Physics_XII | Sample Mock Paper Class 12th SA2(Paper_1)

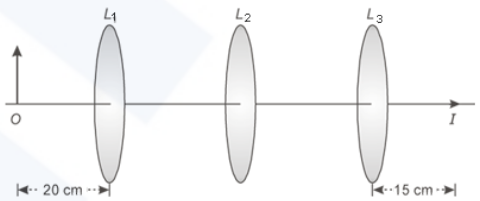
Name : ..... **Date : 01-03-2022**

Time : 120 Mins **M.M. : 35**

General Instructions:

1. Question 1 to 3 Short answer type (SA1) questions of 2 Mark each.
2. Question 4 to 11 Short answer type (SA2) questions of 3 Mark each.
3. Question 12 Long answer type (LA) questions of 5 Mark each.

Q1 You are given three lenses L_1, L_2 and L_3 each of focal length 15 cm. An object is kept at 20 cm in front of L_1 as shown in Fig. [2]



The real image is formed at the focus 1 of L_3. Find the separations between L_1, L_2 and L_3.

Q2 Give the energy band diagram for (a) insulators, (b) metals and (c) semiconductors. [2]

Q3 In Bohr's theory of hydrogen atoms, calculate the energy of the photon emitted during a transition of the electron from the first excited state to its ground state. Write in which region of the electromagnetic spectrum this transition lies. [2]

Given Rydberg constant $R = 1.03 \times 10^7\ m^{-1}$.

Q4 The number of silicon atoms per m^3 is 5×10^{28}. This is doped simultaneously with 5×10^{22} atoms per m^3 of Arsenic and 5×10^{20} per m^3 atoms of Indium. Calculate the number of electrons and holes. Given that $n_i = 1.5 \times 10^{16}\ m^{-3}$. Is the material *n*-type or *p*-type? [3]

Q5 (a) Why are coherent sources necessary to produce a sustained interference pattern? [3]

(b) In young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is *K* units. Find out the intensity of light at a point where path difference is $\lambda/3$.

Q6 (a) Ultraviolet light of wavelength 2271 Å from a 100 W mercury source is incident on a photocell made of molybdenum metal. If the stopping potential is 1.3 V, estimate the work function of the metal. [3]

(b) How would the photocell respond to high intensity ($10^5\ Wm^{-2}$) red light of wavelength 6328 Å produced by He-Ne laser?

Q7 State the two postulates of Bohr's atomic model. Obtain Bohr's quantisation condition of angular momentum on the basis of the wave picture of electron. [3]

Q8 Distinguish between nuclear fission and fusion. In a fusion reaction 3

$$^{2}_{1}H + ^{3}_{1}H + \rightarrow ^{4}_{2}He + n,$$

calculate the amount of energy, in MeV released. Given,

$m(^{2}_{1}H) = 2.014102u$; $m(^{3}_{1}H) = 3.016049\,u$; $m(^{4}_{2}He) = 4.002603u$; $m_n = 1.00867\,u$;

$1u = 931.5$ MeV

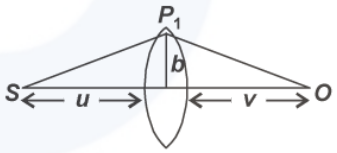
Q9 The de-Broglie wavelength of a particle of kinetic energy K is λ. What would be the wavelength of the particle, if its kinetic energy were $K/4$? 3

Q10 What do you by depletion region and potential barrier in a junction diode? 3

Q11 What is displacement current ? Why was this concept introduced? 3

Q12 (a) Consider a thin lens placed between a source (S) and an observer (O) (see figure). 5

Let the thickness of the lens vary as $w(b) = w_0 - \frac{b^2}{\alpha}$, where b is the vertical distance from the pole. w_0 is a constant. Using Fermat's principle *i.e.*, the time of transit for a ray between the source and observer is an extremum, find the condition that all paraxial rays starting from the source will converge at a point O on the axis. Find the focal length.



(b) A gravitational lens may be assumed to have a varying width of the form

$$w(b) = k_1 \ln\left(\frac{k_2}{b}\right) \qquad b_{min} < b < b_{max}$$

$$= k_1 \ln\left(\frac{k_2}{b_{min}}\right) \qquad b < b_{min}$$

Show that an observer will see an image of a point object as a ring about the center of the lens with an angular radius

$$\beta = \sqrt{\frac{(n-1)k_1\frac{u}{v}}{u+v}}.$$