CBSE PRACTICE PAPER
CLASS XII
PHYSICS THEORY
TERM II
SESSION 2021 – 22

MM : 35 **TIME : 2 Hours**

General Instructions :

(i) There are 12 questions in all. All questions are compulsory.

(ii) This question paper has three sections: Section A, Section B and Section C.

(iii) Section A contains three questions of two marks each, Section B contains eight questions of three marks each, Section C contains one case study-based question of five marks.

(iv) There is no overall choice. However, an internal choice has been provided in one question of two marks and two questions of three marks. You have to attempt only one of the choices in such questions.

(v) You may use log tables if necessary but use of calculator is not allowed.

SECTION-A

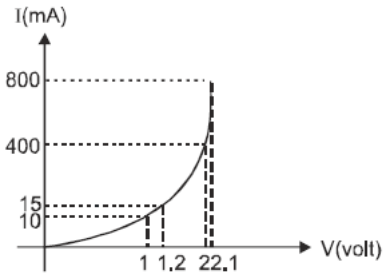
1. Explain, with the help of a circuit diagram, the working of a p-n junction diode as a half-wave rectifier.

2. Given the ground state energy E_0 = -13.6 eV and Bohr radius r_0 = 0.53 Å. Find out how the de Broglie wavelength associated with the electron orbiting in the ground state would change when it jumps into the first excited state.

OR

A proton and an alpha- particle are accelerated through the same potential difference. Which one of the two has (i) greater de-Broglie wavelength, and (ii) less kinetic energy ? Justify your answer.

3. The i-V characteristic of a p-n junction diode is shown in figure. Find the approximate dynamic resistance of the p-n junction when (a) a forward bias of 1 volt is applied, (b) a forward bias of 2 volt is applied –



SECTION-B

4. Using Rutherford model of the atom, derive the expression for the total energy of an electron in hydrogen atom. What is the significance of total negative energy possessed by the electron ?

5. (i) Describe the working principle of a solar cell, mention three basic processes involved in the generation of emf.

(ii) Why Si and GaAs are preferred materials for solar cells. ?

6. The fission properties of $_{94}Pu^{239}$ are very similar to those of $_{92}U^{235}$. The average energy released per fission is 180 MeV. How much energy, in MeV, is released if all the atoms in 1 kg of pure $_{94}Pu^{239}$ undergo fission ?

7. Two harmonic waves of monochromatic light $y_1 = a\cos \omega t$ and $y_2 = a\cos(\omega t + \phi)$ are superimposed on each other. Show that maximum intensity in interference pattern is four times the intensity due to each slit. Hence write the conditions for constructive and destructive interference in terms of the phase angle ϕ.

8. (a) Derive the mathematical relation between refractive indices n_1 and n_2 of two radii and radius of curvature R for refraction at a convex spherical surface. Consider the object to be a point source lying on the principle axis in rarer medium of refractive index n_1 and a real image formed in the denser medium of refractive index n_2. Hence derive lens maker's formula.

(b) A magician during a show makes a glass lens with n = 1.47 disappear in a trough of liquid. What is the refractive index of the liquid ? Could the liquid be water ?

OR

(a) Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact. Obtain the expression for the power of this combination in terms of the focal lengths of the lenses.

(b) A convex lens of focal length 30 cm is in contact with concave lens of focal length 20 cm. Find out if the system is converging or diverging.

9. (a) The wavelength λ of a photon and the de-Broglie wavelength of an electron have the same value. Show that energy of a photon is $(2\lambda mc/h)$ times the kinetic energy of electron; where m, c and h have their usual meaning.

(b) Define intensity of radiation on the basis of photon picture of light. Write its S.I. unit.

10. (a) Light from a point source in air falls on a convex spherical glass surface of refractive index 1.5 and radius of curvature 20 cm. The distance of light source from the glass surface is 100 cm. At what position is the image formed ?

(b) For a glass prism $\left(\mu = \sqrt{3}\right)$ the angle of minimum deviation is equal to the angle of the prism. Calculate the angle of the prism.

11. (a) Write different waves of electromagnetic spectrum, in ascending order of frequency.

(b) Write one use for each of following-

(i) Microwaves (ii) Infra-red rays

(c) Write any four main properties of electromagnetic waves.

OR

What is meant by diffraction of light ? Draw a graph to show the relative intensity distribution for a single slit diffraction pattern. Obtain an expression for the first minima of diffraction.

SECTION-C

CASE STUDY

12. Compound Microscope

A compound microscope is an optical Instrument used for observing highly magnified images of tiny objects. Magnifying power of a compound microscope is defined as the ratio of the angle subtended at the eye by the final image to the angle subtended at the eye by the object, when both the final image and the object are situated at the least distance of distinct vision from the eye. It can be given that : $m = m_e \times m_o$, where m_e is magnification produced by eye lens and m_o is magnification produced by objective lens.

Consider a compound microscope that consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by a distance of 15 cm.

(i) The object distance for eye-piece, so that final image is formed at the least distance of distinct vision, will be :

(a) 3.45 cm (b) 5 cm (c) 1.29 cm (d) 2.59 cm

(ii) How far from the objective should an object be placed in order to obtain the condition described in part (i) ?

(a) 4.5 cm (b) 2.5 cm (c) 1.5 cm (d) 3.0 cm

(iii) What is the magnifying power of the microscope in case of least distinct vision ?

(a) 20 (b) 30 (c) 40 (d) 10

(iv) The intermediate image formed by the objective of a compound microscope is

(a) real, inverted and magnified (b) real, erect and magnified

(c) virtual, erect and magnified (d) virtual, inverted and magnified

(v) The magnifying power of a compound microscope increases with

(a) the focal length of objective lens is increased and that of eye lens is decreased

(b) the focal length of eye lens is increased and that of objective lens is decreased

(c) focal lengths of both objects and eye-piece are increased

(d) focal lengths of both objects and eye-piece are decreased