CBSE EXAMINATION PAPER-2022

PHYSICS

(Solved)

Time allowed : 3 hours | Maximum Marks : 38

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **15 questions.** All questions are **compulsory.**

ii. This question paper is divided into **3 sections.**

iii. **Section A** – questions number **1 to 1** are case based questions

iv. **Section B** – questions number **2 to 5** are very short answer

v. **Section C** – questions number **6 to 15** are short answer

vi. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

vii. Use of calculator is NOT allowed.

Section A

Question 1.

The British physicist Thomas Young explained the interference of light using the principle of superposition of waves. He observed the interference pattern on the screen, in his experimental set-up - known now as Young's double slit experiment. The two slits S_1 and S_2 were illuminated by light from a slit S. The interference pattern consists of dark and bright bands of light. Such bands are called fringes. The distance between two consecutive bright and dark fringes is called fringe width.

(1)

If the screen is moved closer to the plane of slits S1 and S2, then the fringe width :

(i) will decrease, but the intensity of bright fringe remains the same.

(ii) will increase, but the intensity of bright fringe decreases.

(iii) will decrease, but the intensity of bright fringe increases.

(iv) and the intensity both remain the same.

[1 Marks]

(2)

What will happen to the pattern on the screen, when the two slits S1 and S2 are replaced by two independent but identical sources ?

(i) The intensity of pattern will increase

(ii) The intensity of pattern will decrease

(iii) The number of fringes will become double

(iv) No pattern will be observed on the screen

[1 Marks]

(3)

Two sources of light are said to be coherent, when both emit light waves of :

(i) same amplitude and have a varying phase difference.

(ii) same wavelength and a constant phase difference.

(iii) different wavelengths and same intensity.

(iv) different wavelengths and a constant phase difference.

[1 Marks]

(4)

The fringe width in a Young's double slit experiment is β . If the whole set-up is immersed in a liquid of refractive index μ , then the new fringe width will be :

(i) β

(ii) βμ

(iii) β/μ

(iv) β/μ^2

[1 Marks]

(5)

The total path difference between two waves meeting at points P1 and P2 on the screen are 3λ/2 and 2λ respectively. Then :

(i) bright fringes are formed at both points.

(ii) dark fringes are formed at both points.

(iii) a bright fringe is formed at P1 and a dark fringe is formed at P2.

(iv) a bright fringe is formed at P2 and a dark fringe is formed at P1.

[1 Marks]

Section B

Question 2. Explain the formation of depletion region in a p-n junction.

[2 Marks]

Question 3. How is an emf generated by a solar cell due to the three basic processes involved? Explain.

[2 Marks]

Question 4.

(a) (i) Define the terms : ' impact parameter' and 'distance of closest approach' for an α -particle in Geiger-Marsden scattering experiment.

(ii) What will be the value of the impact parameter for scattering angle (I) θ= 0 degree and (II) θ= 180 degree?

[2 Marks]

Question 5.

(b) Photoelectric emission occurs when a surface is irradiated with the radiation of frequency (i) v1, and (ii) v2. The maximum kinetic energy of the electrons emitted in the two cases are K and 2K respectively. Obtain the expression for the threshold frequency for the surface.

[2 Marks]

Section C

Question 6.

(a) (i) Depict a plane electromagnetic wave propagating along the x-axis. Write the expressions for its oscillating electric and magnetic fields.

(ii) Write three characteristics of electromagnetic waves.

[3 Marks]

Question 7.

(a) State the conditions for total internal reflection to take place.

(b) A tank is filled with a transparent liquid to height 'H'. A coin suspended by a thread in the liquid is gradually lowered till it touches the bottom. The apparent depth is determined corresponding to different positions of the coin.

(i) Plot a graph showing variation of the apparent depth with the real depth of the coin.

(ii) What is the physical significance of the slope of the graph ?

[3 Marks]

Question 8.

(a) Draw a labelled ray diagram showing the formation of an image by an astronomical refracting telescope in normal adjustment. Hence, obtain the expression for its magnifying power.

[3 Marks]

Question 9.

A converging lens made of glass (μ= 1·5) has its spherical faces of radii of curvature 10 cm and 20 cm. Find its focal length

(a) in air, and

(b) when it is immersed in a liquid of refractive index 1·25.

[3 Marks]

Question 10.

The energy of a hydrogen atom in the first excited state is -3.4 eV. Find :

(a) the radius of this orbit. (Take Bohr radius = 0·53 Å)

(b) the angular momentum of the electron in the orbit.

(c) the kinetic and potential energy of the electron in the orbit.

[3 Marks]

Question 11.

(a) Depict the variation of the potential energy of a pair of nucleons with the separation between them.

(b) Imagine the fission of a 56 /26Fe into two equal fragments of 28 /13 Al nucleus. Is the fission energetically possible ? Justify your answer

by working out Q value of the process.

Given : m 56 /26 Fe = 55·93494 u, m 28/ 13 Al = 27·98191 u.

[3 Marks]

Question 12.

Find the ratio of the de Broglie wavelengths associated with an alpha particle and a proton, if both

(a) have the same speeds,

(b) have the same kinetic energy,

(c) are accelerated through the same potential difference.

[3 Marks]

Question 13.

With the help of a circuit diagram, explain the working of a p-n junction diode as a full-wave rectifier. Also draw its input and output waveforms.

[3 Marks]

Question 14.

(b) Name the electromagnetic waves which are produced by the following :

(i) Radioactive decays of nucleus

(ii) Welding arcs

(iii) Hot bodies

Write one use each of these waves.

[3 Marks]

Question 15.

(b) A plane wavefront of light of wavelength 'λ' is incident normally on a narrow slit of width 'a' and a diffraction pattern is observed on a screen at a distance 'D' from the slit.

(i) Depict the intensity distribution in the pattern observed.

(ii) Obtain the expression for the first maximum from the central maximum.

[3 Marks]