

CBSE Class 12 Physics 2017 - Delhi Set 2

- 55/1/2



Question Paper

Conducted by the Central Board of Secondary Education (CBSE)

Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions

- (i) All questions are compulsory. There are 26 questions in all.
- (ii) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
- (iii) Section A contains five questions of 1 mark each; Section B contains five questions of 2 marks each; Section C contains twelve questions of 3 marks each; Section D contains one value-based question of 4 marks; and Section E contains three questions of 5 marks each.
- (iv) There is no overall choice. However, internal choices are provided in one 2-mark question, one 3-mark question and all three 5-mark questions. Attempt only one alternative in each such question.
- (v) You may use the supplied values of physical constants wherever necessary.

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

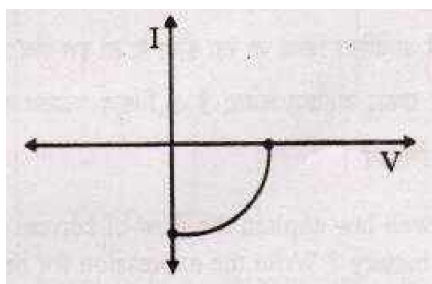
$$\begin{aligned}c &= 3 \times 10^8 \text{ m/s} \\h &= 6.63 \times 10^{-34} \text{ Js} \\e &= 1.6 \times 10^{-19} \text{ C} \\\mu_0 &= 4\pi \times 10^{-7} \text{ T m A}^{-1} \\\epsilon_0 &= 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \\\frac{1}{4\pi\epsilon_0} &= 9 \times 10^9 \text{ N m}^2 \text{ C}^{-2}\end{aligned}$$

$$\begin{aligned}\text{Mass of electron } (m_e) &= 9.1 \times 10^{-31} \text{ kg} \\\text{Mass of neutron} &= 1.675 \times 10^{-27} \text{ kg} \\\text{Mass of proton} &= 1.673 \times 10^{-27} \text{ kg} \\\text{Avogadro's number} &= 6.023 \times 10^{23} \text{ per gm mole} \\\text{Boltzmann constant} &= 1.38 \times 10^{-23} \text{ JK}^{-1}\end{aligned}$$

Section A

1. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60° . What is the value of horizontal component of the earth's magnetic field at equator?

2. Name the junction diode whose I-V characteristics are drawn below:



3. Does the charge given to a metallic sphere depend on whether it is hollow or solid? Give reason for your answer.

4. How is the speed of em-waves in vacuum determined by the electric and magnetic fields?

5. A long straight current carrying wire passes normally through the centre of circular loop. If the current through the wire increases, will there be an induced emf in the loop? Justify.

Section B

6. Find the wavelength of the electron orbiting in the first excited state in hydrogen atom.

7. Distinguish between a transducer and a repeater.

8. How does Ampere-Maxwell law explain the flow of current through a capacitor when it is being charged by a battery? Write the expression for the displacement current in terms of the rate of change of electric flux.

9. Define the distance of closest approach. An α -particle of kinetic energy ' K ' is bombarded on a thin gold foil. The distance of the closest approach is ' r '. What will be the distance of closest approach for an α -particle of double the kinetic energy?

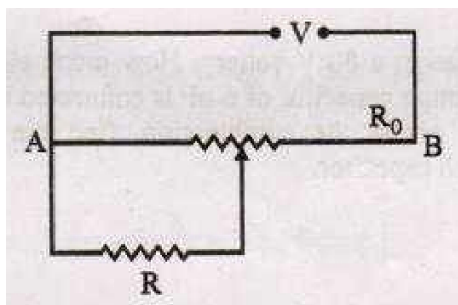
OR

9. Write two important limitations of Rutherford nuclear model of the atom.

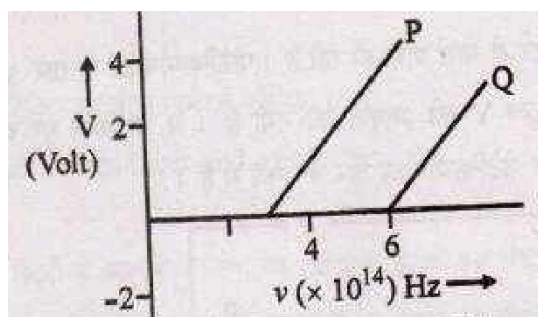
10. Why should the objective of a telescope have large focal length and large aperture? Justify your answer.

Section C

11. A resistance of R draws current from a potentiometer. The potentiometer wire, AB, has a total resistance of R_0 . A voltage V is supplied to the potentiometer. Derive an expression for the voltage across R when the sliding contact is in the middle of potentiometer wire.



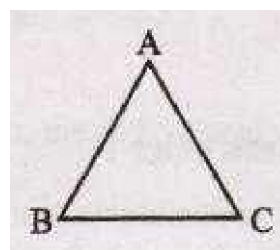
12. In the study of a photoelectric effect the graph between the stopping potential V and frequency ν of the incident radiation on two different metals P and Q is shown below:



- (i) Which one of the two metals has higher threshold frequency?
- (ii) Determine the work function of the metal which has greater value.
- (iii) Find the maximum kinetic energy of electron emitted by light of frequency 8×10^{14} Hz for this metal.

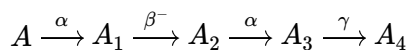
13. A 12 pF capacitor is connected to a 50 V battery. How much electrostatic energy is stored in the capacitor? If another capacitor of 6 pF is connected in series with it with the same battery connected across the combination, find the charge stored and potential difference across each capacitor.

14. (i) A ray of light incident on face AB of an equilateral glass prism, shows minimum deviation of 30° . Calculate the speed of light through the prism.



(ii) Find the angle of incidence at face AB so that the emergent ray grazes along the face AC.

15. (i) A radioactive nucleus 'A' undergoes a series of decays as given below:



The mass number and atomic number of A_2 are 176 and 71 respectively. Determine the mass and atomic numbers of A_4 and A.

(ii) Write the basic nuclear processes underlying β^+ and β^- decays.

16. Describe the working principle of a moving coil galvanometer. Why is it necessary to use (i) a radial magnetic field and (ii) a cylindrical soft iron core in a galvanometer? Write the expression for current sensitivity of the galvanometer. Can a galvanometer as such be used for measuring the current? Explain.

OR

16. (a) Define the term 'self-inductance' and write its S.I. unit.

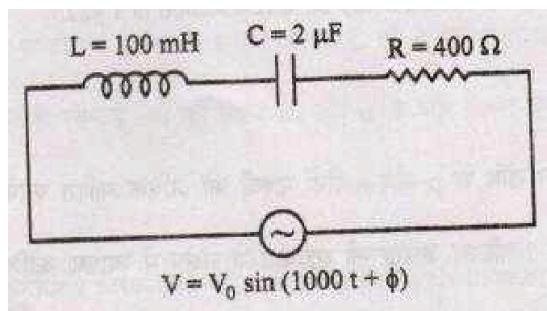
(b) Obtain the expression for the mutual inductance of two long co-axial solenoids S_1 and S_2 wound one over the other, each of length L and radii r_1 and r_2 and n_1 and n_2 number of turns per unit length, when a current I is set up in the outer solenoid S_2 .

17. For a CE-transistor amplifier, the audio signal voltage across the collector resistance of $2\text{ k}\Omega$ is 2 V . Given the current amplification factor of the transistor is 100, find the input signal voltage and base current, if the base resistance is $1\text{ k}\Omega$.

18. A zener diode is fabricated by heavily doping both p- and n- sides of the junction. Explain, why? Briefly explain the use of zener diode as a dc voltage regulator with the help of a circuit diagram.

19. (i) Find the value of the phase difference between the current and the voltage in the series LCR circuit shown below. Which one leads in phase: current or voltage?

(ii) Without making any other change, find the value of the additional capacitor C_1 , to be connected in parallel with the capacitor C , in order to make the power factor of the circuit unity.



20. Define the term 'amplitude modulation'. Explain any two factors which justify the need for modulating a low frequency base-band signal.

21. An electron of mass m_e revolves around a nucleus of charge $+Ze$. Show that it behaves like a tiny magnetic dipole. Hence prove that the magnetic moment associated with it is expressed as $\vec{\mu} = -\frac{e}{2m_e}\vec{L}$, where $\vec{L}$ is the orbital angular momentum of the electron. Give the significance of negative sign.

22. (i) Derive the expression for the electric potential due to an electric dipole at a point on its axial line.

(ii) Depict the equipotential surfaces due to an electric dipole.

23. Mrs. Rashmi Singh broke her reading glasses. When she went to the shopkeeper to order new specs, he suggested that she should get spectacles with plastic lenses instead of glass lenses. On getting the new spectacles, she found that the new ones were thicker than the earlier ones. She asked this question to the shopkeeper but he could not offer satisfactory explanation for this. At home, Mrs. Singh raised the same question to her daughter Anuja who explained why plastic lenses were thicker.

(a) Write two qualities displayed each by Anuja and her mother.

(b) How do you explain this fact using lens maker's formula?

Section E

24. (a) Distinguish between unpolarized light and linearly polarized light. How does one get linearly polarised light with the help of a polaroid?

(b) A narrow beam of unpolarised light of intensity I_0 is incident on a polaroid P_1 . The light transmitted by it is then incident on a second polaroid P_2 with its pass axis making angle of 60° relative to the pass axis of P_1 . Find the intensity of the light transmitted by P_2 .

OR

24. (a) Explain two features to distinguish between the interference pattern in Young's double slit experiment with the diffraction pattern obtained due to a single slit.

(b) A monochromatic light of wavelength 500 nm is incident normally on a single slit of width 0.2 mm to produce a diffraction pattern. Find the angular width of the central maximum obtained on the screen.

Estimate the number of fringes obtained in Young's double slit experiment with fringe width 0.5 mm, which can be accommodated within the region of total angular spread of the central maximum due to single slit.

25. (i) Derive an expression for drift velocity of electrons in a conductor. Hence deduce Ohm's law.

(ii) A wire whose cross-sectional area is increasing linearly from its one end to the other, is connected across a battery of V volts. Which of the following quantities remain constant in the wire?

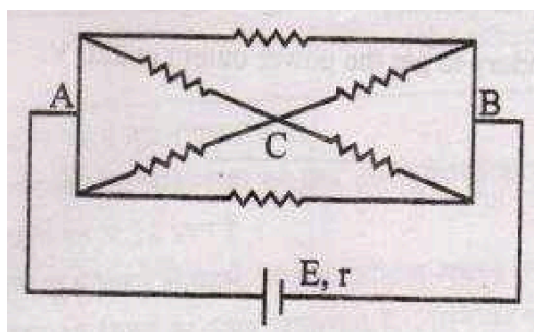
- (a) drift speed
- (b) current density
- (c) electric current
- (d) electric field

Justify your answer.

OR

25. (i) State the two Kirchhoff's laws. Explain briefly how these rules are justified.

(ii) The current is drawn from a cell of emf E and internal resistance r connected to the network of resistors each of resistance r as shown in the figure. Obtain the expression for (i) the current drawn from the cell and (ii) the power consumed in the network.



26. (a) Draw a labelled diagram of AC generator. Derive the expression for the instantaneous value of the emf induced in the coil.

(b) A circular coil of cross-sectional area 200 cm^2 and 20 turns is rotated about the vertical diameter with angular speed of 50 rad s^{-1} in a uniform magnetic field of magnitude $3.0 \times 10^{-2} \text{ T}$. Calculate the maximum value of the current in the coil.

OR

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

(b) A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.

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