MARKING SCHEME

SeniorSecondary School Term IICompartment Examination,2022
PHYSICS (Subject Code–042)
[Paper Code :55/B/6]

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks
	Section - A		

1.

Distinction between intrinsic and extrinsic semiconductor	1+1

Intrinsic Semiconductor	**Extrinsic Semiconductor**	Marks
1. These are pure semiconductors having no impurity.	1. These are the semiconductors doped either with pentavalent or trivalent impurity atoms.	1
2. They have low electrical conductivity.	2. Their conductivity is greater than that of intrinsic semiconductors.	1
3. The number density of electrons and holes is equal i.e $n_e = n_h$	3. The number density of electrons and holes is different depending on the type of doping.	

(Any two of the above /any other two difference) — Total Marks: 2

2 (a)

Explanation	2

Nuclear fusion is the source of energy generation in the proton- proton cycle taking place in the sun. — 1

In the core of the sun, due to extremely high temperature, hydrogen nuclei fuse together and form helium nuclei releasing thermonuclear energy. — 1

Alternatively

Equations depicting fusion of four hydrogen nuclei i.e

$$4\,{}^{1}_{1}\mathrm{H} + 2e^{-} \rightarrow {}^{4}_{2}\mathrm{He} + 2\nu + 6\gamma + 26.7\,\mathrm{MeV}$$

$$\text{or}\ \ (4\,{}^{1}_{1}\mathrm{H} + 4e^{-}) \rightarrow ({}^{4}_{2}\mathrm{He} + 2e^{-}) + 2\nu + 6\gamma + 26.7\,\mathrm{MeV}$$

OR

Effect on photoelectric current with	
(i) Increase in intensity and justification	½ + ½
(ii) Decrease in frequency any justification	½ + ½

(b)

(i) Increases : — ½ +½

As the intensity of the incident radiation increases, the number of photons in the beam increases implying the emission of more number of photoelectrons.

(ii) No Effect : — ½ +½

As the decrease in frequency will effect the energy of the photon and not the number of photoelectrons. — Total Marks: 2

3	Difference between drift and diffusion current 1 Net Current at p-n junction in equilibrium 1 Drift Current: Movement of minority charge carriers (electrons and holes) due to the electric field generated across the junction, constitutes drift current. Diffusion current: Due to the concentration gradient across p-side & n -side, holes diffuse from p-side to n-side & electrons diffuse from n-side to p-side. The current so formed is diffusion current. Net current at p-n junction in equilibrium is zero.	½ ½ 1	2
	Section - B		
4	(a) Definition of distance of closest approach 1 (b) Calculation of Kinetic energy 2 (a) Centre to centre distance between the α- particle and the nuclear when the kinetic energy of α- particle is completely converted to the potential energy of the system consisting α- particle and the nucleus. Alternatively Centre to centre distance between the α- particle and the target nucleus when α- particle stops momentarily before rebounding. Alternatively When an α- particle approaches a target nucleus in a head-on position, the minimum distance of the α- particle from the centre of the target nucleus just before it rebounds is called distance of closest approach. (b) $r_0 = \frac{2\,Z\,e^2}{4\,\pi\epsilon_0 E_k}$ $\therefore \quad E_k = \frac{2\,Z\,e^2}{4\,\pi\epsilon_0 r_0}$ $= \frac{9\times10^{9}\times2\times79\times(1.6\times10^{-19})^2}{28.8\times10^{-15}}$ $= 126.4\times10^{-14}$ J = 7.9 MeV	1 ½ ½ ½ ½	3
5.	Explanation of working 1 Two advantages 1+1 Working – When LED is forward biased, electrons moves from n- side to p-side & holes from p- side to n-side, the concentration of minority charge carriers at the junction boundary increases. These excess minority	1	

*These answers are meant to be used by evaluators

	charge carriers combine with majority charge carriers near the junction boundary and release energy in the form of photon. Advantages-Low operational voltage and less power/ fast action and no warm-up time required / the bandwidth of emitted light is nearly monochromatic/ long life and ruggedness/ fast on-off switching capability. (Any two)	1+1	3
6.	a) Proof of same nuclear density 2 b) Finding the radius of the nucleus 1 (a) Mass of the nucleus= m A Nuclear density $= \frac{\text{Mass}}{\text{Volume}}$ $= \frac{mA}{\frac{4}{3}\pi R^3}$ But $R = R_0A^{1/3}$ Nuclear density $= \frac{m}{\frac{4}{3}\pi R_0^3}$ which is constant (b) $R = R_0A^{1/3} = 1.2\,(64)^{1/3}$ $R = 1.2 \times 4 = 4.8$ fm	½ ½ ½ ½ ½ ½	3
7.	a) Definition and unit of power of lens ½ + ½ b) Calculation of power 2 (a) Power of a lens is defined as the tangent of the angle by which it converges and diverges a beam of light falling at unit distance from the optical centre. Alternatively Power :- Ability to converge or diverge the beam of light incident on a lens. Alternatively Power of the lens is given by the reciprocal of its focal length. S.I unit is dioptre or m^{-1}. (b) $P = \frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ $= (1.6 - 1)\left(\frac{1}{-0.1} + \frac{1}{0.3}\right)$ $= (0.6)\left(\frac{-3+1}{0.3}\right)$	½ ½ ½ ½ ½	

		Marks	Total
	= - 4 D	½	3
8.	(a) (i) Explanation 1 (ii) Finding the required tube length of microscope 2 (a) (i) The magnification produced by a compound microscope is inversely proportional to the focal length of the objective and the eyepiece. Hence short focal length increases magnification. Alternatively m = $(\frac{L}{f_0})$ $(\frac{D}{f_e})$, where f_0 and f_e are small then magnification m will be large. (ii) $m = m_0 \times m_e = \frac{L \times D}{f_0 \times f_e}$ $30 = \frac{L \times (25)}{1.25 \times 5}$ $\therefore$ L = 7.5 cm **OR** (b) (i) Effect on Interference Pattern 1 (ii) Calculation of the wavelength of light 2 (i) The central maxima will be white followed by coloured fringes. (ii) $x = \frac{n\lambda D}{d}$ $1.4 \times 10^{-2} = \frac{3 \times \lambda \times 1.4}{0.18 \times 10^{-3}}$ $\lambda = 6 \times 10^{-7} m = 600 nm$	1 1 ½ ½ ½+½ 1 ½ ½	3
9.	(a)Two differences ½ +½ (b) Ratio of de Broglie Wavelengths 2 (a)		

Matter Waves	**Electromagnetic Waves**	
(1)Matter waves are associated with every moving mass.	(1)EM waves can only be produced by accelerating charged particles.	½
(2)Matter waves associated with moving particle cannot achieve a speed of 3×10^8 m/s.	(2)Speed of EM wave in free space is 3×10^8 m/s.	½

(Any other two difference)

	(a) $\lambda = \frac{h}{m\upsilon} = \frac{h}{\sqrt{2m \times E}}$ where E is the kinetic energy of the particle $\frac{\lambda_D}{\lambda_T} = \frac{h}{\sqrt{2m_D E}} \times \frac{\sqrt{2m_T E}}{h}$ $\frac{\lambda_D}{\lambda_T} = \sqrt{\frac{3}{2}}$	½ 1 ½	3
10.	(a)Calculation of refractive index of the prism 1½ (b)Showing the refractive index $\mu = 2\cos(\frac{A}{2})$ 1½ (a) $\mu = \frac{\sin\left(\frac{A+D_m}{2}\right)}{\sin A/2}$ $= \frac{\sin\left(\frac{60^o+30^o}{2}\right)}{\sin 60/2}$ $= \frac{\sin 45^o}{\sin 30^o} = \sqrt{2}$ (b) $\mu = \frac{\sin\left(\frac{A+D_m}{2}\right)}{\sin A/2}$ $= \frac{\sin\left(\frac{A+A}{2}\right)}{\sin A/2} = \frac{\sin A}{\sin A/2}$ $\mu = \frac{2\sin A/2 \cos A/2}{\sin A/2} = 2\cos A/2$	½ ½ ½ ½ ½ ½	3
11	(a) Naming of EM waves (i), (ii) & (iii) ½ + ½ + ½ One use of each EM wave ½ + ½ + ½ (i) γ – rays **Uses** – Radiotherapy / Sterilization and disinfection / Research purpose (Any one) (ii) Infrared Waves **Uses**- Heat sensors/Thermal imaging/ night vision equipment / Remote control (Any one) (iii) UV rays **Uses** – Water purification/ Killing of bacteria (Any one) **OR** (b) (i) Explanation of conditions for observing maximum and minimum intensity 2 (ii) Reason of sharp decrease of intensity 1	½ ½ ½ ½ ½ ½	

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	(i) When the path difference (p) = d $\sin\theta$ = (2n+1)$\frac{\lambda}{2}$, then the secondary wavelets starting from consecutive parts of slit having a path difference of λ/2 except the last part, cancel each other contribution, leading to formation of maxima at a point on the screen. When the path difference (p) = $d\sin\theta$ = nλ , then secondary wavelets starting from consecutive parts of the slit having path difference of λ/2 cancel each other contribution leading to formation of minima at a point on the screen. (ii) Maximum intensity is obtained at a point on the screen when the path difference is (2n+1) $\frac{\lambda}{2}$. With increasing 'n' only one- third, one-fifth, one-seventh etc of the slit contribute, hence intensity of maxima decreases sharply. Alternatively With the increase of order (n) the number of secondary wavelets responsible for the formation of secondary maxima, decreases resulting in sharp decrease of intensity.	1 1 1	3
	Section - C		
12.	(a) (iv) (b) (iii) (c) (iii) (d) (iv) (e) (iv)	1 1 1 1 1	5