

# 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 **14 questions**. All questions are **compulsory**.
- ii. This question paper is divided into **2 sections**.
- iii. **Section A** – questions number **1 to 4** are very short answer Each question carries **2 marks**.
- iv. **Section B** – questions number **5 to 14** are short answer Each question carries **3 marks**.
- v. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.
- vi. Use of calculator is NOT allowed.

### Section A

**Question 1.** Explain the formation of depletion region in a p-n junction.

[2 Marks]

**Question 2.** How is an emf generated by a solar cell due to the three basic processes involved? Explain.

[2 Marks]

**Question 3.**

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

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

[2 Marks]

#### Question 4.

(b) Photoelectric emission occurs when a surface is irradiated with the radiation of frequency (i)  $\nu_1$ , and (ii)  $\nu_2$ . 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 B

#### Question 5.

(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 6.

(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 7.

(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 8.

A converging lens made of glass ( $\mu = 1.5$ ) 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 9.

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 =  $0.53 \text{ \AA}$ )
- (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 10.

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

(b) Imagine the fission of a  ${}^{56}_{26}\text{Fe}$  into two equal fragments of  ${}^{28}_{13}\text{Al}$  nucleus. Is the fission energetically possible? Justify your answer

by working out Q value of the process.

Given :  $m {}^{56}_{26}\text{Fe} = 55.93494 \text{ u}$ ,  $m {}^{28}_{13}\text{Al} = 27.98191 \text{ u}$ .

[3 Marks]

### Question 11.

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 12.

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 13.

(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 14.

(b) A plane wavefront of light of wavelength ' $\lambda$ ' 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]

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