ISC · CLASS 12 · PHYSICS

ISC Class 12 Physics Guess Paper 2027

Time: 3 hours · Maximum marks: 70 · 36 questions

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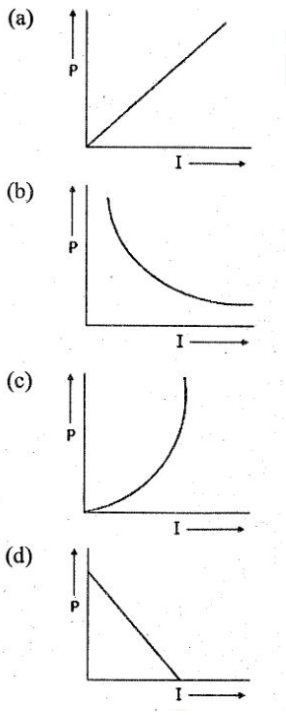
Section A

Compulsory. Question 1 consists of fourteen sub-parts of one mark each: part (A) is seven multiple-choice questions and part (B) is seven very-short-answer questions. No internal choice.

Q1. Identify the phenomena that occur when a P-N junction diode is forward biased. 1 mark

(P) The width of the depletion layer decreases.
(Q) The height of the potential barrier is lowered.
(R) The effective resistance of the diode increases significantly.
(S) The reverse current flows mainly due to the diffusion of majority charge carriers.
(a) Both (P) and (Q)
(b) Both (R) and (S)
(c) Both (P) and (S)
(d) Both (Q) and (R)

Q2. 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 (a)-(d) are the graphs shown) 1 mark



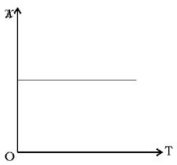
Q3. Explain why resistance of a semiconductor material decreases when its temperature is increased. 1 mark

Q4. 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? 1 mark

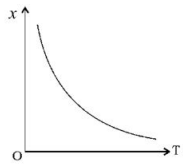
Q5. A thin convex lens of power 5D is kept in contact with a thin concave lens of power 8D. Calculate the focal length of the combination. 1 mark

Q6. The variation of magnetic susceptibility (x) with absolute temperature (T) for a diamagnetic substance is: (options (a)-(d) are the graphs shown) 1 mark

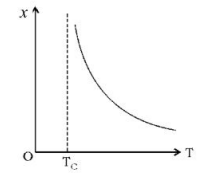
(a)



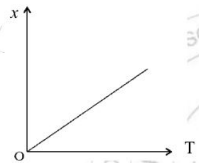
(b)



(c)



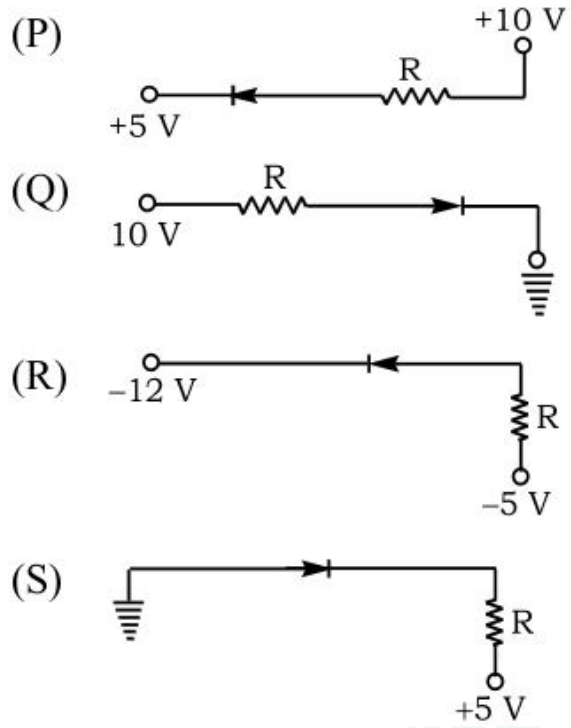
(d)



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Q7. In which of the following figures is the p-n diode forward biased? 1 mark

(a) Only (P), (Q) and (S)
(b) Only (R)
(c) Only (P) and (R)
(d) Only (Q) and (S)



Q8. Study the diagram shown in Figure 12. Identify a primary wavefront in Figure 12. 1 mark

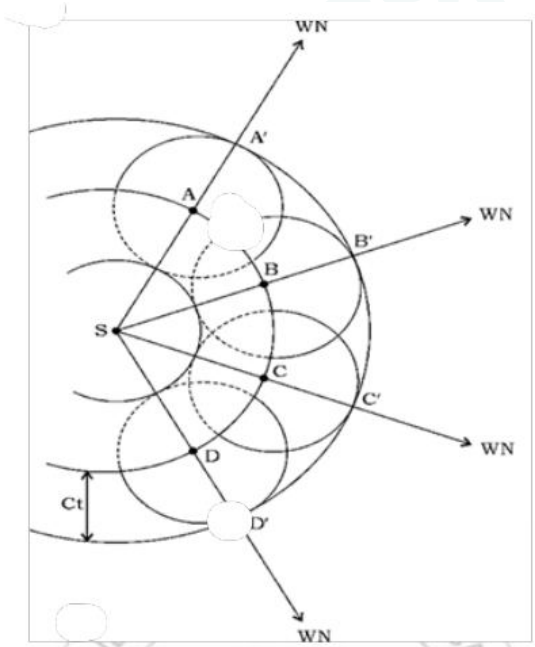
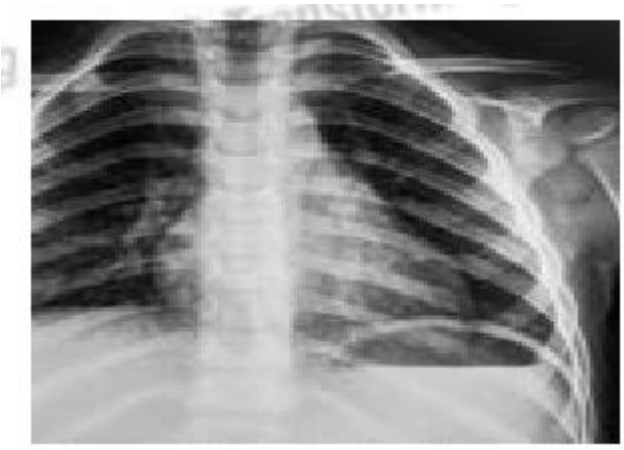


Figure 12

Q9. A student studies details of a microorganism with the help of an instrument. Name the instrument used by him. 1 mark

Q10. Name the electromagnetic radiation that has been used in obtaining the image below. 1 mark



Q11. Teacher: Two students performed the same Young's double slit experiment. One student obtained wider fringes. What is the possible reason for this observation? Student: The student who obtained wider fringes must have increased the distance between the two slits. State whether the answer is correct or incorrect; correct it with a brief explanation. 1 mark

Q12. [context: With reference to the lens maker's formula (Figure 13), the formula of refraction at a single spherical surface has been applied to the first and second spherical surfaces of a lens.] Combine these two expressions / equations to obtain an expression for focal length of the lens. 1 mark

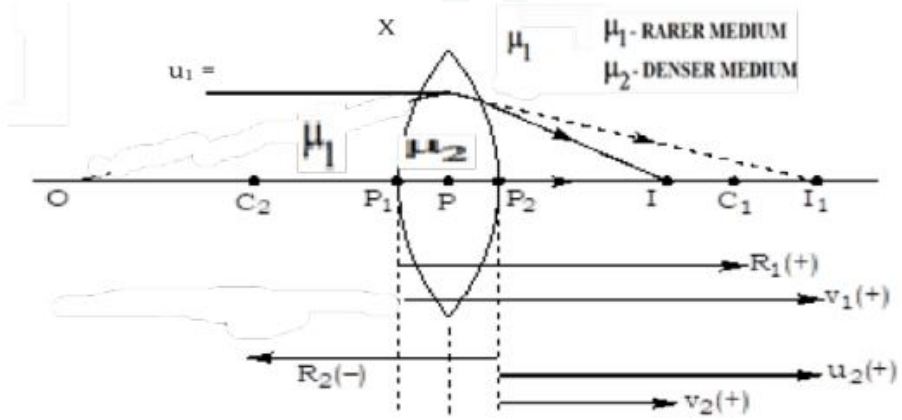


Figure 13

Q13. If the photon energy in image B = 2·8 eV (work function 2·3 eV), calculate the maximum kinetic energy of the emitted photo electrons. 1 mark

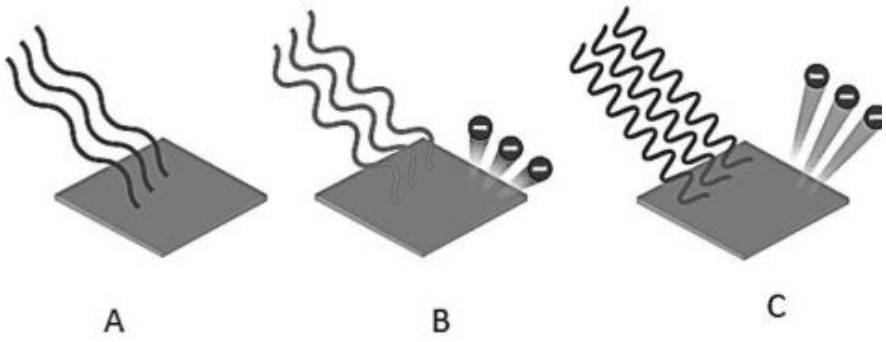


Figure 9

Q14. What happens when an electron collides with a positron? 1 mark

Section B

Seven questions of two marks each (short answer / short numerical). Internal choices are provided in two of these questions.

Q15. 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. 2 marks

Q16. 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. 2 marks

Q17. Calculate the radius of the circular path described by the electron ($v = 8\times10^{7}$ ms^{-1}, $B = 1\cdot3\times10^{-3}T$). 2 marks

Q18. Figure 6 shows an electric circuit. Apply Kirchhoff's laws to calculate: (a) current 'I' flowing through the 2Ω resistor. (b) emf of the cell 'E'. 2 marks

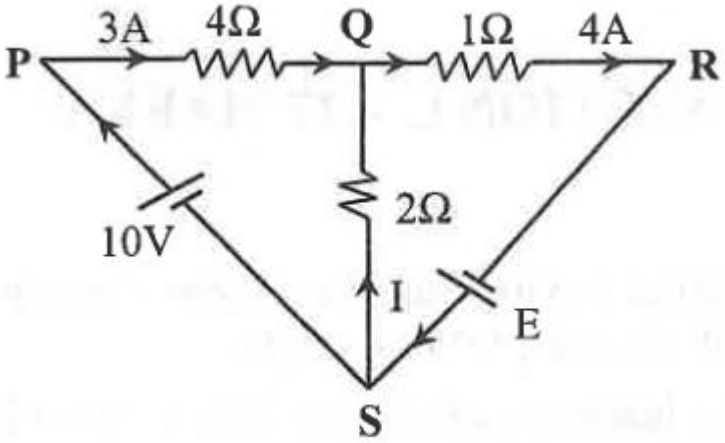


Figure 6

Q19. Calculate the minimum amount of energy which a gamma ray photon should possess in order to produce a proton and an anti-proton pair. 2 marks

Q20. Use Huygen's wave theory to prove Snell's law. 2 marks

Q21. A train is moving on horizontal tracks that are 1·2m apart. Its displacement (x) depends on time (t) as $x(m) = 3t^2 + 6$. Vertical component of earth's magnetic field in its region of motion is 2×10^{-5} T. Calculate the emf induced between two ends of its axle rod 10s after the train starts moving. 2 marks

Section C

Nine questions of three marks each (derivations, reasoning and numericals). Internal choices are provided in two of these questions.

Q22. A 220V, 50Hz ac source is connected to a coil having coefficient of self-inductance of 1H and a resistance of 400Ω. Calculate: (1) the reactance of the coil. (2) the impedance of the coil. (3) the current flowing through the coil. 3 marks

Q23. Obtain an expression of intensity of electric field at a point lying on the axis of an electric dipole. 3 marks

Q24. 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. (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)? 3 marks

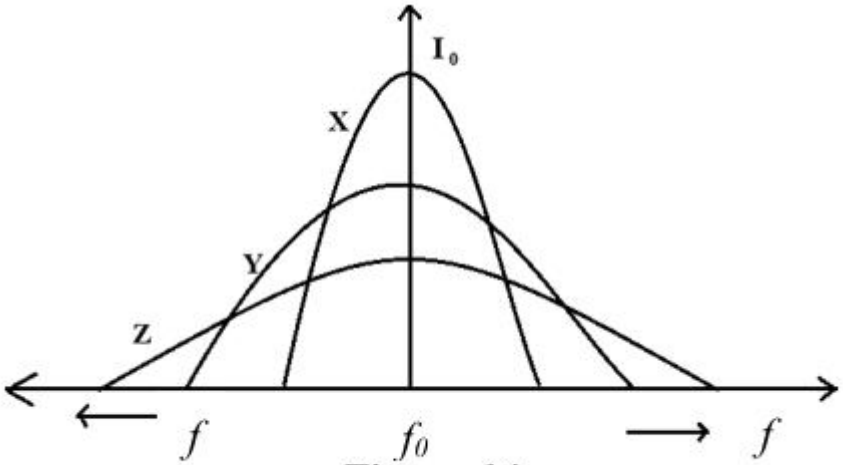


Figure 14

Q25. State the postulate of Bohr's theory regarding (1) Quantisation of angular momentum of an electron. (2) Emission of energy by an atom. 3 marks

Q26. 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. 3 marks

Q27. Using Huygen's wave theory and a labelled diagram, show that angle of reflection (r) is equal to angle of incidence (i). 3 marks

Q28. An electric dipole is kept in a uniform electric field E with its axis making an angle θ with the field. Show forces acting on each charge and hence prove that torque acting is given by $\tau = pE \sin\theta$ 3 marks

Q29. 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. 3 marks

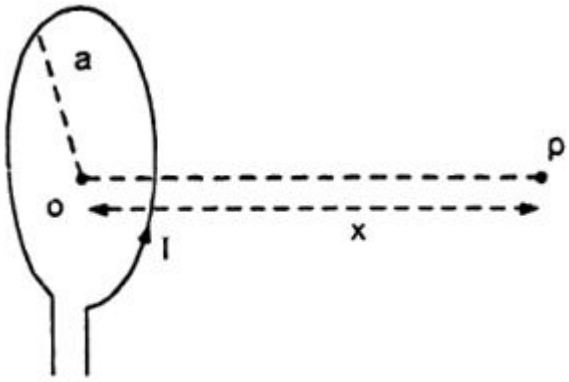


Figure 11

Q30. In an atom X (energy levels E_1 = 0·00eV, E_2 = 1·78eV, E_3 = 2·95eV, ground state 0 eV), transition takes place between E_1 and E_2. (1) What wavelength of radiation is needed to excite the atom to energy level E_2 from E_1? (2) Suppose the external source has a power of 100 W. What would be the rate of photon emission? 3 marks

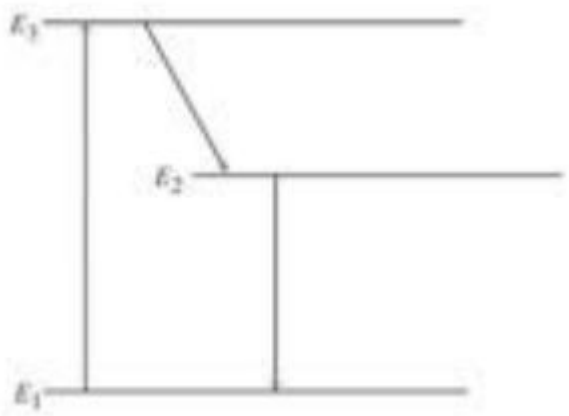


Figure 10

Section D

Three questions of five marks each (long answer with multiple sub-parts, derivations and numericals); each is set here as its 3-mark and 2-mark sub-parts. Internal choices are provided in two of these questions.

Q31. In the circuit shown in Figure 5, the central zero galvanometer G shows no deflection when the key K is closed. Calculate the value of resistor R_1. 3 marks

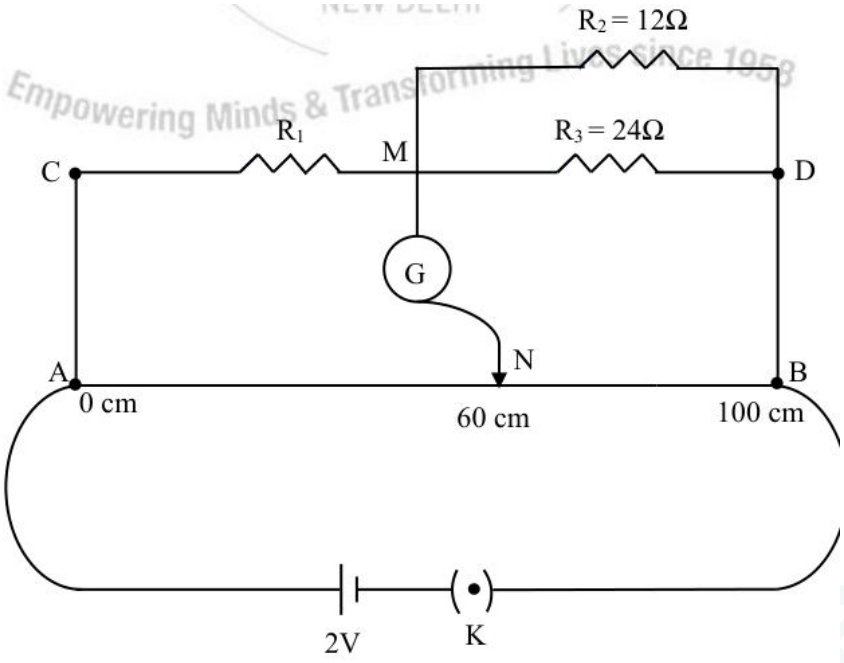


Figure 5

Q32. For any prism, show that refractive index 'n' of its material is given by: $n = \sin((A+\delta_m)/2) / \sin(A/2)$, where the terms have their usual meaning. 3 marks

Q33. Study the two circuits shown in Figure 6. The cells in the two circuits are identical. 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. 3 marks

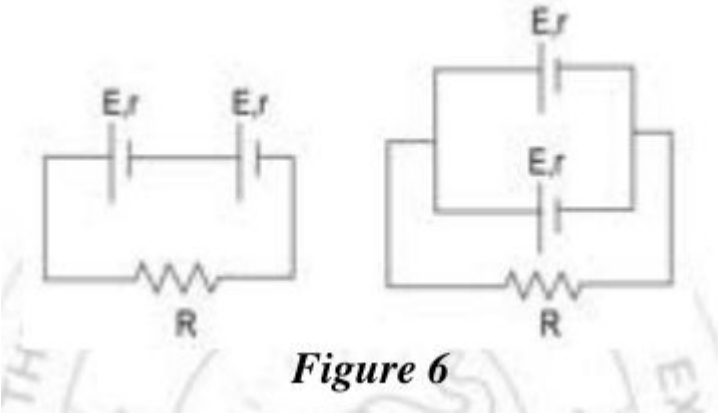


Figure 6

Q34. 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). 2 marks

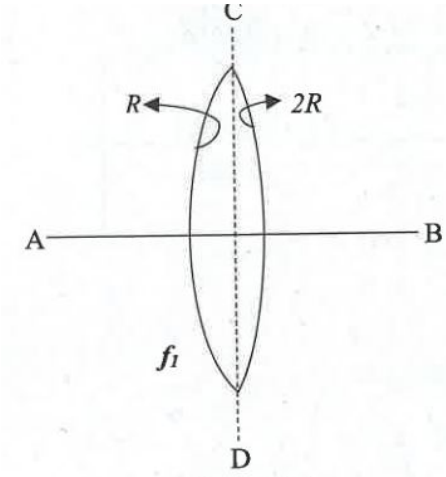


Figure 3(a)

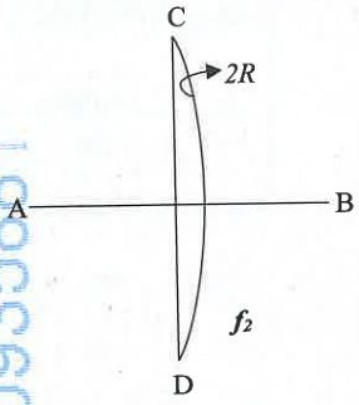


Figure 3(b)

Q35. A galvanometer of resistance 100 Ω 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 0-200 mA? 2 marks

Q36. A monochromatic ray of light incident on one refracting surface of an equilateral prism suffers a deviation as shown in Figure 7. Calculate the refractive index of the material of the prism. 2 marks

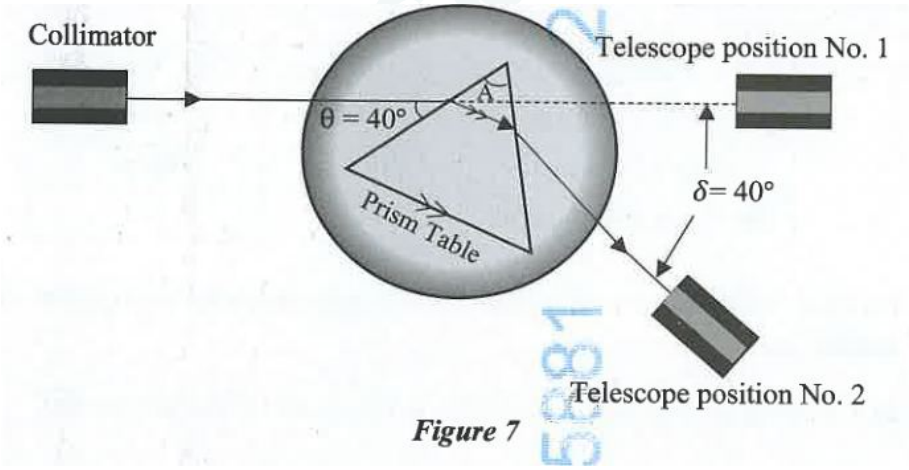


Figure 7

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