

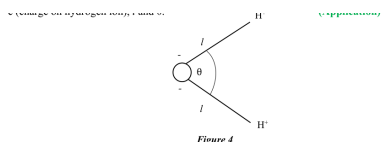
ISC Class 12 • Physics

Important Questions 2027

Most repeated questions from the last few years of board and sample papers, grouped chapter-wise.

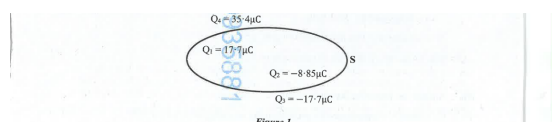
Electrostatics

1. Arrangement of an oxygen ion and two hydrogen ions in a water molecule is shown in Figure 4. Calculate electric dipole moment of water molecule. Express your answer in terms of e (charge on hydrogen ion), l and θ .



Seen in: Sample 2025, 2026

2. Four-point charges $Q_1 = +17.7\mu\text{C}$, $Q_2 = -8.85\mu\text{C}$, $Q_3 = -17.7\mu\text{C}$ and $Q_4 = 35.4\mu\text{C}$ are kept as shown in Figure 1 (only Q_1 enclosed by the closed surface S). Calculate electric flux emanating from the closed surface S .



Seen in: Board 2026 · Sample 2026

3. In case of a short electric dipole, what is the locus of a point having zero potential?

Seen in: Board 2024, 2025 · Sample 2023

4. Show that the intensity of electric field at a point in end on position i.e., axial position of an electric dipole is given by $E = (1/4\pi\epsilon_0) 2pr/(r^2 - l^2)^2$ where the terms have their usual meaning.

Seen in: Board 2026 · Sample 2023

5. Obtain an expression for equivalent capacitance C when three capacitors C_1 , C_2 and C_3 are connected in series.

Seen in: Board 2024 · Sample 2024

6. Obtain an expression for intensity of electric field at a point in broadside position of an electric dipole.

Seen in: Board 2023 · Sample 2024

7. A hollow sphere of radius R has a point charge q at its centre. Electric flux emanating from the sphere is X . How will the electric flux change, if at all, when (a) radius of the sphere is doubled? (b) charge q is replaced by an electric dipole?

Seen in: Board 2023, 2024

Current Electricity

8. Using Kirchhoff's laws of electrical networks, calculate the current I_3 (Figure 10: 33V, 1Ω branch through 2Ω ; 24V, 2Ω branch through 6Ω ; 8Ω branch carrying I_3).

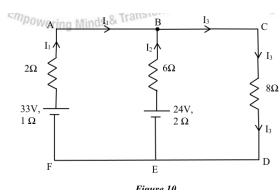
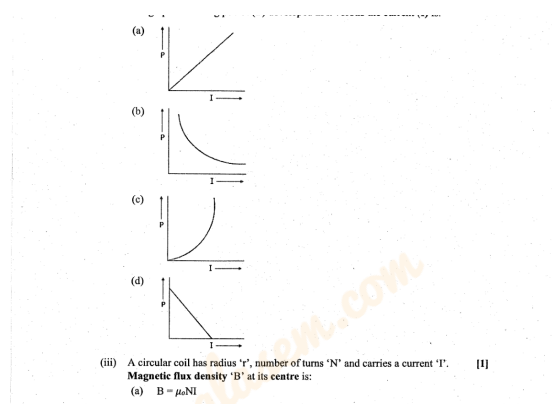


Figure 10

Seen in: Board 2023, 2024, 2025 · Sample 2026

9. An electric current (I) flowing through a metallic wire is gradually increased. The graph of heating power (P) developed in it versus the current (I) is: (options are graphs (a) linear rising, (b) decaying, (c) rising concave, (d) linear falling).

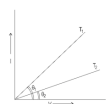


Seen in: Board 2023 · Sample 2025, 2026

10. The drift velocity of electrons in a conductor is $v_d = -eE\tau/m$. How does the drift velocity change with a change in the potential difference across the conductor?

Seen in: Board 2024 · Sample 2024, 2025

11. The current (I)-voltage (V) graphs for a conductor are given at two different temperatures T_1 and T_2 . (a) At which temperature T_1 or T_2 is the resistance higher? (b) Which temperature (T_1 or T_2) is higher?



Seen in: Sample 2025, 2026

12. Figure 2 shows a part of Wheatstone bridge circuit (2A into A; 3Ω arm A to B; 1A from B; 6Ω from B to C; 4Ω arm A to C). With the help of Kirchhoff's loop rule, calculate the current flowing through the 4Ω resistor.

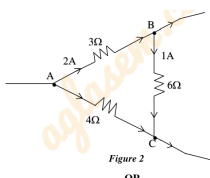


Figure 2

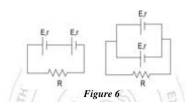
OR

Seen in: Sample 2024, 2025

- 13.** In a potentiometer, a cell is balanced against 110 cm when the circuit is open. A cell is balanced at 100 cm when short-circuited through a resistance of $10\ \Omega$. Find the internal resistance of the cell.

Seen in: Sample 2024, 2025

- 14.** Study the two circuits shown in Figure 6. The cells in the two circuits are identical (Circuit 1: two cells E, r in series with load R ; Circuit 2: two cells E, r in parallel with load R). The resistance of R is the same in both. If the same current flows through R in both circuits, calculate the internal resistance of each cell in terms of the resistance R .



Seen in: Sample 2024, 2025

- 15.** A copper wire of length ' l ' is connected to a source. If the copper wire is replaced by another copper wire of the same area of cross-section but length ' $4l$ ', how will the drift velocity change? Explain your answer.

Seen in: Sample 2024, 2025

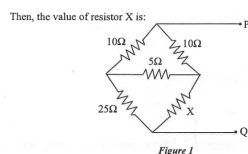
- 16.** (a) Find the value of current ' I ' in Figure 2 (junction with 8A in, 7A out, 5A out, 3A and I). (b) State the conservation principle on which your calculation is based.



(b) State the conservation principle on which your calculation is based

Seen in: Board 2026 · Sample 2025

- 17.** When a battery is connected between the terminals P and Q, as shown in Figure 1, it is found that no current flows through $5\ \Omega$ resistor. (Arms: $10\ \Omega$, $10\ \Omega$, $25\ \Omega$, X with $5\ \Omega$ as bridge). Then, the value of resistor X is: (a) $10\ \Omega$ (b) $20\ \Omega$ (c) $25\ \Omega$ (d) $45\ \Omega$

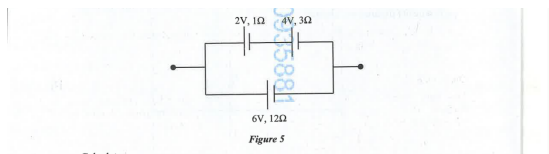


Seen in: Board 2025 · Sample 2025

- 18.** State the condition for a balanced Wheatstone bridge.

Seen in: Board 2023 · Sample 2024

19. Figure 5 shows a battery consisting of three cells ($2V, 1\Omega$ and $4V, 3\Omega$ in the two parallel top branches, $6V, 12\Omega$ in another branch). Calculate: (a) emf of the battery. (b) internal resistance of the battery.



Seen in: Board 2023, 2026

Magnetic Effects of Current and Magnetism

20. Calculate the radius of the circular path described by the electron ($v = 8 \times 10^7 \text{ ms}^{-1}$, $B = 1.3 \times 10^{-3} \text{ T}$).

Seen in: Sample 2023, 2025, 2026

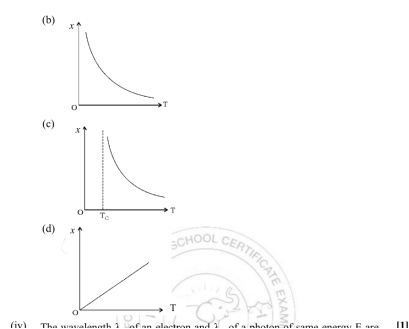
21. Using Ampere circuital law, obtain an expression for magnetic field 'B' at a point at a perpendicular distance 'r' from a long current carrying conductor.

Seen in: Board 2023 · Sample 2024, 2026

22. A galvanometer of resistance 100Ω gives a full-scale deflection for a potential difference of 200 mV . What must be the resistance connected to convert the galvanometer into an ammeter of the range $0\text{-}200 \text{ mA}$?

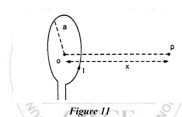
Seen in: Board 2023 · Sample 2024, 2025

23. The variation of magnetic susceptibility (χ) with absolute temperature (T) for a diamagnetic substance is: (graphs: (a) horizontal line, (b) decaying curve, (c) decaying curve with T_c , (d) rising line).



Seen in: Sample 2025, 2026

24. A student records data for the magnitude (B) of the magnetic field at axial points at different distances x from the centre O of a circular coil of radius a carrying current I : $B = B_0$ at $x=0$, $B_0/(2\sqrt{2})$ at $x=a$, $B_0/(5\sqrt{5})$ at $x=2a$, $B_0/(10\sqrt{10})$ at $x=3a$. Verify (for any two) that these observations agree with the expected theoretical values of B .



Seen in: Sample 2025, 2026

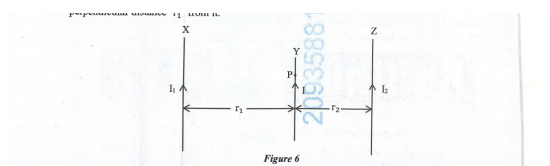
25. An electron moving along positive X axis with a velocity of $8 \times 10^7 \text{ ms}^{-1}$ enters a region having uniform magnetic field $B = 1.3 \times 10^{-3} \text{ T}$ along positive Y axis. Explain why the electron describes a circular path.

Seen in: Sample 2025, 2026

26. Obtain an expression for magnetic field (B) at the centre of a circular coil having 'n' turns of radius 'R' when it is carrying a current 'I'.

Seen in: Board 2024, 2026 · Sample 2023

27. Figure 6 shows a long straight conductor X carrying a current I_1 . A point P is at a perpendicular distance ' r_1 ' from it. How much force does conductor X exert on a short conductor Y of length 'l' which is carrying a current 'I' and is kept at point P parallel to the conductor X?



Seen in: Board 2024, 2026 · Sample 2023

28. A circular coil having N turns of radius R carrying a current I produces a magnetic field B at its centre O. If this coil is opened and rewound such that the radius of the newly formed coil is 2R, carrying the same current I, what will be the magnetic field at the centre O? (a) 2B (b) B (c) B/2 (d) B/4

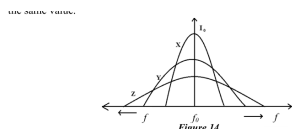
Seen in: Sample 2024, 2025

Electromagnetic Induction and Alternating Currents

29. An alternating emf $E = 5.0 \sin(314t) \text{ V}$ is applied to a circuit containing a resistor connected in series with an unknown component X. The current in the circuit is $I = 3.0 \sin(314t - \pi/3) \text{ A}$. (a) Identify the component X. (b) Calculate rms value (I_{rms}) of the current. (c) Find the frequency of the source. (d) Calculate power factor. (e) Find the impedance (Z) of the circuit.

Seen in: Board 2023, 2024, 2025 · Sample 2023, 2024

30. Three students X, Y and Z studied variation of A.C. with frequency in a series LCR circuit using an AC source of same emf and inductance of the same value, obtaining resonance curves (X sharpest, then Y, then Z). (a) Who used minimum resistance? (b) In which case will the quality Q factor be maximum? (c) What did the students conclude about the nature of impedance at resonant frequency (f_0)?



Seen in: Board 2024 · Sample 2025, 2026

- 31.** An ideal capacitor is connected across 220V, 50Hz, and 220V, 100Hz supplies. Find the ratio of current flowing through it in the two cases.

Seen in: Sample 2025, 2026

- 32.** What is motional emf?

Seen in: Board 2023, 2026 · Sample 2024

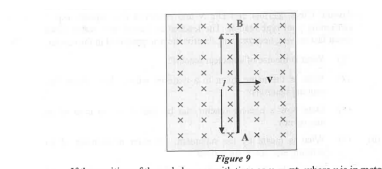
- 33.** When a coil is connected to a 200V dc supply, the current flowing through it is 1A. However, when it is connected to the 200V, 50Hz ac supply, the current is 0.5A. (1) Explain why current flowing is less when the coil is connected to an ac supply. (2) Calculate coefficient of self-inductance (L) of the coil.

Seen in: Board 2026 · Sample 2026

- 34.** A 20cm length of a long iron cored solenoid has 25 turns. If the area of cross section of the solenoid is $4 \times 10^{-4} \text{ m}^2$, calculate its coefficient of self-inductance (L). (Relative permeability of iron = 3000.)

Seen in: Board 2026 · Sample 2024

- 35.** Figure 9 shows a metallic rod MN of length $l = 3\text{m}$ moving in an external uniform magnetic field $B = (1/\pi) \text{ T}$ directed into the plane of paper. The position of the rod changes with time as $x = \pi t$ (x in metre, t in second). (1) Calculate the motional emf developed in the rod. (2) Name the law used to find the direction of induced current.



Seen in: Board 2025 · Sample 2023

- 36.** State why soft iron is preferred to steel as a material for the core of a transformer.

Seen in: Board 2024, 2026

- 37.** When current flowing through a solenoid decreases from 15A to 0 in 0.2s, an emf of 30V is induced in it. Calculate the coefficient of self-inductance of the solenoid.

Seen in: Board 2024, 2025

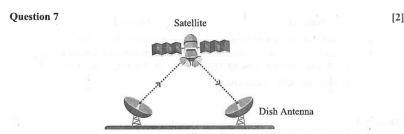
Electromagnetic Waves

- 38.** Name the electromagnetic radiation that has been used in obtaining the image below (an X-ray chest radiograph).



Seen in: Board 2023, 2026 · Sample 2025, 2026

39. Name the electromagnetic wave travelling from the satellite to the dish antenna shown in the image above.



(i) Name the electromagnetic wave travelling from the satellite to the dish antenna in the image above.
Seen in: Board 2025 · Sample 2024, 2026

40. Which physical quantity is the same for UV rays, red light and radio waves when they are travelling in vacuum?

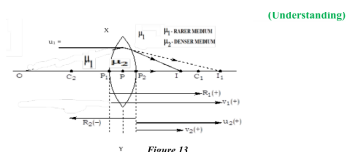
Seen in: Board 2024, 2026

Ray Optics and Optical Instruments

41. A student studies details of a microorganism with the help of an instrument. Name the instrument used by him.

Seen in: Board 2024 · Sample 2023, 2025, 2026

42. With reference to the lens maker's formula: Apply the formula (expression) of refraction at a single spherical surface to (a) refraction at first spherical surface. (b) refraction at second spherical surface.

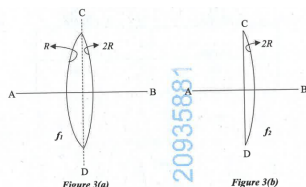


Seen in: Sample 2023, 2026

43. Draw a labelled ray diagram of an image formed by this instrument (compound microscope), assuming (a) a small upright object. (b) image lies at least distance of distinct vision.

Seen in: Sample 2024, 2025, 2026

44. A bi-convex lens of focal length f_1 is placed in air (Figure 3a). The radii of curvature of its first and second surfaces are R and $2R$ respectively. The lens is cut along the plane CD. Compare the focal length f_2 of the resulting lens (Figure 3b) with that of the original lens (Figure 3a).



Seen in: Board 2026 · Sample 2024, 2025

45. Why are giant telescopes of reflecting type? Give any one scientific reason.

Seen in: Board 2024, 2025 · Sample 2026

46. A thin convex lens of power 5D is kept in contact with a thin concave lens of power 8D. Calculate the focal length of the combination.

Seen in: Board 2025, 2026 · Sample 2023

47. For any prism, show that refractive index 'n' of its material is given by: $n = \frac{\sin((A + \delta_m)/2)}{\sin(A/2)}$, where the terms have their usual meaning.

Seen in: Board 2023, 2025 · Sample 2023

48. The focal length of a double convex lens is equal to the radius of curvature of either surface. What is the refractive index of its material?

Seen in: Sample 2024, 2025

49. What is meant by a thin prism?

Seen in: Sample 2024, 2025

50. The two parts are arranged as shown in Figure 4B. What is the focal length of the final combination?



Seen in: Sample 2024, 2025

51. When a beam of white light is incident on a prism, the prism: (a) only disperses the incident light. (b) only deviates the incident light. (c) deviates as well as disperses incident light. (d) neither deviates nor disperses incident light.

Seen in: Board 2024 · Sample 2026

52. For refraction at convex spherical surface of denser medium n_2 surrounded by a rarer medium of refractive index n_1 , derive a formula connecting object distance u, image distance v, and radius of curvature R for the object in rarer medium and a real image formed inside the denser medium.

Seen in: Board 2023 · Sample 2024

53. What is the ability of an optical instrument to form enlarged images called?

Seen in: Board 2024 · Sample 2023

54. Name any two phenomena which take place in the formation of a rainbow.

Seen in: Board 2023 · Sample 2023

Wave Optics

55. Use Huygen's wave theory to prove Snell's law.

Seen in: Board 2024, 2025 · Sample 2023, 2024

- 56.** Using Huygen's wave theory and a labelled diagram, show that angle of reflection (r) is equal to angle of incidence (i).

Seen in: Board 2023, 2026 · Sample 2025

- 57.** In Young's double slit experiment, how is interference pattern affected when the slits are brought closer to each other?

Seen in: Sample 2024, 2025

- 58.** In Young's double slit experiment, show that fringe width ω (fringe separation) is given by $\omega = \lambda D/d$ where the terms have their usual meaning.

Seen in: Board 2024 · Sample 2026

- 59.** What will be the change in the interference pattern if the given light is replaced with monochromatic light of wavelength 500nm?

Seen in: Board 2025 · Sample 2025

- 60.** In Young's double slit experiment, what should be the path difference between two overlapping waves to form a bright band / fringe?

Seen in: Sample 2023, 2024

- 61.** With what type of source of light are plane wavefronts associated?

Seen in: Board 2023 · Sample 2024

- 62.** In a single slit Fraunhofer diffraction experiment, how does the angular width of central maximum change when the slit width is increased?

Seen in: Board 2023 · Sample 2023

- 63.** What is the essential condition for obtaining a sustained interference?

Seen in: Board 2023 · Sample 2023

- 64.** Two identical rectangular slits 5mm apart are illuminated with a monochromatic light of wavelength 600nm. The screen is kept 1.2m away from the slits. Calculate the distance between the 5th bright fringe on one side and the 3rd bright fringe on the other side of the central bright band.

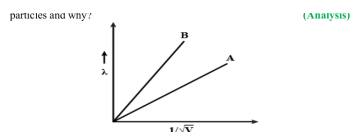
Seen in: Board 2023, 2025

Dual Nature of Radiation and Matter

- 65.** What happens when an electron collides with a positron?

Seen in: Sample 2024, 2025, 2026

66. Two charged particles having same charge but different masses are passed through a potential difference V . When V is varied, de-Broglie wavelength (λ) of the particles varies as shown in graphs (λ vs $1/\sqrt{V}$, lines A and B). Which graph is for heavier particles and why?



Seen in: Board 2026 · Sample 2026

67. In the photoelectric effect, the maximum kinetic energy of the emitted photoelectron is 'a' and the work function of the metal is W_0 . If the frequency of incident radiation is made 'K' times, then calculate the change in maximum KE of the ejected electron.

Seen in: Board 2023 · Sample 2026

68. The work functions for metals M_1 and M_2 are 1.9eV and 5.0eV respectively. Perform necessary calculations to find out which metal emits photoelectrons, when monochromatic light of wavelength 410nm is incident on them.

Seen in: Board 2026 · Sample 2024

69. How does stopping potential in photoelectric emission vary if the intensity of the incident radiation increases?

Seen in: Board 2024 · Sample 2025

70. State the conclusion that was drawn from Davisson-Germer's experiment.

Seen in: Board 2025, 2026

71. Calculate the minimum amount of energy which a gamma ray photon should possess in order to produce a proton and an anti-proton pair.

Seen in: Board 2025, 2026

72. What is 'Pair production'?

Seen in: Board 2024 · Sample 2024

73. Plot a labelled graph of stopping potential (V_s) versus frequency (f) of incident UV radiation.

Seen in: Board 2025 · Sample 2023

74. State how the value of Planck's constant can be determined from this graph (stopping potential vs frequency).

Seen in: Board 2025 · Sample 2023

75. If kinetic energy of moving electrons is made four times, then their de Broglie wavelength becomes: (a) eight times. (b) four times. (c) two times. (d) half.

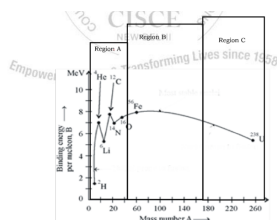
Seen in: Board 2024, 2025

Atoms and Nuclei

76. What is meant by the following statement? 'Angular momentum of an orbiting electron is quantised.'

Seen in: Board 2024, 2025, 2026 · Sample 2023

77. Study the binding energy per nucleon versus mass number graph (Region A: light nuclei; Region B: intermediate; Region C: heavy nuclei). Indicate which region corresponds to: (1) Nuclei prone to fission. (2) Nuclei prone to fusion. (3) Most stable nuclei.

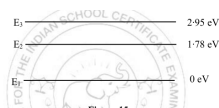


Seen in: Board 2026 · Sample 2023, 2026

78. Find the energy released during the fission reaction ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{236}_{92}\text{U} \rightarrow {}^{90}_{36}\text{Kr} + {}^{143}_{56}\text{Ba} + 3{}^1_0\text{n}$, given masses ${}^{235}_{92}\text{U} = 235.0439\text{u}$, ${}^{90}_{36}\text{Kr} = 89.9195\text{u}$, ${}^{143}_{56}\text{Ba} = 142.9206\text{u}$, ${}^1_0\text{n} = 1.0087\text{u}$.

Seen in: Board 2024 · Sample 2024, 2025

79. In an atom X (energy levels $E_1 = 0.00\text{eV}$, $E_2 = 1.78\text{eV}$, $E_3 = 2.95\text{eV}$, ground state 0 eV for reference), electrons absorb energy exciting them to higher levels and emit photons on returning. What wavelength of radiation is needed to excite the atom to energy level E_2 from E_1 ?



Seen in: Sample 2025, 2026

80. Show that radius (r_n) of the nth Bohr orbit varies directly with square of the principal quantum number (n) of the orbit.

Seen in: Board 2024, 2025 · Sample 2023

81. During Rutherford's gold foil experiment, most alpha-particles did not deflect, however some showed a deflection of 180° . What hypothesis was made to justify the deflection of alpha-particle by 180° ?

Seen in: Sample 2024, 2025

82. A group of students visited Bhabha Atomic Research Centre and observed reactors (Apsara a swimming pool type reactor; water slows fast neutrons and absorbs heat). (1) What is the use of a nuclear reactor? (2) What is the name given to a material which slows down fast moving neutrons? (3) State how a nuclear reactor can be shut down in case of an emergency.

Seen in: Board 2023, 2024, 2025

83. According to Bohr's theory of hydrogen atom, calculate (1) angular momentum of the electron in second Bohr orbit. (2) radius of the third Bohr orbit.

Seen in: Board 2023 · Sample 2026

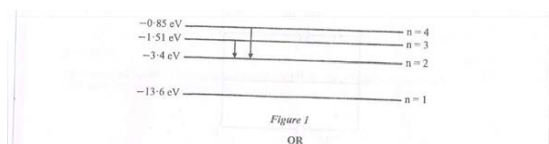
84. Find the binding energy per nucleon of ${}^{235}_{92}\text{U}$ given mass of neutral ${}^{235}_{92}\text{U} = 235.0439\text{u}$, mass of a proton = 1.0073u , mass of a neutron = 1.0087u .

Seen in: Board 2024 · Sample 2025

85. Radius of the first Bohr orbit of hydrogen atom is 0.05nm . Calculate the radius of the third orbit.

Seen in: Board 2024, 2026

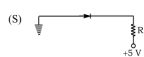
86. Figure 1 is the Energy level diagram for Hydrogen atom (levels $n=1$ to $n=4$ with transitions to $n=2$). Study the transitions shown and answer: (a) State the type of spectrum obtained. (b) Name the series of spectrum obtained.



Seen in: Board 2023, 2024

Electronic Devices (Semiconductors)

87. In which of the following figures is the p-n diode forward biased? (P: $+5\text{V}$ –R– $+10\text{V}$; Q: 10V –R–diode–ground; R: -12V –diode–R– 5V ; S: ground–diode–R– $+5\text{V}$.) (a) Only (P), (Q) and (S) (b) Only (R) (c) Only (P) and (R) (d) Only (Q) and (S)



Seen in: Sample 2025, 2026

88. What is meant by potential barrier?

Seen in: Board 2024, 2026 · Sample 2023

89. When a p-n junction diode is forward-biased: (a) it acts as an insulator and no current flows through it. (b) it offers a low resistance and a large current flows through it. (c) it offers a high resistance and a small current flows through it. (d) the width of depletion region increases.

Seen in: Board 2026 · Sample 2025

90. How did Annie obtain an extrinsic semiconductor from an intrinsic semiconductor?

Seen in: Board 2026 · Sample 2023

91. N-type semiconductor is that which has: (a) majority of holes as charge carriers. (b) majority of free electrons as charge carriers. (c) trivalent element added as an impurity. (d) an equal number of holes and free electrons.

Seen in: Board 2025 · Sample 2023

92. With reference to a semiconductor diode, define the following term: depletion region.

Seen in: Board 2024 · Sample 2023

93. How does the resistance of a semiconductor crystal vary with its temperature?

Seen in: Board 2023, 2025

94. In an energy band diagram of a certain material, forbidden band is absent. Identify this material.

Seen in: Board 2023, 2025

95. Draw a labelled diagram of a full wave rectifier. Show graphically how its output voltage varies with time.

Seen in: Board 2023, 2025