CBSE Class 12 Physics 2026 - 55/4/2

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)

Time Allowed: 3 Hours **Maximum Marks: 70**

General Instructions

(i) This question paper contains **33 questions**. All questions are **compulsory**.

(ii) The question paper is divided into Sections A, B, C, D, E.

(iii) Section A - Questions 1 to 16 carry 1 mark each.

(iv) Section B - Questions 17 to 21 carry 2 marks each.

(v) Section C - Questions 22 to 28 carry 3 marks each.

(vi) Section D - Questions 29 to 30 carry 4 marks each.

(vii) Section E - Questions 31 to 33 carry 5 marks each.

(viii) There is no overall choice. Where an internal choice is provided, attempt only one of the alternatives.

You may use the following values of physical constants wherever necessary:

$c = 3 \times 10^8$ m/s

$h = 6.63 \times 10^{-34}$ Js

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

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

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

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N m^2 C^{-2}

Mass of electron (m_e) $= 9.1 \times 10^{-31}$ kg

Mass of neutron $= 1.675 \times 10^{-27}$ kg

Mass of proton $= 1.673 \times 10^{-27}$ kg

Avogadro's number $= 6.023 \times 10^{23}$ per gm mole

Boltzmann constant $= 1.38 \times 10^{-23}$ JK^{-1}

Section A

1. A wire is gradually stretched to make it 100% longer. Its resistance will increase by:

(A) 100% (B) 200%

(C) 300% (D) 400%

2. A closely wound long solenoid of self-inductance L is cut into two identical solenoids. The value of self-inductance of each small solenoid will be:

(A) $\frac{L}{2}$ (B) $2L$

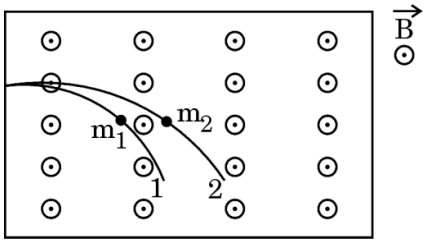
(C) $3L$ (D) $4L$

3. Which of the following characteristics of electrons determines the current in the conductor?

(A) Drift velocity only (B) Thermal velocity only

(C) Both drift velocity and thermal velocity (D) Neither drift nor thermal velocity

4. Two particles of masses m_1 and m_2 having charges q_1 and q_2 respectively are projected with the same velocity in a region of uniform magnetic field $\vec{B}$ pointing vertically upward. If they describe circular paths as shown in the figure, one may conclude that:



(A) $\frac{m_1}{m_2} > \frac{q_1}{q_2}$ (B) $\frac{m_1}{m_2} > \frac{q_2}{q_1}$

(C) $\frac{m_1}{m_2} < \frac{q_1}{q_2}$ (D) $\frac{m_1}{m_2} < \frac{q_2}{q_1}$

5. Paschen series in spectrum of hydrogen atom lies in:

(A) infrared region (B) ultraviolet region

(C) visible region (D) partly in ultraviolet region and partly in visible region

6. The kinetic energy of a charged particle is increased to four times of its initial value. The de Broglie wavelength associated with the particle will:

(A) increase by 100% of its initial value. (B) increase by 50% of its initial value.

(C) decrease by 25% of its initial value. (D) decrease by 50% of its initial value.

7. In a reversed-biased p-n junction diode, the applied voltage mostly drops across:

(A) p-region only (B) n-region only

(C) depletion region (D) the diode

8. A coil having 100 closely wound turns and area of cross-section 300 mm^2 carries a current of 5 mA. The magnitude of the magnetic moment associated with the coil is:

(A) 6×10^{-4} A m^2 (B) 3×10^{-5} A m^2

(C) $1 \cdot 5 \times 10^{-4}$ A m^2 (D) 5×10^{-5} A m^2

9. An ac voltage is given as $v = 14 \sin(314\,t)$ V. The average and the effective value of the voltage (in V) over a cycle are respectively:

(A) 14 and 7 (B) 10 and 14

(C) 0 and 10 (D) 10 and 0

10. The ratio of amplitude of electric field to the amplitude of the magnetic field associated with an electromagnetic wave propagating in glass $(n = 1 \cdot 5)$ is:

(A) 3×10^8 m s^{-1} (B) 2×10^8 m s^{-1}

(C) $3 \cdot 3 \times 10^{-9}$ m s^{-1} (D) 5×10^{-9} m s^{-1}

11. Radiation of wavelength 331 nm irradiates the following metals:

Metal	Work Function (eV)
Na	1·92
K	2·15
Ca	3·20
Mo	4·17

Which of the following statements is correct?

(A) Only Na and K show photoelectric emission.

(B) Only Mo will not show photoelectric emission.

(C) All of the given metals show photoelectric emission.

(D) None of them show photoelectric emission.

12. In an experiment on photoelectric emission, the intensity of incident radiation is halved keeping its frequency constant. As a result:

(A) cut-off potential will increase.

(B) maximum kinetic energy of photoelectrons will remain the same.

(C) photocurrent will increase.

(D) cut-off potential will decrease.

Question numbers 13 to 16 are Assertion (A) and Reason (R) type questions. Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Both Assertion (A) and Reason (R) are false.

13. **Assertion (A):** The conductivity of an n-type semiconductor is higher than that of a p-type semiconductor at a given temperature.

Reason (R): The electrons being in the conduction band in n-type semiconductor are more mobile than the holes in the valence band in p-type semiconductor.

14. Directions: Questions are Assertion (A) and Reason (R) type. Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D).

Assertion (A): The work done, in taking a unit charge around a closed loop of an electric circuit involving cells and resistors in the loop, is zero.

Reason (R): The potential at a point depends on the location of the point in the loop. After completing one round, the charge comes back to the point of start.

15. **Assertion (A):** When a ferromagnetic substance is heated to high temperature it becomes paramagnetic in nature.

Reason (R): The disappearance of magnetisation of a ferromagnet is abrupt and not gradual.

16. **Assertion (A):** When a convex lens made of glass is immersed in water, its converging power increases.

Reason (R): The focal length of a lens depends only on the radii of curvature of its two faces.

Section B

17. **(a)** State Huygens principle. How did Huygens justify the absence of the backwave on a spherical wavefront?

OR

(b) In a single-slit diffraction experiment, light of wavelength λ illuminates the slit of width 'a'. The diffraction pattern is observed on a screen kept at a distance D from the slits.

(i) Depict variation of intensity in the fringe pattern with the angular position of the fringes.

(ii) How is the linear width of central maximum affected when separation between the slit and the screen is decreased?

18. The hole concentration in an intrinsic semiconductor is 5×10^{16} m^{-3}. When it is doped with certain impurity, the electron concentration becomes 4×10^{12} m^{-3}. Find the new value of the hole concentration. Also identify the type of new semiconductor formed after doping.

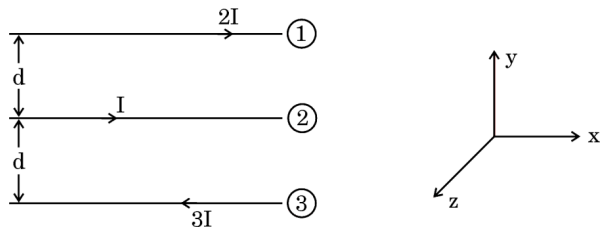
19. A concave mirror of radius of curvature 16 cm produces two-times enlarged real image of an object kept in front of it. Find the position of the object.

20. Prove that the density of nuclear matter is same for all nuclei.

21. An electric dipole consists of two point charges $+1\,\mu C$ and $-1\,\mu C$, held 10 cm apart. It is subjected to a uniform electric field of 100 N/C. Calculate the amount of work done in turning the dipole from its position of stable equilibrium to the position of unstable equilibrium, in the field.

Section C

22. **(a)** The figure given below shows three straight long parallel conductors (1), (2) and (3) kept in x-y plane, carrying currents $2I$, I and $3I$ respectively as shown in figure.



Find the magnitude and direction of:

(i) net magnetic field at a point on conductor (1) and

(ii) net magnetic force acting on unit length of conductor (1), due to conductors (2) and (3).

OR

(b) A rectangular loop of sides l and b and resistance 'R' is kept in a region in which the magnetic field varies as $B = B_0 \sin \omega t$.

(i) Derive expression for the emf induced in the loop.

(ii) Find the effective value of current that flows in the loop.

23. With the help of a circuit diagram, explain the working of a full wave rectifier. Depict the input and output waveforms.

24. In Bohr model of hydrogen atom, calculate:

(a) the radius of the innermost electron orbit, and

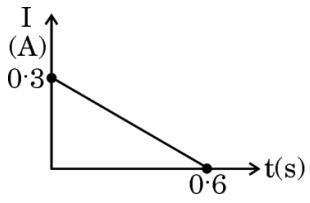
(b) the speed of electron in this orbit.

25. (a) Explain how the dual aspect of matter is evident in the de Broglie relation.

(b) Radiation of wavelength λ is incident on a photosensitive surface. Find the de Broglie wavelength of electrons emitted from the surface. Assume that the work function of the surface is negligible.

26. What are microwaves? How are they produced? Give any two uses of microwaves.

27. A conducting rectangular loop of area 5 cm^2 and resistance 4 Ω is removed from a region of uniform magnetic field, acting normal to the plane of the loop. The value of induced current I in the loop varies with time t, as shown in the figure.



Find:

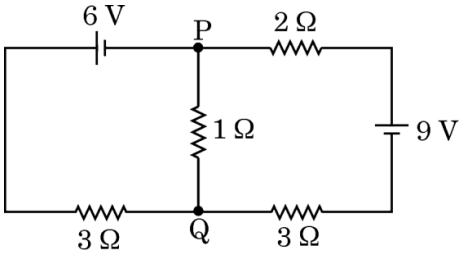
(a) total charge that passed through the loop

(b) change in magnetic flux through the loop

(c) magnitude of magnetic field in the region

28. (a) The two Kirchhoff's rules are based on law of conservation of two physical quantities. Name the quantities.

(b) Find magnitude and direction of current in 1 Ω resistor in the given circuit.



Section D

Question numbers 29 and 30 are Case Study-based questions. Read the following paragraphs and answer the questions that follow.

29. An astronomical telescope consists of two converging lenses. One of them of large aperture and large focal length is called objective lens and the other one, of smaller focal length and smaller aperture is called the eyepiece. It is used to see distant objects which are not seen clearly with naked eyes. The image formed by the objective lens acts as an object for the eyepiece and the final image produced by the eyepiece is magnified.

29(i). The images formed by the objective lens and the eyepiece are respectively:

(A) virtual, real
(B) real, virtual
(C) virtual, virtual
(D) real, real

29(ii). The magnification produced by the telescope does not depend upon the:

(A) colour of light
(B) focal length of objective lens
(C) focal length of eyepiece
(D) apertures of objective lens and eyepiece

29(iii). Which of the following statements is not correct for this telescope?

(A) The focal length of objective lens (f_o) is larger than the focal length of eyepiece (f_e).
(B) Its magnifying power can be increased by increasing the focal length of objective lens (f_o).
(C) The distance between two lenses is more than ($f_o + f_e$).
(D) The magnifying power can be decreased by increasing the focal length of eyepiece.

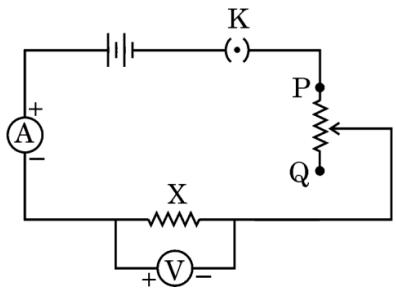
29(iv)(a). An astronomical telescope has objective lens and eyepiece of focal lengths 80 cm and 4 cm respectively. To view the image in normal adjustment, the lenses must be separated by a distance of:

(A) 84 cm
(B) 76 cm
(C) 20 cm
(D) 320 cm

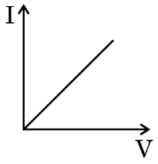
29(iv)(b). Consider the telescope described in question (iv) (a). Its magnifying power in normal adjustment will be:

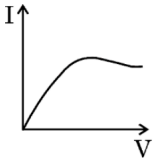
(A) 320
(B) 84
(C) 76
(D) 20

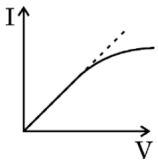
30. A student sets up the circuit as shown in the figure to find the value of unknown resistance X and records a set of readings of the voltmeter and the ammeter by using the rheostat.

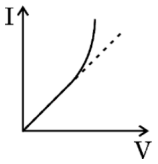


30(i). If resistor X were made of manganin and readings for V and I are taken without switching off the circuit, the graph between V and I will be as:

(A) 

(B) 

(C) 

(D) 

(A) Graph (A)
(B) Graph (B)
(C) Graph (C)
(D) Graph (D)

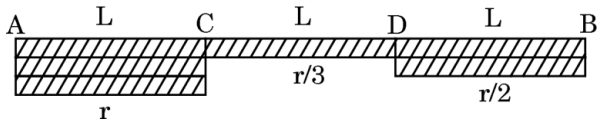
30(ii). Error in the value of X obtained from different sets of voltmeter and ammeter readings, is:

(A) due to error in voltmeter reading only.
(B) due to error in ammeter reading only.
(C) equal to the sum of error in voltmeter reading and error in ammeter reading.
(D) equal to error in voltmeter reading divided by the error in ammeter reading.

30(iii). If the movable end of rheostat is moved towards P, then:

(A) reading in ammeter decreases and reading in voltmeter increases.
(B) readings in both voltmeter and ammeter increase.
(C) reading in ammeter increases and reading in voltmeter decreases.
(D) readings in both voltmeter and ammeter decrease.

30(iv)(a). Suppose the unknown resistance X is replaced by a wire made of the same metal. This wire consists of three parts, of the same length L but has radii r, $r/3$ and $r/2$ as shown in the figure.



For a particular setting of the rheostat, let v_1, v_2 and v_3 be the value of drift velocities in parts AC, CD and DB. Then:

(A) $v_1 > v_2 > v_3$
(B) $v_2 > v_3 > v_1$
(C) $v_3 > v_2 > v_1$
(D) $v_1 = v_2 = v_3$

30(iv)(b). Consider the same wire, as shown in figure in question (iv) (a) connected in place of X. For a particular setting of rheostat, let E_1, E_2 and E_3 be the value of electric fields in part AC, CD and DB. Then:

(A) $E_1 = E_2 = E_3$
(B) $E_1 > E_2 > E_3$
(C) $E_2 > E_3 > E_1$
(D) $E_2 > E_1 > E_3$

Section E

31. (a)

(i) Explain the following statements giving reason:

(I) An equipotential surface through a point is normal to the electric field at that point.

(II) When a dielectric is placed in an external electric field, the electric field inside the dielectric is less than that outside it.

(III) The potential difference between the plates of a charged parallel plate capacitor decreases when its plates are brought closer.

(ii) Obtain an expression for the work done to dissociate the system of three charges q, $-4q$ and $2q$ placed at the vertices A, B and C respectively of an equilateral triangle of side 'a'.

OR

(b)

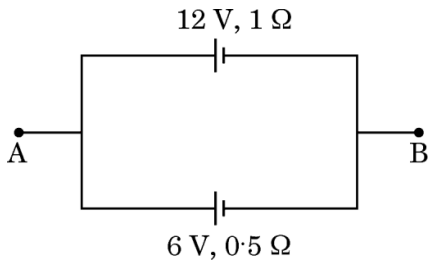
(i) Answer the following giving reason:

(I) The electron drift speed is estimated to be only a few mm/s for currents in the range of a few amperes. How, then, is the current established almost the instant a circuit is closed?

(II) A low voltage supply from which one needs high currents must have very low internal resistance. Why?

(III) The assertion that V = IR is a statement of Ohm's law is not true. Why?

(ii) Two cells of emfs 12 V and 6 V are connected in parallel as shown in the figure. Their internal resistances are 1 Ω and 0·5 Ω respectively. Calculate the emf and internal resistance of the equivalent cell between points A and B.

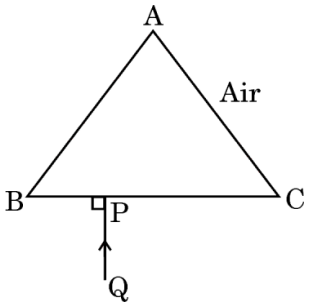


32. (a)

(i) Define refractive index of a medium in terms of speed of light.

(ii) Derive the relation for the refractive index (μ) of a prism in terms of angle of minimum deviation (δ_m) and angle of prism (A).

(iii) A ray of light QP is incident normally on the face BC of a triangular prism ABC of refractive index 1·5 kept in air, as shown in the figure. Trace the path of the ray as it passes through the prism and give relevant explanation.



OR

(b)

(i) What is the difference between a ray and a wavefront?

(ii) A plane wave is incident on a reflecting surface. Using Huygens principle, show how it is reflected from the surface. Hence, verify the law of reflection.

(iii) Depict refraction of a plane wave by a convex lens.

33. (a)

(i) Define the terms (I) resonant frequency, and (II) power factor of a series LCR circuit. For what value of the power factor will the power dissipated in the circuit be maximum?

(ii) An inductor of 5 H, a capacitor of 50 μF and a resistor of 400 Ω are connected in series across an ac voltage $v = 140 \sin(100\pi t)$ V. Calculate:

(I) impedance of the circuit, and

(II) rms value of current that flows in the circuit.

(Take $\sqrt{2} = 1 \cdot 4$)

OR

(b)

(i) Draw a labelled diagram of a step-up transformer. Obtain the ratio of secondary voltage to primary voltage in terms of number of turns in the two coils.

(ii) The number of turns in the primary and the secondary coil of an ideal transformer are 100 and 5000 respectively. If 3·3 kW power is supplied to the transformer at 220 V, find (I) current in the primary coil, and (II) output voltage.

- End of Question Paper -