KENDRIYA VIDYALAYA SANGATHAN, LUCKNOW REGION

SESSION: 2023-24

CLASS: XII

Pre-Board Examination

XII-T1

SUBJECT: PHYSICS (THEORY)

12/02/24

Maximum Marks: 70 Time Allowed: 3 hours

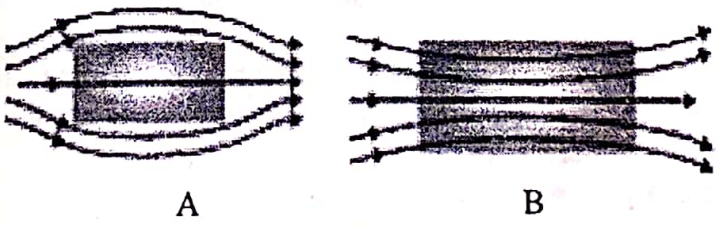
General Instructions:

1) There are 33 questions in all. All questions are compulsory.
2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3) All the sections are compulsory.
4) **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.
5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in **Section C**, one question in each CBQ in **Section D** and all three questions in **Section E**. You have to attempt only one of the choices in such questions.
6) Use of calculators is not allowed.
7) You may use the following values of physical constants where ever necessary.

i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $e = 1.6 \times 10^{-19}$ C
iv. $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}
v. $h = 6.63 \times 10^{-34}$ J s
vi. $\varepsilon_0 = 8.854 \times 10^{-12}\ C^2 N^{-1} m^{-2}$
vii. Avogadro's number = 6.023 X 10^{23} per gram mole

SECTION-A

Q. No.	Question	Marks
1	If the direction of the electric field line due to two unlike point charges is from left to right then: (a) Positive charge is at left and negative charge is at right (b) Negative charge is at left and positive charge is at right (c) Both charges are at left (d) Both charges are at right	1
2	If 1μA current flows through a conductor when potential difference of 2 V is applied across its ends, then the resistance of the conductor is (a) $2 \times 10^{-6}\ \Omega$ (b) $2 \times 10^{6}\ \Omega$	1

	(c) $0.2 \times 10^5\ \Omega$ (d) $2 \times 10^3\ \Omega$	
3	Three capacitors each of capacity C are connected in series. The resultant capacity will be (a) 3C (b) 3/C (c) C/3 (d) 1/ 3C	1
4	Magnetic dipole moment is a vector quantity directed from (a) West to East direction (b) North to South Pole (c) East to West direction (d) South to North Pole	1
5	Which of the following is an example for diamagnetic substances? (a) Copper (b) nickel (c) aluminium (d) iron	1
6	If a wire of length 2 m is moving with a velocity of 1 m/s perpendicular to a magnetic field of 0.5 T, then E.M.F. induced in the wire will be (a) 0.2 V (b) 1.0 V (c) 0.5 V (d) 2 V	1
7	A hot-wire ammeter reads 10 A in an AC circuit. The peak value of the current is (a) 5π A (b) $10\sqrt{2}$ A (c) $10/\sqrt{2}$ A (d) $1/\sqrt{2}$ A	1
8	In photoelectric effect the maximum kinetic energy of emitted electron depends on (a) wavelength (b) work function (c) intensity (d) frequency	1
9	The total energy of an electron in the first excited state of hydrogen atom is about -3.4 eV. Its kinetic energy in this state is (a) 3.4 eV (b) -3.4 eV (c) -6.8 eV (d) 6.8 eV	1
10	An electromagnetic wave is produced by oscillating electric and magnetic fields E and B. Choose the only incorrect statement from the following. (a) E is perpendicular to B. (b) E is parallel to B. (c) E is perpendicular to the direction of propagation of the wave. (d) B is perpendicular to the direction of propagation of the wave.	1
11	A uniform magnetic field gets modifies as shown in Figure below, when two specimens A and B are placed in it.  A B (a) A is Paramagnetic, B is diamagnetic (b) A is ferromagnetic, B is paramagnetic (c) A is diamagnetic, B is ferromagnetic (d) A is diamagnetic, B is paramagnetic	1

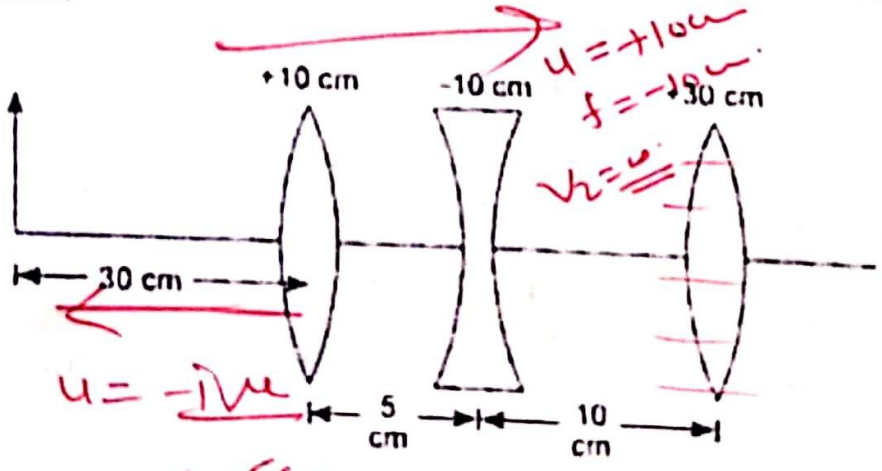
12	Two spherical nuclei have mass number 216 and 64 with their radii R1 andR2 respectively. The ratio R1/R2 is equal to (a) 1:3 (b) 2:3 (c) 3:1 (d) 3:2	1
	For Questions 13 to 16, two statements are given one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. (a) 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 (a)	**Assertion (A):** the focal length of a lens for red light is more than that of blue light ($f_r > f_b$), **Reason(R):** the refractive index of material is depend on wave length of light i.e. ($\mu_b > \mu_r$)	1
14 (a)	**Assertion (A):** To increase the range of an ammeter, we must connect a suitable high resistance in series with it. **Reason(R):** The ammeter with increased range should have high resistance	1
15 (c)	**Assertion (A):** In the process of photoelectric emission, all emitted electrons do not have same kinetic energy. **Reason(R):** the energy of emitted electrons depends on the intensity of incident radiation.	1
16 (a)	**Assertion (A):** V-I characteristic of p-n junction diode is same as that of any other conductor. **Reason(R):** p-n junction diode obeys Ohm's law.	1

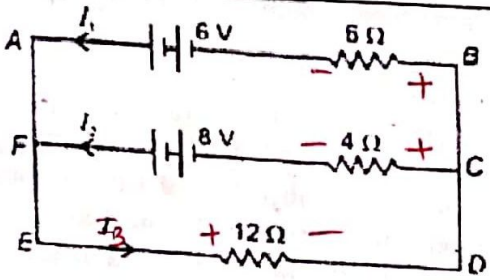
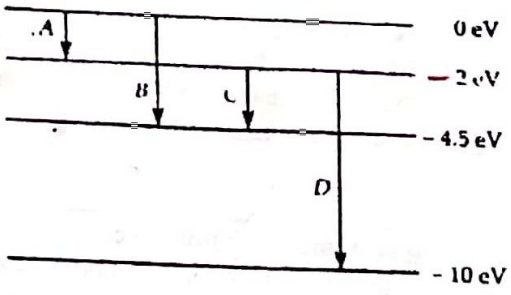
SECTION-B

17	A conductor of length 'l' is connected to a dc source of potential 'V'. If the length of the conductor is tripled by gradually stretching it, keeping 'V' constant, how will (i) drift speed of electrons and (ii) resistance of the conductor be affected? Justify your answer.	2
18	(a) Arrange the following electromagnetic waves in the descending order of their wavelengths. **Microwaves, γ-rays, Ultraviolet radiation, Visible light** (b)Write one use of above waves having lowest and highest wavelength.	2
19	The refractive index of a material of a concave lens is μ_1. It is immersed in a medium of refractive index μ_2. A parallel beam of light is incident on the lens. Trace the path of emergent rays when	2

	i) $\mu_2 > \mu_1$ conv. ii) $\mu_2 < \mu_1$ div.	
20	Draw suitable graphs to show the variation of photoelectric current(Ip) with collector plate potential (V) for i) a fixed frequency but different intensities $I_1 > I_2 > I_3$. ii) a fixed intensity but different frequencies $\nu_1 > \nu_2 > \nu_3$.	2
21	Explain, with the help of a suitable diagram, how (i) depletion layer and (ii) potential barrier is formed in a p-n junction diode. OR Draw a circuit diagram of a full wave rectifier. Draw the input and output waveforms indicating clearly the functions of the two diodes used.	2

SECTION-C

22	Two long straight parallel conductors carry study currents I_1 and I_2 separated by a distance d. If the current are flowing in the same direction, show how the magnetic field setup in one produces an attractive force on the other. Obtain the expression for this force. Hence define one ampere. $f = \frac{\mu_0 I_1 I_2}{2\pi d}$. OR (a) With the help of labelled diagram, explain the underlying principle and working of a moving coil galvanometer. (a) What is the function of (i) uniform radial field (ii) soft iron core, in such a device?	3
23	Three lenses focal lengths + 10 cm, - 10 cm and +30 cm are arranged coaxially as in the figure given below. Find the position of the final image formed by the combination.  $u = +10$ cm $f = -10$ cm $v_2 = v$ $v = 30$ cm $u = -15$ cm $v_1 = 15$ cm	3
24	Draw a plot showing the variation of binding energy per nucleon with mass number A. Write two important conclusions which you can draw from this plot.	3
25	Define self inductance and write its SI unit. Obtain an expression of self inductance of a solenoid of length 'l' cross-sectional area 'A' having 'N' no. of turns. $\mu_0 N^2 A$	3
26	In the network shown in fig. Calculate currents I_1, I_2 and I_3.	3

		
27	A parallel plate capacitor each with plate area 'A' and separation d is charged to a potential V, which is then disconnected. A dielectric slab of thickness d and dielectric constant K is now placed between the plates. What change if any, will take place in (i) capacitance (ii) potential difference between the plates (iii) electric field between the plates Justify your answer of each case.	3
28	The energy levels diagram of an atom is shown in Fig. Which of the transitions show the emission of a photon of wavelength 275 nm? Which of these transitions corresponds to emission of radiation of (i) maximum and (ii) minimum wavelength? 	3

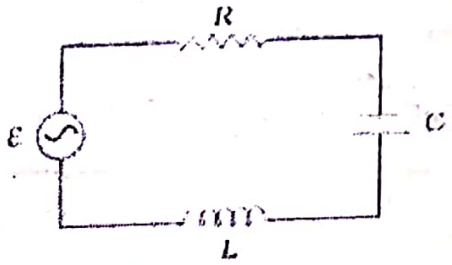
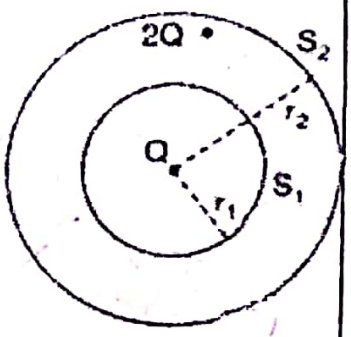
SECTION-D

Case Study Based Questions

29	A compound microscope consists of two lenses. A lens of short aperture and short focal length facing the object is called the object lens and another lens of short focal length but large aperture is called the eye lens. Magnifying power is defined as the ratio of angle subtended by the final image at the eye to the angle subtended by the object is seen directly, when both are placed at least distance of distinct vision.	
(i)	**An objective lens consists of** (a) Short aperture and short focal length (b) Large aperture and large focal length (c) Short aperture and large focal length (d) Large aperture and short focal length	1
(ii)	**An eyepiece consists of** (a) Short aperture and short focal length (b) Large aperture and short focal length	1

	(c) Short aperture and large focal length (d) Large aperture and large focal length	
(iii)	**Formula of magnifying power** (a) M= 1+ (alpha/beta) (b) M= (alpha/beta) (c) M= (beta/alpha) (d) M=1+ (beta/alpha)	1
(iv)	**A compound microscope with an objective of 1.0 cm, focal length and eyepiece 2.0 cm. Focal length of a tube is 20 cm. Calculate the magnifying power of the microscope, if final image is formed at least distance of distinct vision** (a) 170 (b) 27 (c) 140 (d) 270 OR **A compound microscope has magnification of 30. The focal length of eyepiece is 5 cm. assuming the final image is to be formed at least distance of distinct vision (25 cm), calculate the magnification produced by objective.** (a) 10 (b) 15 (c) 13 (d) 5	1
30	A pure semiconductor germanium or silicon, free of every impurity is called intrinsic semiconductor. At room temperature, a pure semiconductor has very small number of current carriers (electrons and holes). Hence its conductivity is low. When the impurity atoms of valance five or three are doped in a pure semiconductor, we get respectively n-type or p type extrinsic semiconductor. In case of doped semiconductor $n_e\, n_h = n_i^2$. Where n_e and n_h are the number density of electron and hole charge carriers in a pure semiconductor. The conductivity of extrinsic semiconductor is much higher than that of intrinsic semiconductor.	
(i)	**Which of the following statements is not true?** (a) The majority charge carriers in n- type semiconductors are holes. (b) Doping pure Si with trivalent impurities gives p- type semiconductors. (c) The resistance of intrinsic semiconductor decreases with increase of temperature. (d) All of the above.	1
(ii)	**The impurity atoms with which pure Ge should be doped to make a p-type semiconductor is** **(a)** Phosphorus (b) Boron (c) Arsenic (d) Antimony	1
(iii)	**Si at absolute zero temperature acts as** (a) Semiconductor (b) Metal (c) Insulator (d) None of these	1
(iv)	**Electrons are majority charge carriers in** (a) Intrinsic semiconductors (b) p-type semiconductor (c) metals (d) n-type semiconductors OR **Electrons & holes are charge carriers in pairs** (a) Extrinsic semiconductors (b) n - type semiconductors (c) p - type semiconductors (d) Intrinsic semiconductors	1

SECTION-E

31	(a) With the help of labelled diagram, describe the principle and working of an ac generator. Hence, obtain an expression for the instantaneous value of the emf generated. (b) The coil of an ac generator consists of 100 turns of wire, each of area 0.5 m2. The resistance of wire is 100 Ω The coil is rotating in a magnetic field of 0.8 T perpendiculars to its axis of rotation, at constant angular speed of 60 rad/s. Calculate the maximum emf generated and power dissipated in the coil. OR A series LCR circuit connected to a variable frequency 230 V source. L = 5.0 H, C = 80 μF, R = 40 Ω is shown in fig.  (a) Determine the source frequency which drives the circuit in resonance. (b) Obtain the impedance of the circuit and the amplitude of current at the resonating frequency. (c) Determine the rms potential drops across the Capacitor & resistor of the circuit. (d) Power factor of this circuit. (e) Plot a graph showing variation of current and frequency of a.c. source in series LCR circuit.	5
32	(a) State Gauss law of electrostatics. Using it, calculate the electric field due to uniformly charged thin spherical shell at a point (i) inside the shell, (ii) outside the shell, (b) Two hollow concentric spheres S_1 and S_2 enclosing charges Q and 2Q respectively as **shown in** fig. What is the ratio of electric flux through S_1 and S_2?  OR (a) Derive an expression for torque experienced by an electric dipole in a **uniform** electric field 'E'. What is net force acting on this dipole?	5

	(b) An electric dipole of length 2 cm is placed with its axis making an angle of 60° with respect to uniform electric field of 10^5 N/C. If it experiences a torque of $8\sqrt{3}$ Nm, calculate the magnitude of the (i) electric dipole moment, (ii) charge and (iii) Potential energy.	
33	(a) Draw ray diagram to show the refraction of light through a glass prism. Hence obtain relation for angle of deviation in terms of the angle of incidence, angle of emergence, and angle of prism. Write any two factors on which angle of deviation depend. (b) Calculate the angle of minimum deviation for an equilateral prism of refractive index $\sqrt{3}$. OR (a) State Huygens's principle. With the help of a diagram, show how a plane wave is reflected from a surface. Hence verify the law of reflection. (b) A concave mirror of focal length 12 cm forms a three times magnified virtual image of an object. Find the distance of object from the mirror.	5

x