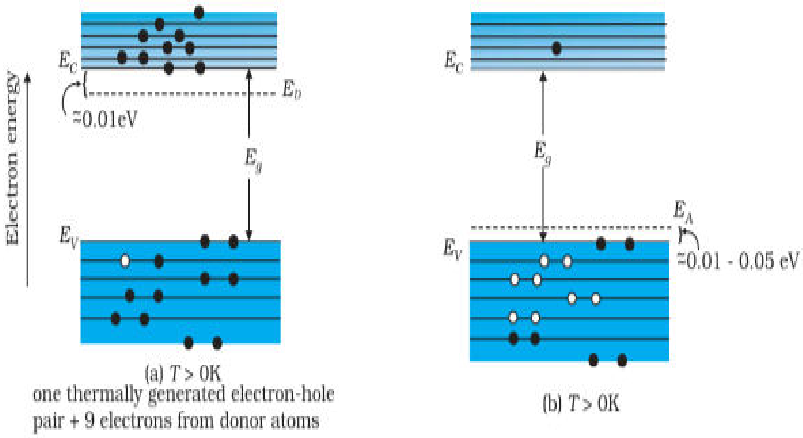
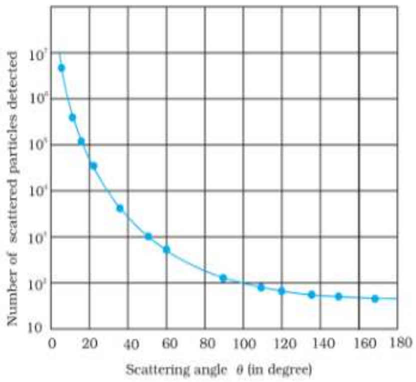
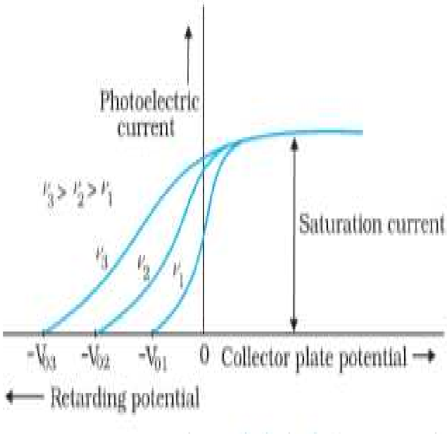
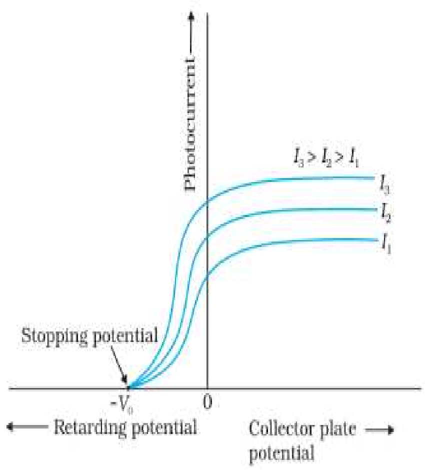
MARKING SCHEME

Senior Secondary School Examination TERM–II, 2022

PHYSICS (Subject Code–042)

[Paper Code : 55/1/1]

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks
	SECTION—A		
1.	Energy band diagram ½ + ½ Significance 1		
	 **n-type** **p-type**	½ + ½	
	Significance n-type semiconductors – small energy gap between donor level and conduction band which can be easily covered by thermally excited electrons.	½	
	p- type semiconductors - small energy gap between acceptor level and valence band which can be easily covered by thermally excited electrons.	½	
	Alternatively The conductivity of semiconductor is improved with the creation of donor and acceptor levels.		2

2(a).	Graph 1 Conclusions (any two) ½ + ½		
		1	
	(Give full credit if axis are marked and values are not given)		
	Conclusions • Most of the alpha particles pass undeviated through the gold foil. • A few alpha particles, get deflected through 90° or more. • Only about 0.14% of the incident alpha particles are reflected by large angle. • A very few alpha particles retrace their path. **Any other two conclusions**	½+½	2
	OR		
2(b).	i) Same intensity different frequency 1 ii) Same frequency different intensity 1		
	(i)  **(ii)** 	1+1	2

3.	Explanation 2 The unidirectional property of a diode makes it suitable for rectification. **Alternatively** The diode conducts when forward biased and does not conduct when reverse biased. **(Award 1 mark if a student draws the forward and reverse characteristics of a diode.)**	2	2
	SECTION- B		
4.	Definition of distance of closest approach 1 ½ Effect on distance of closest approach due to change in K.E. 1 ½ The minimum distance up to which an alpha particle travel along the central line of the nucleus before it rebounds is called distance of closest approach. **Alternatively** An alpha particle travelling directly towards the centre of a nucleus slows down as it approaches the nucleus due to repulsive force. At a distance r_0 from the nucleus, the α- particle stops and its total kinetic energy converts into electrostatic potential energy. This distance r_0 is called distance of closest approach. $r_0 = \frac{2Ze^2}{4\pi \in_0 \, K.E.}$ i.e., $r_0 \propto \frac{1}{K.E.}$ as K is doubled , r_0 is halved. **(Award full 1½ marks if a student writes r_0 is halved without writing formula)**	1 ½ ½ ½ ½	3
5.	Finding distance from source 2 Finding nature of image 1 Relation for concave spherical surface $\frac{\mu_1}{-u} + \frac{\mu_2}{v} = \frac{\mu_2 - \mu_1}{R}$ $\frac{1}{-u} + \frac{\mu}{v} = \frac{\mu - 1}{R}$ $\frac{1}{-(-24)} + \frac{1 \cdot 5}{v} = \frac{1 \cdot 5 - 1}{-60}$ $\therefore v = -30$ cm	 ½ ½ ½	

Distance of image from point source = $-24-(-30) = 6$ cm ½

Nature of image = Virtual image 1 | 3

6.

Calculation of mass defect	2
Calculation of energy released	1

$${}_{1}^{2}\text{H} + {}_{1}^{3}\text{H} \rightarrow {}_{2}^{4}\text{He} + n + Energy$$ ½

Mass defect = mass of reactants – mass of products ½

$\Delta m = m({}_{1}^{2}\text{H} + {}_{1}^{3}\text{H}) - m({}_{2}^{4}\text{He} + {}_{0}^{1}n)$ ½

Mass defect $= (2\cdot014102 + 3\cdot016049) - (4\cdot002603 + 1\cdot008665)$

$= 5\cdot030151 - 5\cdot011268$

$= 0\cdot018883u$ ½

Energy released = Δm × 931.5 MeV ½

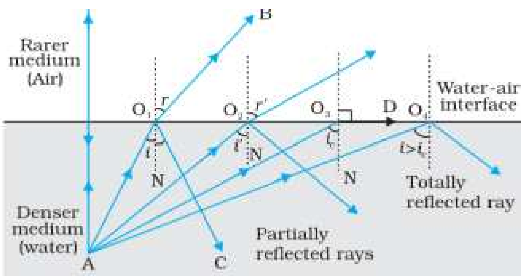
= 0.018883 × 931.5 MeV

$= 17\cdot58$ MeV ½ | 3

7.

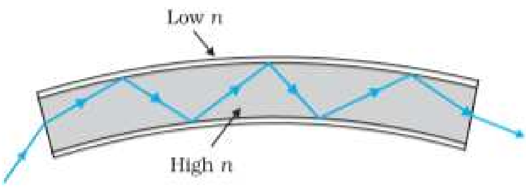
Principle of optical fibre	1
Diagram of TIR	1
Use of optical fibre	½ +½

An optical fibre works on the principle of Total internal reflection. 1



1

Alternatively



Uses of optical fibres(any two)

i) Medical and optical examination (endoscopy).

ii) Transmission and reception of signals

iii) Photometric sensors. ½+½ | 3

8(a).

Calculation of distance of first minimum	1 ½
Calculation of distance of second maximum	1 ½

	(i) $y = \frac{\lambda D}{a}$	½	
	$= \frac{600\times10^{-9}\times1}{0.2\times10^{-3}}$	½	
	$= 3\times10^{-3} m = 3$ mm	½	
	(ii) $y = (n+\frac{1}{2})\frac{\lambda D}{a}$	½	
	$y = (2+\frac{1}{2})\frac{\lambda D}{a}$	½	
	$y = \frac{5}{2}\frac{\lambda D}{a}$		
	$y = \frac{5}{2}\times\frac{600\times10^{-9}\times1}{0.2\times10^{-3}}$		3
	$= 7.5\times10^{-3} = 7\cdot5$ mm	½	
	OR		
8(b).	Finding the ratio of powers 1½ Finding the power of combination and nature 1½		
	(i) From $P = (\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$	½	
	$P_1 = P_{convex} = (\mu-1)\left(\frac{1}{R_1}-(-\frac{1}{R_2})\right)$	½	
	$= (\mu-1)(\frac{2}{R})$		
	$P_2 = P_{concave} = (\mu-1)\left(-\frac{1}{R_1}-\frac{1}{R_2}\right)$		
	$= -(\mu-1)(\frac{2}{R})$		
	$\therefore \frac{P_1}{P_2} = \frac{(\mu_1-1)}{-(\mu_2-1)} = \frac{(\mu_1-1)}{(1-\mu_2)}$	½	
	(ii) $P = P_1 + P_2$	½	
	$= (\mu_1-1)\left(\frac{2}{R}\right)+(-(\mu_2-1))\left(\frac{2}{R}\right)$		
	$P = \frac{2(\mu_1-\mu_2)}{R}$	½	
	As $\mu_2 > \mu_1$, P is negative		
	$\therefore$ Nature is diverging	½	3

9.	i) Calculation of energy of Radiation 1 ½ ii) Calculation of kinetic energy of photoelectron 1 ½ i) Energy of incident radiation $E = h\nu = h\frac{c}{\lambda}$ $= \frac{6\cdot63\times10^{-34}\times3\times10^{8}}{330\times10^{-9}}$ $= 6\cdot027\times10^{-19}$ J ii) Kinetic energy of photoelectron $\text{K.E.} = E - \phi_0$ $= (6\cdot027\times10^{-19} - 3\cdot5\times10^{-19})$ J $= 2\cdot527\times10^{-19}$ J	½ ½ ½ ½ ½ ½	3
10.	Statement of working principle of LED 1 Advantages ½ + ½ Disadvantages ½ +½ When the diode is forward biased, electrons are sent from n region to p region and holes are sent from p region to n region. At the junction the concentration of minority carriers increases. Thus at the junction, the excess minority carriers recombine with majority carriers and energy is released in the form of photons. **Advantages (any two):** *(i)* Low operational voltage *(ii)* Less power consumption *(iii)* Fast action *(iv)* Long life and ruggedness **Disadvantages (any two) :** *(i)* High cost *(ii)* Can get damaged due to overheating *(iii)* Excess of voltage or current can damage LED **(Note: Award last 1 mark, even if disadvantages are not given.)**	1 ½+½ ½+½	3
11(a).	i) Reason 1 ii) Identification of radiation 1 Uses ½ + ½ i) Refraction arises through interaction of incident light with the atomic constituents of matter. Atoms may be viewed as oscillators which take up the frequency of the external agency causing forced oscillations. Thus the frequency of refracted light equals the frequency of incident light.	1	

Alternatively

Frequency is the characteristic of the source of light. So it remains unaffected. But λ depends on refractive index (μ) of the medium as —

$$\lambda_m = \frac{\lambda_o}{\mu}$$

ii) Infrared/ Microwaves/ Radio waves — 1

Uses of Infrared rays (any two)

- Remote control
- Green house effect
- Photography in foggy condition
- To reveal secret writings — ½ + ½
- Infrared lamps

Uses of Microwaves (any two)

- Radar System
- Geostationary satellite
- Microwave ovens

Uses of Radiowaves (any two)

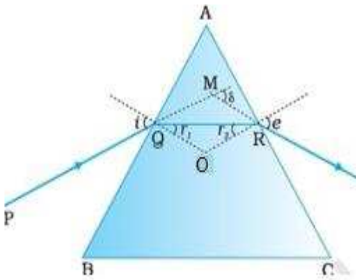
- TV transmission
- Radio broadcast — 3
- Mobile transmission

11(b).

OR

i)Diagram	1
Proof of relation $\delta = (i+e) - A$	1 ½
ii)Finding minimum deviation	½

i) Diagram



1

$$\delta = (i - r_1) + (e - r_2)$$ ½

$$\delta = (i + e) - (r_1 + r_2)$$

In Quadrilateral AQOR

$\angle Q = \angle R = 90^\circ$ $\therefore \angle A + \angle O = 180^\circ$ ---------(1) ½

In ΔQOR

$O + r_1 + r_2 = 180^\circ$ ---------(2)

Comparing (1) and (2)

$\therefore A = r_1 + r_2$

$\therefore \delta = (i + e) - A$ ½

	ii) If a ray passes symmetrically through a prism (parallel to base of prism), the value of angle of deviation is minimum. At this angle $\angle i = \angle e$ and $\angle r_1 = \angle r_2$	½	3
	SECTION- C		
12.	I (B) II (C) III (D) IV (C) V (C)	1 1 1 1 1	5

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