

Sample Question Paper

Class XII

Subject: Physics

Max. Marks: 70

Max. Time: 3 Hours

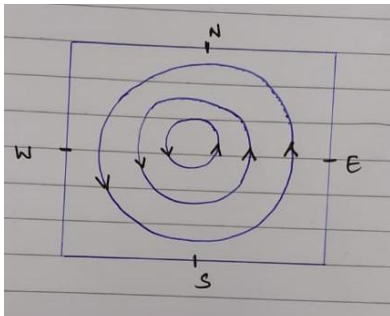
General Instructions:

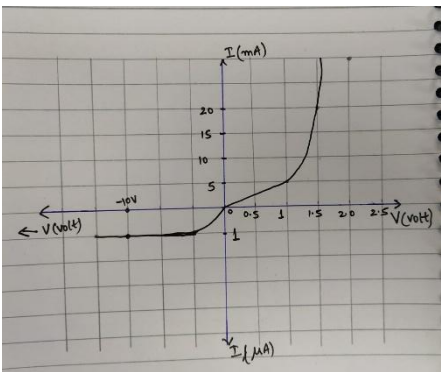
- I. All questions are compulsory.
- II. This Question Paper has four sections of Section A, B, C, and D.
- III. Section A has all Multiple Choice Questions. Out of which Q 1 to Q 8, each question carries 1 mark and has single correct answer. In Q 9 to Q12, each question carries 2 marks, and you need to choose the most appropriate answer.
- IV. Section B has Very Short Answer type questions from Q 13 to Q 25. Each question carries 1 mark.
- V. Section C has Short Answer type questions from Q 26 to Q 32. Each question carries 3 marks.
- VI. Section D has Long Answer type questions from Q 33 to Q 36. Each question carries 5 marks.

List of Constants:

1. Planck's Constant: $h = 6.625 \times 10^{-34} \text{ J s}$
2. Charge on an electron: $e = 1.6 \times 10^{-19} \text{ C}$
3. Mass of an electron: $m_e = 9.1 \times 10^{-31} \text{ kg}$
4. Speed of light: $c = 3 \times 10^8 \text{ m/s}$
5. $\epsilon_0 = 8.85 \times 10^{-12} \frac{\text{F}}{\text{m}}$
6. $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$

S.no	Question	Marks
Section A		
1	A wire of fixed length is first bent into a circular coil (C_1) with one turn. The same wire is then bent into a smaller-radius coil (C_2) with two turns. If the same current flows through both coils, what is the ratio of the magnetic field strength at the centre of C_1 to that at the centre of C_2? A. 1:2 B. 1:4 C. 2:1 D. 4:1	1
2	Which of the following changes would reduce the current sensitivity of a moving-coil galvanometer? I. Increase the number of turns II. Decrease the coil area III. Increase the torsional constant of the spring IV. Decrease the magnetic field strength	1

	A. I and III only B. I, II, and IV only C. II, III, and IV only D. I, II, III, and IV	
3	Which of the following statements describe ways to produce a magnetic field? I. Using moving charges II. Using a static electric field III. Using stationary charges IV. Using a current carrying conductor A. I only B. Both I and IV C. I, II and III D. Both II and IV	1
4	When a sheet of metal is placed in magnetic field, that increases from zero to a maximum value, induced currents circulate counterclockwise (as shown in the diagram). What is the direction of the magnetic field?  A. Into the plane of the paper B. Out of the plane of the paper C. East to West D. North to South	1
5	Which of the following statements explains why an induction cooktop heats a steel pan efficiently? A. Changing magnetic fields induce circulating currents in the pan that produce heat. B. The cooktop transfers heat through direct conduction from the coil to the pan. C. Steel absorbs microwaves emitted by the cooktop and converts them into heat. D. The magnetic field increases the thermal conductivity of steel.	1
6	Two metals, Sodium and Copper, have work functions of 2.3 eV and 4.6 eV respectively. What is the ratio of their threshold wavelengths (Sodium:Copper)? A. 4:1 B. 1:2 C. 2:1 D. 1:4	1
7	Which of the following statements describes the effect of applying reverse bias to a p-n junction diode? A. Raises the potential barrier. B. Increases the majority current carriers. C. Lowers the potential barrier.	1

	D. Increases the minority current carriers.		
8	The V-I characteristic of a silicon diode is given below. Calculate the resistance of the diode at voltage 10 V? A. $10^{-7} \Omega$ B. $10^{-6} \Omega$ C. $10^6 \Omega$ D. $10^7 \Omega$		1
9	In a classroom group activity, students must compute the potential energy of a system of three-point charges. In a group, two members disagree on whether to include the signs of charges into the calculation, while another argues that only magnitudes are needed. Which of the following actions would be most appropriate for the group to resolve the disagreement and complete the calculation? A. Write each pairwise interaction term and check if the sign of each charge pair affects the total energy. B. Calculate the energy using only magnitudes first and adjusting signs later if needed. C. Choose the method that produces a positive final answer, since energy should be positive. D. Each student calculates the total energy on their own and lets the teacher choose the correct one later.		2
10	While solving a circuit problem using Kirchhoff's laws, with a classmate, your partner labels current directions differently from the method taught in class and claims it is a quicker approach. You are unsure if it is correct. Which of the following actions would be most appropriate? A. Explain why you find the method taught in the class is better but acknowledge that their alternative approach might work. B. Agree to follow their approach for the problem to maintain harmony in the group, even if you remain doubtful of its efficiency. C. Suggest trying the alternative approach for one loop of the circuit and compare outcomes before deciding. D. Insist on using only the method taught in the class because you are more comfortable with it, and switching may lead to errors in the calculation.		2
11	Two students disagree on how to draw the phasor diagram for a series LCR circuit. One student argues that current must always lag due to the inductor, the other says it must lead due to the capacitor. Which of the following actions would best help resolve the disagreement and complete the activity on time? A. Both explain their reasoning and check using the reactance values given in the problem. B. Check classroom notes for phasor diagrams and redraws the diagram together from the beginning. C. Draw individual phasor diagrams and compare where the phase angle differs across the drawings.		2

	D. Review formulas for inductive and capacitive reactances before drawing again.	
12	A group must design a classroom demonstration showing the relationship between the electric and magnetic fields in an electromagnetic wave within limited time. The group members have different ideas: I. computer animation, II. cardboard 3-D model, III. laser pointers with polarizing films. The teacher expects a joint demonstration. Which of the following actions would be most appropriate for the group? A. Analyze the strengths and weaknesses of each idea and then choose a combined approach. B. Select the simplest idea by voting to finish quickly. C. Divide work so each person develops one idea and pick the best later. D. Work individually and let the teacher choose the best.	2
Section B		
13	Does the resistance of a copper wire depend on the potential difference applied across its ends? Explain briefly.	1
14	Under what condition does an electron moving through a magnetic field experience maximum magnetic force?	1
15	State any two methods to enhance the magnetic field inside a solenoid, other than increasing current.	1
16	Name any two methods to improve the resolving power of a compound microscope.	1
	Read the given text carefully. Based on the information given, answer the questions from 17 to 19. A group of students maps magnetic field patterns using iron filings and small compass needles around different materials in a physics lab. They observed the following: Observation 1: Around a long solenoid, the field outside is nearly zero, and inside it is strong and uniform. Observation 2: Around a bar magnet, the field lines look similar to those in observation 1. Observation 3: Near a strong ferromagnetic slab, the compass needles tilt sharply. The students sketch these patterns in their notebooks and discuss possible reasons for what they observe.	
17	Which scientific concept explains the similarity in the pattern of observations 1 and 2?	1
18	Based on Observation 3, what property of ferromagnetic materials can be inferred?	1
19	What is one major limitation of using magnetic field line diagrams to represent magnetic fields?	1
20	Define the coefficient of mutual inductance for a pair of coils and state its unit.	1
21	What is the dimensional formula for magnetic flux?	1
22	How could the excessive dispersion of colors by a prism during an experiment be reduced without changing the original light source?	1
23	What is mass defect in a nucleus? Write the mathematical relation to calculate it.	1
24	What would happen if the electrons in an atom were stationary?	1
25	A glass fiber fails to produce total internal reflection because the light refracts into the surrounding medium. Suggest one strategy to resolve the issue for each case: a. related to the material.	1

	b. related to the angle of incidence.	
Section C		
26	Three students were asked to study how the energy stored in a capacitor change as the applied voltage increases. Describe one role for each student and explain how they can collaborate so that the derivation, data collection, and graph all connect properly to ensure a correct overall analysis.	3
27	An aluminum wire is stretched so its length increases by 0.5%. Assuming volume remains constant, calculate the percentage change in its resistance.	3
28	Based on the theoretical understanding, A student expects that increasing inductance always increases impedance in a series LCR circuit. However, during an experiment, the student was surprised to observe that near the resonance frequency, the impedance decreased even though the value of the inductor increased. What concept was missing in the student's understanding?	3
29	Atmospheric refraction makes the sun appear above the horizon before actual sunrise. Why is this effect more noticeable near oceans than in mountainous regions?	3
30	When the radiation of frequency 10^{14} Hz is incident on two photosensitive surfaces X & Y, the observations are: Surface X: Photoemission occurs; electrons have zero kinetic energy. Surface Y: Photoemission occurs; electrons have some kinetic energy. a. Which surface has a higher work function? b. If the frequency is slightly reduced, what happens to photoemission on both surfaces?	3
31	Calculate the radius of the third Bohr's of hydrogen atom and the energy of the electron in that orbit.	3
32	During an experiment on radioactivity, a group of students disagreed about the safety of handling weak radioactive sources in school laboratories. Some students say they are too dangerous, and others say they are completely harmless. Using your knowledge of radioactive decay, explain how the students can resolve this disagreement and reach a conclusion.	3
Section D		
33	a. State Gauss's law and write its mathematical expression. b. Prove Gauss's law for a spherically symmetric charge distribution. c. Derive Coulomb's law from Gauss's law.	1+2+2
34	Design a low-cost optical device using prisms and lenses to project diagrams and text in a classroom without electronic equipment. Explain its principle and working with the help of a suitable ray diagram.	5
35	a. Define diffraction of light and describe how intensity varies with angle in a single-slit experiment. b. How does the diffraction pattern of a single slit experiment change when: i. slit width increases? ii. monochromatic light is replaced by white light? c. A screen is 2 m away from a narrow slit. The first minimum lies 5 mm from the central maximum on either side when light of wavelength $0.3 \times 10^{-7} \text{ m}$ is used. Calculate the slit width.	2+1+2

36	a. Explain how a p-n junction diode functions as a rectifier. b. Draw the circuit diagram of a full-wave rectifier and explain its working. c. Sketch the input and output waveform.	1+3+1
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