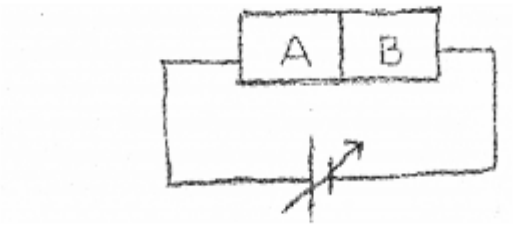
INDIAN SCHOOL SOHAR
PRE-BOARD II EXAMINATION (2021-22)
PHYSICS THEORY

CLASS: XII **MAX MARKS: 35**
DATE: 03/04/2022 **TIME ALLOWED: 2 HOURS**

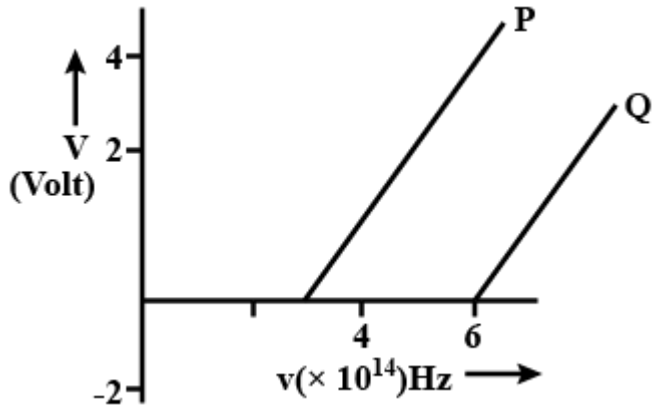
General Instructions:

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	Two semiconductor materials A and B shown in the given figure are made by doping germanium crystal with arsenic and indium respectively. The two are joined end to end and connected to a battery as shown  i) Will the junction be forward biased or reverse biased? ii) When a p-n junction diode is forward biased, how will its barrier potential be affected? iii) Why are Si and GaAs preferred materials for fabrication in solar cells?	2
2	i) Show the variation of photocurrent with collector plate potential for different frequencies but same intensity of incident radiation. ii) The stopping g potential in an experiment on photoelectric effect is 1.5 V. what is the maximum kinetic energy of the photoelectrons emitted? **OR** Calculate the de Broglie wavelength of a neutron of kinetic energy 150 eV. Mass of neutron = 1.67×10^{-27} kg. (h = 6.63×10^{-34} Js)	2
3	Describe briefly, with the help of a diagram, the role of the two important processes involved in the formation of a p-n junction.	2

SECTION B

4	a) Using Bohr's postulate, derive the expression for the total energy of the electron in the stationary state of the hydrogen atom. b) Using Rydberg formula, calculate the wavelength of the spectral lines of the first member of the Lyman series and of the Blamer series. ($R = 1.09 \times 10^7\ m^{-1}$)	3
5	i) Draw V-I characteristics of a p-n junction diode. Explain, why the current under reverse bias is almost independent of the applied voltage up to the critical voltage. ii) You are given three semiconductors: A, B and C with respective bandgaps of 3 eV, 2 eV and 1 eV for use in photodetector to detect λ = 1200 nm. Select the suitable semiconductor. Give reasons. ($h = 6.63 \times 10^{-34}$ Js & $C = 3 \times 10^8$ m/s)	3
6	The Q- Value of a nuclear reaction A + b $\longrightarrow$ C + d, is define by $Q = [m_A + m_b - m_C - m_d]\ c^2$ Where the masses refer to the respective nuclei. Determine from the given data the Q-value of the following reactions and state whether the reactions are exothermic or endothermic. (i) $^1_1H + {}^3_1H \rightarrow {}^2_1H + {}^2_1H$ (ii) $^{12}_6C + {}^{12}_6C \rightarrow {}^{20}_{10}Ne + {}^4_2He$ Atomic mass $m(^1_1H) = 1.007825$ u — Atomic mass of $m(^{12}_6C) = 12.0$ u Atomic mass $m(^3_1H) = 3.016049$ u — Atomic mass of $m(^{20}_{10}Ne) = 19.992439$ u Atomic mass $m(^2_1H) = 2.014102$ u — Atomic mass of $m(^4_2He) = 4.002603$ u	3
7	i) A ray of light is incident on a prism whose refractive index is 1.52 at angle of 40°. If the angle of emergence is 60°, calculate the angle of the prism. (sin 40 = 0.6427 & sin 60 = 0 .8660). ii) Calculate the focal length of a convex lens whose radii of curvature of two surfaces is 10 cm and 15 cm respectively and its refractive index is 1.5.	3
8	Draw a ray diagram to show the formation of the image of an object placed on the axis of a convex refracting surface of radius of curvature 'R ', separating the two media of refractive indices 'n1'and 'n2'(n2 > n1). Use this diagram to deduce the relation n2/v – n1/u = n2- n1/R. **OR** i) Using Huygens's Principle this principle draws a diagram to show a plane wave front incident at the interface of the two media gets refracted when it propagates form a denser to a rarer medium. ii) A compound microscope consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by distance of 15 cm. How far from the objective should an object be place in order to obtain the final image at **(a)** the least distance of distinct vision (25 cm) and **(b)** at infinity? What is the magnifying power of the microscope in each case?	3

9	In the study of a photoelectric effect the graph between the stopping potential V and frequency v of the incident radiation on two different metals P and Q is shown below:  i) Which one of the two has higher value of work- function? Justify your answer. 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 x 10^{14} Hz for this metal. (h = 6.63 x 10^{-34} Js)	3
10	(i) Draw a schematic labelled ray diagram of a reflecting type telescope. (ii) Write two important advantage justifying why reflecting type telescopes are preferring over refracting telescopes. (iii) The objective of a telescope is of large focal length and of larger aperture (compared to the eyepiece). Why? Give reasons.	3
11	An electromagnetic spectrum is an orderly arrangement of electromagnetic radiations in the ascending or descending order of frequency/wavelength. a) Arrange the following electromagnetic radiations in the ascending order of frequency. Visible rays, Infrared rays, X-rays, microwaves. b) i) Give two applications of infrared and X-rays each. ii) is absorbed by the ozone layer in the atmosphere. iii) used in medicine to destroy cancer cells. OR (i) In Young's double slit experiment, show graphically how intensity of light varies with distance. (ii) In diffraction, how is the angular width of the central bright fringe affected when slit separation is increased? iii) In Young's double slit experiment using monochromatic light of wavelength 600 nm, 5th bright fringe is at a distance of 0.48 mm from the center of the pattern. If the screen is at a distance of 80 cm from the plane of the two slits, calculate: (a) Distance between the two slits. (b) Fringe width i.e., fringe separation.	3

12	**SECTION C** **CASE STUDY:** 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 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	1
ii	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.	1
iii	What is the magnifying power of the microscope in case of least distinct vision? (a) 20 (b) 30 (c) 40 (d) 10	1
	If v1 and v2 denote the velocity of light in medium 1 and medium 2 respectively and λ1 and λ2 denote the wavelength of light in medium 1 and medium 2. $\frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2}$ or $\frac{v_1}{\lambda_1} = \frac{v_2}{\lambda_2}$ Thus The above equation implies that when a wave gets refracted into denser medium (v1 > v2) the wavelength and the speed of propagation decreases but the frequency	
iv	When light travels from one medium to another medium which are separated by a sharp boundary, the characteristic which does not change is: (a) velocity (b) wavelength (c) frequency (d) amplitude	1
v	When light travels from a rarer to a denser medium, the speed of light in the medium: (a) increases (b) decreases (c) remains the same (d) first increases and then decreases	1

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