences a resultant force (a) In the direction of field (b) In the direction opposite to that field (c) In the direction perpendicular to both the field and its velocity (d) Equal to zero	1
10	A charged ball B hangs from a silk thread S, which makes an angle θ with a large charged conducting sheet P, as shown in figure, the surface charge density is σ of the sheet is proportional to ___  (a). sin θ (b) cos θ (c) tan θ (d) cot θ	1
11	A parallel plate capacitor with oil between the plates (dielectric constant of oil K = 2) has a capacitance C. If the oil is removed, then capacitance of the capacitor becomes (a) $\sqrt{2}$C (b) 2C (c) $\frac{C}{\sqrt{2}}$ (d) $\frac{C}{2}$	1
12	A diamagnetic material in a magnetic field moves (a) from weaker to stronger parts (b) perpendicular to the field (c) from stronger to weaker parts (d) in none of the above directions	1
	For Question 13 to 16, two statements are given – one labelled as Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below:	

	A. Assertion and Reason are true and Reason is the correct explanation of Assertion. B. 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: Thin films such a soap bubble or a thin layer of oil on water show beautiful colours when illuminated by white light. Reason: It happens due to the interference of light reflected from the upper surface of the thin film	1
14	**Assertion:** The diffusion current in a p-n junction is from the p-side to the n-side. **Reason:** The diffusion current in a p-n junction is greater than the drift current when the junction is in forward biased.	1
15	Assertion: The resistance offered by an inductor in a d.c. circuit is always constant. Reason: The resistance of inductor in steady state is non-zero.	1
16	Assertion (A): No two electric lines of force can intersect each other. Reason (R): Tangent at any point of electric line of force gives the direction of electric field.	1
	Section B	
17	An electron and alpha particle have the same de-Broglie wavelength associated with them. How are their kinetic energies related to each other?	2
18	Write down the equation of induced current at any instant in L-C-R circuit when circuit is inductive.	2
19	(i) Write two characteristic features of nuclear force. (ii) Draw a plot of the potential energy of a pair of nucleons as a function of their separation.	2
20	Two nuclei have mass numbers in the ratio 1: 2. What is the ratio of their nuclear densities?	2
21	Draw the voltage-current characteristic curve of a diode and mark its important parameter. OR Draw V- I characteristics of a p-n junction diode. Answer the following questions, giving reasons: (i) Why is the current under reverse bias almost independent of the applied potential up to a critical voltage? (ii) Why does the reverse current show a sudden increase at the critical voltage?	2
	Section C	
22	Define the terms drift velocity and relaxation time. Establish the relation between drift velocity of electrons and electric field applied to the conductor.	3
23	A capacitor of capacitance C is charged fully by connecting it to a battery of emf E. It is then disconnected from the battery. If the separation between the plates of the capacitor is now doubled, how will the following change?	3

	(i) charge stored by the capacitor. (ii) field strength between the plates. (iii) energy stored by the capacitor	
24	Name the parts of the electromagnetic spectrum which is: (a) Suitable for radar systems used in aircraft navigation. (b) Used to treat muscular strain. (c) Used as a diagnostic tool in medicine. Write in brief, how these waves can be produced.	3
25	Applying Biot-Savart's law deduce the expression for the magnetic field at the axial point of a circular current carrying coil. Hence write the expression for magnetice field at centre of a semicircular loop of radius R carrying current I.	3
26	A ray PQ incident on the refracting face BA is refracted in the prism ABC as shown in the figure and emerges from the other refracting face AC as RS such that AQ = AR. If angle of prism A = 60o and refractive index of material of prism is $\sqrt{3}$ calculate angle θ 	3
27	The ground state energy of hydrogen atom is -13. 6 eV. If an electron makes a transition from an energy level -0 8. e 5 V to -3 4. eV, calculate the wavelength of the spectral line emitted. To which series of hydrogen spectrum does this wavelength belong?	3
28	Explain briefly the reasons why wave theory of light is not able to explain the observed features of photo-electric effect. OR  The following graph shows the variation of stopping potential Vs with the frequency (ν) of the incident radiation for two photosensitive metals X and Y . (i) Which of the metals has larger threshold wavelength? Give reason. (ii) Explain giving reason which metal gives out electrons having larger kinetic energy, for the same wavelength of the incident radiation. (iii) If the distance between the light source and metal X is halved, what will be the kinetic energy of electrons emitted due to this change? Give reason.	3
	Section D	
29	Read the following paragraph and answer the question that follows. An optical fibre is a thin tube of transparent material that allows light to pass through, without being refracted into the air or another	4

	external medium. It make use of total internal reflection. These fibres are fabricated in such a way that light reflected at one side of the inner surface strikes the other at an angle larger than critical angle. Even, if fibre is bent, light can easily travel along the length.  (i) Which of the following is based on the phenomenon of total internal reflection of light? (a) Sparkling of diamond (b) Optical fibre communication (c) Instrument used by doctors for endoscopy (d) All of these (ii) A ray of light will undergo total internal reflection inside the optical fibre, if it (a) goes from rarer medium to denser medium (b) is incident at an angle less than the critical angle (c) strikes the interface normally (d) is incident at an angle greater than the critical angle (iii) If in core, angle of incidence is equal to critical angle, then angle of refraction will be (a) 0° (b) 45° (c) 90° (d) 180° (iv) In an optical fibre (shown), correct relation for refractive indices of core and cladding is  (a). n1 = n2 (b) n1 > n2 (c) n1 < n2 (d) n1 + n2 =2 OR (v) If the value of critical angle is 30° for total internal reflection from given optical fibre, then speed of light in that fibre is, in m/s: (a) 3 X 10^8 (b) 1.5 X 10^8 (c) 6 X 10^8 (d) 4.5 X 10^8.	
30	Read the following paragraph and answer the question that follows. The potential barrier in the p-n junction diode is the barrier in which the charge requires additional force for crossing the region. In other words, the barrier in which the charge carrier stopped by the obstructive force is known as the potential barrier. When a p-type semiconductor is brought into a close contact with n-type semiconductor, we get a p-n junction with a barrier potential 0.4 V and width of depletion region is 4 0 10-7 This p-n junction is forward biased with a battery of voltage 3 V and negligible  	4

	internal resistance, in series with a resistor of resistance R, ideal millimeter and key K as shown in figure. When key is pressed, a current of 20 mA passes through the diode. (i). The intensity of the electric field n the depletion region when p-n junction is unbiased is (a) 0.5×10^4 Vm^{-1} (b) 1.0×10^4 Vm^{-1} (c) 2.0×10^4 Vm^{-1} (d) 1.5×10^4 Vm^{-1} (ii). The resistance of Resistor R is _____ (a) 150Ω (b) 300 Ω (c) 130 Ω (d) 180 Ω (iii). In a p-n junction the potential barrier is due to the charges on either side of the junction, these charges are (a) Majority carriers (b) minority carriers (b) Both (a) and (b) (d) fixed donor and acceptor ions. (iv). If the voltage of the potential barrier is Vo. A voltage V is applied to the input,m at what moment will the barrier disappear? (a) V < Vo (b) V = Vo (c) V > Vo (d) V <<< Vo. OR (iv). If an electron with speed 4.0×10^6 ms-1 approaches the p-n junction from the n-side, the speed(m/s) with which it will enter the p-side is (a). 1.39×10^5 (b) 2.78×10^5 (c) 1.39×10^6 (d) 2.78×10^6.	
	Section E	
31	A thin metallic spherical shell of radium R carries a charge Q on its surface. A point charge Q/2 is placed at the centres C and other charge +2Q is placed outside the shell at A at a distance X from the centre as shown in the figure  (i) Find the electric flux through the shell. (ii) State the law used. (iii)Find the force on the charges at the centre C of the shell and at the point A. OR (a) Define electric flux. (b) State and prove Gauss theorem. (c) A square of side 1m has four charges of $+2 \times 10^{-9}$ C, 1×10^{-9} C, -2×10^{-9} and -3×10^{-9} C respectively at its corners. What is the resultant potential at the centre of the square?	5
32	(a) Draw a labeled ray diagram of compound microscope and derive an expression for its magnifying power. (b) The focal length of the objective and eye lens of a compound microscope are 2 cm, 6.25 cm respectively. The distance between the lenses is 15 cm. How far from the objective lens, will the object	5

	be kept, so as to obtain the final image at the least distance of distinct vision of the eye ? Also calculate its magnifying power. OR (a) State the essential conditions for diffraction of light. (b) Explain diffraction of light due to a narrow single slit and the formation of pattern of fringes on the screen. (c) Write the relation for width of central maximum in terms of wavelength λ width of slit a , and separation between slit and screen D. (d) If the width of the slit is made double the original width, how does it affect the size and intensity of the central band?	
33	(a) An alternating voltage V= Vo sin wt applied to a series LCR circuit drives a current given by I =Io sin (wt+θ) Deduce an expression for the average power dissipated over a cycle. (b) For circuits used for transporting electric power, a large power factor implies large power losses in transmission. Explain. Or (a) An AC source of voltage V= Vo sin wt is connected to a series combination of L,C and R. Use the phasor diagram to obtain expression for impedance of the circuit and phase angle between voltage and current. Find the condition when current will be in phase with the voltage. What is the circuit in this condition called? (b) In a series LR circuit X_L =R and power factor of the circuit is P_1, When capacitor with Capacitance C such that X_L=X_C is put in series, the power factor becomes P_2. Calculate ratio of P_1 and P_2.	5

SAMPLE QUESTION PAPER-5: 2025-26

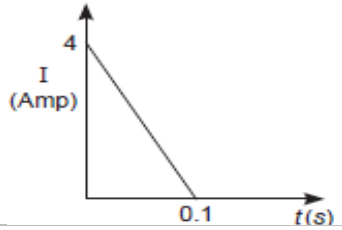
CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX MARKS:70**

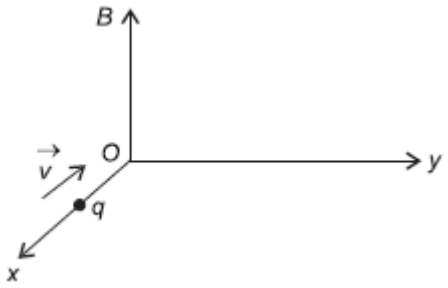
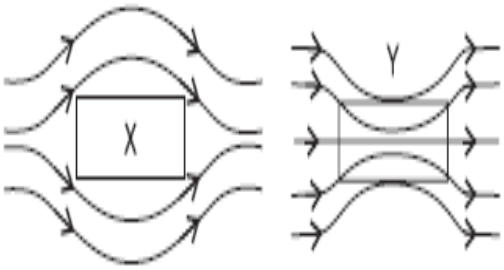
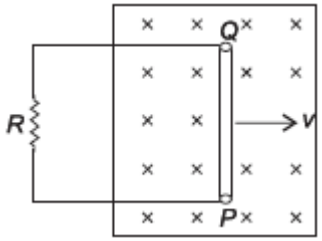
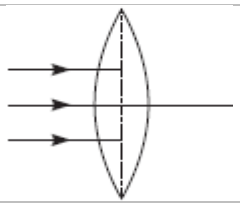
General Instructions

(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 wherever 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 A^{-1}
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
viii Avogadro's number = 6.023 X 10^{23} per gram mole

Q. No.	SECTION -A	Mark
1.	Drift velocity v_d varies with the intensity of electric field as per the relation (a). $v_d \propto E$ (b). $v_d \propto 1/E$ (c). $v_d = constant$ (d). $v_d \propto E^2$	1
2	A test charge of 1.6×10^{-19} C is moving with a velocity $\vec{v} = (4\hat{\imath} + 3\hat{k})$ m s^{-1} in a magnetic field $\vec{B} = (3\hat{k} + 4\hat{\imath})$ T. The force on this test charge is: (a). 24 $\hat{\jmath}$ N (b). -24 $\hat{\imath}$ N (c). 24 $\hat{k}$ N (d). 0	1
3.	In a coil of resistance 10 π, the induced current developed by changing magnitude of change in flux through the coil is weber is (a) 8 (b) 2 (c) 6 (d) 4 	1
4	In a coil of self-inductance 5 H, the rate of change of current is 2 As^{-1}. Then emf induced in the coil is (a) 10 V (b) – 10 V (c) 5 V (d) – 5 V	1
5	If $\vec{E}$ and $\vec{B}$ represent electric and magnetic field vector of the electromagnetic waves then the direction of propagation of the EM wave is that of (a). $\vec{E} \cdot \vec{B}$ (b). $\vec{B} \cdot \vec{E}$ (c). $\vec{E} \times \vec{B}$ (d). $\vec{B} \times \vec{E}$	1
6	Radio waves are produced by (a) accelerated motion of electrons in oscillating circuits. (b) sudden deceleration of fast moving electrons by metal target (c) heating of certain substances at particular temperature. (d) de excitation of electron from higher energy orbital to lower one.	1

7.	When a ray of light enters from one medium to another, then which of the following does not change? (a) Frequency (b) Wavelength (c) Speed (d) Amplitude	1
8.	In Young's double slit experiment, if the monochromatic source of yellow light is replaced by red light, the fringe width (a) increases (b) decreases. (c) remains unchanged. (d) the fringes disappear	1
9.	For a given kinetic energy which of the following has smallest de Broglie wavelength? (a) Electron (b) Proton (c) Deuteron (d) α-particle	1
10	Which of the following shows particle nature of light? (a) Photoelectric effect (b) Refraction (c) Interference (d) Polarization	1
11	Average binding energy is maximum for (a) C^{12} (b) Fe^{56} (c) U^{235} (d) Po^{210}	1
12	The cause of the barrier layer in a p-n junction is (a) doping (b) recombination (c) barrier (d) ions	1
	For the following question, two statements are given–one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. (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 and R is also false.	
13	**Assertion:** The total number of electric lines of force passing through a given area in a normal direction is called electric flux. **Reason:** Electric flux is a vector quantity.	1
14	**Assertion (A):** A charge moving in magnetic field experiences a force. **Reason (R):** Magnetic field is always associated with moving charge which charge which interacts with the external magnetic field.	1
15.	**Assertion**: Electromagnetic waves do not require any medium to travel. **Reason**: Electromagnetic waves cannot travel through any medium.	1
16	**Assertion**: In a half-wave rectifier if diode is short circuited the output from the rectifier will be identical to the wave of the input primary voltage. **Reason**: Since the diode is shorted, it acts as a piece of wire.	1
	SECTION-B	
17.	In a medium the force of attraction between two-point electric charges, distance *d* apart is *F*. What distance apart should these be kept in the same medium so that the force between them becomes (i) 3*F* (ii) F/3 OR An electron and a proton are released in the uniform electric field. Will they experience same force and have same acceleration?	2
18.	A charge q moving along the x-axis with a velocity $\vec{v}$ is subjected to a uniform magnetic field B acting along the z-axis as it crosses the origin O.	2

	(i) Trace its trajectory. (ii) Does the change gain kinetic energy as it enters the magnetic field? Justify your answer. 	
19.	Is the phenomenon of interference of light in accordance with the law of conservation of energy? Justify.	2
20.	The frequency of incident light on a metal surface is doubled. How will this affect the value of K.E. of emitted photoelectrons?	2
21.	Distinguish between 'intrinsic' and 'extrinsic' semiconductors.	2
	SECTION-C	
22.	Calculate the electrostatic potential energy of a system of three-point charges q_1, q_2 and q_3 located respectively at $\vec{r_2}.\vec{r_3}$ with respect to a common origin *O*. OR A conducting slab of thickness *t* is introduced without touching between the plates of a parallel plate capacitor, separated by a distance *d* (*t* < *d*). Derive an expression for the capacitance of the capacitor.	3
23	(i) A uniform magnetic field gets modified as shown below when two specimens X and Y are placed in it. Identify whether specimens X and Y are diamagnetic, paramagnetic or ferromagnetic.  (ii) How is the magnetic permeability of specimen X different from that of specimen Y?	3
24.	A conducting rod, PQ, of length l, connected to a resistor R, is moved at a uniform speed, v, normal to a uniform magnetic field, B, as shown in the figure.  (i) Deduce the expression for the emf induced in the conductor. (ii) Find the force required to move the rod in the magnetic field. (iii) Mark the direction of induced current in the conductor.	3
25.	A convex lens of material of refractive index n_1 is kept in a medium of refractive index n_2. The parallel rays of light are incident on the lens. Complete the path of rays of light refracted from the lens when (i) $n_2 = n_1$, (ii) $n_2 > n_1$ and (iii) $n_2 < n_1$. 	3

26.	What is a wavefront? How does it propagate? Using Huygens' principle, explain reflection of a plane wavefront from a surface and verify the laws of reflection.	3
27.	(i) What characteristic property of nuclear force explains the constancy of binding energy per nucleon (BE/A) in the range of mass number *A* lying 30 < A < 170? (ii) Show that the density of nucleus over a wide range of nuclei is constant independent of mass number *A*.	3
28.	Draw *V–I* characteristics of a *p–n* junction diode. Answer the following questions, giving reasons: (i) Why is the current under the reverse bias almost independent of the applied potential up to a critical voltage? (ii) Why does the reverse current show a sudden increase at the critical voltage? Name any semiconductor device which operates under the reverse bias in the breakdown region.	3
	SECTION-D	
29.	**Kirchhoff's Laws** In 1942, a German Physicist Kirchhoff extended Ohm's law to the complicated circuits and gave two laws, which enable us to determine current in any part of such a circuit. Kirchhoff's first law is also known as current law and it is based on conservation of charge whereas, his 2nd law is also known as Kirchhoff's voltage law and it is based on conservation of energy. (i) Kirchhoff's current law is based on the fact that (a) there is a possibility for a node to store energy. (b) there cannot be an accumulation of charge at a junction. (c) charge accumulation is possible at junction. (d) charge accumulation may or may not be possible. (ii) Which of the following law is used with Kirchhoff's current law? (a) Ohm's law (b) Faraday's law (c)Coulomb's law (d)Both (b) and (c) (iii) Which of the formula defines KCL where i_1, i_2 are incoming currents and i_3, i_4 are outgoing currents from a node in a circuit? (a) $i_1 + i_2 = i_3 + i_4$ (b) $i_1 + i_3 = i_2 + i_4$ (c) $i_1 - i_2 = i_3 - i_4$ (d) $i_4 - i_1 = i_1 + i_3$ (iv) Algebraic sum of voltages around any closed path in a network is equal to (a) infinity (b)1 (c) zero (d) negative polarity ***Or*** (iv) The equation $\sum E = \sum IR$, is applicable to which law? (a) Kirchhoff's first law (b) Kirchhoff's junction rule (c) Kirchhoff's second law (d) Newton's second law	4
30.	The energy levels of a hypothetical one atom are shown in figure below: n = ∞ _____ 0 eV	4

	n = 5 _____ –0.80 eV n = 4 _____ –1.45 eV n = 3 _____ –3.08 eV n = 2 _____ –5.30 eV n = 1 _____ –15.6 eV (i) What is the ionization potential of the atom? (a) –15.6 V (b) 15.6 V (c) 3.08 V (d) –3.08 V (ii) What is the short wavelength limit of the series terminating at n = 2? (a) l = 1339 Å (b) l = 4335 Å (c) l = 2339 Å (d) l = 1578 Å (iii) What is excitation potential for the state n = 3? (a) 3.08 V (b) 15.6 V (c) 12.08 V (d) 12.52 V (iv) What is the wave number of the photons emitted for the transition n = 3 to n = 1 (a) $0.009 \times 10^7\ m^{-1}$ (b) $1.000 \times 10^7\ m^{-1}$ (c) $1.009 \times 10^{-7}\ m^{-1}$ (d) $1.009 \times 10^7\ m^{-1}$ Or (iv) The initial kinetic energy of an electron is 11 eV and it interacts with the hypothetical one electron atom. What is the minimum energy carried by the electron after interaction? (a) 0.7 eV (b) 1.7 eV (c) 2.0 eV (d) 2.1 Ev	
	SECTION-E	
31.	A potential difference is set up between the plates of a parallel plate capacitor by a battery and then the battery is removed. If the distance between the plates is decreased, then how the (a) charge (b) potential difference, (c) electric field (d) energy and (e) energy density will change? OR Derive an expression for the electric potential at a point due to an electric dipole. Also mention the contrasting features of electric potential of a dipole at a point as compared to that due to a single charge.	5
32.	(a) With the help of a labelled diagram, describe briefly the underlying principle and working of a step-up transformer. (b) Write any two sources of energy loss in a transformer. (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) Write the function of a transformer. State its principle of working with the help of a diagram. Mention various energy losses in this	5

	device. (b) The primary coil of an ideal step-up transformer has 100 turns and transformation ratio is also 100. The input voltage and power are respectively 220 V and 1100 W. Calculate (i) number of turns in secondary (ii) current in primary (iii) voltage across secondary (iv) current in secondary (v) power in secondary	
33	Derive the lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ for a concave lens, using necessary ray diagram. Two lenses of powers 10 D and –5 D are placed in contact. (a) Calculate the power of new lens. (b) Where should an object be held from the lens, so as to obtain a virtual image of magnification 2? OR (a) Draw a ray diagram showing image formation in a compound microscope. Define the term 'limit of resolution' and name the factors on which it depends. How is it related to resolving power of microscope? (b) Suggest two ways by which the resolving power of a microscope can be increased. (c) "A telescope resolves whereas a microscope magnifies." Justify this statement.	5

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SAMPLE QUESTION PAPER-6: 2025-26

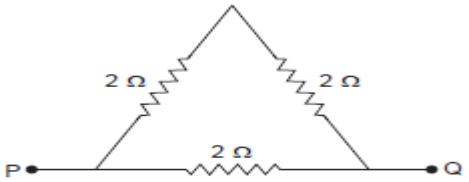
CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX MARKS:70**

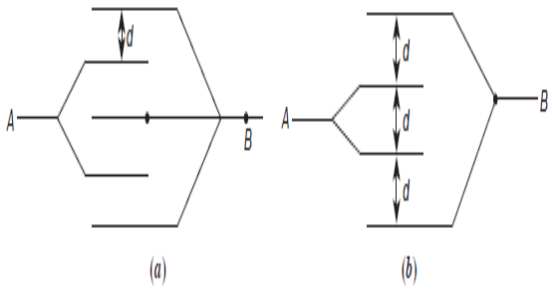
General Instructions

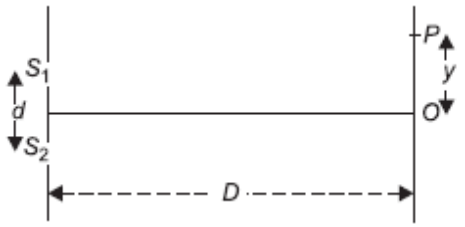
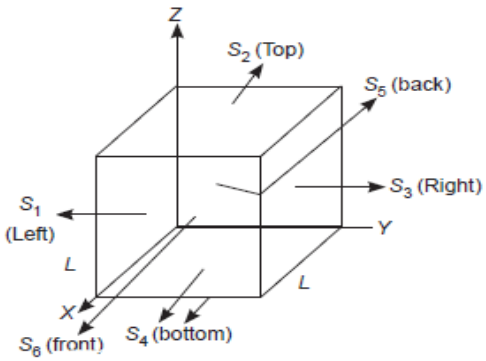
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark 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 wherever necessary

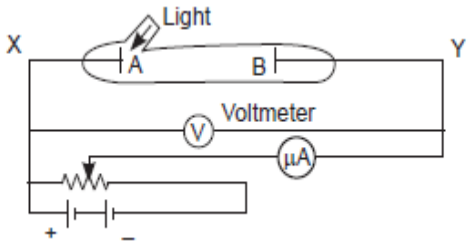
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$ C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
viii Avogadro's number = 6.023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

Q. No.	SECTION -A	Mark
1	Three resistors each of 2 ohm are connected together in a triangular shape. The resistance between any two vertices will be  (a) 4/3 ohm (b) 3/4 ohm (c) 3 ohm (d) 6 ohm	1
2	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 be accelerated along the axis. (b) The electron path will be circular about the axis. (c) The electron will experience a force at 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
3	A charged particle after being accelerated through a potential difference 'V' enters in a uniform magnetic field and moves in a circle of radius r. If V is doubled, the radius of the circle will become (a). 2r (b). $\sqrt{2}\,r$ (c). 4r (d). $\frac{r}{\sqrt{2}}$	1
4	As the frequency of an ac circuit increases, the current first increases and then decreases. What combination of circuit elements is most likely to comprise the circuit? (a) Inductor and capacitor. (b) Resistor and inductor. (c) Resistor and capacitor. (d) Inductor only.	1

5	In an alternating current circuit consisting of elements in series, the current increases on increasing the frequency of supply. Which of the following elements are likely to constitute the circuit? (a) Only resistor. (b) Resistor and an inductor. (c) Resistor and a capacitor. (d) Only an inductor.	1
6	Electromagnetic waves with wavelength 'λ' are used by a FM radio station for broadcasting. Here λ belongs to (a) radio waves (b) VHF radio waves (c) UHF radio waves (d) microwaves	1
7	The ratio of contributions made by the electric field and magnetic field components to the intensity of an EM wave is (a). c : 1 (b). c^2 : 1 (c). 1 : 1 (d). $\sqrt{c}$: 1	1
8	Air bubble in water behaves as (a) sometimes concave, sometimes convex lens (b) concave lens (c) convex lens (d) always reflecting surface	1
9	The wavefront due to a source situated at infinity is (a) spherical (b) cylindrical (c) planar (d) circular	1
10	The Balmer series for the H-atom can be observed (a) if we measure the frequencies of light emitted when an excited atom falls to the ground state. (b) if we measure the frequencies of light emitted due to transitions between excited states and the first excited state. (c) in any transition in a H-atom. (d) as a sequence of frequencies with the lower frequencies getting closely packed.	1
11	The Bohr model for the spectra of a H-atom (a) will be applicable to hydrogen in the molecular from. (b) will not be applicable as it is for a He-atom. (c) is valid only at room temperature. (d) predicts continuous as well as discrete spectral lines.	1
12	Electrical conductivity of a semiconductor (a) decreases with the rise in its temperature. (b) increases with the rise in its temperature. (c) does not change with the rise in its temperature. (d) first increases and then decreases with the rise in its temperature.	1
	For the following question, two statements are given–one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. (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 and R is also false.	
13	**Assertion:** The total number of electric lines of force passing through a given area in a normal direction is called electric flux. **Reason:** Electric flux is a vector quantity.	1

14	**Assertion:** There is no current in the metals in the absence of electric field. **Reason:** Motion of free electrons in a conductor is random.	1
15	**Assertion**: Microwaves are considered suitable for radar systems. **Reason**: Microwaves are of shorter wavelength.	1
16	**Assertion**: Full-wave rectifier preferred to half-wave rectifier. **Reason**: The output of a full-wave rectifier is twice as great as the half-wave rectifier.	1
	SECTION-B	
17	Explain the term 'drift velocity' of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of 'drift velocity'. OR Define mobility of electron in a conductor. How does electron mobility change when (i) temperature of conductor decreases and (ii) applied potential difference is doubled at constant temperature?	2
18	Both, the electric and magnetic fields can deflect a moving electron. What is the difference between these deflections?	2
19	At what angle of incidence should a light beam strike a glass slab of refractive index $\sqrt{3}$ such that the reflected and the refracted rays are perpendicular to each other?	2
20	State Bohr's quantization condition of angular momentum. Calculate the shortest wavelength of the Bracket series and state to which part of the electromagnetic spectrum does it belong.	2
21	Draw energy band diagrams of an *n*-type and a *p*-type semiconductor at temperature $T > 0$ K. Mark the donor and acceptor energy levels with their energies.	2
	SECTION-C	
22	A conducting slab of thickness *t* is introduced without touching between the plates of a parallel plate capacitor, separated by a distance *d* ($t < d$). Derive an expression for the capacitance of the capacitor. OR Five identical horizontal square metal plates each of area *A* are placed at a distance d apart in air and connected to the terminals *A* and *B* as shown in the figures (a) and (b). Find the effective capacitance between the two terminals *A* and *B*.  	3
23	Write three points of differences between para, dia and ferro magnetic materials, giving one example for each.	3
24	An inductor *L* of inductance X_L is connected in series with a bulb *B* and an ac source. How would brightness of the bulb change when	3

	(i) number of turns in the inductor is reduced, (ii) an iron rod is inserted in the inductor and (iii) a capacitor of reactance $X_C = X_L$ is inserted in series in the circuit. Justify your answer in each case.	
25	Draw a ray diagram showing the image formation by a compound microscope. Hence obtain expression for total magnification when the image is formed at infinity.	3
26	The intensity at the central maxima (O) in a Young's double slit experiment is I_o. If the distance OP equals one-third of the fringe width of the pattern, show that the intensity at point P would be $\frac{I_o}{4}$. 	3
27	(a) Draw the plot of binding energy per nucleon (BE/A) as a function of mass number A. Write two important conclusions that can be drawn regarding the nature of nuclear force. (b) Use this graph to explain the release of energy in both the processes of nuclear fusion and fission.	3
28	(a) Explain with the help of a diagram, how depletion region and potential barrier are formed in a junction diode. (b) If a small voltage is applied to a *p–n* junction diode how will the barrier potential be affected when it is (i) forward biased, and (ii) reverse biased?	3
	SECTION-D	
29	In electrostatics, electric flux is the measure of the electric field through a given surface, although an electric field in itself cannot flow. It is a way of describing the electric field strength at any distance from the charge causing the field. Now, consider a cube of each edge 0.30 m is placed with its one corner at the origin. The cube is placed in a non-uniform electric field. $\vec{E} = (-2x\hat{i} + 3\hat{j})$ N/C  (i) The surfaces that have zero electric flux are (a) S_1 and S_2 (b) S_1 and S_6 (c) S_2 and S_4 (d) S_1 and S_3 (ii) Electric flux passing through surface S_1 is (a) $-0.27\ Nm^2C^{-1}$ (b) $0.27\ Nm^2C^{-1}$ (c) $-0.18\ Nm^2C^{-1}$ (d) $-0.18\ Nm^2C^{-1}$ (iii) Electric flux passing through surface S_4 is (a) $-0.18\ Nm^2C^{-1}$ (b) $+0.18\ Nm^2C^{-1}$ (c) $+0.27\ Nm^2C^{-1}$ (d) zero	4

	(iv) Total net flux passing through the cube if $\vec{E} = 2\hat{i}$ N/C (a) zero (b) $-0.18\ Nm^2C^{-1}$ (c) $0.18\ Nm^2C^{-1}$ (d) $0.27\ Nm^2C^{-1}$ ***Or*** (iv) Total charge enclosed inside the cube is (a) 0 (b) –1.62 pC (c) +1.62 pC (d) 2.4 pC	
30	In the investigation of "Photoelectric effect", light is incident on electrode A. This electrode A, along with electrode B is placed inside a vacuum tube diode. These electrodes are made from same metal and are connected to a microammeter and a variable voltage supply. Light enters vacuum tube through a window. With the help of filters, wavelength of light entering the window can be changed.  (i) Emission of electron from the surface of metal when radiation of appropriate frequency is allowed to incident on it is called (a) thermionic radiation. (b) Compton effect. (c) photoelectric effect. (d) none of these. (ii) Choose the correct option among the following regarding work function of material in a photoelectric effect. (a) It is different for different materials. (b) It is same for all metals. (c) It does not depend on frequency of the incident light (d) It depends on intensity of the incident light. (iii) For a photosensitive surface, the work function is 3.3×10^{-19} J. Find the threshold frequency. (h = 6.6 × 1034 Js) (a) 5×10^{14} Hz (b) 0.5×10^{14}Hz (c) 25×10^{14} Hz (d) 2.5×10^{14} Hz (iv) Maximum kinetic energy of electrons emitted in photoelectric effect increases when (a) intensity of light is increased. (b) light source is brought nearer the metal. (c) frequency of light is decreased (d) wavelength of light is decreased. OR (iv) The minimum energy required to remove an electron is called (a) stopping potential. (b) kinetic energy. (c) work function.	4

	(d) none of these.	
	SECTION-E	
31	On charging a parallel plate capacitor to a potential V, the spacing between the plates is halved, and a dielectric medium of $\varepsilon_r = 10$ is introduced between the plates, without disconnecting the d.c. source. Explain, using suitable expressions, how the (i) capacitance, (ii) electric field and (iii) energy density of the capacitor change. OR Derive an expression for the electric potential at a point due to an electric dipole. Also mention the contrasting features of electric potential of a dipole at a point as compared to that due to a single charge.	5
32	(a) Define the term 'mutual inductance'. Deduce the expression for the mutual inductance of two long co-axial solenoids of different radii and different number of turns. (b) A coil is mechanically rotated with constant angular speed ω in a uniform magnetic field which is perpendicular to the axis of rotation of the coil. The plane of the coil is initially held perpendicular to the field. Plot a graph showing variation of (i) magnetic flux f and (ii) the induced emf in the coil as a function of ωt. OR Calculate self-inductance for a long solenoid of length l, number of turns N and radius r.	
33	A thin convex lens having two surfaces of radii of curvature R_1 and R_2 is made of a material of refractive index μ_2. It is kept in a medium of refractive index μ_2. Derive, with the help of a ray diagram, the lens maker's formula when a point object placed on the principal axis in front of the radius of curvature R_1 produces an image I on the other side of the lens. OR Draw a labelled ray diagram of an astronomical telescope for the near point adjustment. You are given three lenses of powers 0.5 D, 4 D, 10 D. State, with reason, which two lenses will you select for constructing a good astronomical telescope. Derive the expression for magnifying power when the final image is at infinite.	5

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SAMPLE QUESTION PAPER-7: 2025-26

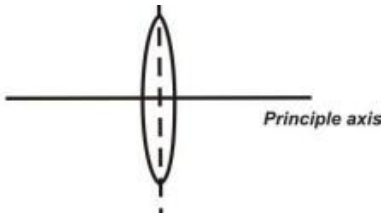
CLASS: XII **SUBJECT: PHYSICS**
TIME:3Hrs **MAX MARKS:70**

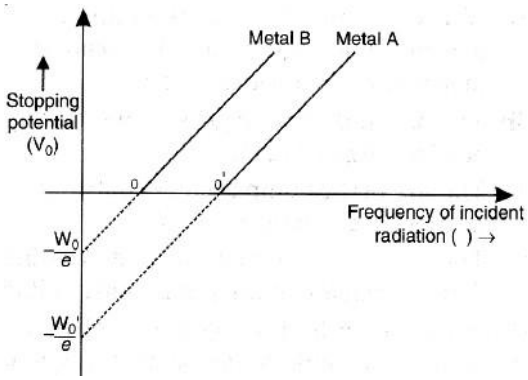
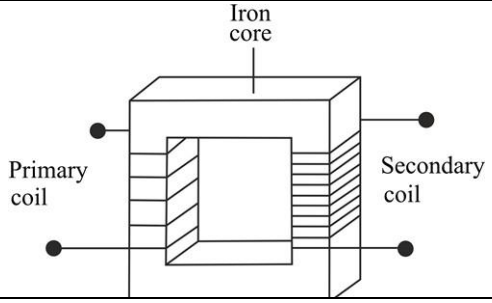
General Instructions

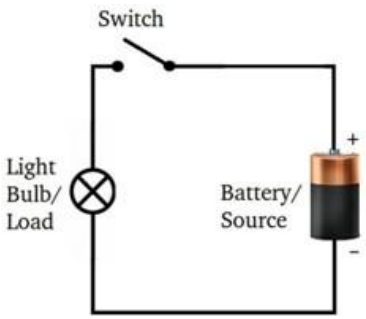
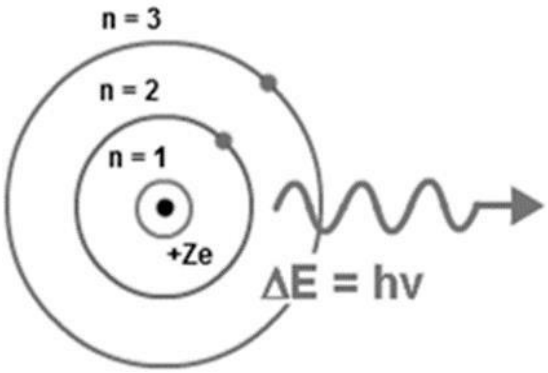
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark 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 wherever 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

Q. No.	SECTION – A	Marks
1	At any point on the perpendicular bisector of the line joining two equal and opposite charges (A) the electric field is zero (B) the electric potential is zero (C) the electric potential and electric field, both are zero. (D) the electric field is perpendicular to the line joining the charges	1
2	A metal wire of resistance 40 Ω is bent in the form of a square. The resistance between diagonally opposite corners of it is (A) 20 Ω (B) 10 Ω (C) 25 Ω (D) 5 Ω	1
3	A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not Depend on (A) area of loop (B) number of turns (C) shape of loop (D) angle between normal of coil and magnetic field	1
4	The power factor of LCR ac circuit at resonance is (A) 0.5 (B) 1 (C) √2 (D) zero	1
5	Which of the following waves has the maximum wavelength? (A). X-rays (B)Infrared rays (C)Ultraviolet rays (D)Radio waves	1
6	Two sources of light are said to be coherent, when they give light waves of same (A). amplitude and phase	1

	(B) wavelength and constant phase difference (C) intensity and wavelength (D) phase and speed	
7	A convex lens of focal length 30com is cut in to two equal parts perpendicular to its principalaxis. What is the focal length of each part of it in cm?  A) 30 B) 40 C) 50 D) 60	1
8	The magnitude of photoelectric current depends upon (A)frequency (B) Intensity (C) Work function (D) Stoppingpotential	1
9	The density of a nucleus is of the order of (A) 10^{15} kg m^{-3} (B) 10^{18} kg m^{-3} (C) 10^{17} kg m^{-3} (D) 10^{16} kg m^{-3}	1
10	Which of the following statements is not true in the case of a semiconductor? (A). It is heat sensitive (B) It is a crystalline solid (C) It has a negative temperature coefficient of resistance. (D) Its resistivity is very high	1
11	The refractive index of a medium is √2. Its critical angle is (A) 30^0 (B) 45 (C) 60^0 (D) 90^0	1
12	Current provided by a battery is maximum, when (A) Internal resistance equal to external resistance (B) Internal resistance is greater than external resistance (C) Internal resistance is less than external resistance (D) None of these	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 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: Nichrome wire is generally used as a heating element in heating appliances. REASON: It offers large resistance and has high melting point.	1
14	ASSERTION: The focal length of a lens doesn't change if it is placed water. REASON: Focal length of a lens is independent of the medium in which it is placed.	1
15	ASSERTION: A semiconductor at room temperature behaves as insulator. REASON: Electrical conductivity of a semiconductor can be increased by doping.	1

16	ASSERTION: Heavy water is used as a moderator in nuclear reactor. REASON: Heavy water eliminates some neutrons from the reaction.	1
	SECTION -B	
17	State Faradays laws of electromagnetic induction.	2
18	Draw a labelled diagram of compound microscope	2
19	Mention any two differences between matter waves and EM waves.20.In the following graph related to photoelectric effect, i) which metal has higher work function? ii) What is the common factor for the two graphs and what is its significance? 	2
20	Define the terms related to the PN junction: i). depletion layer ii) barrier potential.	2
21	What is self-induction? Write equation for self-induction of a long solenoid.	2
	SECTION - C	
22	A point charge of 17.7μC is at the centre of a hallow cube of side 10cm. Find the flux andflux density on any one surface of the cube	3
23	Using Ampere's circuital law, derive the equation for magnetic field strength at a pointinside a solenoid.	3
24	i) What is the principle of this device shown below? ii) Mention any two energy losses in it. iii) How is it useful in long distance power transmission? 	3
25	In a LR ac circuit, connected to a 200V – 50Hz source, the current is 4A and the phaseangle is π/3.Calculate the values of R and X_L.	3
26	An EM wave has a wavelength of 2 X 10^{-7} m. Identify the wave and mention any twodaily life uses of it.	3
27	Using Huygens wave theory, prove Snell's law.(OR) What is the principle of working of an optical fibre? With a labelled diagram describe itsconstruction and working.	3
28	With the help of a neat circuit diagram, describe the working of a full wave rectifier alsodraw the input and output wave forms for a full wave rectifier.	3
	SECTION – D	

29	In physics, electric power measures the rate of electrical energy transfer by an electric circuit per unit of time. Denoted by P and measured using the SI unit of power which is wattor one joule per second. Electric power is commonly supplied by electric batteries and produced by electric generators.  i.) A 25 W and 100 W are joined in series and connected to the mains. Which bulb will glowbrighter? (A) 100 W (B) 25 W (C) Both bulbs will glow brighter (D) None will glow brighter ii) The heat emitted by a bulb of 100 W in 1 min is (A) 100 J (B) 1000 J (C) 600 J (D) 6000 J iii)The power(P) of a device is related to its resistance (R) as (A) P α R (B) P α 1/R (C) P α √R (D) P α R^2 iv) A heater coil is marked as 800W-200V. What is the maximum current drawn by it? (A) 5A (B) 4A (C) 3A (D) 0.25 A	4
30	Bohr Model of the hydrogen atom first proposed the planetary model, but later an assumption concerning the electrons was made. The assumption was the quantization of the structure of atoms. Bohr's proposed that electrons  orbited the nucleus in specific orbits or shells with a fixed radius. Only those shells with a radius provided by the equation below were allowed, and it was impossible for electrons to exist between these shells. i). The radius of first Bohr's orbit is A) 0.53A^0 B) 0.35A^0 C)1.2A^0 D) 0.65A^0 ii). The ionization energy of Hydrogen atom is A) 1.36eV B) 13.6eV C) -1.36eV D) 13.6eV iii). According to Bohr's theory, which physical quantity of electron is quantized? A). Energy B) momentum C) angular momentum D)speed iv). Lyman series belongs to which part of EM spectrum? A). gamma rays B) visible rays C) Infrared rays D) UV rays	4

	SECTION -E	
31	i) What is the principle of a capacitor? ii). Derive the equation for capacitance of a parallel plate capacitor with a dielectric slab iii). What type of energy is stored between the two plates of a charged capacitor? OR i). Derive the equation for potential at any point due to a short dipole. ii). Mention any two properties of equipotential surface.	5
32	i) Show that like currents attract each other and derive the equation for the force betweenthem. ii). Find the magnetic field strength at the center of a circular loop of radius 5cm , with 10turns carrying a current of 2A. OR i)What is the principle of working a moving coil galvanometer?ii)What is the significance of radial magnetic field in it? iii) If only 10% of the total current can pass through a galvanometer of resistance 45Ω,what value of shunt is required?	5
33	i) Derive prism equation. ii) What is the deviation produced by a prism of angle 6^0, with refractive index 1.5. OR i). Draw interference and diffraction patterns and mention any two differences between them. ii)In YDS experiment, light of wavelength $6000A^0$ is used. If the distance between thetwo slits is 1.5mm and the distance of the screen is 2m , find the positions of second bright and 3ed dark images from the center of the screen	5

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SAMPLE QUESTION PAPER-1: 2025-26

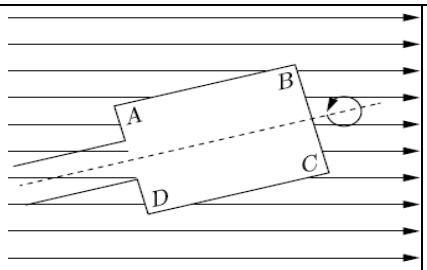
CLASS: XII **SUBJECT: PHYSICS**
TIME:3Hrs **MAX MARKS:70**

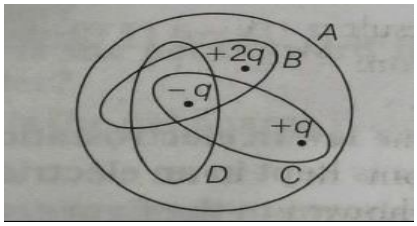
General Instructions

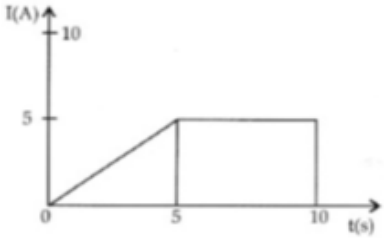
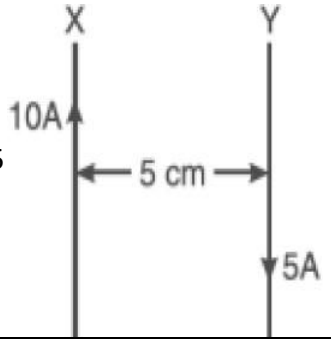
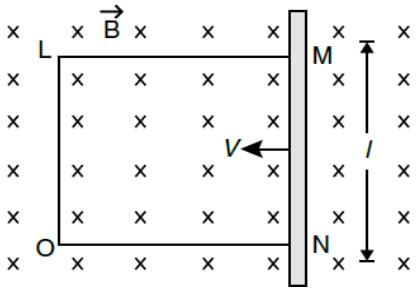
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark 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 wherever 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

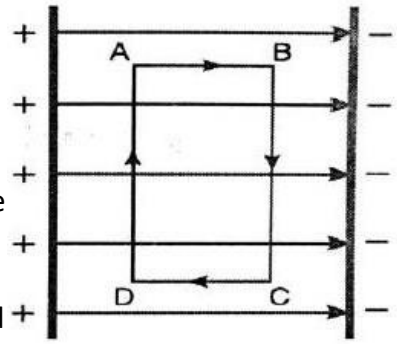
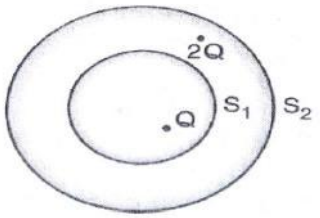
Q. No.	SECTION – A	Marks
1	Charge Q is kept in a sphere of 5 cm first than it is kept in a cube of side 5 cm. the outgoing flux will be (a) More in case of sphere (b) More in case of cube (c) Same in both case (d) Information Incomplete	1
2	Three capacitors of capacitances 1μf, 2μF & 3μF are connected in series and a potential difference of 11V is applied across the combination then the potential difference across the plates of 1μf capacitor is (a) 2V (b) 4V (c)1V (d) 6V	1
3	A wire in the form of a circular loop, of one turn carrying a current, produces magnetic induction B at the center. If the same wire is looped into a coil of two turns and carries the same current, the new value of magnetic induction at the center is (a) B (b) 2B (c) 4B (d)8B	1
4	Current sensitivity of a galvanometer can be increased by decreasing: (a) Magnetic field B (b) number of turns N (c) Torsional constant K (d) Area A	1
5	The relative permeability of a substance *X* is slightly less than unity and that of substance *Y* is slightly more than unity, then (a) *X* is paramagnetic and *Y* is ferromagnetic (b) *X* is diamagnetic and *Y* is ferromagnetic (c) *X* and *Y* both are paramagnetic (d) *X* is diamagnetic, and *Y* is paramagnetic	1
6	A wire of magnetic dipole moment *M* and *L* is bent into shape of a semicircle of radius *r.* What will be its new dipole moments? (a). M (b). M/2π (c). M/ π *(d). 2M/π*	1

7	A rectangular coil *ABCD* is rotated anticlockwise with a uniform angular velocity about the axis shown in the figure. Initially, the axis of rotation of the coil as well as the magnetic field *B* were horizontal. The induced E.M.F. in the coil would be maximum when plane of the coil  (a). is horizontal. (b). is at right angle to the magnetic field. (c). makes an angle of 30^0 with the horizontal. (d). makes an angle of 45^0 with the direction of magnetic field.	1
8	The magnetic flux through a circuit of resistance *R* changes by an amount Δϕ in a time Δt. The total electric charge *Q* that passes any point in the circuit during the time Δ*t* is represented by (a). $Q = \frac{\Delta\emptyset}{\Delta t}$ (b). $Q = \frac{\Delta\emptyset}{\Delta t}$ (c). $Q = R\ x\ \frac{\Delta\emptyset}{\Delta t}$ (d). $Q = \frac{1}{R}\ x\ \frac{\Delta\emptyset}{\Delta t}$	1
9	One requires 11eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in (a) visible region (b) infrared region (c) ultraviolet region (d) microwave region	1
10	Which of the following has maximum stopping potential when metal is illuminated by visible light? (a)Blue (b)Yellow (c)Violet (d)Red	1
11	The energy *E* of a hydrogen atom with principal quantum no. *n* is given by $E = -\frac{13.6}{n^2}eV$. The energy ejected when the electron jumps from *n* = 3 state to *n* = 2 state of hydrogen is approximately. (a) 0.85 eV (b) 1.5 eV (c) 1.9 eV (d) 3.4 eV	1
12	The radius of a nucleus with nucleon number 16 is 3×10^{-15} m. Then, the radius of a nucleus with nucleon number 128 will be: - (a) 3×10^{-15} m (b) 6×10^{-15} m (c) 9×10^{-15} m (d) 24×10^{-15} m	1
	Assertion(A) and Reasoning(R) (1 Mark Each) For questions 13–16, choose the correct option: 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.	
13	**Assertion:-** The electric field at every point is normal to the equipotential surface passing through that point. **Reason:-** No work is required to move a test charge on an equipotential surface.	1

<table>
<tr><td>14</td><td>Assertion :- When tiny circular obstacle is placed in the path of light from some distance, a bright spot is seen at the centre of the shadow of the obstacle.
Reason :- Destructive interference occurs at the centre of the shadow.</td><td>1</td></tr>
<tr><td>15</td><td>Assertion :- Kinetic energy of photo electrons emitted by a photosensitive surface depends upon the intensity of incident photon.
Reason :- The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency.</td><td>1</td></tr>
<tr><td>16</td><td>Assertion:- Silicon is preferred over germanium for making semiconductor devices.
Reason:- The energy gap for germanium is more than the energy gap of silicon</td><td>1</td></tr>
<tr><td></td><td>Section – B</td><td></td></tr>
<tr><td>17</td><td>Rank the Gaussian surfaces as shown in the figure. In order of increasing electric flux, starting with the most negative.
 
</td><td>2</td></tr>
<tr><td>18</td><td>The refractive index of diamond is much higher than that of glass. How does a diamond cutter make use of this fact?</td><td>2</td></tr>
<tr><td>19</td><td>Find the radius of curvature of the convex surface of a plano-convex lens, whose focal length is 0.3 m and the refractive index of the material of the lens is 1.5
(OR)
A telescope consists of two lenses of focal lengths 20 cm and 5 cm. Obtain its magnifying power when the final image is (i)at infinity (ii)at 25 cm from the lenses of eye.</td><td>2</td></tr>
<tr><td>20</td><td>If light of wavelength 412.5nm is incident on each of the metals given below, which ones will show photoelectric emission and why
<table>
<tr><th>Metal</th><th>Work Function (eV)</th></tr>
<tr><td>Na</td><td>1.92</td></tr>
<tr><td>K</td><td>2.15</td></tr>
<tr><td>Ca</td><td>3.20</td></tr>
<tr><td>Mo</td><td>4.17</td></tr>
</table></td><td>2</td></tr>
<tr><td>21</td><td>Draw the energy band diagram when intrinsic semiconductor (Ge) is doped with impurity atoms of Antimony (Sb). Name the extrinsic semiconductor so obtained and majority charge carriers in it.
(OR)
Draw energy band diagram of p and n type semiconductors. Also, write two differences between p-type and n-type semiconductors.</td><td>2</td></tr>
<tr><td></td><td>Section – C</td><td></td></tr>
<tr><td>22</td><td>A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of 80 $\mu C/m^2$.
(a). Find the charge on the sphere.
(b). What is the total electric flux leaving the surface of the sphere?</td><td>3</td></tr>
</table>

23	Deduce the relationship between current 'I' flowing through a conductor and drift velocity of the electrons. Following figure shows a plot of current 'I' flowing through the cross section of a wire versus the time T. Use the plot to find the charge flowing in 10 seconds through the wire. 	3
24	(a) What is the principle of a moving coil galvanometer? (b) Give two reasons to explain why a galvanometer cannot as such be used to measure the value of the current in a given circuit. (c) Define the terms: (i) voltage sensitivity and (ii) current sensitivity of a galvanometer. (OR) Two parallel straight wires X and Y separated by a distance 5 cm in air carry current of 10 A and 5 A respectively in opposite direction as shown in diagram. Calculate the magnitude and direction of the force on a 20 cm length of the wire Y. 	3
25	A rectangular conductor LMNO is placed in a uniform magnetic field of 0.5 T. The field is directed perpendicular to the plane of the conductor. When the arm MN of length of 20 cm is moved towards left with a velocity of 10 ms^{-1}, calculate the emf induced in the arm. Given the resistance of the arm to be 5 ohm (assuming that other arms are of negligible resistance), find the value of the current in the arm. 	3
26	Name the parts of the electromagnetic spectrum which is (i) suitable for RADAR systems in aircraft navigations. (ii) used to treat muscular strain. (iii) used as a diagnostic tool in medicine. Write in brief, how these waves can be produced? (OR) (i) Name the EM waves which are used for the treatment of certain forms of cancer. Write their frequency range. (ii) Thin ozone layer on top of stratosphere is crucial for human survival. Why? (iii) Why is the amount of the momentum transferred by the EM waves incident on the surface so small?	3
27	The ground state energy of hydrogen atom is – 13.6 eV. If an electron makes a transition from an energy level – 1.51 eV to – 3.4 eV, calculate the wavelength of the spectral line emitted and name the series of hydrogen spectrum to which it belongs.	3

28	Calculate the energy released in MeV in the following nuclear reaction: $_{238}^{92}U \rightarrow {}_{234}^{90}Th + {}_{4}^{2}H + Q$ Mass of $_{238}^{92}U$ = 238.05079 amu; Mass of $_{234}^{90}Th$ = 234.043630 amu; Mass of $_{4}^{2}H$ = 4.002600 amu; 1 u = 931.5 MeV/c^2	3
	Section – D	
29	Case Study: Read the following paragraph and answer the questions. Two sources of light which continuously emit light waves of same frequency (or wavelength) with a zero or constant phase difference between them, are called coherent sources. Two independent sources of light cannot act as coherent sources, they have to be derived from the same parent source. In Young's double slit experiment, two identical narrow slits S1 and S2 are placed symmetrically with respect to narrow slit S illuminated with monochromatic light. The interference pattern is obtained on an observation screen placed at large distance D from S1 and S2. a) Mention any 2 conditions for sustained interference. b) In the Young's double slit experiment using a monochromatic light of wavelength λ, what is the path difference (in terms of an integer n) corresponding to any point having half the peak intensity? c) Calculate the ratio of the fringe width for bright and dark fringes in YDS experiment. (OR) d) In Young's double slit experiment, while using a source of light of wavelength 4500 Å, the fringe width obtained is 0.4 cm. If the distance between the slits and the screen is reduced to half, calculate the new fringe width.	4
30	Case Study: Read the following paragraph and answer the questions. A p-n junction is a single crystal of Ge or Si doped in such a manner that one-half portion of it acts as p-type semiconductor and other half functions as n-type semiconductor. As soon as junction is formed, the holes from the p-region diffuse into the n-region and electrons from n-region diffuse into p-region. This results in the development of potential barrier VB across the junction which opposes the further diffusion of electrons and holes through the junction. The small region in the vicinity of the junction which is depleted of free charge carriers and has only immobile ions been called the depletion region. a) Why is germanium preferred over silicon for making semiconductor devices? b) Which type of biasing results in a very high resistance of a p n junction diode. Draw a diagram showing this bias. c) How does the width of the depletion region of a pn junction vary, if the reverse bias applied to it decreases. (OR) (c)Name the 2 important processes involved in the formation of a p n junction.	4

	Section – E	
31	a) What work must be done in carrying an alpha particle across a potential difference of 1volt? (b) A uniform field E exists between two charged plates as shown in fig. What would be the work done in moving a charge q along the closed rectangular path ABCDA?  (c) A parallel plate capacitor is charged to a potential difference V by a d.c source. The battery remains connected, and a dielectric slab of thickness d and dielectric constant K is introduced between the plates of the capacitor. How the following will change: (i) Electric field between the plates (ii) capacitance and(iii) charge on the plates of the capacitor **(OR)** (a) S1 and S2 are two parallel concentric spheres enclosing charges Q and 2Q as shown in fig.  (i) What is the ratio of the electric flux through S1 and S2? (ii) How will the electric flux through the sphere S1 change, if a medium of dielectric constant 5 is introduced in the space inside S1 in place of air? (b). Obtain the expression for the electric field intensity due to a uniformly charged infinite plane sheet	5
32	(i) A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V. (ii) A step-up transformer converts a low voltage into high voltage. Does it not violate the principle of conservation of energy? Explain. (iii) Write any two sources of energy loss in a transformer. (OR) (i) A coil of number of turns N, area A is rotated at a constant angular speed ω in a uniform magnetic field **B** and connected to a resistor R. Deduce an expression for maximum emf induced in the coil. (ii) A circular coil of cross-sectional area 200 cm^2 and 20 turns is rotated about the vertical diameter with angular speed of 50 rad/s in a uniform magnetic field of magnitude 3x 10^{-2} T. Calculate the maximum value of emf in the coil.	5
33	State Huygens principle. (b) Define the term wavefront. (c) Draw a ray diagram to show the working of a compound microscope. Derive an expression for its magnifying power. **(OR)**	5

	(a) Write two points of difference between interference pattern and diffraction pattern. (b) Draw the ray diagram to show the working of a refracting telescope. Derive an expression for its magnifying power (normal adjustment).	

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SAMPLE QUESTION PAPER-9: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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 A^{-1}

vi. $h = 6.63 \times 10^{-34}$ J s

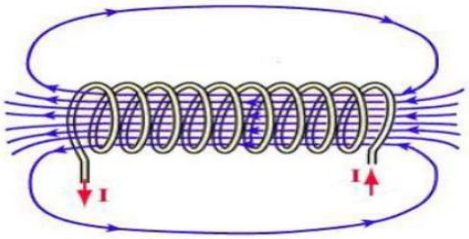
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$

viii Avogadro's number = 6.023 X 10^{23} per gram mole

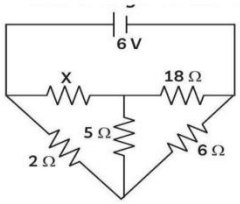
Q. No.	SECTION – A	Marks
1.	coil of resistance 20π ohm and self-inductance 10 mH is connected to an ac source of frequency 1000Hz. The phase difference between current in the circuit and the source voltage is : (A) 30° (B) 60° (C) 75° (D) 45°	1
2.	Two-point charges placed in a medium of dielectric constant 5 are at a distance r between them, experience an electrostatic force ' F '. The electrostatic force between them in vacuum at the same distance r will be: (a) 5 F. (b) F. (c) F/2. (d) F/5	1
3.	An isolated point charge particle produces an electric field E at a point 3 m away from it. The distance of the point at which the field is $E/4$ will be: (a) 2 m (b) 3 (c) 4 m (d) 6 m	1
4.	Which of the following is NOT the property of equipotential surface? (a) They do not cross each other. (b) The rate of change of potential with distance on them is zero. (c) For a uniform electric field, they are concentric spheres. (d) They can be imaginary spheres.	1

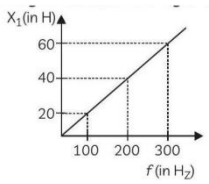
5.	A conductor of 10Ω is connected across a 6 V ideal source. The power supplied by the source to the conductor is: (a) 1.8 W (b) 2.4 W (c) 3.6 W (d) 7.2 W	1
6.	An electron is released from rest in a region of uniform electric and magnetic fields acting parallel to each other. The electron will: (a) move in a straight line (b) move in circle (c) remain stationary (d) move in a helical path	1
7.	The magnetic flux linked with the coil (in Weber) is given by the equation: $\phi(t) = 5t^2 + 3t + 16$. The induced EMF in the coil at time, $t = 4$ will be: (a) −27 V (b) −43 V (c) −108 V (d) 210 V	1
8.	Choose the wave relevant to aircraft navigation: (a) ultraviolet (b) infrared (c) microwave (d) visible light	1
9.	A ray of light of wavelength 600 nm propagates from air into a medium. If its wavelength in the medium becomes 400 nm, the refractive index of the medium is: (a) 1.4 (b) 1.5 (c) 1.6 (d) 1.8	1
10.	The shape of the interference fringes in Young's double slit experiment when D (distance between slit and screen) is very large as compared to fringe width is nearly: (a) straight line (b) parabolic (c) circular (d) hyperbolic	1
11.	When alpha particles are sent through a thin gold foil, most of them go straight through the foil, because: (a) alpha particles are positively charged. (b) the mass of an alpha particle is more than the mass of an electron. (c) most of the part of an atom is empty space. (d) alpha particles move with high velocity	1
12.	At equilibrium, in a $p - n$ junction diode the net current is: (a) due to diffusion of majority charge carriers. (b) due to drift of minority charge carriers. (c) zero as diffusion and drift currents are equal and opposite. (d) zero as no charge carriers cross the junction.	1
	For Questions 13to 16, two statements are given -one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options given below. **(a) If both Assertion and Reason are true and Reason is 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) : Photoelectric effect demonstrates the particle nature of light. Reason (R) : Photoelectric current is proportional to frequency of incident radiation.	1
14.	Assertion (A) : A proton and an electron enter a uniform magnetic field B with the same momentum p such that p is perpendicular to B . They describe circular paths of the same radius. Reason (R) : In a magnetic field, orbital radius r is equal to p/qB	1
15.	**Assertion :** Density of all the nuclei is same. **Reason :** Radius of nucleus is directly proportional to the cube root of mass number.	1
16.	**Assertion :** Hydrogen atom consists of only one electron but its emission spectrum has many lines. **Reason :** Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.	1
	SECTION-B	
17.	A proton, a deuteron and an alpha particle, are accelerated through the same potential difference and then subjected to a uniform magnetic field, perpendicular to the direction of their motions. Compare (i) their kinetic energies, and (ii) if the radius of the circular path described by proton is 5 cm, determine the radii of the paths described by deuteron and alpha particle.	2
18.	State Huygens principle. Consider a plane wavefront incident on a thin convex lens. Draw a proper diagram to show how the incident wavefront traverses through the lens and after refraction focusses on the focal point of the lens, giving the shape of the emergent wavefront. (OR) How will the interference pattern in Young's double-slit experiment be affected if. (i) The screen is moved away from the plane of the slits. (ii) The source slit is moved away from the plane of the slits.	2
19.	Why it is the frequency and not the intensity of light source that determines whether emission of photoelectrons will occur or not? Explain.	2
20.	Name the spectral series for a hydrogen atom which lies in the visible region. Find the ratio of the maximum to the minimum wavelengths of this series.	2

21.	Show that density of nucleus is independent of its mass number A	2
	SECTION-C	
22.	Write, using Biot-Savart law, the expression for the magnetic field B due to an element Di carrying current I at a distance r from it in a vector form. Hence derive the expression for the magnetic field due to a current carrying loop of radius R at a point P distant x from its centre along the axis of the loop.	3
23.	Name the extrinsic semiconductors formed when a pure Germanium is doped with (A) a trivalent and (B) pentavalent impurity. Draw the energy band diagrams of extrinsic semiconductors so formed.	3
24	Two identical conducting balls A and B have charges $-Q$ and $+3Q$ respectively. They are brought in contact with each other and then separated by a distance d apart. Find the nature of Coulomb force between them. (OR) Two point charges of $+1\mu$C and $+4\mu$C are kept 30 cm apart. How far from the $+1\mu$C charge on the line joining the two charge, will the net electric field be zero?	3
25.	Derive an expression for the capacitance of a parallel plate capacitor with air present between the two plates.	3
26.	Under what conditions does the phenomenon of total internal reflection take place? Draw a ray diagram showing how a ray of light deviates by 90∘ after passing through a right angled isosceles prism.	3
27.	The total magnification produced by a compound microscope is 20. The magnification produced by the eye piece is 5. The microscope is focused on a certain object. The distance between the objective and eye-piece is observed to be 14 cm. If least distance of distinct vision is 20 cm, calculate the focal length of the objective and the eye-piece.	3
28.	Explain with the help of a circuit diagram, the working of a $p-n$ junction diode as a half-wave rectifier.	3
	SECTION:D	
29.	As shown in figure a solenoid where the wire is coiled around a cylinder, each wire loop in this coil acts as if it was a separate circular wire carrying the same current I, the current in the coiled wire 	4

	and the dense enough array of such loops may be approximated by a cylindrical current sheet with the current density K = I × (N/L) = I × L (loops) /solenoid length. For simplicity, let's assume a long solenoid (length ≫ diameter) which we approximate as infinitely long. For a long solenoid (compared to its diameter), the magnetic field inside the solenoid is approximately uniform and approximately parallel to the axis, except near the ends of the solenoid. Outside the solenoid, the magnetic field looks like the field of a physical dipole, with the North pole at one end of the solenoid and the South pole at the other end and is approximately negligible.	
	i. Which of the following material can be used to make loops around the cylindrical core of Solenoid ? (a)Plastic (b) Glass (c) Quartz (d) copper ii. The magnetic field inside the solenoid is (a) Non-Uniform and parallel to the axis (b) Uniform and parallel to the axis (c) Non-uniform and perpendicular to the axis (d) Uniform and perpendicular to the axis iii. A proton is moving from left to right direction and outside the solenoid, then what is the direction of force on the proton? (a) upwards (b) downwards (c) proton will not deflect (d) inwards iv. How the magnetic field inside the solenoid depends upon the number of turns? (a) inversely proportional (b) directly proportional (c) proportional to the square of number of turns (d) none of these (OR) v. Direction of magnetic field due to the solenoid can be determined by (a) Ohm's Law (b) Fleming's left-hand rule (c) Ampere's Right-hand rule (d) Biot-savart law	
30.	In 1905, Albert Einstein explained the photoelectric effect, a phenomenon observed when light strikes a metal surface and ejects electrons. According to Einstein, light behaves as particles called photons, each having an energy of , where is Planck's constant and is the frequency of light. For electrons to be ejected from the surface of the metal, the energy of the photons must exceed a certain minimum value known as the work function () of the metal. If the frequency of the incident light is less than the threshold frequency (), no photoelectric emission occurs regardless of the intensity of the light. This challenged the classical wave theory of light, which could not explain why the emission depended on frequency rather than intensity.	4

	1. Which of the following parameters determines whether photoelectric emission occurs? a) Intensity of light b) Threshold frequency c) Wavelength of light d) Angle of incidence 2. If the frequency of light is increased while keeping the intensity constant, which of the following increases in the photoelectric effect? a) Number of emitted electrons b) Energy of emitted electrons c) Work function d) Threshold frequency 3. What does the photoelectric effect demonstrate about the nature of light? a) Wave-like nature b) Particle-like nature c) Dual nature d) Corpuscular theory 4. Which law of classical physics was contradicted by the results of the photoelectric effect experiment? a) Newton's second law b) Maxwell's equations. c) Law of conservation of energy d) Wave theory of light (OR) 4. If the frequency of incident light is doubled, how is the energy of the photons affected? a) Doubled b) Halved c) Quadrupled d) Unchanged	
	SECTION-E	
31.	(A) What is Wheatstone bridge? (B) When is the bridge said to be balanced? (C) Find out the magnitude of resistance X in the circuit shown in figure. When no current flows through the 5Ω resistance.  (D)State the two Kirchhoff's rules . (OR) (A) Show that a voltmeter when placed across the cell and across the resistor, in turn, gives the same reading. (B) To record the voltage and the current in the circuit, why is voltmeter placed in parallel and ammeter in series in the circuit? (C) Two cells of emfs 1.5 V and 2.0 V having internal resistances 0.2Ω, and 0.3Ω, respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell	5
32.	(A) Show that an ideal inductor does not dissipate power in an AC circuit. (B) The variation of inductive reactance (X_L) of an inductor with	5

	frequency (f) of the AC source of 100 V and variable frequency is shown in the figure.  (i) Calculate the self-inductance of the inductor. (ii) When the inductor is used in series with a capacitor of unknown value and a resistor of 10Ω at 300 s−1, maximum power dissipation occurs in the circuit. Calculate the capacitance of the capacitor. (OR) A series LCR circuit is connected to an A.C. source having voltage $V = V_o$ sin ωt. Derive the expression for the instantaneous current I and its phase relationship to the applied voltage. Obtain the condition for resonance to occur. Define 'power factor'. State the conditions under which it is (A) maximum, (B) minimum.	
33.	(A) 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. (B) 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) (A) Two thin lenses are placed coaxially in contact. Obtain the expression for the focal length of this combination in terms of the focal lengths of the two lenses. (B) A converging lens of refractive index 1.5 has a power 10D. When it is completely immersed in liquid, it behaves as a diverging lens of focal length 50 cm. Find the refractive index of the liquid.	5

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SAMPLE QUESTION PAPER-10: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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

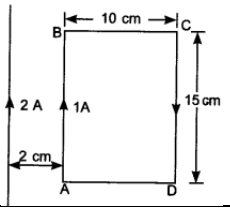
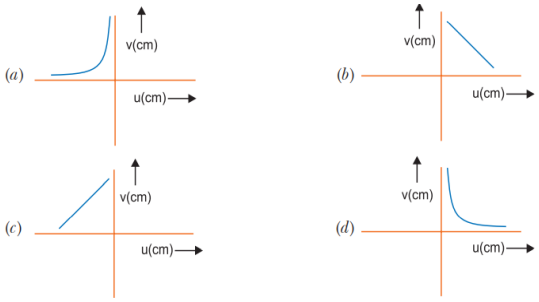
v. $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

vi. $h = 6.63 \times 10^{-34}$ J s

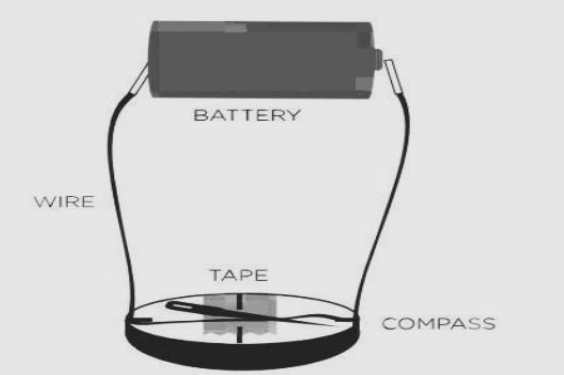
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$

viii Avogadro's number = 6.023 X 10^{23} per gram mole

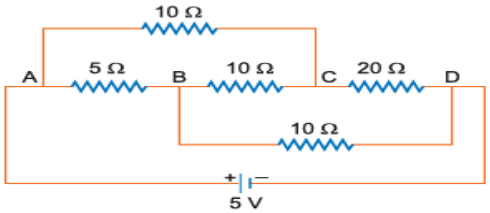
Q. No.	SECTION – A	Marks
1	Two-point charges + Q and + q is separated by a certain distance. If + Q > + q then in between the charges the electric field is zero at a point (a) closer to + Q (b) exactly at the mid-point of line segment joining + Q and + q. (c) closer to + q (d) nowhere on the line segment joining + Q and + q.	1
2	A positively charged particle is released from rest in a uniform electric field. The electric potential energy of the charge (a) remains a constant because the electric field is uniform. (b) increases because the charge moves along the electric field. (c) decreases because the charge moves along the electric field. (d) decreases because the charge moves opposite to the electric field.	1
3	A capacitor is charged by a battery. The battery is removed, and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system. (a) increases by a factor of 4. (b) decreases by a factor of 2. (c) remains the same. (d) increases by a factor of 2.	1
4	The relaxation time in conductors (a) increases with the increases of temperature (b) decreases with the increases of temperature (c) it does not depend on temperature (d) all of sudden changes at 400 K	1

5	What is the net force on the rectangular coil? (a) 25 × 10-7 N towards wire. (b) 25 × 10-7 N away from wire. (c) 35 × 10-7 N towards wire. (d) 35 × 10-7 N away from wire. 	1
6	Two coils are placed closed to each other. The mutual inductance of the pair of coils depends upon (a) the rate at which currents are changing in the two coils. (b) relative position and orientation of two coils. (c) the material of the wires of the coils. (d) the currents in the two coils.	1
7	Electromagnetic waves used as a diagnostic tool in medicine are: (a) X-rays (b) ultraviolet rays (c) infrared radiation (d) ultrasonic waves	1
8	A student measures the focal length of a convex lens by putting an object pin at a distance 'u' from the lens and measuring the distance 'v' of the image pin. The graph between 'u' and 'v' plotted by the student should look like. 	1
9	In a single diffraction pattern observed on a screen placed at D ,distance from the slit of width d , the ratio of the width of the central maxima to the width of other secondary maxima is (a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 3 : 1	1
10	In the phenomenon of interference, energy is (a) destroyed at destructive interference (b) created at constructive interference (c) conserved but it is redistributed (d) same at all points	1
11	When an electron in an atom goes from a lower to a higher orbit, its (a) kinetic energy (KE) increases, potential energy (PE) decreases (b) KE increases, PE increases (c) KE decreases, PE increases (d) KE decreases, PE decreases	1
12	The conductivity of a semiconductor increases with increase in temperature because (a) number density of free current carriers increases. (b) relaxation time increases. (c) both number density of carriers and relaxation time increase. (d) number density of current carriers increases; relaxation time decreases but effect of decrease in relaxation time is much less than increase in number density	1

	For Questions 13to 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 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): The coils of a spring come close to each other, when current is passed through it. Reason (R): It is because, the coils of a spring carry current in the same direction and hence attract each other.	1
14	Assertion (A): The energy (E) and momentum (p) of a photon are related as p = E/c Reason (R): The photon behaves like a particle.	1
15	Assertion (A): Bohr postulated that the electrons in stationary orbits around the nucleus do not radiate. Reason (R): According to classical Physics, all moving electrons radiate	1
16	Assertion (A): Two atoms of different elements having same mass number, but different atomic numbers are called isobars. Reason (R): Atomic number is the number of protons present in atom and atomic mass number is the total number of protons and neutrons present in a nucleus	1
	SECTION -B	
17	A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. It is suspended in mid-air by a uniform horizontal magnetic field. What is the magnitude of the field?	2
18	Use Huygens' geometrical construction to show the behaviour of a plane wavefront, (i) passing through a biconvex lens and (ii) reflected by a concave mirror. (OR) The ratio of maximum and minimum intensities of two sources is 4:1. Find the ratio of their amplitudes.	2
19	Calculate the ratio of the accelerating potential required to accelerate a Proton and an α-particle to have the same de-Broglie wavelength associated with them.	2
20	The total energy of an electron in H-atom in ground state is -13.6ev .Find its kinetic energy and potential energy.	2
21	Explain the processes of nuclear fission and nuclear fusion by using the plot of binding energy per nucleon (BE/A) versus the mass number A.	2
	SECTION -C	
22	Derive a relation for the intensity of electric field at an equatorial point of an electric dipole.	3

23	If a dielectric slab is introduced between the plates of a parallel plate capacitor after the battery is disconnected. How do the following quantities change? (i) Charge (ii) Potential difference (iii) Capacitance (iv) Energy.	3
24	State Biot-Savart Law. Using this law, find an expression for the magnetic field at the centre of a circular coil of N-turns, radius R, carrying current I. OR State ampere's circuital law. Using this derive expression for magnetic field at a point (i) inside and (ii) out side the infinetely long straight current carrying conductor.	3
25	An object is kept in front of a concave mirror of focal length 15 cm. The image formed is real and three times the size of the object. Calculate the distance of the object from the mirror.	3
26	A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is 3/4 of the angle of prism. Calculate the speed of light in the prism.	3
27	Write two characteristic features to distinguish between n-type and p-type semiconductors.	3
28	Draw the energy band diagram when intrinsic semiconductor (Ge) is doped with impurity atoms of Antimony (Sb). Name the extrinsic semiconductor so obtained and majority charge carriers in it.	3
	SECTION -D	
29	In 1820, a Danish physicist, Hans Christian Oersted, discovered that there was a relationship between electricity and magnetism. By setting up a compass through a wire carrying an electric current, Oersted showed that moving electrons can create a magnetic field.  Oersted found that, for a straight wire carrying a steady (DC) current: The magnetic field lines encircle the current-carrying wire. The magnetic field lines lie in a plane perpendicular to the wire. If the direction of the current is reversed, the direction of the magnetic force reverses. The strength of the field is directly proportional to the magnitude of the current. The strength of the field at any point is inversely proportional to the distance of the point from the wire. i. First Scientist who discovered the relation between electric and magnetic field is- (a) Hans Christian (b) Charles William Oersted (c) Charles Maxwell (d) Andre Marie Ampere	4

	ii. If magnitude of the current in the wire increases, strength of magnetic field- (a) Increases (b) Decreases (c) remains unchanged (d) none of these iii. Which of the following statements is true? (a) There is no relationship between electricity and magnetism. (b) An electrical current produces a magnetic field (c) A compass is not affected by electricity. (d) A compass is not affected by a magnet. iv. A compass needle is placed below a straight conducting wire. If current is passing through the conducting wire from North to South. Then the deflection of the compass is ____. (a) Towards West. (b) Towards East. (c) keeps oscillating in East-West direction (d) No deflection OR iv. Charges at rest can produces- (a) Static electric field (b) Magnetic field (c) Induced current (d) Conventional current	
30	The oil drop experiment: In 1909, Robert Millikan and Harvey Fletcher conducted the oil drop experiment to determine the charge of an electron. They suspended tiny, charged droplets of oil between two metal electrodes by balancing downward gravitational force with upward drag and electric forces. The density of the oil was known, so Millikan and Fletcher could determine the droplets' masses from their observed radii (since from the radii they could calculate the volume and thus, the mass). Using the known electric field and the values of gravity and mass, Millikan and Fletcher determined the charge on oil droplets in mechanical equilibrium. By repeating the experiment, they confirmed that the charges were all multiples of some fundamental value. They calculated this value to be 1.5924×10^{-19} Coulombs (C), which is within 1% of the currently accepted value of $1.602176487 \times 10^{-19}$ C. They proposed that this was the charge of a single electron. (i)What was determined from Millikan's oil drop experiment? (a)Electric Charge of alpha particle (b) Electric charge of oil drop (c) mass of electron. (d) None of these (ii)What is the currently accepted value of electric charge of an electron? (a)1.5924×10^{-19} C (b) 9.1×10^{-31} C (c) $1.602176487 \times 10^{-19}$C (d) None of these (iii)How was the mass of an electron determined? (a)By the calculation of electric charge (b) by the calculation of density and Volume (c) By the calculation of electric field (d) By the calculation of gravitational force (iv)What was the conclusion of Millikan's oil drop experiment? (a)Electric charge is integral multiple of fundamental charge (b)Electric charge is integral multiple of charge of alpha particle (c) No result (d) All of the above	4

	SECTION-E	
31	a)Define the term drift velocity of charge carriers in a conductor. Write its relationship with the current flowing through it. b) How does the mobility of electrons in a conductor change, if the potential difference applied across the conductor is doubled, keeping the length and temperature of the conductor constant? c) Give an example of a material for which the temperature coefficient of resistivity is (i) positive, (ii) negative. OR a)Draw a circuit diagram of the Wheatstone Bridge. Use Kirchhoff's rules to obtain the balance condition in terms of the resistances of the four arms of Wheatstone Bridge.  b) Calculate the value of the current drawn from a 5 V battery in the circuit as shown.	5
32	With the help of a ray diagram, show the formation of image of a point object by refraction of light at a spherical surface separating two media of refractive indices n1 and n2 (n2 >n1) respectively. Using this diagram, derive the relation between n2,n1,the object distance u, image distance v and radius of curvature R. OR a) Define a wave front. Using Huygens's principle verify the laws of reflection at a plane surface. (b) In Young's double slit experiment the width of the fringes obtained with the light of wavelength 6000Å is 2 mm. What will be the fringe width, if the entire apparatus is immersed in a liquid of refractive index 1.33?	5
33	A series LCR circuit is connected to an ac source. Using the phasor diagram, derive the expression for the impedance of the circuit. Plot a graph to show the variation of current with frequency of the source, explaining the nature of its variation. OR Draw a schematic diagram of a step-up transformer. Explain its working principle. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils. In an ideal transformer, how is this ratio related to the currents in the two coils? How is the transformer used in large scale transmission and distribution of electrical energy over long distances?	5

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SAMPLE QUESTION PAPER-11: 2025-26

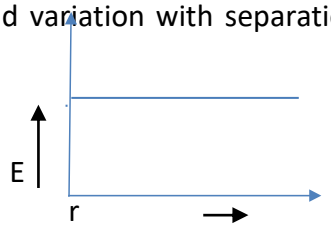
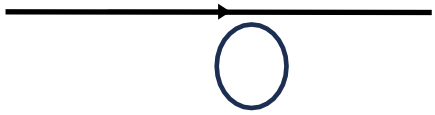
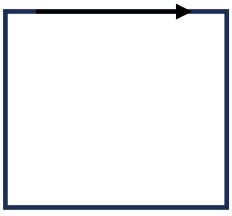
CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX MARKS:70**

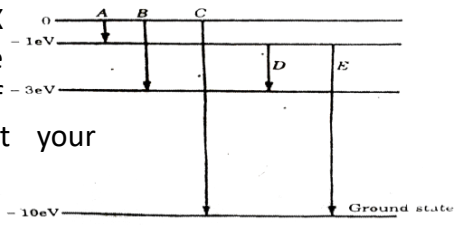
General Instructions

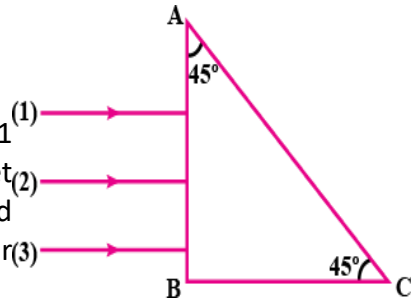
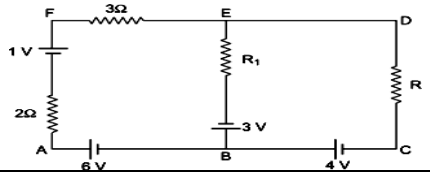
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark 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 wherever 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 A^{-1}
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
viii Avogadro's number = 6.023 X 10^{23} per gram mole

Q. No.	SECTION – A	Marks
1	Name the charge distribution whose electric field variation with separation is represented in the graph given below.  a. Uniformly charged thin wire b. Infinitely charged thin plane sheet c. charged spherical shell d. a point charge	1
2	Ratio of specific charge of two charges is found to be 3:4. If these two charges enter into a uniform perpendicular magnetic field with velocities in the ratio of 3:4, find the ratio of radii of the two charges. a. 9:16 b. 16:9 c. 1:1 d: 4:3	1
3	  Current through a straight conductor is increasing and current through the square loop is constant. How to move the square loop such that there would be no probability for induced current in the circular ring in between the two as shown. a. Towards right b. Towards left c. Downwards d. Upwards	1

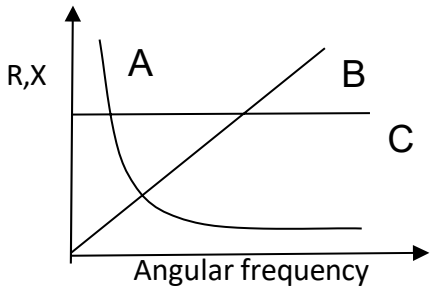
4	In a given AC circuit, it is found that current is leading voltage. On adding which element in series in the circuit one can expect maximum current? a. Inductor b. Resistor c. Capacitor d. Transformer	1
5	Average power over a full cycle in a pure resistive circuit is P. If a capacitor of capacitive reactance R is connected in series with the resistor, then the average power over full cycle is: a. 0 b. P/2 c. P d. P/√2	1
6	If an electromagnetic wave is propagated along +X direction, what is the probable direction of oscillating electric and magnetic fields at any given instant? a. +X and +X b. +Y and -Z c. -Y and Z d. +Y and +Z	1
7	When a convex lens of power +10D is kept in contact with a lens, resultant power of the combination is observed to be -10D. Focal length of the second lens is: a. 5cm b. 5m c. -5cm d. -5m	1
8	A plane wave front is incident on a concave mirror of radius of curvature R. The radius of curvature of the reflected wave front will be: a. 2R b. R c. R/2 d. R/4	1
9	Dynamic mass of a photon of energy E is: a. 0 b. EC^2 c. C^2/E d. E/C^2	1
10	If the velocity of electron in the ground state of hydrogen atom is v, it's velocity in the second excited state would be: a. 2v b. v/2 c. 3v d. v/3	1
11	Nuclear forces are i. strongest force in nature ii. short range force iii. charge dependent iv. spin dependent a. i and ii only b. i, ii and iii only c. i, ii and iv only d. all are correct	1
12	Energy gap of a semiconductor decreases with (i). Increase in temperature (ii). Increase in doping concentration a. i only b. ii only c. either i or ii only d. both i and ii	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**: If a dielectric is inserted between the plates of a charged capacitor which is disconnected from the battery, then charge on the capacitor remains the same. **Reason**: Charge on isolated system remains conserved.	1
14	**Assertion**: if two charges of same magnitude and opposite polarity are projected against each other into a perpendicular magnetic field then they	1

	execute circular paths of the same sense of revolution. (i.e. either both in clockwise sense or in anticlockwise sense). **Reason**: If velocity of two charge particles is in opposite direction in perpendicular magnetic field, then the force will be in opposite direction.	
15	**Assertion**: An alternating current of frequency 50Hz becomes zero for 100 times in one second. **Reason**: Alternating current changes direction and becomes zero twice in a cycle.	1
16	**Assertion**: Among the particles of same kinetic energy, lighter particles have greater de-Broglie wavelength. **Reason**: The de-Broglie wavelength of a particle depends only on the charge of the particle.	1
	SECTION-B	
17	A circular loop of radius R has linear charge density $\boldsymbol{\lambda}$ C/m. Find the potential at a distance 2R from its centre on its axis.	2
18	Suppose that the electric field amplitude of an electromagnetic wave is E_O = 120 N/C and that its frequency $\boldsymbol{\nu}$=50M Hz. Determine B_O, ω, K and $\boldsymbol{\lambda}$. **OR** How does an oscillating charge radiate an electromagnetic wave? Give the relation between frequency of radiated wave and the frequency of oscillating charge.	2
19	Explain how one can convert a full cycle of AC into DC with the help of circuit diagram.	2
20	Plot the suitable graphs to show the variation of photoelectric current with the collector plate potential for the incident radiation. i. the same intensity but different frequencies $\boldsymbol{\nu}1$,$\boldsymbol{\nu}2$ and $\boldsymbol{\nu}3$ ($\boldsymbol{\nu}1<\boldsymbol{\nu}2<\boldsymbol{\nu}3$) ii. the same frequency but different intensities I1, I2 and I3 (I1 < I2< I3)	2
21	Light from a point source in air falls on a spherical glass surface (n = 1.5 and radius of curvature = 20 cm). The distance of the light source from the glass surface is 100 cm. At what position the image is formed?	2
	SECGION-C	
22	a) The energy levels of an atom of element X are shown in the diagram. Which one of the level transitions will result in the emission of photons of wavelength 620nm? Support your answer with mathematical calculations.  b) Name the hydrogen spectral series that can be observed in the visible region.	3
23	Draw the graph showing the variation of binding energy per nucleon with the mass number. Explain with the help of this plot the release of energy in the processes of nuclear fission and fusion.	3

24	Three rays (1,2,3) of different colours fall normally on one of the sides of an isosceles right-angle prism as shown. The refractive index of prism for these rays is 1.36, 1.44 and 1.51 respectively. Find which of these rays get internally reflected and which get only refracted from AC. Trace the paths of rays justify your answer with the help of necessary calculations. 	3
25	Draw the ray diagram of image formation by a reflecting type of telescope. Write any three advantages of reflecting telescope over refracting telescope.	3
26	A) A bar magnet of magnetic moment 1.5 JT^{-1} lies aligned with the direction of a uniform magnetic field 0.22 T. What is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment (i) normal to the field direction? (ii) opposite to the field direction? (iii) What is the torque on the magnet in cases (i) and (ii). **OR** B) The magnitude F of the force between two straight parallel current carrying conductors kept at a distance **d** apart in air is given by $F = \frac{\mu_O I_1 I_2}{2\pi d}$ Where I1 and I2 are the currents flowing through the two wires. Use this expression and the sign convention that the: "Force of attraction is assigned a negative sign and force of repulsion is assigned a positive sign". Draw graphs showing dependence of F on i. I1I2 when d is kept constant ii. when the product I1I2 is maintained at a constant positive value. iii. when the product I1I2 is maintained at a constant negative value.	3
27	Using Kirchhoff's rules to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network shown in the figure. 	3
28	Show, on a plot, variation of resistivity of (i) a conductor, and (ii) a typical semiconductor as a function of temperature. Using the expression for the resistivity in terms of number density and relaxation time between the collisions, explain how resistivity in the case of a conductor increases while it decreases in a semiconductor, with the rise of temperature.	3
	SECTION - D	
29	Loudspeakers: A common application of magnetic force on a current carrying wire is found in loudspeakers. the magnetic field created the permanent magnet exerts a force on the voice coil that is proportional to the current in the coil; the direction of the force is either to the left or to the right, depending on the direction of the current. The signal coming from the amplifier causes the current to oscillate in direction and magnitude. The coil and the speaker cone to which it is attached respond by oscillating with amplitude proportional to the amplitude of current in the coil. Turning up the volume knob on the amplifier increase the current	4

	amplitude and hence the amplitudes of the cone's oscillation and of the sound wave produced by the moving cone. The force is always perpendicular to both the conductor and the field, with the direction determined by the same right-hand rule we used for a moving positive charge. Hence, this force can be expressed as a vector product, just like the force on a single moving charge. We represent the segment of wire with a vector **l** along the wire in the direction of the current, then force **F** on this segment is F=i(l x B) (i.e., magnetic force on a straight wire segment) i. Loudspeaker works on the principle of a. detector b. generator c. amplifier d. motor ii. Electrodynamic speaker can handle which type of audio power relative to a permanent magnet type speaker? a. Lower b. Equal c. Higher d. both (a) and (b) iii. To increase the power handling capacity in loudspeakers which type of magnet is used? a. Temporary magnet b. Permanent magnet c. Electromagnet d. none **OR** A horizontal wire 0.1 m long carries 5 A. Find the magnitude and direction of the magnetic field, which can balance the weight of wire. Given the mass of the wire is $3x10^{-3}$ kg/m and g=10 m/s^2. a. 6×10^{-3} T, acting horizontally perpendicular to wire b. 6×10^{-3} T, acting vertically upwards c. 6×10^{-2} T, acting vertically downwards d. 6×10^{-2} T, acting horizontally perpendicular to wire iv. A square current carrying loop is suspended in uniform magnetic field acting in the plane of the loop. if the force on one arm of the loop is F, the net force on the remaining three arms of the loop is a. F b. -F c. 3F d. -3F	
30	Motions of the Charge Carriers: If you burst a helium-filled balloon, helium atoms will diffuse (spread) outward into the surrounding air. This happens because these are very few helium atoms in normal air. In more formal language, there is a helium density gradient at the balloon-air interface (the number density of helium atoms varies across the interface), the helium atoms move so as to reduce the gradient. In the same way, electrons on n-side are close to the junction plane tend to diffuse across it and into the p- side, where there are very few free electrons. Similarly, holes on p-side are close to the junction plane tend to diffuse across that plane and into the n-side, where there are very few holes. The motions of both the electrons and the holes contribute to diffusion current (I_{diff}).	4

	i. Silicon is doped with which of the following to obtain p-type semiconductor? a. Phosphorus b. Gallium c. Germanium d. Bismuth ii. A semiconductor has an electron concentration of $6x10^{22}$ per m^3 and hole concentration of $8.5x10^9$ per m^3. Then it is a. n-tye b. p-type c. intrinsic d. conductor iii. In p-n junction diode a. the current in the reverse biased condition is generally very small (in micro ampere) b. the current in the reverse biased condition is small but the forward biased current is independent of the biased voltage c. the reverse biased current is strongly dependent on the applied voltage d. the forward biased current is very small in comparison to reverse biased current iv. In the middle of the depletion layer of a reverse biased p-n junction, the a. electric field is zero b. potential is maximum c. electrified is maximum d. Potential is zero OR The dominant mechanism for the motion of charge carriers in forward and reverse biased silicon junctions are a. drift in forward bias, diffusion in reverse bias b. diffusion in forward bias, drift in reverse bias c. diffusion in both forward and reverse bias d. drift in both forward and reverse bias	
	SECTION - E	
31	A. Use Gauss' law to derive the expression for the electric field due to a straight uniformly charged infinite line of charge density **λ** C/m. i. Draw a graph to show the variation of E with perpendicular distance r from the line of charge. ii. Find the work done in bringing a charge q from perpendicular distance r_1 to r_2 ($r_1<r_2$) from the line charge. OR i. Find the capacitance of a capacitor which is partially filled with a dielectric. hence write the expression for the capacitance when it is fully filled with dielectric. ii. Two parallel plate capacitors, X and Y, have the same area of plates and same separation between them. X has air between the plates while Y contains a dielectric of dielectric constant 4. Calculate capacitance of each capacitor if equivalent capacitance of the combination is $4\mu F$.	5
32	a. Draw the schematic arrangement for winding of primary and secondary coils in a transformer when the two coils are wound on top of each other. b. state the underlying principle of a step-up transformer and obtain the expression for the ratio of secondary to primary voltage in terms of number of turns. c. A transformer of 100% efficiency has 200 turns in the primary and 40,000 turns in the secondary. it is connected to a 220V a.c. mains and the secondary feeds to a 100 k Ohm resistance. Calculate the output potential difference per	5

	turn. **OR** a. Figure shows the variation of resistance and reactance versus angular frequency. Identify the curve which corresponds to inductive reactance and capacitive reactance write the mathematical form of their reactance.  a. A series LCR circuit is connected to an ac source (200V, 50Hz). The voltages across the resistor, capacitor and inductor are respectively 200V, 250V and 250V. i. The algebraic sum of the voltages across the three elements is greater than the voltage of the source. How is this paradox resolved? ii. Given the value of the resistance of the resistance of R is 40 Ohm, calculate the current in the circuit.	
33	a. Draw a ray diagram to show the refraction of a ray of light through a prism. Hence derive the expression for refraction through it. b. A ray of light passing through an equilateral triangular glass from air undergoes minimum deviation when angle of incidence is 3/4th of the angle of prism. Calculate the speed of light in the prism. **OR** a. Plot the variation intensity of interference when a monochromatic source is incident on a plane of double slit with path difference. Also plot the variation in intensity if one of the slits is closed. b. Write two characteristic features to distinguish between the interference fringes in YDSE and diffraction due to single slit. c. A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is a distance of 2.5 mm away from the centre. Find the width of the slit.	5

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SAMPLE QUESTION PAPER-12: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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

1. Identify the false statement from the following.

(A) Field lines start with positive charges and end at negative charges.

(B) In a charge-free region, electric field lines can be taken to be discontinuous curves without any breaks.

(C) Two field lines can never cross each other.

(D) Electrostatic field lines do not form closed loops.

2. A storage battery of emf 8.0 V and internal resistance 0.5 Ω is being charged by a 120 V dc supply using a series resistor of 15.5 Ω. What is the terminal voltage of the battery during charging?

(A) 10 V (B) 11 V (C) 11.5 V (D) 8 V

3. A solenoid of length 0.5 m has a radius of 1 cm and is made up of 500 turns. It carries a current of 5A. What is the magnitude of the magnetic field inside the solenoid?

(A). $\pi\ x\ 10^{-3}T$ (B). $2\pi\ x\ 10^{-3}T$ (C). $3\pi\ x\ 10^{-3}T$ (D). $4\pi\ x\ 10^{-3}T$

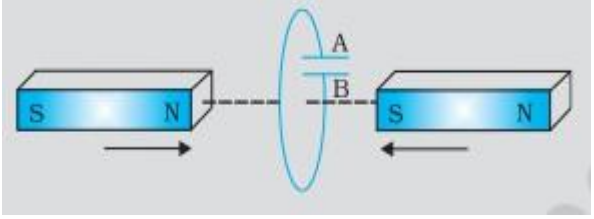
4. Predict the polarity of the capacitor in the situation described by Fig.

(A) A positive and B negative

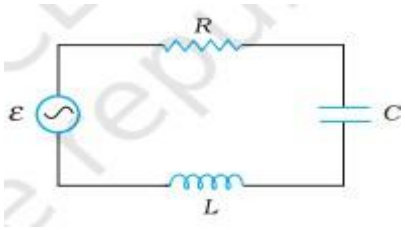
(B) Both A and B are positive

(C) A negative and B positive

(D) Both A and B are negative.



5. Figure shows a series LCR circuit connected to a variable frequency 230 V source. L = 5.0 H, C = 80□F, R = 40 □. Determine the source frequency which drives the circuit in resonance?



(A) all possible frequencies. (B) 150 rad/s
(C) 75 rad/s (D) 50 rad/s

6. Production of infra-red Rays is due to
(A) Rapid acceleration and decelerations of electrons in aerials
(B) Klystron valve or magnetron valve
(C) Vibration of atoms and molecules
(D) Inner shell electrons in atoms move from one energy level to a lower level.

7. A tank is filled with water to a height of 12.5 cm. The apparent depth of a needle lying at the bottom of the tank is measured by a microscope to be 9.4 cm. What is the refractive index of water?
(A) 1.55 (B) 2.33 (C)1.23 (D) 1.33

8. In Young's double-slit experiment using monochromatic light of wavelength □, the intensity of light at a point on the screen where path difference is □, is K units. What is the intensity of light at a point where path difference is □ /3?
(A) k (B) k/2 (C) k/4 (D) zero

9. Which of the following is the form of energy?
(A) Light (B) Pressure (C) Momentum (D) Power

10. A proton and an alpha particle are accelerated through the same potential. What is the ratio of de Broglie Wavelength
(A) 2:1 (B) 1:2 (C) $2\sqrt{2}$:1 (D) 1: $2\sqrt{2}$

11. What is the ratio of the nuclear density for the elements He_2^4 and N_7^{14}
(A) 4:1 (B) 2:7 (C) 7:2 (D) 1:1

12. In a full wave rectifier circuit operating from 50 Hz mains, the fundamental frequency in the ripple will be
(A) 50Hz (B) 100 Hz (C) 70.7 Hz (D) 25 Hz

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 given below.

(A) If both Assertion and Reason are true and Reason is 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: Total energy of an electron in a hydrogen atom is positive.
Reason: Electron in an atom is not held by Coulomb force.

14. Assertion: In the wave picture of light, intensity of light is determined by the square of the amplitude of the wave
Reason: For a given frequency, intensity of light in the photon picture is determined by the number of photons crossing a unit area per unit time

15. Assertion: Lenz's law states that the polarity of the induced emf is such that it tends to produce a current which opposes the magnetic flux that produces it.

Reason: Lenz's law is a consequence of conservation of charge.

16. Assertion: Manganin and constantan materials are widely used in wire bound standard resistors.

Reason: They exhibit a very weak dependence of resistivity with temperature

SECTION-B

17. Two capacitors of capacitance of 6 ?F anf 12 ?F are connected in series with a battery. The voltage across the 6?F capacitor is 2V. Compute the total battery voltage.

18. Depict the behaviour of magnetic field lines near (i) diamagnetic and (ii) paramagnetic substances. Justify, giving reasons.

19. In a plane electromagnetic wave, the electric field oscillates sinusoidal at a frequency of 2.0×10^{10} Hz and amplitude 48 V m^{-1}.

(a) What is the wavelength of the wave?

(b) What is the amplitude of the oscillating magnetic field?

20. A difference of 2.3 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom makes a transition from the upper level to the lower level?

OR

A hydrogen atom initially in the ground level absorbs a photon, which excites it to the n = 4 level. Determine the wavelength and frequency of photon.

21. Explain with the help of a circuit diagram, the working of a p-n junction diode as a half wave rectifier.

SECTION-C

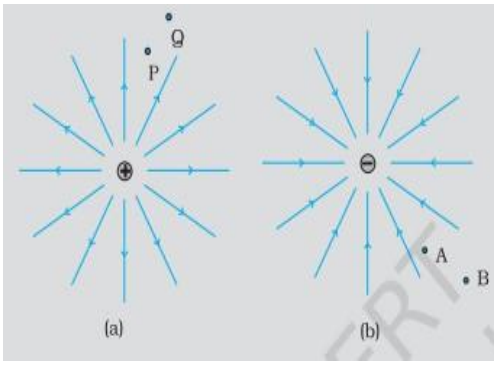
22. What is electric flux? Write its S.I unit. Using Gauss's theorem deduce an expression for the electric field at a point due to a uniformly charged infinite plane sheet.

23. Figures (a) and (b) show the field lines of a positive and negative point charge respectively.

(a) Give the signs of the potential difference $V_P - V_Q$; $V_B - V_A$.

(b) Give the sign of the potential energy difference of a small negative charge between the points Q and P, A and B.

(c) Give the sign of the work done by the external agency in moving a small negative charge from B to A.



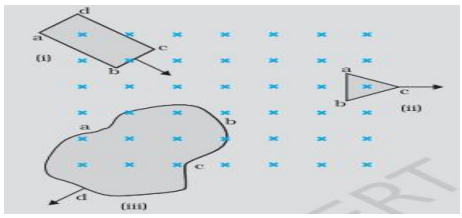
24. (a) Define the term self-inductance and write its S.I unit.

(b) Obtain the expression for the mutual inductance of two long co axial solenoids S1 and S2 wound one over the other, each of length L and radii r_1 and r_2 and n_1 and n_2 number of turns per unit length, when the current I is set up in the outer solenoid.

OR

Figure shows planar loops of different shapes moving out of or into a region of a magnetic field which is directed normally to the plane of the loop away from the reader.

Determine the direction of induced current in each loop using Lenz's law.



25. A resistor of 200 ohm and a capacitor of 15.0 μF are connected in series to a 220 V, 50 Hz ac source.

(a) Calculate the current in the circuit.

(b) Calculate the voltage (rms) across the resistor and the capacitor.

26. (i) If f = 0.5 m for a glass lens, what is the power of the lens?

(ii) A convex lens has 20 cm focal length in air. What is focal length in water?

(Refractive index of air-water = 1.33, refractive index for air-glass = 1.5.)

27. What is the shape of the wave front in each of the following cases:

(a) Light diverging from a point source.

(b) Light emerging out of a convex lens when a point source is placed at its focus.

(c) The portion of the wave front of light from a distant star intercepted by the Earth.

28. Calculate the binding energy per nucleon of iron nucleus. Given mass of $^{56}_{26}Fe = 55.934939u$, mass of a neutron = 1.008665u, mass of a proton = 1.007825u.

SECTION-D

29. **Case study-based question: Read the following passage and answer the questions.**

When light falls on a metal surface, some electrons near the surface absorb enough energy from the incident radiation to overcome the attraction of the positive ions in the material of the surface. After gaining sufficient energy from the incident light, the electrons escape from the surface of the metal 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 value, called the threshold frequency. This minimum frequency depends on the nature of the material of the emitter plate.

Some alkali metals such as lithium, sodium, potassium, cesium and rubidium were sensitive even to visible light. All these photosensitive substances emit electrons when they are illuminated by light. After the discovery of electrons, these electrons were termed as photoelectrons. The phenomenon is called photoelectric effect.

This maximum value of the photoelectric current is called saturation current. Saturation current corresponds to the case when all the photoelectrons emitted by emitter plate C reach the collector plate A.

The minimum negative (retarding) potential V_0 given to plate A for which the photocurrent stops or becomes zero is called the cut off or stopping potential.

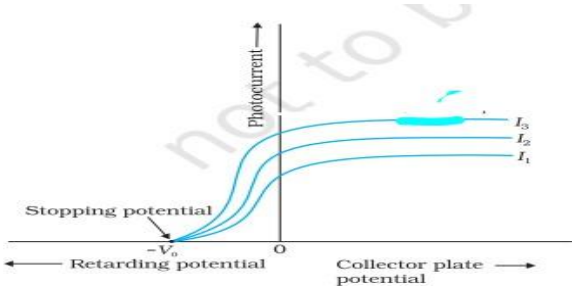
(i) Identify the relation between the intensity of radiation as shown in the figure.

(a) I1=I2=I3

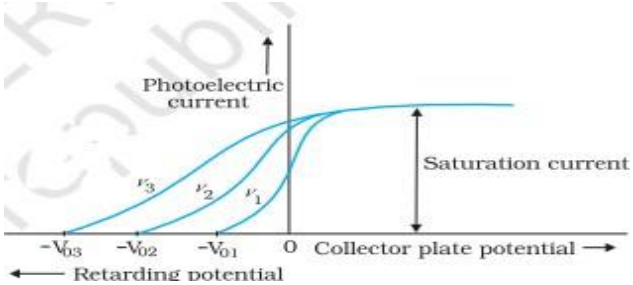
(b) I1<I2<I3

(c) I1>I2>I3

(d) I2<I1<I3



(ii) Identify the relation between the frequency of
radiation as shown in the figure.



(a) □1= □2= □3
(b) □1< □2< □3
(c) □1> □2> □3
(d) □2< □1< □3

(iii) For a given photosensitive material and frequency of incident radiation (above the threshold frequency), the photoelectric current is directly proportional
(a) to the intensity of incident light.
(b) to frequency of incident light
(c) on frequency and intensity of incident light.
(d) None of these

(iv) Above the threshold frequency, the stopping potential or equivalently the maximum kinetic energy of the emitted photoelectrons
(a) increases linearly with the frequency of the incident radiation.
(b) dependent of its intensity of incident radiation.
(c) decreases linearly with the frequency of the incident radiation.
(d) None of these.

OR

(v) The photoelectric cut-off voltage in a certain experiment is 1.5 V. What is the maximum kinetic energy of photoelectrons emitted?
(a) Zero (b) 1 eV (c) 1.5 J (d) 2.4 X 10^{-19} J

30. Case study-based question: Read the following passage and answer the questions.

A p-n junction is the basic building block of many semiconductor devices like diodes, transistors, etc. Two important processes occur during the formation of a p-n junction: diffusion and drift. This space-charge region on either side of the junction together is known as depletion region as the electrons and holes taking part in the initial movement across the junction depleted the region of its free charges. The potential tends to prevent the movement of electron from the n region into the p region, it is often called a barrier potential.

When an external voltage V is applied across a semiconductor diode such that p-side is connected to the positive terminal of the battery and n-side to the negative terminal it is said to be forward biased.

When an external voltage (V) is applied across the diode such that n-side is positive and p-side is negative, it is said to be reverse biased. For diodes, we define a quantity called dynamic resistance as the ratio of small change in voltage ΔV to a small change in current ΔI:

Answer the following Questions:

(i) In an unbiased p-n junction, holes diffuse from the p-region to n-region because
(a) free electrons in the n-region attract them.
(b) They move across the junction by the potential difference.
(c) hole concentration in p-region is more as compared to n-region.
(d) All the above.

(ii) When a forward bias is applied to a p-n junction, it
(a) Raises the potential barrier.

(b) Reduces the majority carrier current to zero.
(c) Lowers the potential barrier.
(d) None of the above.

(iii) In forward bias the width of depletion region
(a) Increases (b) decrease (c) either increases or decreases (d) remains same

(iv) If the voltage of the potential barrier is V_0. A voltage V is applied to the input, at what moment will the barrier disappear?
a) $V < V_0$ b) $V = V_0$ c) $V > V_0$ d) $V << V_0$

(OR)

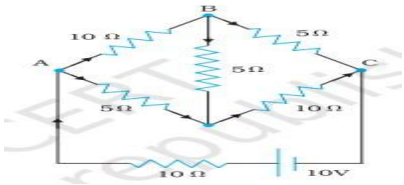
(v) Which of the following statements is incorrect?
(a) The resistance of intrinsic semiconductors decreases with increase of temperature.
(b) Doping pure Si with trivalent impurities give p-type semiconductors.
(c) The majority of carriers in n-type semiconductors are holes.
(d) A p-n junction can act as a semiconductor diode

SECTION-E

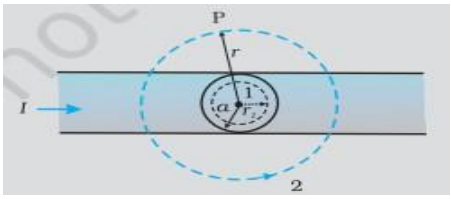
31. (i) Define the term drift velocity.
(ii) On the basis of electron drift, derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. What factors does resistivity of a conductor depend on?
(iii) Why are alloys like constantan and manganin used for making standard resistors?

OR

(i) State the two Kirchhoff's laws.
(ii) Determine the current in each branch of the network shown in Fig.



32. (i) State and explain Ampere's circular law?
(ii) Figure shows a long straight wire of a circular cross-section (radius a) carrying steady current I. The current I is uniformly distributed across this cross-section. Calculate the magnetic field in the region r < a and r > a.



OR

(i) With the help of a neat and labelled diagram, explain the underlying principle and working of a moving coil galvanometer.
(ii) What is the function
(a) uniform radial field
(b) Soft iron core in such a device.

33. Draw a labelled diagram for the formation of image by a compound microscope. Deduce an expression for the total magnification of a compound microscope? Explain why both the objective and the eyepieces of a compound microscope must have short focal lengths.

OR

(i) Draw a ray diagram to show refraction of a ray of monochromatic light passing through a glass prism.
(ii). Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation.

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SAMPLE QUESTION PAPER-13: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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

1. Charge Q is kept in a sphere of 5 cm first then it is kept in a cube of side 5 cm. The outgoing flux will be
(a) More in case of sphere (b) More in case of cube
(c) Same in both cases (d) Information Incomplete

2. Three capacitors of capacitances 1μf, 2μF & 3μF are connected in series and a potential difference of 11V is applied across the combination them the potential difference across the plates of 1μF capacitor is
(a) 2V (b) 4V (c) 1V (d) 6V

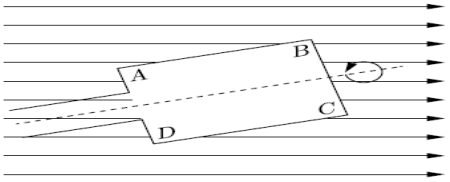
3. A wire in the form of a circular loop, of one turn carrying a current, produces magnetic induction B at the center. If the same wire is looped into a coil of two turns and carries the same current, the new value of magnetic induction at the center is
(a) B (b) 2B (c) 4B (d)8B

4. Current sensitivity of a galvanometer can be increased by decreasing:
(a) Magnetic field B (b) Number of turns N (c) Torsional constant K (d) Area A

5. The relative permeability of a substance *X* is slightly less than unity and that of substance *Y* is slightly more than unity, then
(a) *X* is paramagnetic and *Y* is ferromagnetic (b) *X* is diamagnetic and *Y* is ferromagnetic
(c) *X* and *Y* both are paramagnetic (d) *X* is diamagnetic and *Y* is paramagnetic

6. A wire of magnetic dipole moment *M* and *L* is bent into shape of a semicircle of radius *r.* What will be its new dipole moments?

(a) *M* (b) $\frac{M}{2\pi}$ (c) $\frac{M}{\pi}$ (d) $\frac{2M}{\pi}$



7. A rectangular coil *ABCD* is rotated anticlockwise with a uniform angular velocity about the axis shown in the figure. Initially, the axis of rotation of the coil as well as the magnetic field *B* were horizontal. The induced e.m.f. in the coil would be maximum when plane of the coil

(a) is horizontal

(b) is at right angle to the magnetic field

(c) makes an angle of 30^0 with the horizontal

(d) makes an angle of 45^0 with the direction of magnetic field

8. The magnetic flux through a circuit of resistance *R* changes by an amount Δϕ in a time Δt. The total electric charge *Q* that passes any point in the circuit during the time Δ*t* is represented by

(a) $Q = \frac{\Delta\emptyset}{\Delta t}$ (b) $Q = \frac{\Delta\emptyset}{R}$ (c) $Q = R \times \frac{\Delta\emptyset}{\Delta t}$ (d) $Q = \frac{1}{R} \times \frac{\Delta\emptyset}{\Delta t}$

9. One requires 11eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in

(a) visible region (b) infrared region (c) ultraviolet region (d) microwave region

10. Which of the following has maximum stopping potential when metal is illuminated by visible light?

(a) Blue (b) Yellow (c) Violet (d) Red

11. The energy *E* of a hydrogen atom with principal quantum no. *n* is given by $E = -\frac{13.6}{n^2} eV$. The energy ejected when the electron jumps from *n* = 3 state to *n* = 2 state of hydrogen is approximately

(a) 0.85 eV (b) 1.5 eV (c) 1.9 eV (d) 3.4 eV

12. The radius of a nucleus with nucleon number 16 is 3×10^{-15} m. Then, the radius of a nucleus with nucleon number 128 will be: -

(a) 3×10^{-15} m (b) 6×10^{-15} m (c) 9×10^{-15} m (d) 24×10^{-15} m

13. **Assertion:-** The electric field at every point is normal to the equipotential surface passing through that point.

Reason:- No work is required to move a test charge on an equipotential surface.

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) The Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :-**When tiny circular obstacle is placed in the path of light from some distance, a bright spot is seen at the centre of the shadow of the obstacle.

Reason :-Destructive interference occurs at the centre of the shadow.

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) The Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :-** Kinetic energy of photo electrons emitted by a photosensitive surface depends upon the intensity of incident photon.

Reason :-The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency.

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) The Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion:-** Silicon is preferred over germanium for making semiconductor devices.

Reason:- The energy gap for germanium is more than the energy gap of silicon

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

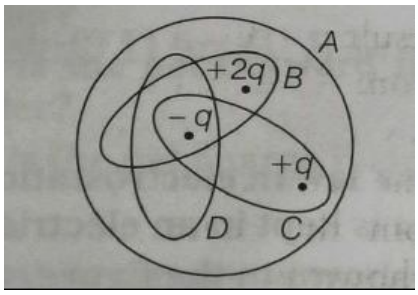
(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) The Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Section – B

17. Rank the Gaussian surfaces as shown in the figure in order of increasing electric flux, starting with the most negative.



18. The refractive index of diamond is much higher than that of glass. How does a diamond cutter make use of this fact?

19. Find the radius of curvature of the convex surface of a plano-convex lens, whose focal length is 0.3 m and the refractive index of the material of the lens is 1.5

(OR)

A telescope consists of two lenses of focal lengths 20 cm and 5 cm. Obtain its magnifying power when the final image is (i) at infinity (ii) at 25 cm from the lenses of eye.

20. If light of wavelength 412.5nm is incident on each of the metals given below, which ones will show photoelectric emission and why?

Metal	Work Function (eV)
Na	1.92
K	2.15
Ca	3.20
Mo	4.17

21. Draw the energy band diagram when intrinsic semiconductor (Ge) is doped with impurity atoms of antimony (Sb). Name the extrinsic semiconductor so obtained and majority charge carriers in it.

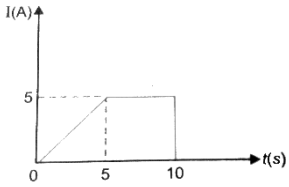
(OR)

Draw energy band diagram of p and n type semiconductors. Also write two differences between p-type
and n-type semiconductors.

Section – C

22. A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of 80 $\mu C/m^2$.
(a) Find the charge on the sphere.
(b) What is the total electric flux leaving the surface of the sphere?

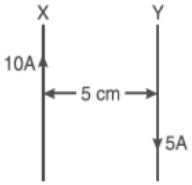
23. Deduce the relationship between current I flowing through a conductor and drift velocity of the electrons. Following figure shows a plot of current I flowing through the cross section of a wire versus the time T. Use the plot to find the charge flowing in 10 seconds through the wire.



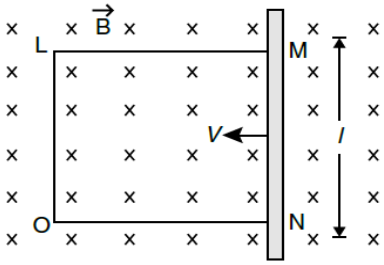
24. (a) What is the principle of a moving coil galvanometer?
(b) Give two reasons to explain why a galvanometer cannot be used to measure the value of the current in a given circuit.
(c) Define the terms: (i) voltage sensitivity and (ii) current sensitivity of a galvanometer.

(OR)

Two parallel straight wires X and Y separated by a distance 5 cm in air carry current of 10 A and 5 A respectively in opposite direction as shown in diagram. Calculate the magnitude and direction of the force on a 20 cm length of the wire Y.



25. A rectangular conductor LMNO is placed in a uniform magnetic field of 0.5 T. The field is directed perpendicular to the plane of the conductor. When the arm MN of length of 20 cm is moved towards left with a velocity of 10 ms^{-1}, calculate the emf induced in the arm. Given the resistance of the arm to be 5 W (assuming that other arms are of negligible resistance), find the value of the current in the arm.



26. A) Name the parts of the electromagnetic spectrum which is (i) suitable for RADAR systems in aircraft navigations. (ii) used to treat muscular strain. (iii) used as a diagnostic tool in medicine.
Write in brief, how can these waves be produced?

(OR)

B) (i) Name the EM waves which are used for the treatment of certain forms of cancer. Write their frequency range.

(ii) Thin ozone layer on top of stratosphere is crucial for human survival. Why?

(iii) Why is the amount of the momentum transferred by the EM waves incident on the surface so small?

27. The ground state energy of hydrogen atom is – 13.6 eV. If an electron makes a transition from an energy level – 1.51 eV to – 3.4 eV, calculate the wavelength of the spectral line emitted and name the series of hydrogen spectrum to which it belongs.

28. Calculate the energy released in MeV in the following nuclear reaction:

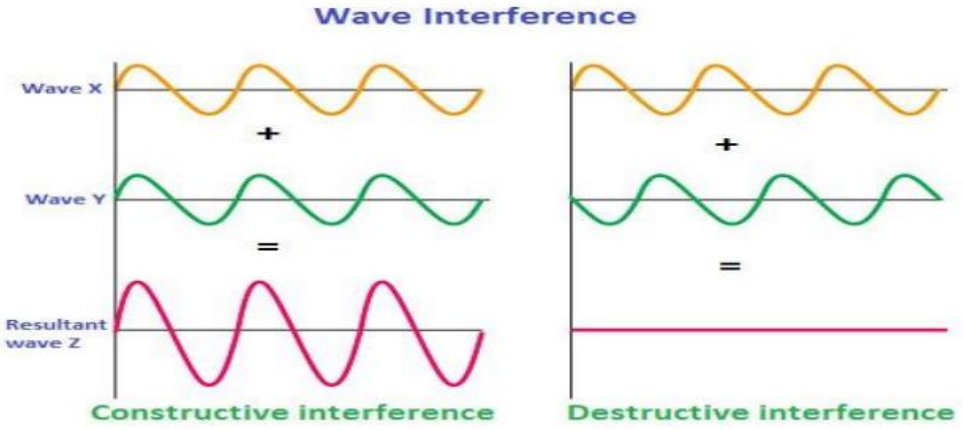
$$_{238}^{92}U \rightarrow {}_{234}^{90}Th + {}_{4}^{2}H + Q$$

Mass of $_{238}^{92}U$ = 238.05079 amu; Mass of $_{235}^{90}Th$ = 234.043630 amu; Mass of $_{4}^{2}He$ = 4.002600 amu; 1 u = 931.5 MeV

Section – D

29. **Case Study based question**: Read the following paragraph and answer the questions.

When two light waves of the same frequency and having zero or constant phase difference travelling in the same direction superpose each other, the intensity in the region of superposition gets redistributed, becoming maximum at some points and minimum at others. This phenomenon is called interference of light. The two sources of light are said to be coherent only when the phase difference between the light waves produced by them is zero or constant. The point at which two waves are in phase or if trough of one wave coincides with the trough of other or crest of one wave coincides with the crest of other then the resultant intensity produced at that point will be larger and amplitude also maximum. Such points are the points where 'constructive interference' takes place. While there are some points where two light waves are not in phase with each other and crest of one wave coincides with the trough of other and vice versa due to which resultant intensity at that point is minimum and amplitude also get decreased. Such points are the points where 'destructive interference' takes place. For constructive interference, the path difference is equal to integral multiple of wavelengths and resultant intensity will be maximum at that points. While for destructive interference, the path difference is (n + 1/2) multiple of wavelengths and where resultant intensity is zero.



(i) Two waves having a phase difference of 90° between them, will interfere

(a) Constructively (b) Destructively

(c) Will not interfere (d) Both (i) and (ii)

(ii) For two sources to be coherent, path difference between them should be

(a) Integral multiple of λ (b) Even multiple of λ
(c) Odd multiple of λ (d) Zero or constant

(iii) Two coherent sources should have
(a) Same frequency (b) Same wavelength
(c) Zero or constant phase difference (d) All of the above

(iv) A phase difference of 2π is associated with a path difference of
(a) λ (b) 2 λ (c) 3 λ (d) λ/2

OR

(v) Which of the following is conserved when light waves interfere?
(a) Intensity (b) Amplitude (c) Phase (d) None of the above

30. **Case Study based question**: Read the following paragraph and answer the questions. P-N junction is a semiconductor diode. It is obtained by bringing p-type semiconductor in close contact with n-type semiconductor. A thin layer is developed at the p-n junction which is devoid of any charge carrier but has immobile ions. It is called depletion layer. At the junction a potential barrier appears which does not allow the movement of majority charge carriers across the junction in the absence of any biasing of the junction. If p-side of p-n junction is connected to positive terminals of external battery and n-side is connected to negative terminal of external battery, then the p-n junction is said to be forward biased. If n-side of p-n junction is connected to positive terminals of external battery and p-side is connected to negative terminal of external battery, then the p-n junction is said to be reverse biased. The p-n junction offers low resistance when forward biased and high resistance when reverse biased.

(i) In the middle of depletion layer of reverse biased p- n junction, the
(a) Electric field is zero (b) Potential is zero
(c) Potential is maximum (d) Electric field is maximum

(ii) The current in the circuit shown in the figure is
(a) 20 A (b) 2×10^{-3} A (c) 200 A (d) 2×10^{-4} A

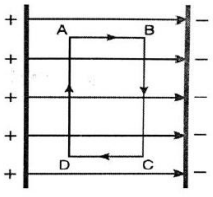
(iii) The number of majority carriers crossing the junction of diode depends
(a)Concentration of doping impurities (b) Magnitude of potential barriers
(c)Magnitude of the forward bias voltage (d) Rate of thermal generation of electron–hole pairs

(iv) In an unbiased p-n junction, holes diffuse from the p- region to the n- region
(a) Free electron in the n-region attract them
(b) They move across the junction due to potential difference
(c) Hole concentration in p-region is more as compared to n-region
(d) All of the above

OR

v) In forward bias, the width of potential barrier in a p-n junction diode
(a) Increases (b) decreases (c) Remains constant (d) First increase and decreases

Section – E



31. (a) What work must be done in carrying an alpha particle across a potential difference of 1volt?

(b) A uniform field E exists between two charged plates as shown in fig. What would be the work done in moving a charge q along the closed

rectangular path ABCDA?

(c) A parallel plate capacitor is charged to a potential V by a DC source. The battery remains connected, and a dielectric slab of thickness d and dielectric constant K is introduced between the plates of the capacitor.

How the following will change:

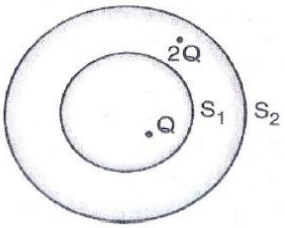
(i) electric field between the plates

(ii) capacitance and

(iii) charge on the plates of the capacitor

(OR)

(a). S_1 and S_2 are two parallel concentric spheres enclosing charges Q and 2Q as shown in fig.



i) What is the ratio of the electric flux through S_1 and S_2?

ii) How will the electric flux through the sphere S_1 change, if a medium of dielectric constant 5 is introduced in space inside S_1 in place of air?

(b). Obtain the expression for the electric field intensity due to a uniformly charged infinite plane sheet

31. (i) A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.

(ii) A step-up transformer converts a low voltage into high voltage. Does it not violate the principle of conservation of energy? Explain.

(iii) Write any two sources of energy loss in a transformer.

(OR)

(i) A coil of number of turns N, area A is rotated at a constant angular speed ω in a uniform magnetic field **B** and connected to a resistor R. Deduce an expression for maximum emf induced in the coil.

(ii) A circular coil of cross-sectional area 200 cm^2 and 20 turns is rotated about the vertical diameter with angular speed of 50 rad/s in a uniform magnetic field of magnitude $3x\ 10^{-2}$ T. Calculate the maximum value of emf in the coil.

32. (a)State Huygen's principle.

(b) Define the term wavefront.

(c) Draw a ray diagram to show the working of a compound microscope. Derive an expression for its magnifying power.

(**OR)**

(a). Write two points of difference between interference pattern and diffraction pattern.

(b) Draw the ray diagram to show the working of a refracting telescope. Derive an expression for its magnifying power (normal adjustment).

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SAMPLE QUESTION PAPER-14: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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

1. Two large vertical and parallel metal plates having a separation of 1 cm are connected to a dc voltage source of potential difference X. A proton is released at rest midway between the two plates. It is found to move at 450 to the vertical just after release. Then X is nearly

(a) 1×10^{-5} V (b) 1×10^{-7}V (c) 1×10-9 V (d) 1×10^{-10} V

2. Two capacitors of capacitances C_1 and C_2 are connected in parallel. If a charge q is given to the assembly, the charge gets shared. The ratio of the charge on the capacitor C_1 to the charge that on C_2 is

(a)C_1/ C_2 (b)C_2/C_1 (c) C_1C_2 (d) $1/C_1C_2$

3. The nature of parallel and anti-parallel currents are

(a) parallel currents repel and antiparallel currents attract.

(b) parallel currents attract and antiparallel cur-rents repel.

(c) both currents attract.

(d) both currents repel.

4. Susceptibility of a substance at 300 K is -0.00002. Its susceptibility at 600K is

(a) -0.00001 (b) -0.00004 (c) -0.00006 (d) -0.000025

5. A current I flows through a long straight conductor which is bent into a circular loop of radius R in the middle as shown in the

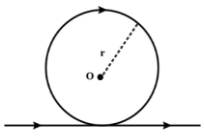


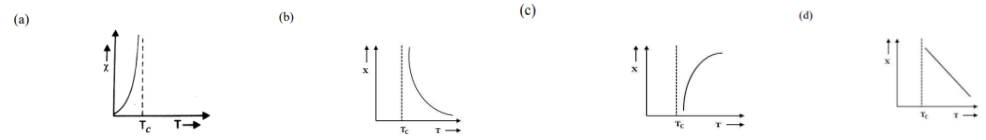
figure. The magnitude of the net magnetic field at point O will be

(a) Zero (b) $\frac{\mu_0 I\ (1+\pi)}{2R}$

(c) $\frac{\mu_0 I}{4R}$ (d) $\frac{\mu_0 I}{2R}(1-\frac{1}{\pi})$

6. The objective of a telescope must be of large diameter in order to
   (a) Remove chromatic aberration
   (b) remove spherical aberration & high magnification
   (c) Gather light and for high resolution
   (d) increase its range of observation

7. The variation of magnetic susceptibility with the temperature of a ferromagnetic material can be plotted as



8. A square loop of wire, side length 10 cm is placed at angel of 45° with a magnetic field that changes uniformly from 0.1 T to zero in 0.7s. The induced current in the loop (its resistance is 1Ω) is

   (a) 1.0 mA (b) 2.5 mA (c) 3.5 mA (d) 4.0 mA

9. In an LCR circuit, capacitance is changed from C to 2C. For the resonant frequency to remain unchanged, the inductance should be changed from L to

(a) 4L (b) 2L (c) L/2 (d) L/4

10. An electromagnetic wave of frequency 3 MHz passes from vacuum into a dielectric medium with permittivity ε= 4. Then,
   (a) Wavelength and frequency both remain unchanged.
   (b) Wavelength is doubled, and the frequency remains unchanged.
   (c) Wavelength is doubled, and the frequency becomes half.
   (d) Wavelength is halved, and the frequency remains unchanged.

11. The threshold frequency for photoelectric effect on sodium corresponds to a wavelength of 5000 Å. Its work function is

   (a) 4×10^{-19} J (b) 1 J (c) 2×10^{-19} J (d) 3×10^{-19} J

12. If the binding energy per nucleon in $_3Li^7$ and $_2He^4$ nuclei are 5.60 MeV and 7.06 MeV respectively, then in reaction $_1H^1 + {}_3Li^7 \rightarrow 2\ {}_2He^4$ energy of proton must be

   (a) 28.24 MeV (b) 17.28 MeV (c)1.46 MeV (d) 39.2 MeV

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 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):** The resistance of a conductor decreases with increase in cross sectional area.

Reason (R): On increasing the cross-sectional area of a conductor, more current will flow through the conductor

14. **Assertion (A):** The resistivity of a semiconductor increases with temperature.

Reason (R): The atoms of a semiconductor vibrate with larger amplitudes at higher temperatures thereby increasing its resistivity.

15. **Assertion (A):** In photoelectron emission, the velocity of electron ejected from near the surface is larger than that coming from interior of metal.

Reason (R): The velocity of ejected electron will be zero.

16. **Assertion (A):** The direction of induced e.m.f. is always such as opposed to the change that causes it.

Reason (R): The direction of induced e.m.f. is given by Lenz's Law.

SECTION - B

17. Name the parts of the electromagnetic spectrum which is

(i) suitable for radar systems used in aircraft navigation.

(ii) used to kill germs in water purifier.

18. Two similar bars, made from two different materials P and Q, are placed one by one, in a non-uniform magnetic field. It is observed that

a) bar P tends to move from the weak to the strong field region.

b) bar Q tends to move from the strong to the weak field region.

(i) Identify the magnetic material used for making these two bars.

(ii) Show with the help of diagrams, the behavior of the field lines, due to an external magnetic field, near each of these two.

19. A straight wire of length L is bent into a semi-circular loop. Use Biot-Savart's law to deduce an expression for the magnetic field at its center due to the current (i) passing through it.

20. Use the mirror equation to show that an object placed between F and 2F of a concave mirror produces a real image beyond 2F.

21. Two material bars A and B of equal area of cross-section are connected in series to a dc supply. A is made of usual resistance wire and B of an n-type semiconductor. In which bar is the drift speed of free electrons greater? Why?

(OR)

Draw the energy band diagram of an n-type semiconductor. How does the energy gap of an intrinsic semiconductor vary with increase in temperature?

SECTION - C

22. Two cells of emfs 1.5 V and 2.0 V having internal resistance 0.2 Ω and 0.3 Ω respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell?

23. A series LCR circuit with R=20 Ω, L =1.5 H and C = 35 μF is connected to a variable frequency 200V ac supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power transferred to the circuit in one complete cycle?

24. a) State Faraday's laws of electromagnetic induction.

b) A metallic rod of 1m length is rotated with a frequency of 50 rev/s, with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 1m, about an axis passing through the centre and perpendicular to the plane of the ring. A constant uniform magnetic field of 1T parallel to the axis is present everywhere. What is the emf between the centre and the metallic ring?

25. Draw a graph between the frequency of incident radiation (ϒ) and the maximum kinetic energy of the electrons emitted from the surface of a photo sensitive material. State clearly how this graph can be used to find a) Planck's constant and b) work function of the material.

(OR)

The work function of Cesium metal is 2.14eV. When light of frequency 6x 10^{14}Hz is incident on the metal surface, photoemission of electrons occurs. What is

a) Maximum kinetic energy of the emitted electron
b) Stopping potential and
c) Maximum speed of the emitted photoelectrons

26. Draw a schematic arrangement of Geiger- Marsden experiment. Calculate the distance of closest approach when a 7.7MeV α-particle approaches a gold nucleus (Z = 79).

27. Explain the formation of central maximum in Young's single slit experiment. Write the expression for the width of central maximum.

28. (a) The mass of a nucleus in its ground state is always less than the total mass of its constituents – neutrons and protons. Explain.

(b) Plot a graph showing the variation of potential energy of a pair of nucleons as a function of their separation.

SECTION - D

29. **Case Study based question**: Read the following paragraph and answer the questions.
Two sources of light which continuously emit light waves of same frequency (or wavelength) with a zero or constant phase difference between them, are called coherent sources. Two independent sources of light cannot act as coherent sources, they have to be derived from the same parent source.
In Young's double slit experiment, two identical narrow slits S_1 and S_2 are placed symmetrically with respect to narrow slit S illuminated with monochromatic light. The interference pattern is obtained on an observation screen placed at large distance D from S_1 and S_2.

(i) In a Young's double slit experiment, the separation between the two slits is 0.9 mm and the fringes are observed one metre away. If it produces the second dark fringe at a distance of 1 mm from the central fringe, the wavelength of monochromatic source of light used is

(a) 500 nm (b) 600 nm (c) 450 nm (d) 400 nm

ii) In a Young's double-slit experiment the fringe width is 0.2 mm. If the wavelength of light used is increased by 10% and the separation between the slits is also increased by 10%, the fringe width will be

(a) 0.20 mm (b) 0.401 mm (c) 0.242 mm (d) 0.165 mm

iii) In an interference experiment, third bright fringe is obtained at a point on the screen with a light of 700 nm. What should be the wavelength of the light source in order obtain 5th bright fringe at the same point

(a) 500 nm (b) 630 nm (c) 750 nm (d) 420 nm

iv) In a Young's double slit experiment, the source illuminating the slits is changed from blue to violet. The width of the fringes

(a) Increases (b) Decreases (c) Becomes unequal (d) Remains constant

(OR)

v) In Young's double slit experiment, the separation between the slits is halved and the distance between the slits and screen is doubled. The fringe width will

(a) be halved (b) be doubled (c) be quadrupled (d) remain unchanged

30. **Case Study based question: Read the following paragraph and answer the questions.**

P-N junction diode: P-N junction is a semiconductor diode. It is obtained by bringing p-type semiconductor in close contact with n- type semiconductors. A thin layer is developed at the p- n junction which is devoid of any charge carrier but has immobile ions. It is called depletion layer. At the junction a potential barrier appears, which does not allow the movement of majority charge carriers across the junction in the absence of any biasing of the junction. P-N junction offers low resistance when forward biased and high resistance when reverse biased.

(i) How many junction(s) do a diode consist of?

a) 0 b) 1 c) 2 d) 3

(ii) If the positive terminal of the battery is connected to the anode of the diode, then it is known as

a) Forward biased b) Reverse biased

c) Equilibrium d) Schottky barrier

(iii) During reverse bias, a small current develops known as

a) Forward current b) Reverse current

c) Reverse saturation current d) Active current

(iv) If the voltage of the potential barrier is V_0. A voltage V is applied to the input, at what moment will the barrier disappear?

a) $V < V_0$ b) $V = V_0$ c) $V > V_0$ d) $V << V_0$

(OR)

v) Which of the following statements is incorrect?

(a) The resistance of intrinsic semiconductors decreases with increase of temperature.

(b) Doping pure Si with trivalent impurities give p-type semiconductors.

(c) The majority of carriers in n-type semiconductors are holes.

(d) A p-n junction can act as a semiconductor diode

SECTION - E

31. a) Derive an expression for the electric field 'E' due to a dipole of length '2a' at a point situated at a distance 'r', from the center of the dipole, on the axial line.

b) Draw a graph of E versus 'r' for r>>a.

c) Four equal point charges each 16μC are placed on the four corners of a square of side 0.2m. Calculate the force on any one of the charges.

(OR)

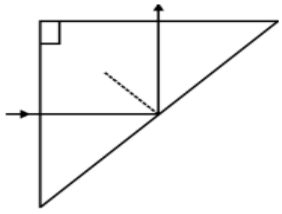
a) Using Gauss' law, deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius 'R' at a point i) outside and ii) inside the shell.

b) Two charges of magnitude -2Q and +Q are located at point (a,0) and (4a, 0) respectively. Find the electric flux due to these charges through a sphere of radius 3a with its centre at the origin.

32. (a) Plot a graph to show variation of the angle of deviation as a function of angle of incidence for light passing through a prism.

(b) Derive an expression for refractive index of the prism in terms of angle of minimum deviation and angle of prism.

(c) A ray of light incident normally on one face of a right isosceles prism is totally reflected as shown in fig. What must be the minimum value of refractive index of glass? Give relevant calculations.



(OR)

a) Define a wave front.

b) Use Huygen's geometrical construction to show the propagation of plane wavefront from a rarer medium to a denser medium. Hence derives Snell's law of refraction.

c) What is the effect on the interference fringes in Young's double slit experiment if the separation between the two slits is decreased? Justify your answer.

33. (a) Plot a graph showing the variation of resistance of a conducting wire as a function of its radius, keeping the length of the wire and its temperature as constant.

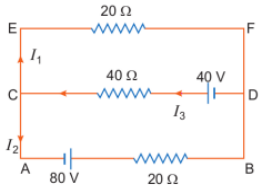
(b) Prove that the current density of a metallic conductor is directly proportional to the drift speed of electrons.

(c) The number density of free electrons in a copper conductor is $8.5\times10^{28}m^3$. How long does an electron take to drift from one end of a wire 3 m long, to its another end? The area of cross section of the wire is 2.0×10^{-6} m^2 and it is carrying a current of 3.0 A.

(OR)

(a) Use Kirchhoff 's laws to determine the value of current I_1 in the given electrical circuit.

(b) Draw a circuit diagram showing balancing of Wheatstone bridge. Use Kirchhoff's laws to obtain balance in terms of the resistance of four arms of Wheatstone bridge.



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SAMPLE QUESTION PAPER-15: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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

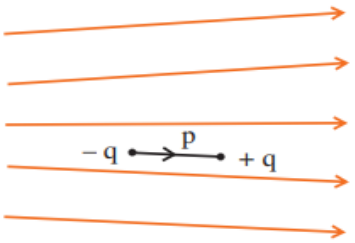
iv. $e = 1.6 \times 10^{-19}$ C

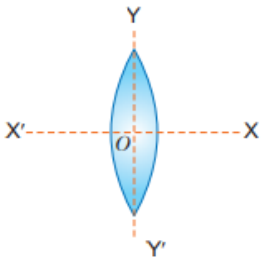
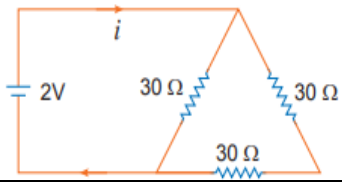
v. $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

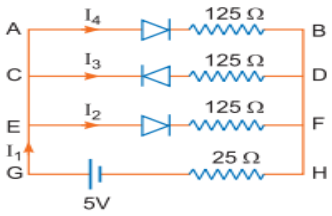
vi. $h = 6.63 \times 10^{-34}$ J s

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

viii Avogadro's number = 6.023 X 10^{23} per gram mole

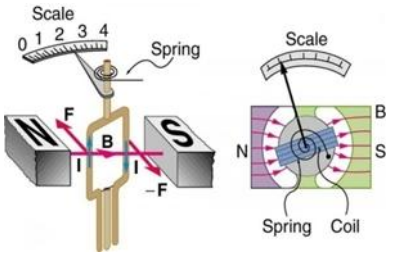
	SECTION – A
1	In bringing an electron towards another electron, the electrostatic potential energy of the system (a) increases (b) decreases (c) remains unchanged (d) becomes zero
2	Figure shows electric field lines in which an electric dipole p is placed as shown. Which of the following statements is correct? (a) the dipole will not experience any force. (b) the dipole will experience a force towards right. (c) the dipole will experience a force towards left. (d) the dipole will experience a force upwards. 
3	When a charged particle moving with velocity v is subjected to a magnetic field of induction B, the force on it is non-zero. This implies that (a) angle between is either zero or 180° (b) angle between is necessarily 90° (c) angle between can have any value other than 90° (d) angle between can have any value other than zero and 180°
4	How can the fringe width increase in Young's double-slit experiment? (a) By decreasing the width of the slit (b) By reducing the separation of slits (c) By reducing the wavelength of the slits (d) By decreasing the distance between slits and the screen

5	A capacitor has some dielectric between its plates, and the capacitor is connected to a dc source. The battery is now disconnected and then the dielectric is removed, then (a) capacitance will increase (b) Energy stored will decrease. (c) Electric field will increase (d) Voltage will decrease.
6	When an AC voltage of 220 V is applied to the capacitor C (a) The maximum voltage between plates is 220 V. (b) The current is in phase with the applied voltage. (c) The charge on the plates is zero. (d) Power delivered to the capacitor is zero.
7	If E and B represent electric and magnetic field vectors of the electromagnetic wave, the direction of propagation of electromagnetic wave is along (a) E (b) B (c) B × E (d) E × B
8	When an electron in an atom goes from a lower to a higher orbit, its (a) kinetic energy (KE) increases, potential energy (PE) decreases (b) KE increases, PE increases (c) KE decreases, PE increases (d) KE decreases, PE decreases
9	An equiconvex lens is cut into two halves along (i) XOX' and (ii) YOY ' as shown in the figure. Let f, f' and f'' be the of the focal lengths of complete lens of each half in case (i) and of each half in case (ii) respectively. Choose the correct statement from the following : (a) f' = 2 f and f'' = f (b) f' = f and f'' = f (c) f' = 2 f and f'' = 2 f (d) f' = f and f'' = 2 f 
10	For light diverging from a point source (a) The wave front is spherical (b) The intensity increases in proportion to the distance squared (c) The wave front is parabolic (d) The intensity at the wave front does not depend on the distance
11	In a n-type semiconductor, which of the following statements is true? (a) Electrons are majority carriers and trivalent atoms are the dopants (b) Electrons are minority carriers and penta-valent atoms are dopants (c) Holes are minority carriers and penta-valent atoms are dopants (d) Holes are majority carriers and trivalent atoms are dopants
12	The current in the adjoining circuit will be (a) $\frac{1}{45}$ A (b) $\frac{1}{15}$ A (c) $\frac{1}{10}$ A (d) $\frac{1}{05}$ A 
	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): A galvanometer can be used as an ammeter to measure the current across a given section of the circuit. Reason (R): For this it must be connected in series with the circuit.
14	Assertion(A): Large angle of scattering of a-particles led to the discovery of atomic nucleus. Reason (R): Entire positive charge of atom is concentrated in the central core.
15	Assertion(A): Density of all nuclei is same. Reason (R): The radius of nucleus is directly proportional to the cube root of mass number.
16	Assertion(A): If intensity of incident light is doubled, the kinetic energy of photoelectron is also doubled. Reason (R): The kinetic energy of photoelectron is directly proportional to intensity of incident light.
	SECTION – B
17	If light of wavelength 412·5 nm is incident on each of the metals given below, which ones will show photoelectric emission and why? <table><tr><th>Metal</th><th>Work Function (eV)</th></tr><tr><td>Na</td><td>1.92</td></tr><tr><td>K</td><td>2.15</td></tr><tr><td>Ca</td><td>3.20</td></tr><tr><td>Mo</td><td>4.17</td></tr></table>
18	Write two points of difference between the phenomena of interference and diffraction. **(OR)** Draw the diagrams to show the behaviour of plane wavefronts as they (a) pass through a thin prism, and (b) pass through a thin convex lens and
19	(i) Write the expression for the magnetic force acting on a charged particle moving with velocity v in the presence of magnetic field B. (ii) A neutron, an electron and an alpha particle moving with equal velocities, enter a uniform magnetic field going into the plane of the paper as shown. Trace their paths in the field and justify your answer. 
20	(i) What characteristic property of nuclear force explains the constancy of binding energy per nucleon (BE/A) in the range of mass number 'A' lying 30 < A < 170? (ii) Show that the density of nucleus over a wide range of nuclei is constant independent of mass number A.
21	A 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 halved? (ii) l is doubled? (iii) D is halved?
	SECTION – C
22	If each diode in figure has a forward bias resistance of 25 Ω and infinite resistance in reverse bias, what will be the values of current I_1, I_2, I_3 and I_4? 

23	Derive an expression for capacitance of parallel plate capacitor with dielectric slab of thickness t (t < d) between the plates separated by distance d. How would the following (i) energy (ii) charge, (iii) potential be affected (a) if dielectric slab is introduced with battery disconnected ? (b) dielectric slab is introduced after the battery is connected ?
24	Using the data given below, state which two of the given lenses will be preferred to construct a (i) telescope (ii) Microscope. Also indicate which is to be used as objective and as eyepiece in each case

Lenses	Power (p)	Apetune (A)
L_1	6 D	1 cm
L_2	3 D	8 cm
L_3	10 D	1 cm

25	State the principle of working of p-n diode as a rectifier. Explain with the help of a circuit diagram, the use of p-n diode as a full wave rectifier. Draw a sketch of the input and output waveforms.
26	Two long straight parallel conductors carry steady current I_1 and I_2 separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field set up in one produces an attractive force on the other. Obtain the expression for this force. Hence define one ampere.
27	Draw a graph to show the angle of deviation with the angle of incidence i for a monochromatic ray of light passing through a prism of refracting angle A. Deduce the relation $\mu = \frac{\sin(\frac{A+\delta_m}{2})}{\sin(\frac{A}{2})}$
28	Find expressions for the force and torque on an electric dipole kept in a uniform electric field An electric dipole is held in a uniform electric field. (i) Using suitable diagram show that it does not undergo any translatory motion, and (ii) Derive an expression for torque acting on it and specify its direction. **(OR)** State Gauss's theorem in electrostatics. Apply this theorem to obtain the expression for the electric field at a point due to an infinitely long, thin, uniformly charged straight wire of linear charge density λ C m^{-1}.
	SECTION – D **Case study based questions**
29	**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 (ii) Pivoted core type or tangent galvanometer. 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 in such a way that magnetic flux passing through the though the coil is maximum. Answer the following questions using above data

	(i) 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. (ii) To make the field radial in moving coil galvanometer a) Number of turns of the coil is kept small b) Horse shoe shaped magnet is taken c) Poles are very strong magnets d) Poles are cylindrically cut (iii) 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 (iv) 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 , then the torque on the coil is a) $NA^2 B^2 I$ b) $NABI^2$ c) $N^2 ABI$ d) NIAB **(OR)** To increase the current sensitivity of a coil we should decrease a) Strength of magnetic field b) Torsional constant of spring c) Number of turns of coil d) Area of coil
30	According to wave theory of light, the light of any frequency can emit electrons from metallic surface provided the intensity of light be sufficient to provide necessary energy for emission of electrons, but according to experimental observations, the light of frequency less than threshold frequency cannot emit electrons; whatever be the intensity of incident light. Einstein also proposed that electromagnetic radiation is quantised. Answer the following questions using above data. (i) In photoelectric effect, electrons are ejected from metals, if the incident light has a certain minimum (a) wavelength (b) frequency (c) amplitude (d) angle of incidence (ii) Kinetic energy of emitted electrons depends upon : (a) frequency (b) intensity (c) nature of atmosphere surrounding the electrons (d) speed of light (iii)The work function of photoelectric material is 3.3 eV. The threshold frequency will be equal to: (a) 8×10^{14} Hz (b) 8×10^{10} Hz (c) 5×10^{10} Hz (d) 4×10^{14} Hz (iv) The strength of photoelectric current depends upon : (a) angle of incident radiation (b) frequency of incident radiation (c) intensity of incident radiation (d) distance between anode and cathode **(OR)** In photo electric emission, for alkali metals the threshold frequency lies in the: (a) visible region (b) ultraviolet region

	(c) infrared region (d) far end of the infrared region
	SECTION - E
31	Derive expression for equivalent e.m.f. and equivalent resistance of a : (a) Series combination (b) Parallel combination of three cells with e.m.f. E_1, E_2, & internal resistances r_1, r_2, respectively. **(OR)** State Kirchhoff's rules for electrical networks. Use them to explain the principle of Wheatstone bridge for determining an unknown resistance. How is it realized in actual practice in the laboratory? Write the formula used.
32	(a) What is impedance? (b) A series LCR circuit is connected to an ac source having voltage $V = V_0 \sin \omega t$. Derive expression for the impedance, instantaneous current and its phase relationship to the applied voltage. Find the expression for resonant frequency. **(OR)** Draw a schematic diagram of a step-up transformer. Explain its working principle. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils. In an ideal transformer, how is this ratio related to the currents in the two coils? How is the transformer used in large scale transmission and distribution of electrical energy over long distances?
33	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. Hence, derive lens maker's formula for a double convex lens. State the assumptions made and sign convention used. **(OR)** Draw the labelled ray diagram for the formation of image by a compound microscope. Derive an expression for its total magnification (or magnifying power), when the final image is formed at the near point. Why both objective of a compound microscope must have short focal lengths?

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SAMPLE QUESTION PAPER-16: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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

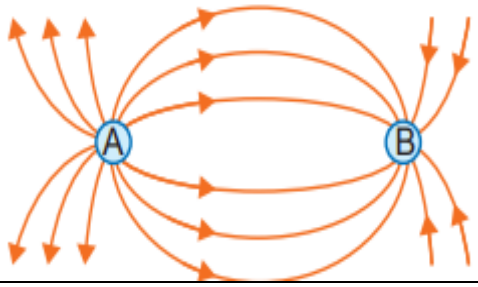
iv. $e = 1.6 \times 10^{-19}$ C

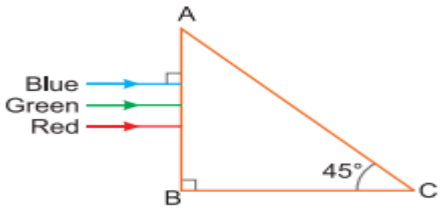
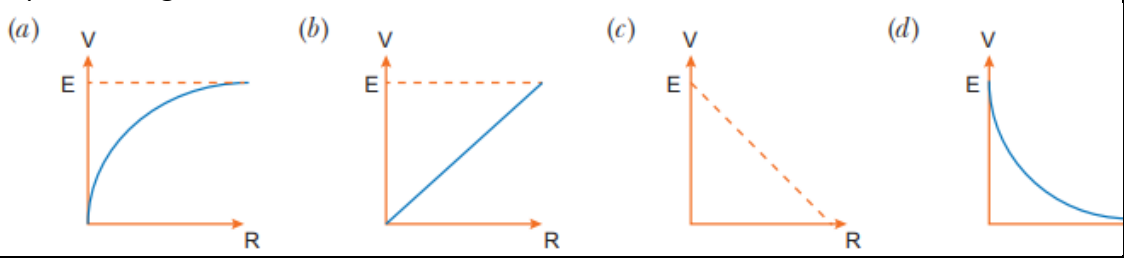
v. $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

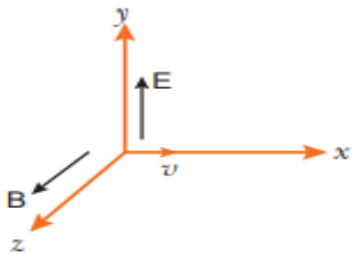
vi. $h = 6.63 \times 10^{-34}$ J s

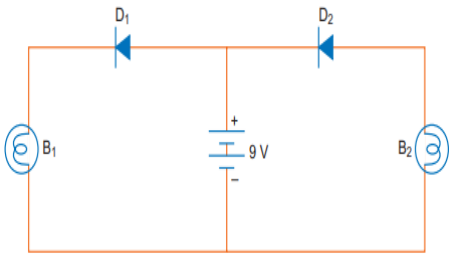
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$

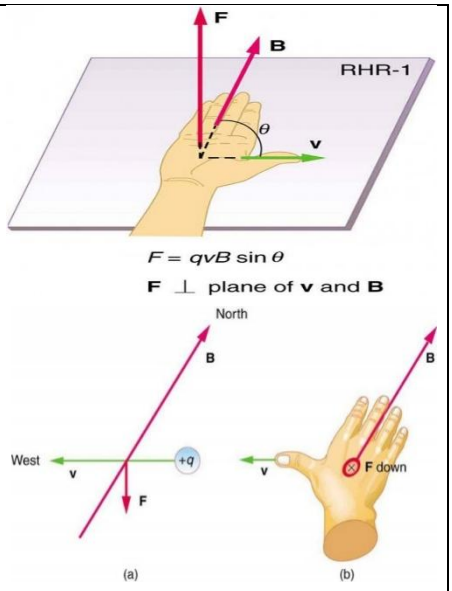
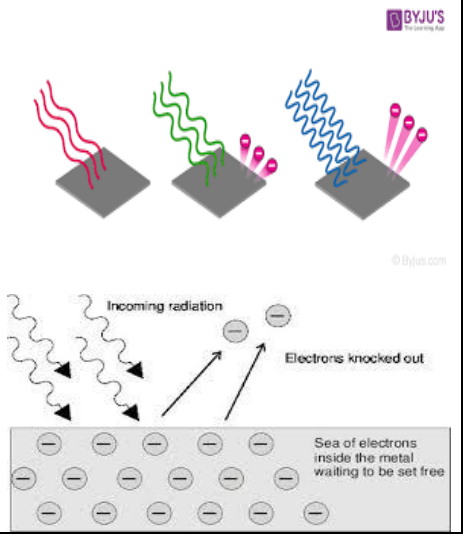
viii Avogadro's number = 6.023 X 10^{23} per gram mole

SECTION - A	
1	Equipotential surface associated with an electric field, which is increasing in magnitude along the X-direction, are (a) planes parallel to YZ-plane (b) planes parallel to XZ-plane (c) planes parallel to XY-plane (d) coaxial cylinder of increasing radii around the X-axis
2	The spatial distribution of the electric field due to two charges (A, B) is shown in figure. Which one of the following statements is correct? (a) A is + ve and B is – ve and |A|>|B| (b) A is – ve and B is + ve, |A|=|B| (c) Both are + ve but A>B (d) Both are – ve but A>B 
3	A compass needle is placed above a straight conducting wire. If current passes through the conducting wire from South to North. Then the deflection of the compass needle (a) is towards West (b) is towards East (c) keeps oscillating in East-West direction (d) no deflection
4	Two light sources are said to be coherent when both the sources of light emit light of (a) The same amplitude and phase (b)The same intensity and wavelength (c) The same speed (d)The same wavelength and constant phase difference

5	Three capacitors of capacitance 1mF, 2 mF and 3 mF are connected in series and a p.d. of 11 V is applied across the combination. Then, the p.d. across the plates of 1 mF capacitor is (a) 2 V (b) 4 V (c) 1 V (d) 6 V
6	In a pure capacitive circuit, the current (a) lags behind the applied emf by angle π/2 (b) leads the applied emf by an angle π (c) leads the applied emf by angle π/2 (d) and applied emf are in same phase
7	Out of the following options which one can be used to produce a propagating electromagnetic wave? (a) A chargeless particles (b) An accelerating charge (c) A charge moving at constant velocity (d) A stationary charge
8	The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is (a) 1 : 1 (b) 1 : –1 (c) 2 : –1 (d) 1 : –2
9	A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive indexes of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The prism will  (a) not separate the three colours at all (b) separate the red colour part from the green and blue colours (c) separate the blue colour part from the red and green colours (d) separate all the three colours from one another
10	In a Young's double slit experiment, the source is white light. One of the holes is covered by a red filter and another by a blue filter. In this case (a) There shall be alternate interference patterns of red and blue (b) There shall be an interference pattern for red distinct from that for blue (c) There shall be no interference fringes (d) there shall be an interference pattern for red mixing with one for blue
11	When an electric field is applied across a semiconductor (a) Electrons move from lower energy level to higher energy level in the conduction band (b) Electrons move from higher energy level to lower energy level in the conduction band (c) Holes in the conduction band move from higher energy level to lower energy level (d) Holes in the valence band move from lower energy level to higher energy level
12	A cell of emf E and internal resistance r is connected across an external resistor R. The graph showing the variation of P.D. across R versus R is 
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): Two parallel conducting wires carrying currents in same direction, come close to each other. Reason (R): Parallel currents attract and anti-parallel currents repel.
14	Assertion(A): Bohr's third postulate states that the stationary orbits are those for which the angular momentum is some integral multiple of $\frac{h}{2\pi}$. Reason (R): Linear momentum of the electron in the atom is quantised.
15	Assertion(A): The binding energy per nucleon, for nuclei with mass number A > 100 decreases with A. Reason (R): The nuclear forces are weak for heavy nuclei.
16	Assertion(A): Photoelectric effect demonstrates the wave nature of light. Reason(R): The number of photoelectrons is proportional to the velocity of incident light
SECTION -B	
17	Write three characteristic features in photoelectric effect which cannot be explained on the basis of wave theory of light, but can be explained only using Einstein's equation.
18	(a) Why are coherent sources necessary to produce a sustained interference pattern? (b) In Young's double slit experiment using monochromatic light of wavelength, the intensity of light at a point on the screen where path difference is **λ**, is K units. Find out the intensity of light at a point where path difference is $\frac{\lambda}{3}$ m. **(OR)** (a) Write the necessary conditions to obtain sustained interference fringes. (b)Also write the expression for the fringe width. What is the effect on the fringe width if the distance between the slits is reduced keeping other parameters same?
19	A particle of charge q is moving with velocity v in the presence of crossed Electric field E and Magnetic field B as shown. Write the condition under which the particle will continue moving along x-axis. How would the trajectory of the particle be affected if the electric field is switched off? 
20	Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is (i) attractive, (ii) repulsive. Write two important conclusions which you can draw regarding the nature of the nuclear forces.
21	(i) Derive an expression for drift velocity of free electrons. (ii) How does drift velocity of electrons in a metallic conductor vary with increase in temperature? Explain.
SECTION - C	

22	In the following diagram, which bulb out of B_1 and B_2 will glow and why? Explain with reason.  **(OR)** Draw the necessary energy band diagrams to distinguish between conductors, semiconductors and insulators. How does the change in temperature affect the behaviour of these materials? Explain briefly.
23	A conducting slab of thickness't' is introduced between the plates of a parallel plate capacitor, separated by a distance d (t < d). Derive an expression for the capacitance of the capacitor. What will be its capacitance when t = d ?
24	Draw a graph to show the angle of deviation with the angle of incidence i for a monochromatic ray of light passing through a prism of refracting angle A. Deduce the relation $\mu = \frac{\sin(\frac{A+\delta_m}{2})}{\sin(\frac{A}{2})}$. **(OR)** (i) What is total internal reflection? Under what conditions does it occur? (ii) Find a relation between critical angle and refractive index. (iii) Name one phenomenon which is based on total internal reflection.
25	Draw a circuit diagram of a full wave rectifier. Explain the working principle. Draw the input/ output waveforms indicating clearly the functions of the two diodes used. **(OR)** Explain how the width of depletion layer in a p-n junction diode changes when the junction is (i) forward biased (ii) reverse biased.
26	Draw the labelled diagram of a moving coil galvanometer. Prove that in a radial magnetic field, the deflection of the coil is directly proportional to the current flowing in the coil.
27	Draw a labelled ray diagram to obtain the real image formed by an astronomical telescope in normal adjustment position. Define its magnifying power. **(OR)** 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. Hence, derive lens maker's formula for a double convex lens.
28	(a) Define electric flux and write its SI unit. (b) Using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it. **(OR)** Derive an expression for the electric field intensity at a point on the equatorial line of an electric dipole of dipole moment p and length 2a. What is the direction of this field?
SECTION – D	

29	**Case Study Based Question: Motion of Charge in Magnetic Field** Consider motion of a charged particle in a uniform magnetic field. First consider the case of v perpendicular to B.The perpendicular force, q (v × B), acts as a centripetal force and produces a circular motion perpendicular to the magnetic field. The particle will describe a circle if v and B are perpendicular to each other. If velocity has a component along B, this component remains unchanged as the motion along the magnetic field will not be affected by the magnetic field. The motion in a plane perpendicular to B is as before a circular one, thereby producing a helical motion.	
	Answer the following questions on the basis of the above case: (i)The force experienced by on a stationary charged particle in a magnetic field is (a) Maximun (b) Constant but greater than zero (c) Zero (d) variable but greater than zero (ii)A proton enters in solenoid with uniform velocity V along the axis of the solenoid then (a) Velocity increases (b) proton is repelled backwards (c) proton moves along the helical path (d) force experienced by the proton is zero (iii)A dipole is thrown into a uniform magnetic field with non zero kinetic energy the dipole will (a) start rotating (b) move in rectilinear motion (c) execute SHM (d) rotate and move along the magnetic field (iv)The force on a charged particle moving with velocity V in a magnetic field B is not (a) perpendicular to both V and B (b) maximum if V is perpendicular to B (c) maximum if V is parallel to B (d) zero if V is parallel to be **(OR)** (v) If cathode rays are projected at right angles to a magnetic field, their trajectory is (a) Ellipse (b) Circle (c) Parabola (d) Helical	
30	**Case Study Based Question: photo Electric Effect** When light of sufficiently high frequency is incident on a metallic surface, electrons are emitted from the metallic surface. This phenomenon is called photoelectric emission. Kinetic energy of the emitted photoelectrons depends on the wavelength of incident light and is independent of the intensity of light. Number of emitted photoelectrons depends on intensity. (hv – ϕ_0=KE) is the maximum kinetic energy of emitted photoelectrons (where ϕ_0 is the work function of metallic surface). Reverse effect of photo emission produces X-ray. X-ray is not deflected by electric and magnetic fields.	

	Wavelength of a continuous X-ray depends on potential difference across the tube. Wavelength of characteristic X-ray depends on the atomic number. Answer the following questions on the basis of the above case: i) Einstein's photoelectric equation is: (a) $E_{max}=h\nu-\phi_0$ (b) $E=mc^2$ (c) $E^2=p^2c^2+(m_0)^2c^4$ (d) $E=\frac{1}{2}mv^2$ ii) Light of wavelength λ which is less than threshold wavelength is incident on a photosensitive material. If incident wavelength is decreased so that emitted photoelectrons are moving with some velocity then stopping potential will (a) increase (b) decrease (c) be zero (d) become exactly half iii) When ultraviolet rays incident on metal plate then photoelectric effect does not occur, it may occur by incident of (a) Infrared rays (b) X-rays (c) Radio wave (d) Microwave iv) If frequency ($\nu > \nu_0$) of incident light becomes n times the initial frequency (v), then K.E. of the emitted photoelectrons becomes (a) n times of the initial kinetic energy (b) More than n times of the initial kinetic energy (c) Less than n times of the initial kinetic energy (d) Kinetic energy of the emitted photoelectrons remains unchanged **(OR)** v) A polychromatic light is used in a photoelectric experiment. The stopping potential (a) Is related to the mean wavelength (b) Intensity of incident light (c) Is not related to the minimum kinetic energy of emitted photoelectrons (d) Is related to the shortest wavelength
	SECTION -E
31	State Kirchhoff's rules for electrical networks. Use them to explain the principle of Wheatstone bridge for determining an unknown resistance. How is it realized in actual practice in the laboratory? Write the formula used. **(OR)** Define current density. Give its SI unit. Whether it is vector or scalar? How does it vary when (i) potential difference across wire increases (ii) length of wire increases (iii) temperature of wire increases (iv) Area of cross-section of wire increases. Justify your answer.
32	a)Explain with the help of a labelled diagram, the principle, construction and working of an AC generator. Write the expression for the emf generated in the coil in terms of speed of rotation. b)Can the current produced by an ac generator be measured with a moving coil galvanometer? **(OR)** (a) State the condition for resonance to occur in series LCR ac circuit and derive an expression for resonant frequency. (b) Draw a plot showing the variation of the peak current (i_{max}) with frequency of the AC source used.
33	a) Draw a labelled ray diagram of a compound microscope and explain its working. b) Derive an expression for its magnifying power if final image is formed at least

	distance of distinct vision. c) A compound microscope uses an objective lens of focal length 4 cm and eyepiece lens of focal length 10 cm. An object is placed at 6 cm from the objective lens. Calculate the magnifying power of the compound microscope. Also calculate the length of the microscope. **(OR)** (a) Derive the mirror formula. What is the corresponding formula for a thin lens? (b) Draw a ray diagram to show the image formation by a concave mirror when the object is kept between its focus and the pole. Using this diagram, derive the magnification formula for the image formed.

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SAMPLE QUESTION PAPER-17: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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

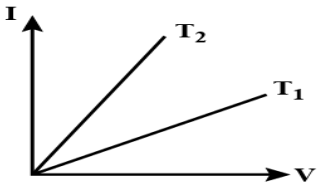
iv. $e = 1.6 \times 10^{-19}$ C

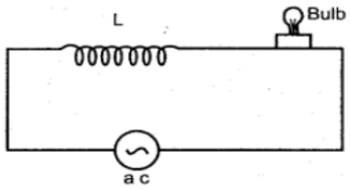
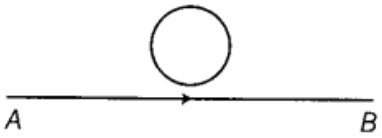
v. $\mu_0 = 4\pi \times 10^{-7}$ T m $\boldsymbol{A^{-1}}$

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

Q.No	**Section-A**	Marks
1	If an object contains n_1 protons and n_2 electrons the net charge on the object is i) $(n_1 + n_2)e$ ii) $(n_1 - n_2)e$ iii) $(n_2 - n_1)e$ iv) Zero	1
2	When the separation between two identical charges is increased the electric potential energy of the charges i) increases ii) decreases iii) remains same iv) may increase or may decrease	1
3	The current - voltage graph for a given metallic wire at two different temperatures T_1 and T_2 as shown in figure, then i) Temperature T_2 is greater than T_1 ii) Temperature T_1 is greater than T_2 iii) Both T_1 and T_2 are equal iv) Resistance of metallic wire is independent of temperature 	1
4	An electron travelling west to east enters a chamber having a uniform magnetic field in north to south, then the direction of deflection is i) Upwards ii) Downwards iii) North iv) South	1
5	Needles N_1, N_2 and N_3 are made of a ferromagnetic, paramagnetic and diamagnetic substance respectively. A magnet is brought close to them will	1

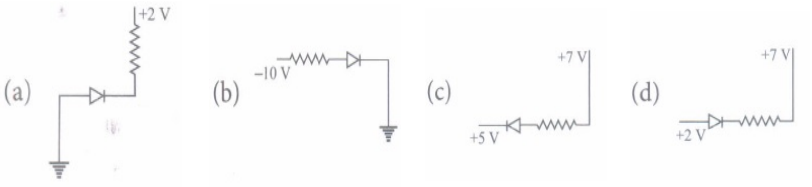
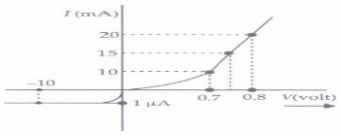
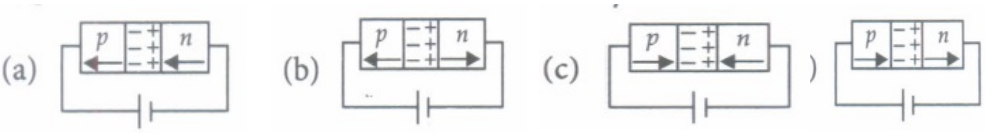
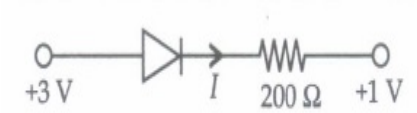
	i) Attract N_1 and N_2 strongly but repel N_3 ii) Attract N_1 strongly , but repel N_2 and N_3 weakly iii) Attract N_1 strongly, N_2 weakly and repel N_3 weakly iv) Attract all these of them.	
6	An iron cored coil is connected in series with an electric bulb with an AC source as shown in figure. When iron piece is introduced into the coil, the brightness of the bulb will  i) increase ii) decrease iii) remains unaffected iv) fluctuate	1
7	Which of the following rays has minimum frequency? i) U V rays ii) X-rays iii) Microwaves iv) Infrared rays	1
8	A Current carrying wire is placed below a coil in its plane, with current flowing as shown. If the current increases.  i) No current will be induced in the coil. ii) An anticlock wise current will be induced in the coil. iii) A clockwise current will be induced in the coil. iv) The current induced in the coil will be first anti clockwise and then clockwise.	1
9	The ratio of maximum to minimum intensity in the interference pattern is 25:1. Then the ratio of amplitudes of the interfering beam is i) 3:2 ii) 5:1 iii) 2:3 iv) 5:3	1
10	A metal of work function 4eV is exposed to a radiation of wavelength 1400Å then the maximum energy of photoelectrons i) 2.43eV ii) 4.86eV iii) 5.24eV iv) 6.24eV	1
11	The energy of electron in the ground state of Hydrogen atom is -13.6eV. The kinetic energy of the electron is the 4^{th} orbit is i)3.4eV ii)0.85eV iii) 1.7eV iv) 0.425eV	1
12	Which of the following is not correct about nuclear forces. i) They are short range attractive forces ii) They are independent of charge iii) They change to repulsive at very close distance iv) They obey inverse square law	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 : The alternating current lags behind the emf by a phase angle of, $\pi/2$ when AC flows through an inductor. Reason : The inductive reactance increases as the frequency of AC source increases.	1
14	Assertion: When a diode is forward biased it acts like a conductor. Reason: Width of depletion layer increases in forward bias.	1
15	Assertion: A galvanometer cannot as such be used as an ammeter to measure the current across a given section of the circuit. Reason: For this it must be connected in series with the circuit	1
16	Assertion : Maximum photoelectric current in a photocell depends upon intensity of incident light if the frequency of incident light is above threshold frequency . Reason: Greater the frequency of incident light, greater will be the maximum velocity of emitted electrons	1

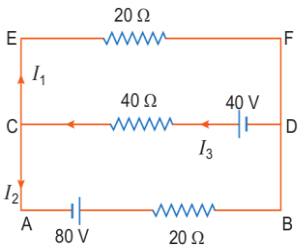
SECTION -B

17	Name the parts of the electromagnetic spectrum which is (i) suitable for radar systems used in aircraft navigation. (ii) used to kill germs in water purifier.	2
18	(a) The susceptibility of a magnetic material is -4.2×10^{-6}. Name the type of magnetic materials it represents. (b) State any two properties of the above type of materials.	2
19	A difference of 2.3 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom makes transition from the upper level to the lower level?	2
20	Write two characteristic features to distinguish between n-type and p-type semiconductors. **OR** Draw energy band diagrams of an n-type and p-type semiconductor at temperature T > 0 K.	2
21	How does the fringe width of interference fringes change, when the whole apparatus of Young's experiment is kept in water (refractive index 4/3)?	2
	Section-C	
22	A ray of light passes through an equilateral glass prism such that the angle of incidence is equal to angle of emergence and each of these angles is equal to $\frac{3}{4}$ of angle of prism. What is the value of angle of deviation?	3
23	Two concentric metallic spherical shells of radii R and 2R are given charges Q_1 and Q_2 respectively. The surface charge densities on the outer surfaces of the shells are equal. Determine the ratio Q_1: Q_2.	3
24	a)Write the expression for the torque acting on a magnetic dipole when placed in a uniform magnetic field. b) Discuss the effect of temperature on magnetic properties.	1 2

25	A long solenoid with 15 turns per cm has a small loop of area 2.0 cm^2 placed inside normal to the axis of the solenoid. The current carried by the solenoid changes steadily from 2A to 4A in 0.1s, what is the induced emf in the loop while the current is changing?	3
26	A series LCR circuit with R=20 Ω, L =1.5 H and C = 35 μF is connected to a variable frequency 200V ac supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power transferred to the circuit in one complete cycle?	3
27	(a) If the potential difference used to accelerate electrons is doubled, by what factor does the de-Broglie wavelength associated with the electrons change? (b) Show on a graph the variation of the de Broglie wavelength (λ) associated with an electron, with the square root of accelerating potential (V). (c) An electron and a proton have the same kinetic energy. Which one of the two has the larger de Broglie wavelength and why? **OR** (a) Draw a graph showing variation of photocurrent with anode potential for a particular intensity of incident radiation. Mark saturation current and stopping potential. (b) How much would stopping potential for a given photosensitive surface go up if the frequency of the incident radiations were to be increased from 4×10^{15} Hz to 8×10^{15} Hz?	3
28	A photon emitted during the de-excitation of electron from a state n to the first excited state in a hydrogen atom, irradiates a metallic cathode of work function 2 eV, in a photocell, with a stopping potential of 0.55 V. Obtain the value of the quantum number of the state n.	3
	Section-D	
29	**Case Study :** **Read the following paragraph and answer the questions.** A prism is a portion of a transparent medium bounded by two plane faces inclined to each other at a suitable angle. A ray of light suffers two refractions on passing through a prism and hence deviates through a certain angle from its original path. The angle of deviation of a prism is, δ = (μ - 1) A, through which a ray deviates on passing through a thin prism of small refracting angle A.If μ is refractive index of the material of the prism, then prism formula is,μ=sin(A+δm)/2/sinA/2 (i) For which colour, angle of deviation is minimum? (a) Red (b) Yellow (c) Violet (d) Blue (ii) When white light moves through vacuum (a) all colours have same speed (b) different colours have different speeds (c) violet has more speed than red (d) red has more speed than violet. (iii) The deviation through a prism is maximum when angle of incidence is (a) 45° (b) 70° (c) 90° (d) 60°	4

	(iv) What is the deviation produced by a prism of angle 6°? (Refractive index of the material of the prism is 1.644). (a) 3.864° (b): 4.595° (c) 7.259° (d) 1.252° **OR** (v) A ray of light falling at an angle of 50° is refracted through a prism and suffers minimum deviation. If the angle of prism is 60°, then the angle of minimum deviation is (a) 45° (b) 75° (c) 50° (d) 40°	
30	**Case Study :** **Read the following paragraph and answer the questions.** When the diode is forward biased, it is found that beyond forward voltage V = Vk, called knee voltage, the conductivity is very high. At this value of battery biasing for p-n junction, the potential barrier is overcome and the current increases rapidly with increase in forward voltage. When the diode is reverse biased, the reverse bias voltage produces a very small current about a few microamperes which almost remains constant with bias. This small current is reverse saturation current. (i) In which of the following figures, the p-n diode is forward biased.  (ii) Based on the V-I characteristics of the diode, we can classify diode as (a) bi-directional device (b) Ohmic device (c) non-Ohmic device (d) passive element (iii) The V-I characteristic of a diode is shown in the figure. The ratio of forward to reverse bias resistance is  (a) 100 (b) 106 (c) 10 (d) 10^{-6} (iv) In the case of forward biasing of a p-n junction diode, which one of the following figures correctly depicts the direction of conventional current (indicated by an arrow mark)?  **OR** (v) If an ideal junction diode is connected as shown, then the value of the current I is  (a) 0.013 A (b) 0.02 A (c) 0.01 A (d) 0.1 A	4

Section-E

31	(a) A point charge of 2.0 nC is at the centre of a cubic Gaussian surface 9.0 cm on edge. What is the net electric flux through the surface? (b)Two large, thin metal plates are parallel and close to each other. On their inner faces, the plates have surface charge densities of opposite signs and of magnitude 17.0×10^{-22} C/m^2 . Calculate the electric field strength E: (i) in the outer region of the first plate (ii) in the outer region of the second plate (iii) between the plates **OR** (a) A regular hexagon of side 10 cm has a charge 5 μC at each of its vertices. Calculate the potential at the centre of the hexagon. (b) Derive an expression for the electric potential at an axial point due to an electric dipole of dipole length 2a. (c) What is the electric potential at any point on the equatorial line of an electric dipole?	5
32	(a) Plot a graph showing the variation of resistance of a conducting wire as a function of its radius, keeping the length of the wire and its temperature as constant. (b) Prove that the current density of a metallic conductor is directly proportional to the drift speed of electrons. (c) The number density of free electrons in a copper conductor is 8.5×10^{28}m^3 . How long does an electron take to drift from one end of a wire 3 m long, to its other end? The area of cross section of the wire is 2.0×10^{-6} m^2 and it is carrying a current of 3.0 A. **OR** (a) Use Kirchhoff 's laws to determine the value of current I_1 in the given electrical circuit. (b) Draw a circuit diagram showing balancing of Wheatstone bridge. Use Kirchhoff 's laws to obtain the balance condition in terms of the resistances of four arms of Wheatstone Bridge. 	5
33	(a) The focal length of an equiconvex lens is equal to the radius of curvature of either face. What is the value of refractive index of the material of the lens? (b) Draw the diagrams to show the behaviour of plane wavefronts as they (i) pass through a thin prism (ii) pass through a thin convex lens (iii) reflect by a concave mirror. **OR** (a) Draw the intensity distribution for (i) the fringes produced in interference (ii) the diffraction bands produced due to single slit. (b) 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. Hence, derive lens maker's formula for a double convex lens.	5

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SAMPLE QUESTION PAPER-18: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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 A^{-1}
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
viii Avogadro's number = 6.023 X 10^{23} per gram mole

SECTION-A

1. Why Silicon is more widely used for semiconductor devices?
   (a) It can be used at much higher temperatures than germanium.
   (b) It is cheaper than germanium.
   (c) It has higher conductivity than germanium.
   (d) None of the above.

2 The work function for a metal surface is 4.14 eV. The threshold wavelength for this metal surface is:
   (a) 4125 Å (b) 2062.5 Å (c) 3000 Å (d) 6000 Å

3. Which Quantity is vector Quantity among the following -
   (a) Electric flux (b) Electric charge (c) Electric field (d) Electric potential

4. A dipole is placed parallel to electric field. If W is the work done in rotating the dipole from 0° to 60°, then work done in rotating it from 0° to 180° is
   (a) 2 W (b) 3 W (c) 4 W (d)6W

5. A magnetic needle is kept in a non-uniform magnetic field. It experiences
   (a) a torque but not a force. (b) neither a force nor a torque.
   (c) a force and a torque. (d) a force but not a torque.

6. Current sensitivity of a galvanometer can be increased by decreasing
   (a) Magnetic field B (b) number of turns N
   (c) torsional constant K (d) Area A

7. In Faraday's experiment on electromagnetic induction, more deflection will be shown by galvanometer, when

(a) Magnet is in uniform motion towards the coil
(b) Magnet is in uniform motion away from the coil
(c) Magnet is in accelerated motion towards the coil
(d) Magnet is at rest near the coil

8. EM waves can be produced by a charge:

(a) An accelerated charged particles (b) A charged particles moving with constant speed
(c) at rest. (d) either at rest or moving with constant velocity.

9. In EM spectrum minimum wavelength is of:

(a) gamma rays (b) radio waves (c) visible rays (d) microwave.

10. Which of the following transport by EM waves:

(a)charge & momentum (b) frequency & wavelength
(c) energy& momentum (d) wavelength & energy

11. Ratio of intensities of two waves are given by 4:1. Then ratio of the amplitudes of the two waves is

(a) 2:1 (b) 1:2 (c) 4:1 (d) 1:4

12. The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6 eV fall on it is 4 eV. The stopping potential, in volt is

(a) 2 (b) 4 (c) 6 (d) 10

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true and R is NOT the correct explanation of A
c) A is true but R is false
d) A is false and R is also false

13. Assertion (A): In balanced condition, if the galvanometer and the voltage source is interchanged, the balanced condition remains same.

Reason (R): The balanced condition of Wheatstone bridge does not depend on the value of the resistances.

14. Assertion (A): A photon has no rest mass, yet it carries definite momentum.

Reason (R): Momentum of photon is due to its energy and hence its equivalent mass

15. Assertion (A): According to Rutherford, atomic model, the path of an electron is parabolic.

Reason (R): Rutherford could not explain the stability of the atom.

16. Assertion: The alternating current lags behind the emf by a phase angle of, $\pi/2$ when AC flows through an inductor.

Reason : The inductive reactance increases as the frequency of AC source increases

SECTION-B

17. Two electric bulbs P and Q have their resistances in the ratio of 1: 2. They are connected in series across a battery. Find the ratio of the power dissipation in these bulbs.

18. Write two points of differences between para, dia and ferromagnetic materials, giving one example for each.

19. Define the terms depletion layer and potential barrier.

20. The ground state energy of hydrogen atom is -13.6 eV. If an electron makes a transition from an energy level-1.51 eV to -3.4 eV, calculate the wavelength of the spectral line emitted and the series of hydrogen spectrum to which it belongs.

OR

The short wavelength limit for the Lyman series of the hydrogen spectrum is 913.4 A^0. Calculate the short wavelength limit for the Balmer series of the hydrogen spectrum.

21. A biconvex lens made of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33. Will the lens behave as a converging or a diverging lens? Justify your answer.

SECTION-C

22. A parallel plate capacitor is charged by a battery. After sometime, the battery is disconnected and a dielectric slab with its thickness equal to the plate separation is inserted between the plates. How will

(i) the capacitances of the capacitor,
(ii) potential difference between the plates and
(iii) the energy stored in the capacitors be affected. Justify your answer in each case.

23. A proton and an alpha particle are accelerated with the same accelerating potential. Find the ratio between their de-Broglie wavelengths.

24. Draw a plot of potential energy of a pair of nucleons as a function of their separation.

(i) Write two important conclusions that can be drawn from the graph.
(ii) What is the significance of negative potential energy in the graph drawn?

25.(a) State Huygen's principle .

(b)Verify the law of reflection using the Huygen's principle.

26. (a) What is the principle of a moving coil galvanometer .

(b) Give two reasons to explain why a galvanometer cannot as such be used to measure the value of the current in a given circuit.

(c) Define the terms: (i) voltage sensitivity and (ii) current sensitivity of a galvanometer.

27. Use Kirchhoff's rules to obtain conditions for the balance condition in a Wheatstone bridge.

28. (a) A capacitor is connected with a voltage source $V= V_0 \sin wt$. Obtain the expression for electric current through the circuit. Draw the phasor diagram showing current and voltage.

OR

(b) An inductor is connected with a voltage source $V= V_0 \sin \omega t$. Find the expression for inductive reactance. Plot a graph showing the variation of inductive reactance with frequency.

SECTION-D

(Case study based questions)

29.**Read the following paragraph and answer the questions.**

Total internal reflection is the phenomenon of reflection of light into denser medium at the interface of denser medium with a rarer medium. For this phenomenon to occur necessary condition is that light must travel from denser to rarer and angle of incidence in denser medium must be greater than critical angle (C) for the pair of media in contact. Critical angle depends on nature of medium and wavelength of light. We can show that $\mu=1/\sin C$.

(i) Critical angle for glass air interface, where μ of glass is 3/2 is

(a) 41.8° (b) 60° (c) 30° (d) 15°

(ii) Critical angle for water air interface is 48.6°. What is the refractive index of water?

(a) 1 (b) 3/2 (c) 4/3 (d) 3/4

(iii) Critical angle for air water interface for violet colour is 49°. Its value for red colour would be

(a) 49° (b) 50° (c) 48° (d) can't say

(iv) Which of the following is not due to total internal reflection?

(a) Working of optical fibre.

(b) Difference between apparent and real depth of a pond.

(c) Mirage on hot summer days.

(d) Brilliance of diamond

OR

(v) Critical angle of glass is θ_1 and that of water is θ_2. The critical angle for water and glass surface would be ($\mu g=3/2, \mu w=4/3$)

(a) less than θ_2 (b) between θ_1 and θ_2 (c) greater than θ_2 (d) less than θ_1

30.**Read the following paragraph and answer the questions.**

The Device used for conversion of AC to DC is called rectifier. Usually crystal diode is used in rectifier. The output of the rectifier is not 100% DC but consists of pulsating voltage. To reduce it again it will fed to filter circuit.

(i) The property of crystal diode which makes it suitable for rectification is

(a) made of semiconductor (b) Unidirectional flow of current

(c) Less current in reverse bias (d) after knee voltage it exceptionally increases

(ii) Capacitor is used in filter circuit because

(a) It allow DC (b) It connect series with load resistor

(c) The pulsating AC can easily passed through capacitor (d) None of above

(iii) The efficiency of rectifier is more when

(a) one diode is used (b) two diode used in series

(c) two diode used in parallel (d) one diode and a capacitor connected in parallel.

(iv) Which of the following is used in a rectifier?

(a) Inductor (b) Capacitor (c) Resistor (d) Diode

OR

(V) In a full wave rectifier, if the input frequency is 50 Hz, then output frequency will be

(a) 50 Hz (b) 75 Hz (c) 100 Hz (d) 200 Hz

SECTION-E

31. (a) Use Gauss' theorem to find the electric field due to a uniformly charged infinitely large plane thin sheet with surface charge density σ.

(b) An infinitely large thin plane sheet has a uniform surface charge density +σ. Obtain the expression for the amount of work done in bringing a point charge q from infinity to a point, distant r, in front of the charged plane sheet.

OR

Capacitor of capacitance C_1 is charged to a potential V_1, while another capacitor of capacitance C_2, is charged to a potential V_2. The capacitors are now disconnected from their respective charging batteries and connected in parallel to each other.

(i) Find the total energy stored in the two capacitors before they are connected.

(ii) Find the total energy stored in the parallel combination of the two capacitors.

(iii) Explain the reason for the difference of energy in parallel combination in comparison to the total energy before they are connected.

32. i) Draw a labelled ray diagram for the formation of image by a compound microscope in normal adjustment.

(ii) Define magnifying power of a compound microscope in normal adjustment and derive an expression for it.

(iii) Compound microscope uses an objective lens of focal length 4 cm and eyepiece lens of focal length 10 cm. An object is placed at 6 cm from the objective lens. Calculate the magnifying power of the compound microscope if final image is formed at infinity. Also calculate the tube length of the microscope.

OR

(a) Draw a labelled ray diagram to obtain the real image formed by an astronomical telescope in normal adjustment position. Define its magnifying power.

(b) You are given three lenses of power 0.5 D, 4D and 10 D to design a telescope.

(i) Which lenses should be used as objective and eyepiece? Justify your answer.

(ii) Why is the aperture of the objective preferred to be large?

33. (a) Draw a labelled diagram of a transformer. Obtain the ratio of secondary to primary voltage in terms of number of turns and currents in the two coils.

(b) A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.

OR

(a) A circular coil of radius 8.0 cm and 20 turns is rotated about its vertical diameter with an angular speed of 50 rad s^{-1} in a uniform horizontal magnetic field of magnitude 3.0×10^{-2} T. Obtain the maximum and average emf induced in the coil. If the coil forms a closed loop of resistance 10 Ω, calculate the maximum value of current in the coil. Calculate the average power loss due to Joule heating.

(c) Current in a circuit falls from 5.0 A to 0. 0 A in 0.1 s. If an average emf of 200 V is induced, give an estimate of the self-inductance of the circuit.

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SAMPLE QUESTION PAPER-19: 2025-26

CLASS: XII **SUBJECT: PHYSICS**

TIME:3Hrs **MAX 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 wherever 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. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$

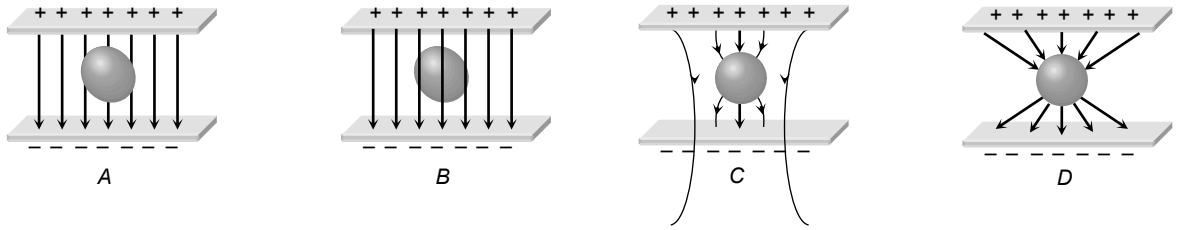
viii Avogadro's number = 6.023 X $\boldsymbol{10^{23}}$ per gram mole

[SECTION – A]

Q1. A charge *q* is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium, if is equal to

(A) - Q/2 (B) - Q/4 (C) +Q/4 (D) + Q/2

Q2. An uncharged sphere of metal is placed in between two charged plates as shown. The lines of force look like



Q3. The electric potential V at any point (x,y,z) in space is given by V=3x2 where x,y,z are all in metre. The electric field at the point (1m,0,2m) is

(A) 6V/m along -x axis (B) 6V/m along +x axis

(C) 1.5V/m along -x axis (D) 1.5V/m along +x axis

Q4. A parallel plate air capacitor having a capacitance 'C' is half-filled by a medium of dielectric constant. What % change will be there in the capacitance of the capacitor?

(A) 200% increase (B) 400% decrease (C) 400% increase (D) 66.6% increase

Q5. A parallel plate capacitor with oil in between the plates (dielectric constant of oil is 2) has a capacitance 'C'. If the oil is removed, what will be the new capacitance?

(A) C √2 (B) $C/2$ (C) $2C$ (D) √2 C

Q6. Correct match of column I with column II is

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) Microwave	S . Vibration of atoms and molecules

(A) 1-P, 2-R, 3-S, 4-Q (B) 1-S, 2-P, 3-O, 4-R
(C) 1-Q, 2-P, 3-S, 4-R (D) 1-S. 2-R, 3-P, 4-Q

Q7. Susceptibility is positive for

(A) Ferromagnetic material (B) Paramagnetic material
(C) Diamagnetic material (D) Option (a) and (b)

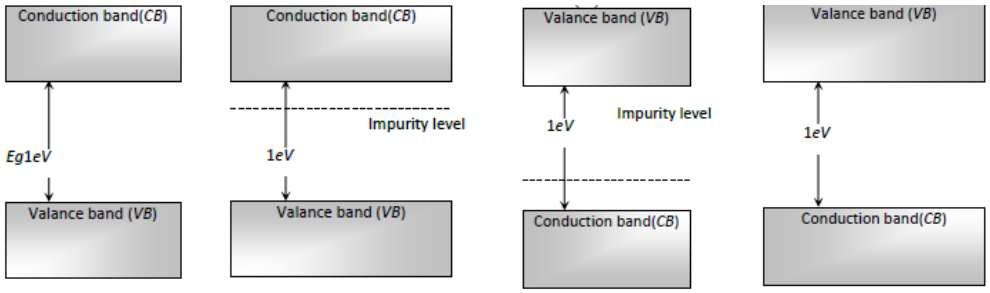
Q8. A bar magnet is cut into two equal halves by a plane parallel to the magnetic axis. Of the Following physical quantities, the one which remains unchanged is

(A) pole strength (B) magnetic moment
(C) Intensity of magnetization (D) retentivity

Q9. Which of the following statements about nuclear forces is not true?

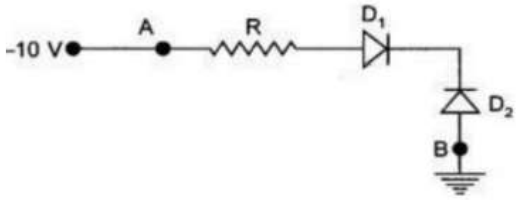
(A) The nuclear force between two nucleons falls rapidly to zero as their distance is more than a few femtometres.
(B) The nuclear force is much weaker than the Coulomb force.
(B) The force is attractive for distances larger than 0.8 fm and repulsive if they are separated by distances less than 0.8 fm.
(D) The nuclear force between neutron-neutron, proton-neutron and proton-proton is approximately the same.

Q10. Which of the following energy band diagram shows the *N*-type semiconductor?



(A) (B). (C) (D)

Q11. In the given figure, assuming the diodes to be ideal, identify the correct statement.



(A) D_1 is forward biased and D_2 is reverse biased and hence current flows from A to B
(B) D_2 is forward biased and D_1 is reverse biased and hence no current flows from B to A and vice versa.
(C) D_1 and D_2 are both forward biased and hence current flows from A to B
(D) D_1 and D_2 are both reverse biased and hence no current flows from A to B and vice versa.

Q12. Which of the following postulates of the Bohr model led to the quantization of energy of the hydrogen atom?
(A)The electron goes around the nucleus in circular orbits
(B) The angular momentum of the electron can only be an integral multiple of $h/2\pi$
(C)The magnitude of the linear momentum of the electron is quantized
(D)Quantization of energy is itself a postulate of the Bohr model

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

Q13. Assertion (A): The force of repulsion between atomic nucleus and α-particle varies with distance according to inverse square law.
Reason(R): Rutherford did α-particle scattering experiment.

Q14. Assertion (A): Diffraction takes place for all types of waves mechanical or non-mechanical, transverse or longitudinal.
Reason (R): Diffraction's effect is perceptible only if wavelength of wave is comparable to dimensions of diffracting device.

Q15. Assertion (A): Faraday's laws are consequence of conservation of energy.
Reason (R): In a purely resistive ac circuit, the current legs behind the emf in phase.

Q16. Assertion (A): focal length of lens varies when it is immersed in liquids.
Reason (R): focal length of lens depends on refractive index of medium in which it is placed.

[SECTION – B] (5x2=10 Marks)

Q17. The oscillating electric field of an EM wave is given by Ey = 30 sin {2x 10^{11} t + 300π x} V/m

a) Obtain the value of the wavelength of EM wave.

b) Write down the expression for oscillating magnetic field.

Q18. Draw the field lines due to an external magnetic field near a

(i) Diamagnetic (ii) Paramagnetic iii) Ferromagnetic substance

Q19. i) Explain briefly with the help of necessary diagrams, the forward and the reverse biasing of a p-n junction diode

OR

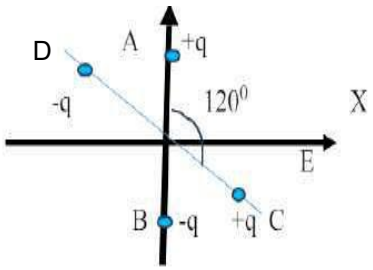
ii) An n-type semiconductor has excess of free electrons while a p-type semiconductor has a deficiency of these. But when a p-n junction is formed, all the electrons do not flow from n-region to the p-region. Why?

Q20. Define the term wave front. State Huygens's principle with the help of diagram.

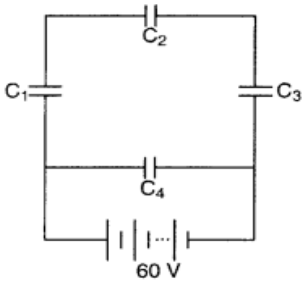
Q21. With the help of a graph showing the variation of B.E./A with mass number, explain how the nuclear energy can be released.

[SECTION – C] (7x3=21 Marks)

Q22. Two small identical electric dipoles AB and CD, each of dipole moment **p** are kept at an angle 120^0 to each other in an electric field E pointing along the X-axis. Find the dipole moment of the arrangement and the magnitude and direction of torque acting on it.



Q23. A network of four capacitors, each of capacitance 30 pF, is connected across a battery of 60V as shown in the figure. Find the net capacitance and the energy stored in each capacitor.



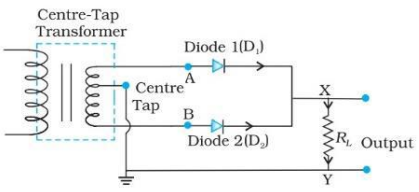
Q24. How the following e.m radiations are produced? Mention one use of them.

(i)radio waves (ii) Infra-red rays (iii) x rays

Q25. (a) Write two characteristic properties of nuclear force.

(b) How does one explain the release of energy in the processes of nuclear fission and nuclear fusion?

Q26. A) If the centre tapping is shifted towards diode D_1 as shown in the diagram, draw the output waveform of the given circuit.



B) Explain the terms depletion layer and potential barrier for a junction diode.

C) Why germanium is preferred over silicon for making semiconductor devices?

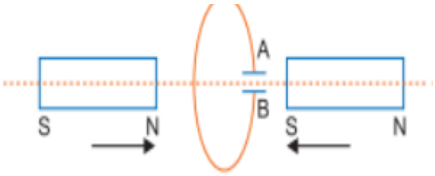
Q27.i) State Huygen's principle. Using this principle draw a diagram to show how a plane wave front incident at the interface of the two media gets refracted when it propagates from a rarer to a denser medium.

OR

ii) Write the distinguishing features between a diffraction patterns due to a single slit and the interference fringes produced in Young's double slit experiment?

Q28. I-(a) What is induced emf? Write Faraday's law of electromagnetic induction. Express it mathematically.

(b) Predict the polarity of the capacitor C connected to coil, which is situated between two bar magnets moving as shown in figur

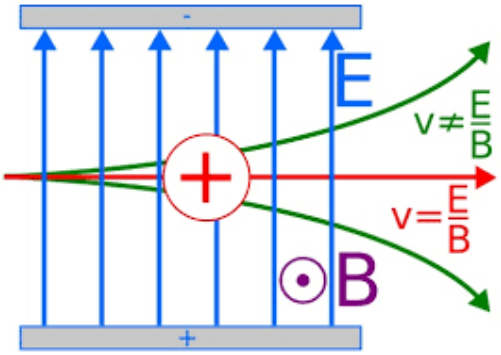


[SECTION D] (02x4=08 Marks)

Case Study Based Question:

Q29. Read the following passage and answer the questions.

Velocity selector is an arrangement used to select charged particles of a specific velocity from a beam in which particles move with different speeds. It consists of a region of crossed electric and magnetic fields. These two fields are perpendicular to each other. In the figure, the electric field is upwards. Magnetic field is perpendicular to the plane of the paper and coming outward. The positively charged particle is deflected upwards (towards the negative plate) with a force $F_E=qE$.



This particle is deflected downwards with a force $FB=qvB$ .When these two forces are equal the particle is not deflected in any direction. $qvB=qE$, $v=E/B$. Hence particles with velocity 'v ' only will be coming out through the straight path. Velocity selector is used in accelerator mass spectroscopy to select particles of a particular velocity.

i) The magnetic field employed in a velocity selector is 25T and the electric field is 200N/C. This can select particles of velocity
$a)\ 10m/s$ $b)\ 3m/s$ $c)\ 8m/s$ $d)\ 80m/s$

ii) Instead of a positive charge let an electron enter into the same arrangement as shown in figure. The electrons will be deflected by the electric field and magnetic field respectively in directions
$a)\ upward,downward$ $b)\ downward,upward$
$c)\ upward,upward$ $d)\ downward,downward$

iii) Let the magnetic field direction is reversed in the above arrangement. Magnetic field is directed into the plane of the paper. Then the positive charge will be
$a)\ deflected\ upwards$ $b)\ deflected\ downwards$
$c)\ un\ deflected$ $d)\ move\ in\ a\ circular\ path$

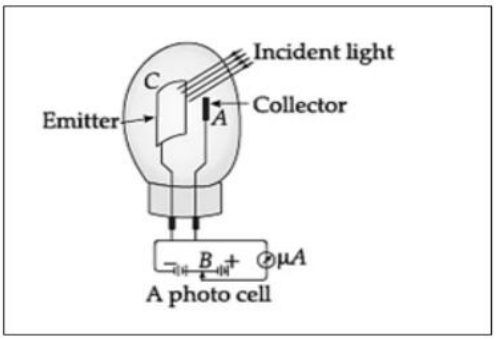
iv) You are requested to select only particles with velocity 10m/s in the selector. The magnetic field provided is 25T. What should be the surface charge density given to the parallel sheets to produce the required electric field.
$a)\ 3.5\times10^{-9}Cm^{-2}$ $b)\ 4.4\times10^{-9}Cm^{-2}$ $c)\ 6.9\times10^{-9}Cm^{-2}$ $d)\ 2.2\times10^{-9}Cm^{-2}$

OR

An electron is moving in a region of electric field and magnetic field, it will gain Energy from

a) *magnetic field* b) *electric field* c) *both fields* d) *none of these*

Q30. Read the following passage and answer the questions.



Photocell: A photocell is a technological application of the photoelectric effect. It is a device whose Electrical properties are affected by light. It is also sometimes called an electric eye. A photocell consists of a semi- cylindrical photo-sensitive metal plate C (emitter) and a wire loop A (collector) supported in an evacuated glass or quartz bulb. It is connected to the external circuit having a high-tension battery B and micro ammeter (μA) as shown in the Figure. Sometimes, instead of the plate C, a thin layer of photosensitive material is pasted on the inside of the bulb. A part of the bulb is left clean for the light to enter it. When light of suitable wavelength falls on the emitter C, photoelectrons are emitted. These photoelectrons are drawn to the collector A. Photocurrent of the order of a few micro amperes can be normally obtained from a photocell. A photocell converts a change in intensity illumination into a change in photocurrent. This current can be used to operate control systems and in light measuring devices.

i) Photosensitive material should be connected to

(a) Negative terminal of the battery (b) Positive terminal of the battery

(c) any one of (A) or (B) (d) Connected to ground

ii) The photocurrent generated is in the order of

(a) Ampere (b) milli ampere (c) microampere (d) None of the above

iii) Photocell is an application of

(a) Thermoelectric effect (b) Photoelectric effect

(c) Photo resistive effect (d) None of the above

iv) A photocell converts a change in_____ of incident light into a change in_____

(a) Intensity, photo voltage (b) wavelength, photo voltage

(c) Frequency, photocurrent (d) intensity, photocurrent

OR

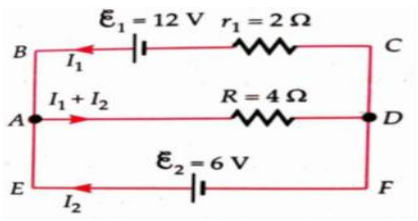
Two metals A and B have work functions 4 eV and 10 eV respectively. Which metal has a higher threshold wavelength?

a) Metal A b) Metal B c) Both d) Neither

[SECTION E] (03X5=15 Marks)

Q31.I-a) Draw a circuit diagram of Wheatstone bridge and obtain condition for balance.

b) State and explain Kirchhoff's laws. In the electric network shown in the figure, use Kirchhoff's rules to calculate the power consumed by the resistance R=4Ω.



OR

II-a) Define the term conductivity of a metallic wire. Write its SI unit.

b) Two cells of emf ε_1 and ε_2 are and internal resistances r_1 and r_2 respectively are connected in series and in parallel. Obtain expressions for the equivalent emf and effective resistance of the combination in the two cases.

Q32.I-a) Draw a labeled diagram of telescope when the image is formed at the least distance of distinct vision.

b) Derive the expression for its magnifying power.

c) A giant refracting telescope at an observatory has an objective lens of focal length 15 m. If an eyepiece of focal length 1.0 cm is used, what is angular magnification of the telescope in normal adjustment?

OR

II-a)Draw a ray diagram for the final image formed at a distance of distinct vision (D) by a Compound microscope.

b) Derive the expression for its magnifying power.

c) An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and an eye piece is 36 cm and the final image is formed at infinity. Calculate the focal length of the objective and the focal length of the eye piece.

Q33.I-a)A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.

b) A step-up transformer converts a low voltage into high voltage. Does it not violate the principle of conservation of energy? Explain.

c) Write any two sources of energy loss in a transformer.

OR

II-a)Draw graphs showing the variations of inductive reactance and capacitive reactance with frequency of applied ac source.

b) Draw the phasor diagram for a series LRC circuit connected to an AC source.

c) When an alternating voltage of 220V is applied across a device X, a current of 0.25A flows which lags behind the applied voltage in phase by $\pi/2$ radian. If the same voltage is applied across another device Y, the same current flows but now it is in phase with the applied voltage.

(i) Name the devices X and Y.

(ii) Calculate the current flowing in the circuit when the same voltage is applied across the series combination of X and Y.

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PHYSICS – Code No. 042
CBSE SAMPLE QUESTION PAPER
CLASS – XII (2025 – 26)

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**.
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(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.No.	**Question**	**Marks**
1.	If a charged hollow sphere and a solid sphere of aluminum and copper of equal radii are in electrostatic equilibrium, then which of the following statements is true? (A) Both the spheres are having equal charges. (B) The hollow sphere will have more charge than solid sphere at its surface. (C) The aluminum sphere will have more charge on its surface than copper sphere. (D) If hollow sphere is also made up of aluminum then it will have more charge.	1

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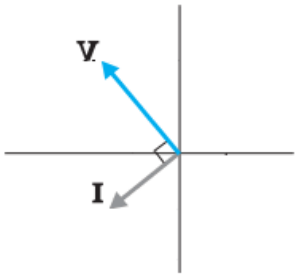
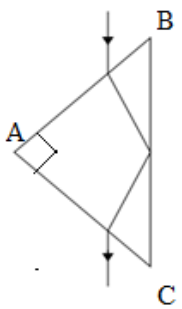
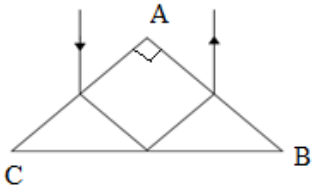
2.	A coil contains N turns of insulated copper wire of diameter d and resistivity ρ wound on a cylinder of diameter D. What is the total resistance between the two ends of the coil of copper wire?(given: D>>d) (A) $\frac{4\rho ND}{d^2}$ (B) $\frac{8\rho ND}{d^2}$ (C) $\frac{2\rho ND}{d^2}$ (D) $\frac{12\rho ND}{d^2}$	1
3.	If the phasor diagram for a device connected to AC supply is as shown in the fig, then which of the following statements is true?  (A) When the frequency of the AC source is increased than the impedance of the device decreases. (B) This device behaves as conducting wire when connected across DC source. (C) When the frequency of the AC source is decreased than the impedance of the device decreases. (D) D. This device stores energy in the form of magnetic potential energy.	1
4.	Which of the following statement is true for the radio waves and the gamma rays? (A) The energy of gamma rays is lesser than that of the radio waves. (B) The frequency of the radio waves is higher than that of gamma rays. (C) The radio waves and the gamma rays have the same energy. (D) The energy of radio waves is lesser than that of the gamma rays.	1
5.	A glass prism has internal angles of 45°, 45° and 90°. The glass has a critical angle of 45°. Which of the following ray diagrams depicts the possible path the of light through the prism? (A) (B)  	1

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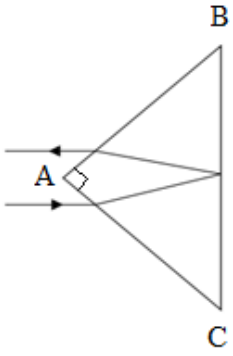
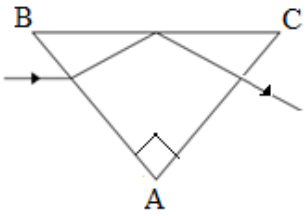
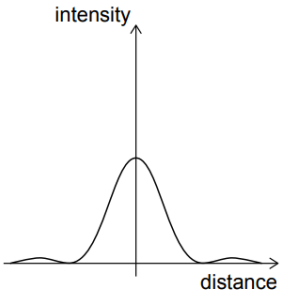
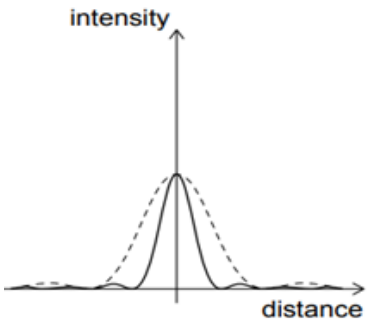
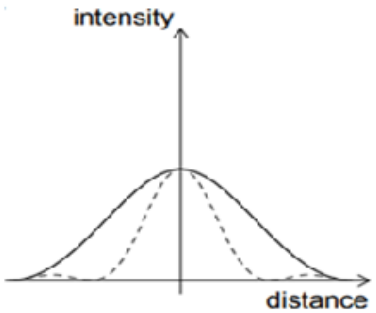
	(C)  (D)  **For VI-Candidates** Light passes from a certain medium into air. The critical angle of the given medium is Θ, which of the following expressions gives the speed of light in the given medium? Where c is the speed of light in air. (A) $\frac{1}{c\sin\theta}$ (B) $\frac{\sin\theta}{c}$ (C) $\frac{c}{\sin\theta}$ (D) $c\sin\theta$	
6.	The light from a monochromatic source is incident on a single slit and the resulting diffraction pattern is viewed on a screen. The graph shows the variation of the intensity with the distance on the screen.  The width of slit is increased keeping the intensity of the source the same. Which of the following graphs is correct? (The original curve is shown with a dashed line.) (A)  (B)  	1

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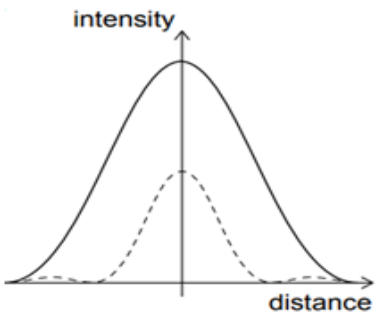
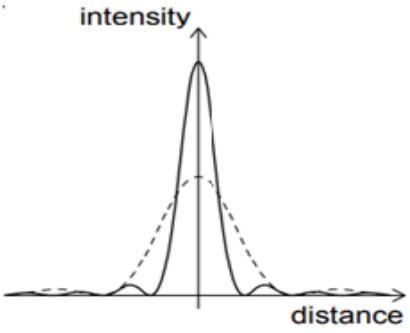
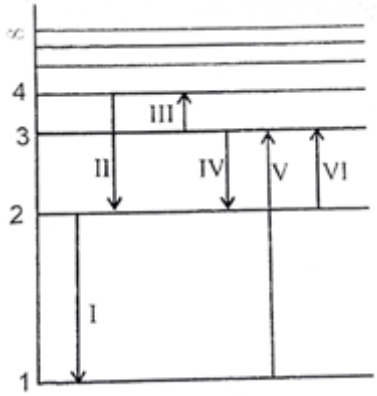
	(C)  (D)  **For VI-Candidates** The phenomenon of superposition of two waves, resulting in redistribution of energy is known as…… (A) diffraction (B) interference (C) reflection (D) refraction	
7.	Which of the following transitions corresponds to the emission of the radiation of the maximum wavelength?  (A) I (B) III (C) IV (D) VI	1
	(for V.I. Candidates) Which of the following transitions corresponds to the emission of the radiation of the maximum wavelength? I — From 4^{th} orbit to 2^{nd} orbit. II — From 2^{nd} orbit to 1^{st} orbit. III — From 3^{rd} orbit to 4^{th} orbit. IV — From 3^{rd} orbit to 2^{nd} orbit. V — From 1^{st} orbit to 3^{rd} orbit. VI — From 2^{nd} orbit to 3^{rd} orbit. (A) I (B) III (C) IV (D) VI	

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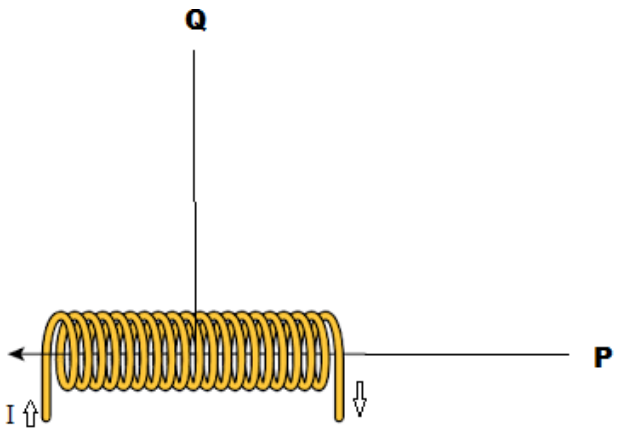
8.	A charged particle is projected along the axis of a current carrying loop. Which of the following statements is true? (A) The acceleration of the charged particle will depend on the velocity with which it is projected. (B) The acceleration of the charged particle will depend on the magnitude of the current passing through the coil. (C) The acceleration of the charged particle will depend on the radius of the coil. (D) The charged particle will move with constant velocity.	1
9.	Two small identical magnets are allowed to fall freely one through a vertical solenoid of 20 m made up of copper and another in air through the same vertical distance. The time taken by the two magnets to fall will be (A) same in both the cases. (B) more for the magnet falling in air. (C) more for the magnet falling through the solenoid. (D) infinite.	1
10.	The emf generated by an AC generator is given by $V=V_o \sin \omega t$, where ω is angular frequency of armature of generator. What will be the emf if the angular frequency is doubled (A) $V=V_o \sin 2\omega t$ (B) $V=2V_o \sin \omega t$ (C) $V=2V_o \sin 2\omega t$ (D) $V=V_o \sin \omega t$	1
11.	The ratio of the nuclear densities of two nuclei having the mass numbers 8 and 27 is (A) 8:27 (B) 3:2 (C)2:3 (D) 1:1	1
12.	When we move magnetic compass from point P to Q then which of the following statement is true  	1

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	(A) The deflection of the magnetic needle at P and Q will be in the same direction. (B) The deflection of the magnetic needle at P and Q will be in the opposite directions. (C) The deflection of the magnetic needle at P and Q will be perpendicular to each other. (D) The deflection of the magnetic needle at P and Q will be inclined at 45^o with respect to each other.	
	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):** Total energy of an electron in hydrogen atom is negative. **Reason (R):** The centripetal force is provided by electrostatic force.	1
14.	**Assertion (A):** The critical angle of light passing from glass to air is minimum for violet colour. **Reason (R):** The wavelength of blue light is greater than the light of other colours.	1
15.	**Assertion (A):** Two light sources emitting waves of similar wavelengths are coherent. **Reason (R):** Two light sources emitting waves having zero or constant phase difference are known as coherent sources.	1
16.	**Assertion (A):** For three point charges to be in equilibrium, they must be collinear. **Reason(R):** One of the three charges must have different polarity than rest of the two.	1
	SECTION B	
17.	The amplitude of the magnetic field of a plane electromagnetic wave propagating along positive X axis in vacuum is 510 nT$\hat{k}$ and its angular frequency is 60 x 10^6 rad/sec. Write the expression for the electric field $(\vec{E})$.	2
18.	The following graph shows the potential difference across the terminals of a cell against its load current.	2

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	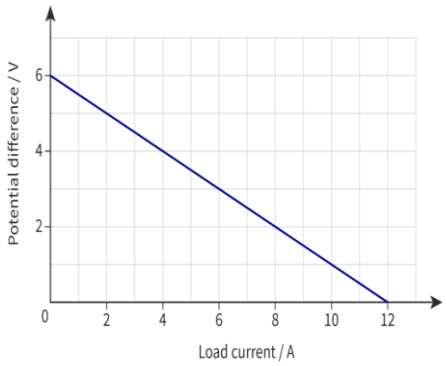 Find, (I) the emf of the cell and (II) the internal resistance of the cell. **For VI candidates** Find the relation between internal resistance, emf, external resistance and the total current in the circuit ?	
19.	A charge q is placed inside a sphere of radius 'a' filled with water and another charge 2q is placed inside cube of side '2a' which is vacuumed inside. Find the ratio of the flux linked with the sphere to that linked with the cube. (Take relative permittivity of water as 80)	2
20(I)	Write an expression for the magnetic force per unit length between two parallel thin current carrying wires. Hence define one ampere. **OR**	2
20(II)	Draw a diagram representing the behaviour of magnetic field lines for a (A) diamagnetic & (B) paramagnetic substance. **For VI-Candidates** Sate Gauss's law of magnetism? Hence find the magnetic flux linked with the sphere enclosing a current carrying solenoid?	2
21(I)	How does the impact parameter affect the trajectory of a α – particles scattered by a heavy nucleus? What is the value of impact parameter for head on collision of α – particles with the nucleus? **OR**	2
21(II)	Plot a graph showing variation of de-Broglie wavelength λ versus $\frac{1}{\sqrt{V}}$, where V is accelerating potential for a particle of mass m and charge q. Obtain the slope of this graph.	

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SECTION C		
22.	With the help of circuit diagram explain working of the full wave rectifier.	3
23.	(I) The current I_1 in a wire is getting divided in two wires with currents I_2 and I_3 at a junction in a circuit.The currents in the three wires are related by $I_1 = I_2 + I_3$. (A) State the fundamental law from which this relation is derived. (B) Explain the validation of law of conservation of energy in Kirchhoff's voltage law? (II) How the balancing condition gets affected if you are interchanging the galvanometer and the cell in the Wheat stone bridge?	3
24.	A fast-moving neutron collides with the nucleus of Plutonium (Pu), thereby producing Xenon (Xe) and Zirconium (Zr) along with neutrons. (I) Write the nuclear fission reaction. (II) Find the energy released in the above nuclear reaction. Given atomic masses: m $(^{239}_{94}Pu) = 239.052157$u, m $(^{103}_{40}Zr) = 102.926597$u, m $(^{134}_{54}Xe) = 133.905040$u & m $(^{1}_{0}n) = 1.00866$u.	3
25.	A compound microscope consists of an objective lens of focal length 0.82 cm and an eyepiece lens of focal length 2.9 cm. An object is placed 0.91 cm from the objective lens. The image is formed at the near point (25 cm) from the eye. (I) Calculate that the angular magnification of the microscope. (II) Draw the ray diagram of compound microscope in normal adjustment.	3
26.	Draw the reflected wave front for a plane wave front incident on a plane reflecting surface. Hence verify the laws of reflection using Huygen's principle. **For VI Candidates** (I) Define wave front? (II) Define wavelet? (III) What will be the shape of the wave front intercepted by a large reflecting type telescope on earth, due to a star far-away from our solar system?	3

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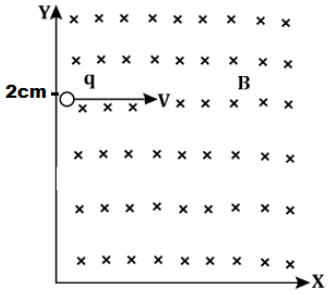
27(I)	If a point sized object having charge 1C and mass 1g is projected with velocity of $2\hat{\imath}$ m/s from a point (0,2cm,0) in the region of magnetic field -0.1$\hat{k}$ T which spreads in the first quadrant.  (A) What will be the shape of the path followed by the given charged particle? (B) At what point it will cross the X-axis? (C) What will be the kinetic energy of particle when it will enter in the fourth quadrant? **OR**	3
27(II)	A solenoid has a core of material with relative permeability 200. The windings of the solenoid are insulated from the core and carry a current of 1A. If the number of turns is 2000 per metre, calculate (A) magnetic intensity, (B) magnetic field & (C) magnetisation	3
28.	A conducting coil of 50 turns and area $\frac{5}{\pi}$ cm^2 is rotating along the axis of solenoid of length 50cm and 2000 turns, carrying current of 5 A. What will be the value of maximum emf generated?	3
	SECTION - D	
29	When an external voltage is applied across a semiconductor diode such that p-side is connected to the positive terminal of the battery and n-side to the negative terminal it is said to be forward biased. The applied voltage mostly drops across the depletion region and the voltage drop across the p-side and n-side of the junction is negligible. When an external voltage is applied across the diode such that n-side is positive and p-side is negative, it is said to be reverse biased. The applied voltage mostly drops across the depletion region.	1 Mark each

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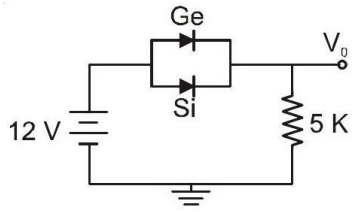
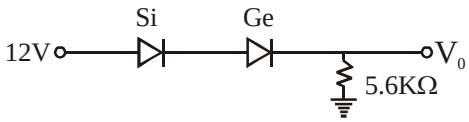
(I) Ge and Si diodes start conducting at 0.3 V and 0.7 V respectively. In the following figure if Ge diode connection are reversed, the value of V_0 changes by (assume that the Ge diode has large breakdown voltage)



(A) 0.2 V (B) 0.4 V

(C) 0.6 V (D) 0.8 V

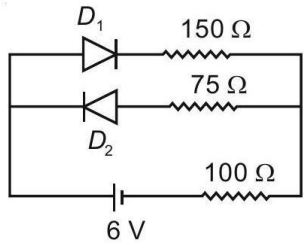
(II.) The value of V_0 and I_d for the network are :



(A) 13 V, 2.32mA (B) 11.7 V, 2.08mA

(C) 11.3V, 2.01mA (D) 11V, 1.96mA

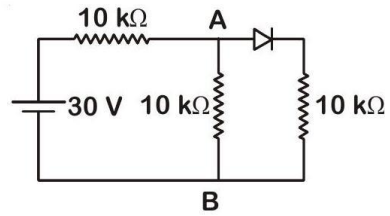
(III.) The circuit shown below contains two ideal diodes, each with a forward resistance of 50Ω. If the battery voltage is 6 V, the current through the 100Ω resistance (in amperes) is



(A) 0.036 (B) 0.020

(C) 0.030 (D) 0.027

(IV) In the figure, potential difference between A and B is



(A) Zero (B) 5 V

(C) 10 V (D) 15 V

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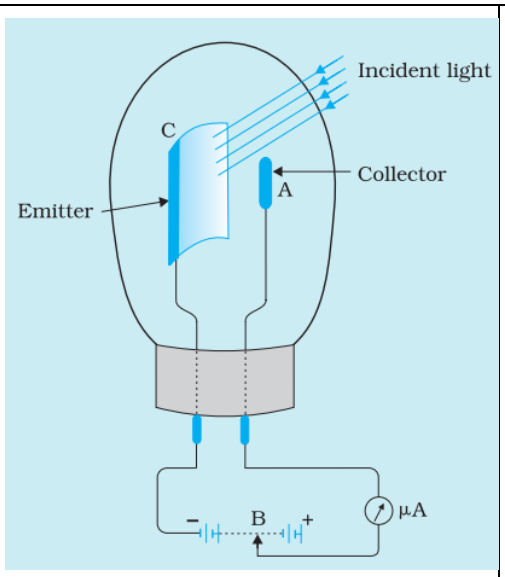
30.	Photoelectric effect is phenomenon of the ejection of electrons when the radiation of suitable frequency is made to fall on the surface of a metal. When light of suitable wavelength falls on the emitter C given in the diagram, the photoelectrons are emitted. These photoelectrons are drawn to the collector A. The photoelectric current of the order of a few microamperes can be normally obtained from the device given in figure. The device given converts a change in intensity of illumination into a change in photocurrent. This current can be used to operate control systems and in light measuring devices. The devices are made up of metals with low ionization enthalpies, for example platinum whose work function is 6.35 eV.  	
	(I) If infrared radiation of 3 x 10^{11} Hz is used as incident radiation, determine the reading of microammeter? Justify mathematically.	2
	(II) In the given diagram, if terminal B is shifted towards the left then how will it affect the reading of the microammeter? **(for V.I. candidates)** (II) If the supplied voltage is decreased, then what will be effect on the reading of the microammeter?	1
	(III) Plot a graph showing this variation in reading of micrometre on shifting the terminal B towards the right. **(for V.I. candidates)** (III) If the intensity of incident radiation is doubled, by what factor will the kinetic energy change?	1
	SECTION E	
31(I)	(A) A dielectric slab of thickness t, is introduced between the plates of parallel plate capacitor of area A and separation d (where t<d). Find an expression for the capacitance with the dielectric slab. (B) A copper sphere of capacitor C is dropped in ocean. Will the capacitance of the sphere increase, decrease or remain same? Justify. (C) A capacitor is connected across a source of potential difference V and then the separation 'd' between the plates is increased using insulating stick. Plot 'V' vs 'd' graph for the given capacitor.	2+2+1

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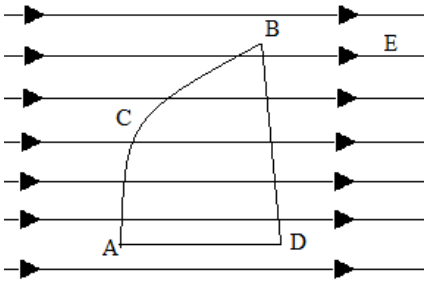
	For VI Candidates (C) A capacitor is connected across potential difference V and is then separation between plates 'd' is increase using insulating stick. Will the energy stored in capacitor increase or decrease? Justify **OR**	
31 (II)	(A) If a charge of 1μC is placed at the origin and another charge of 3 μC placed at the point (20m,0m,0m) in an external uniform electric field of 40V/m $\hat{\imath}$ with the electric potential at origin to be zero. Find the electrical potential energy of system. (B) If one charge particle is moved from A to C To B and another charge particle of equal magnitude is moved from A to D to B, In uniform external magnetic field. Than for which charge particle more work will be needed? (use fig for reference)  (C) Electrostatic potential is constant throughout the volume of conductor has the same value on its surface why? **For VI candidates** (C) If A charge particle is taken from A to B from two different path one path has resistance of 10Ω and another has capacitance of 3μF. work done by which path will be more.	3+1+1
32(I)	(A) Derive lens maker's formula. (B) Equi-convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 10cm? **OR**	3+2
32(II)	(A) Define angle of deviation in a prism? (B) Obtain the relation A+δ=i+e for a prism where A is the angle of prism, δ is the angle of deviation, i is the angle of incidence and e is the angle of emergence. Write this relation for the minimum deviation? (C) Write the condition for minimum deviation.	1+3+1

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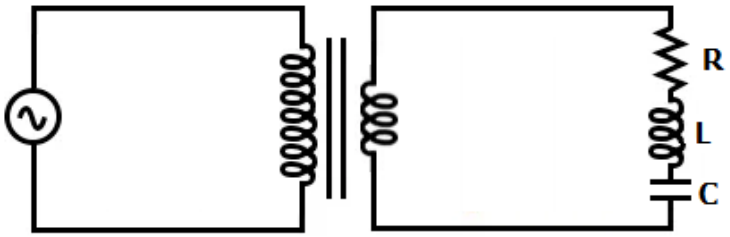
33(I)	(A) State the working principle of a moving coil galvanometer? What modification is required in the galvanometer to make its scale linear? (B) If a galvanometer of resistance 49.5Ω has range of 0.05A. What will be the value of resistance needed to convert it in ammeter of range 5A? (C) How these two resistors should be connected to galvanometer in both cases? **OR**	2+2+1
33(II)	(A) An input potential V_{in}=200 Sin $100\pi t$ V is provided to an ideal transformer having 1000 turns in primary coil and 100 turns in secondary coil as shown in figure. The load circuit has a resistance of 4Ω, a capacitive reactance of 2Ω and an inductive reactance of 6Ω.  Find: (i) the output voltage across the load circuit (ii) the current flowing through the load circuit (iii) the power supplied to the load circuit by the transformer (B) State the working principle of a transformer and explain how it is a key component in the transfer of electrical power over long distances.	3+2

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