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Senior Secondary School Term II Examination, 2022

Marking Scheme – PHYSICS (SUBJECT CODE – 042)

(PAPER CODE – 55/4/1)

General Instructions: -

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5. Evaluators will mark($\sqrt{}$) wherever answer is correct. For wrong answer ‘X’ be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
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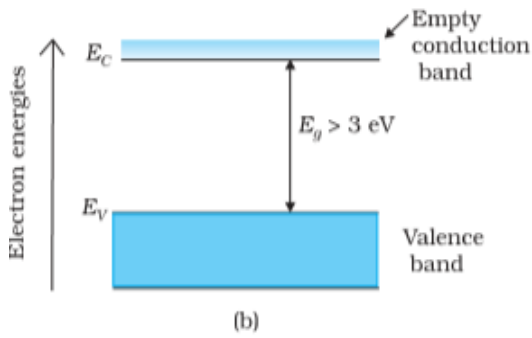
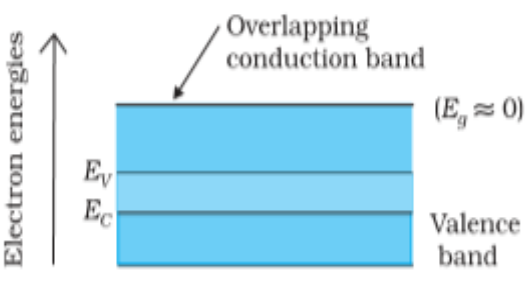
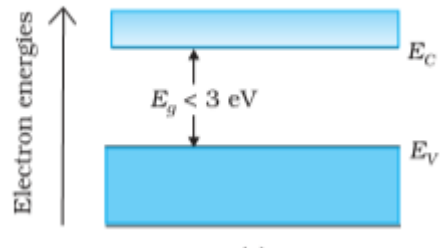
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11. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 30 answer books per day in main subjects and 35 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
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 - Giving more marks for an answer than assigned to it.
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MARKING SCHEME

Senior Secondary School Examination TERM–II, 2022

PHYSICS (Subject Code–042)

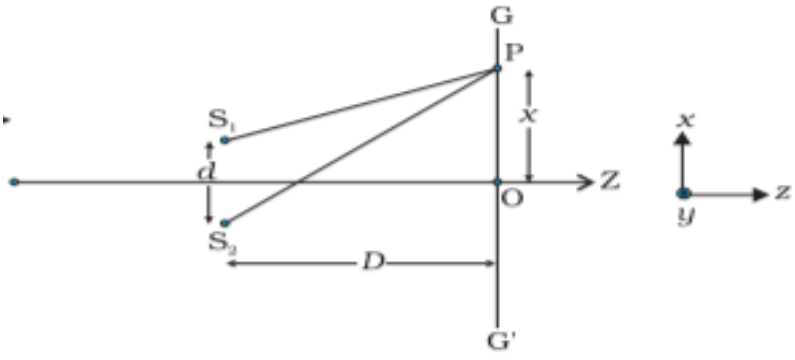
[Paper Code : 55/4/1]

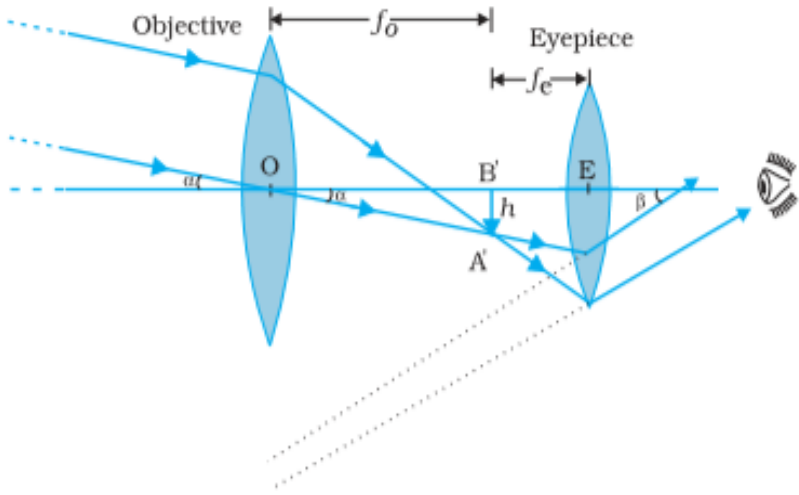
Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks
1.	- Meaning of energy Band gap $\frac{1}{2}$ - Energy Band Diagram of Conductor, Insulator & Semiconductor $(\frac{1}{2} + \frac{1}{2} + \frac{1}{2})$ The gap between the top of the valence band and bottom of the conduction band is called the energy band gap.  (b) ENERGY BAND DIAGRAM FOR INSULATOR  ENERGY BAND DIAGRAM FOR CONDUCTOR  ENERGY BAND DIAGRAM FOR SEMICONDUCTOR	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

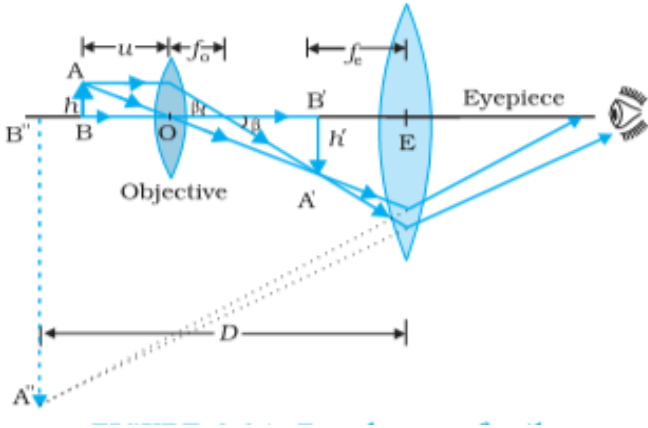
2.	• Name of Spectral Series ½ • Ratio of the wavelength 1½ a) Balmer Series $\frac{1}{\lambda} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$ $\frac{1}{\lambda_{\max}} = R \left(\frac{1}{2^2} - \frac{1}{3^2} \right) \quad (n_f = 2, \quad n_i = 3)$ $\lambda_{\max} = \frac{36}{5R}$ $\frac{1}{\lambda_{\min}} = R \left(\frac{1}{2^2} - \frac{1}{\infty} \right) \quad (n_f = 2, \quad n_i = \infty)$ $\lambda_{\min} = \frac{4}{R}$ $\frac{\lambda_{\max}}{\lambda_{\min}} = \frac{9}{5}$ OR • Meaning of matter waves ½ • Ratio of de- Broglie wavelength 1½ b) Wave associated with moving material particle $\lambda = \frac{h}{\sqrt{2qmV}}$ $\therefore \frac{\lambda_P}{\lambda_\alpha} = \sqrt{\frac{q_\alpha m_\alpha}{q_P m_P}}$ $\therefore \frac{\lambda_P}{\lambda_\alpha} = \sqrt{\frac{2e \cdot 4m}{e \cdot m}}$ $= \frac{2\sqrt{2}}{1}$	½ ½ ½ ½ ½ ½ ½ ½	2
3.	• Naming the device ½ • Any three Uses 1½		

	Light emitting diode (LED) Advantages of LED (Any three of the following) (i) Low operational voltage and less power (ii) Fast on-off switching capability (iii) The bandwidth of emitted light is 100 Å to 500 Å or in other words it is nearly (but not exactly) monochromatic. (iv) Long life and ruggedness. (v) Fast action and no warm up time required (Note- Give credit of half mark to the students for writing electric bulb or other relevant device, and further credit 1½ marks if they mention the advantages of written device only)	½ ½+½+½	2
	SECTION-B		
4.	a) Distinguishing nuclear fission & fusion 1 b) Calculation of duration 2 a) Nuclear fission – The process of breaking a very heavy nucleus into lighter nuclei, having mass number in the range of middle mass number ($30 < A < 170$). Nuclear Fusion- It is the process of joining of very light nuclei ($A \leq 10$) to form a heavier nucleus. b) No. of atoms in 100 g $= \frac{6.023 \times 10^{23}}{2} \times 100 = 3.0115 \times 10^{25}$ Energy released/atom $= \frac{3.27 \text{ MeV}}{2} = 1.635 \text{ MeV}$ Total energy released $= 3.0115 \times 10^{25} \times 1.635 \text{ MeV}$ $= 3.0115 \times 1.635 \times 10^{25} \times 1.6 \times 10^{-13}$ $= 7.878 \times 10^{12} \text{ J}$ $t = \frac{E}{P}$ $= \frac{7.878 \times 10^{12} \text{ J}}{500 \text{ J/s}} = 1.5756 \times 10^{10} \text{ s}$ $= \frac{1.5756 \times 10^{10}}{315 \times 10^7} \simeq 500 \text{ y}$	½ ½ ½ ½ ½ ½ ½	3

	Alternatively : $E = \frac{MQ}{2m_d}$ $= \frac{(0.1 \text{ kg}) \times (3.27 \text{ MeV})}{2(2.04) \times (1.66 \times 10^{-27} \text{ kg} / 4)}$ $= 0.0492 \times 10^{27} = 4.92 \times 10^{25} \text{ MeV}$ $t = \frac{E}{P}$ $= \frac{(4.92 \times 10^{25}) \times (1.6 \times 10^{-13})}{500} = 1.5756 \times 10^{10} \text{ s}$ $= \frac{1.5756 \times 10^{10}}{315 \times 10^7} \simeq 500 \text{ y}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
5.	a) For explaining reason 1 b) For explaining reason 1 c) For explaining reason 1 a) When a <i>p-n</i> junction is forward biased, the junction width decreases and as a result, its resistance also decreases. On the other hand, when a <i>p-n</i> junction is reverse biased, the junction width increases hence resistance increases. b) Conductivity of intrinsic semi-conductors is very low. Hence, no electronic device can be developed using them. Dopping increases conductivity, hence makes intrinsic semiconductor suitable for making electronic devices. c) It is easier to observe the change in the current with change in light intensity if a reverse bias is applied. Alternatively The fractional change due to photo-effects on the minority charge carriers dominated reverse bias current, is more easily measurable than the fractional change in forward bias current.	$\frac{1}{2}$ $\frac{1}{2}$ 1 1	3
6.	a) Calculation of distance of closest approach $1\frac{1}{2}$ b) Calculation of distance of closest approach $1\frac{1}{2}$		

	a) For α particles, distance of closest approach $r_{\alpha} = \frac{1}{4\pi\epsilon_0} \frac{2Ze^2}{E_k}$ $r_{\alpha} = \frac{9 \times 10^9 \times 2 \times 79 \times (1.6 \times 10^{-19})^2}{2.56 \times 10^{-12}}$ $= 14.22 \times 10^{-15} \text{ m}$ $= 14.22 \text{ fm}$ b) For proton, distance of closest approach $r_p = \frac{1}{4\pi\epsilon_0} \frac{Ze^2}{E_k}$ $r_p = \frac{r_{\alpha}}{2}$ $= 7.11 \times 10^{-15} \text{ m}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
7.	• Explanation of bright and dark fringes. 1 • Derivation of the expression of fringe width. 2 We get bright fringes, when waves from two coherent sources meet at a point on the screen with a phase difference $\Delta\phi = 2n\pi \quad (n = 1, 2, 3, \dots)$ We get dark fringes, when waves from two coherent sources meet at a point on the screen with a phase difference $\Delta\phi = (2n+1)\pi \quad (n = 1, 2, 3, \dots)$ (Note: Give full credit for explaining using path difference)  For maxima, $S_2P - S_1P = n\lambda \quad n = 0, 1, 2, 3, \dots$ (1)	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	

	From figure, $(S_2P)^2 - (S_1P)^2 = \left[D^2 + \left(x + \frac{d}{2} \right)^2 \right] - \left[D^2 + \left(x - \frac{d}{2} \right)^2 \right] = 2xd$ $S_2P - S_1P = \frac{2xd}{S_2P + S_1P}$ $S_2P \approx S_1P \approx D$ $S_2P - S_1P = \frac{2xd}{2D} = \frac{xd}{D} \quad (2)$ From equation (1) & (2) $n\lambda = \frac{xd}{D}$ $x_n = \frac{n\lambda D}{d} \quad \text{for } n^{\text{th}} \text{ maxima}$ Similarly for $(n+1)^{\text{th}}$ maxima $x_{n+1} = \frac{(n+1)\lambda D}{d}$ $\therefore \text{fringe width} = x_{n+1} - x_n = \frac{\lambda D}{d}$ Note- Give full credit, if a student derives this relation using condition of minimum intensity.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
8.	(a) (i) Labelled ray diagram of astronomical telescope— 1 (ii) (I) Calculation of length of tube 1 (II) Calculation of magnification 1 a) (i) 	1	

	(ii) Given $f_o = 150 \text{ cm}$, $f_e = 6 \text{ cm}$ (I) Length of the tube $L = f_o + f_e$ $= 150 + 6$ $L = 156 \text{ cm}$ (II) $m = \frac{f_o}{f_e}$ $\frac{150}{6} = 25$ OR b) (i) Labelled ray diagram of compound microscope – 1 (ii) (I) Position of image calculation 1 (II) Calculation of linear magnification 1 b) i)  Ray diagram of image formation by a compound microscope ii) Given $u = -3 \text{ cm}$ $f = 4 \text{ cm}$ (I) Using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ $\frac{1}{v} = \frac{1}{u} + \frac{1}{f} = \frac{1}{-3.0} + \frac{1}{4.0}$ $\frac{1}{v} = \frac{-4+3}{12} = -\frac{1}{12} \quad v = -12 \text{ cm}$ (II) Linear magnification $m = \frac{v}{u}$ $m = \frac{-12}{-3} = 4$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
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	We consider, refracted wavefront CE and triangles ABC & AEC. From the triangles we obtained $\sin i = \frac{BC}{AC} = \frac{v_1 \tau}{AC}$ $\sin r = \frac{AE}{AC} = \frac{v_2 \tau}{AC}$ Thus $\frac{\sin i}{\sin r} = \frac{v_2}{v_1}$ We know $n = \frac{c}{v}$, So $\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$ which is the Snell's law.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
12.	(a) (iv) $\frac{n_1}{v} - \frac{n_2}{u} = \frac{(n_1 - n_2)}{R}$ (b) (iv) virtual and formed in air (c) (i) real and of the size of the object (d) (ii) + 5D (e) (iii) f	1 1 1 1 1	5

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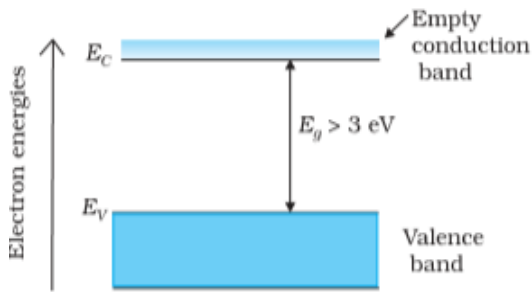
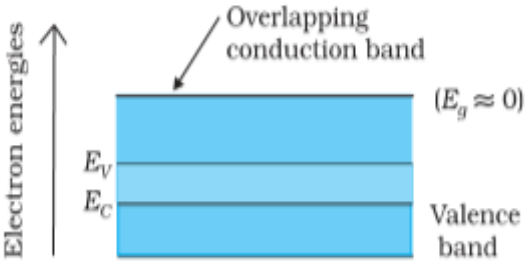
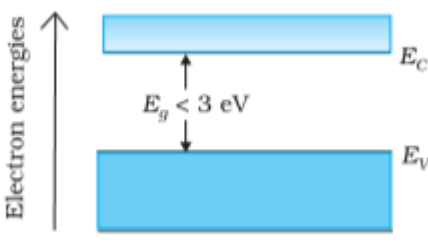
(PAPER CODE – 55/4/2)

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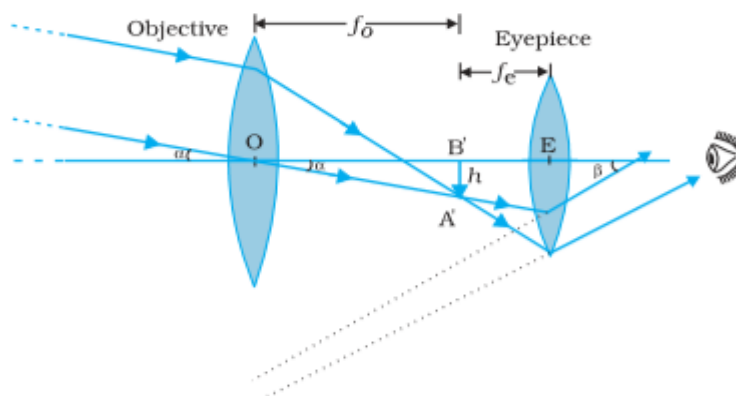
MARKING SCHEME
 Senior Secondary School Examination TERM–II, 2022
PHYSICS (Subject Code–042)
[Paper Code : 55/4/2]

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks
1.	- Meaning of energy Band gap $\frac{1}{2}$ - Energy Band Diagram of Conductor, Insulator & Semiconductor $(\frac{1}{2} + \frac{1}{2} + \frac{1}{2})$ Energy gap : The gap between the top of the valence band and bottom of the conduction band is called the energy band gap.  (b) ENERGY BAND DIAGRAM FOR INSULATOR  ENERGY BAND DIAGRAM FOR CONDUCTOR  ENERGY BAND DIAGRAM FOR SEMICONDUCTOR	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

2.	• Naming the device 1 • Principle of working 1 ❖ Rectifier ❖ The unidirectional property of a diode makes it suitable for reflection. Alternatively: The diode conducts when forward biased and does not conduct when reverse biased	1 1	2
3.	a) • Name of Spectral Series $\frac{1}{2}$ • Ratio of the wavelength $1\frac{1}{2}$ Balmer Series $\frac{1}{\lambda} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$ $\frac{1}{\lambda_{\max}} = R \left(\frac{1}{2^2} - \frac{1}{3^2} \right) \quad (n_f = 2, \quad n_i = 3)$ $\lambda_{\max} = \frac{36}{5R}$ $\frac{1}{\lambda_{\min}} = R \left(\frac{1}{2^2} - \frac{1}{\infty} \right) \quad (n_f = 2, \quad n_i = \infty)$ $\lambda_{\min} = \frac{4}{R}$ $\frac{\lambda_{\max}}{\lambda_{\min}} = \frac{9}{5}$ OR b) • Meaning of matter waves $\frac{1}{2}$ • Ratio of de- Broglie wavelength $1\frac{1}{2}$ Wave associated with moving material particle $\lambda = \frac{h}{\sqrt{2mqmV}}$ $\therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{q_\alpha m_\alpha}{q_p m_p}}$ $\therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{2e \cdot 4m}{e \cdot m}}$ $= \frac{2\sqrt{2}}{1}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

[illegible]

(i)



1

(ii) Given $f_o = 150 \text{ cm}$, $f_e = 6 \text{ cm}$

(I) Length of the tube $L = f_o + f_e$
 $= 150 + 6$

$\frac{1}{2}$

$$L = 156 \text{ cm}$$

$\frac{1}{2}$

(II) $m = \frac{f_o}{f_e}$

$\frac{1}{2}$

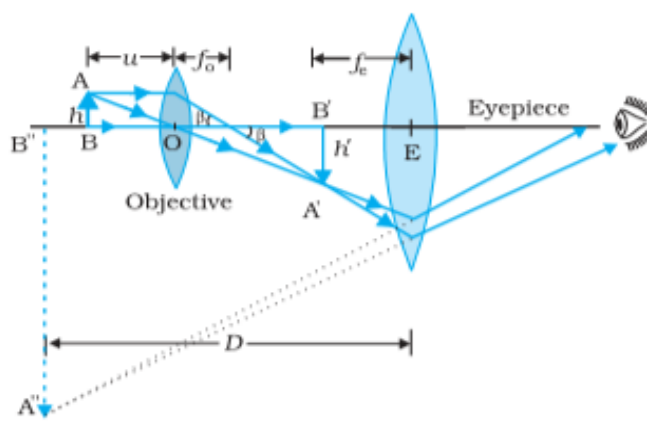
$$\frac{150}{6} = 25$$

$\frac{1}{2}$

OR

- b) (i) Labelled ray diagram of compound microscope—
 (ii) (I) Position of image calculation 1
 (II) Calculation of linear magnification 1

(i)



1

Ray diagram of image formation by a compound microscope

	We consider, refracted wavefront CE and triangles ABC & AEC. From the triangles we obtained $\sin i = \frac{BC}{AC} = \frac{v_1 \tau}{AC}$ $\sin r = \frac{AE}{AC} = \frac{v_2 \tau}{AC}$ Thus $\frac{\sin i}{\sin r} = \frac{v_2}{v_1}$ We know $n = \frac{c}{v}$, So $\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$ which is the Snell's law.	1					
11.	<table><tr><td>a) Tracing the path of emerging ray</td><td>1</td></tr><tr><td>b) Finding the angle of emergence</td><td>2</td></tr></table> a)	a) Tracing the path of emerging ray	1	b) Finding the angle of emergence	2	1	
a) Tracing the path of emerging ray	1						
b) Finding the angle of emergence	2						

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 - Marks in words and figures not tallying.
 - Wrong transfer of marks from the answer book to online award list.
 - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
 - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
14. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
15. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
16. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks								
1.	a) <table border="1"> <tr> <td>• Name of Spectral Series</td><td>$\frac{1}{2}$</td></tr> <tr> <td>• Ratio of the wavelength</td><td>$1\frac{1}{2}$</td></tr> </table> Balmer Series $\frac{1}{\lambda} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$ $\frac{1}{\lambda_{max}} = R \left(\frac{1}{2^2} - \frac{1}{3^2} \right) \quad (n_f = 2, \quad n_i = 3)$ $\lambda_{max} = \frac{36}{5R}$ $\frac{1}{\lambda_{min}} = R \left(\frac{1}{2^2} - \frac{1}{\infty} \right) \quad (n_f = 2, \quad n_i = \infty)$ $\lambda_{min} = \frac{4}{R}$ $\frac{\lambda_{max}}{\lambda_{min}} = \frac{9}{5}$ OR b) <table border="1"> <tr> <td>• Definition /meaning of matter waves</td><td>$\frac{1}{2}$</td></tr> <tr> <td>• Ratio of de- Broglie Wavelength</td><td>$1\frac{1}{2}$</td></tr> </table> Wave associated with moving material particle $\lambda = \frac{h}{\sqrt{2qmV}}$ $\therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{q_\alpha m_\alpha}{q_p m_p}}$ $\therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{2e \cdot 4m}{e \cdot m}}$ $= \frac{2\sqrt{2}}{1}$	• Name of Spectral Series	$\frac{1}{2}$	• Ratio of the wavelength	$1\frac{1}{2}$	• Definition /meaning of matter waves	$\frac{1}{2}$	• Ratio of de- Broglie Wavelength	$1\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
• Name of Spectral Series	$\frac{1}{2}$										
• Ratio of the wavelength	$1\frac{1}{2}$										
• Definition /meaning of matter waves	$\frac{1}{2}$										
• Ratio of de- Broglie Wavelength	$1\frac{1}{2}$										

2

2.	- Meaning of energy Band gap 1/2 - Energy Band Diagram of Conductor, Insulator & Semiconductor (1/2 + 1/2 + 1/2) Energy gap : The gap between the top of the valence band and bottom of the conduction band is called the energy band gap. (b) ENERGY BAND DIAGRAM FOR INSULATOR ENERGY BAND DIAGRAM FOR CONDUCTOR ENERGY BAND DIAGRAM FOR SEMICONDUCTOR	1/2 1/2 1/2	2
3.	- Definition of Barrier Potential 1 - Explanation of thickness of depletion region 1 (i) It is the potential developed across the p-n junction which tends to prevent the movement of majority charge carriers from both sides. (ii) Under reverse bias, direction of applied voltage is same as the direction of barrier potential. As a result barrier height increase & the depletion region widens due to change in electric field.	1 1	2

SECTION-B			
4.	a) For explaining reason 1 b) For explaining reason 1 c) For explaining reason 1 a) When a $p-n$ junction is forward biased, the junction width decreases and as a result, its resistance also decreases. 1/2 On the other hand, when a $p-n$ junction is reverse biased, the junction width increases and as a result, its resistance also increases. 1/2 b) Conductivity of intrinsic semi-conductors is very low. Hence, no electronic device can be developed using them. 1 Dopping increases conductivity, hence makes intrinsic semiconductor suitable for making electronic devices. c) It is easier to observe the change in the current with change in light intensity if a reverse bias is applied. 1 Alternatively The fractional change due to photo-effects on the minority charge carriers dominated reverse bias current, is more easily measurable than the fractional change in forward bias current.		

5.	a) Distinguishing nuclear fission & fusion 1 b) Calculation of duration 2 a) Nuclear fission – The process of breaking a very heavy nucleus into lighter nuclei, having mass number in the range of middle mass number ($30 < A < 170$). Nuclear Fusion- It is the process of joining of very light nuclei ($A \leq 10$) to form a heavier nucleus. b) No. of atoms in 100 g $= \frac{6.023 \times 10^{23}}{2} \times 100 = 3.0115 \times 10^{25}$ Energy released/atom $= \frac{3.27 \text{ MeV}}{2} = 1.635 \text{ MeV}$ Total energy released $= 3.0115 \times 10^{25} \times 1.635 \text{ MeV}$ $= 3.0115 \times 1.635 \times 10^{25} \times 1.6 \times 10^{-13}$ $= 7.878 \times 10^{12} \text{ J}$ $t = \frac{E}{P}$ $= \frac{7.878 \times 10^{12} \text{ J}}{500 \text{ J/s}} = 1.5756 \times 10^{10} \text{ s}$ $= \frac{1.5756 \times 10^{10}}{3.15 \times 10^7} \simeq 500y$ Alternatively : $E = \frac{MQ}{2m_d}$ $= \frac{(0.1 \text{ kg}) \times (3.27 \text{ MeV})}{2(2.04) \times (1.66 \times 10^{-27} \text{ kg/4})}$ $= 0.0492 \times 10^{27} = 4.92 \times 10^{25} \text{ MeV}$ $t = \frac{E}{P}$ $= \frac{(4.92 \times 10^{25}) \times (1.6 \times 10^{-13})}{500} = 1.5756 \times 10^{10} \text{ s}$ $= \frac{1.5756 \times 10^{10}}{3.15 \times 10^7} \simeq 500y$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
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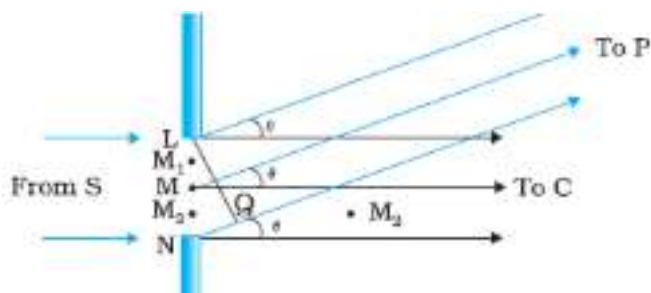
6.

Brief Explanation of bright and dark fringes in diffraction

2

Explanation of decrease in intensity with increasing 'n'

1



Dividing the slit into smaller parts, and adding their contributions at P with the proper phase differences. The path difference $NP - LP$ between the two edges of the slit, $NP - LP = NQ = a \sin \theta \approx a\theta$

 $\frac{1}{2}$

At the central point C on the screen, the angle θ is zero. All path differences are zero and hence all the parts of the slit contribute in phase. This gives maximum intensity at C,

 $\frac{1}{2}$

Similarly other secondary maxima will be formed at $\theta = (n+1/2) \lambda/a$,

For minima (zero intensity) the contributions from M_1 and M_2 are 180° out of phase and cancel in the direction $\theta = \lambda/a$. where λ is the path difference. Similarly other minima are formed due to cancellation of contributions. At an angle $\theta = n\lambda/a$, where $n = \pm 1, \pm 2, \pm 3, \dots$

 $\frac{1}{2}$ $\frac{1}{2}$

Consider an angle $\theta = 3\lambda/2a$ which is midway between two of the dark fringes. Divide the slit into three equal parts. If we take the first two thirds of the slit, the path difference between the two ends would be λ .

 $\frac{1}{2}$

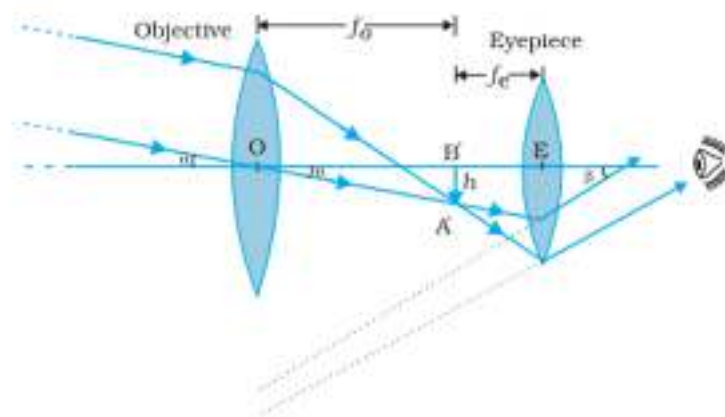
The first two-thirds of the slit can be divided into two halves which have a $\lambda/2$ path difference. The contributions of these two halves cancel, only the remaining one-third of the slit contributes to the intensity at a point between the two minima. Which will be much weaker than the central maximum (where the entire slit contributes in phase). Similarly there are maxima at $(n + 1/2) \lambda/a$ with $n = 2, 3$, etc. These become weaker with increasing n , since only one-fifth, one-seventh, etc., of the slit contributes in these cases.

 $\frac{1}{2}$

7.

a) (i) Labelled Diagram –	1
(ii) (I) Length of tube calculation	1
(II) Calculation of magnification	1

(a) (i)



(ii) Given $f_o = 150 \text{ cm}$, $f_e = 6 \text{ cm}$

(I) Length of the tube $L = f_o + f_e$

$$= 150 + 6$$

$$L = 156 \text{ cm}$$

(II) $m = \frac{f_o}{f_e}$

$$\frac{150}{6} = 25$$

1

$\frac{1}{2}$

$\frac{1}{2}$

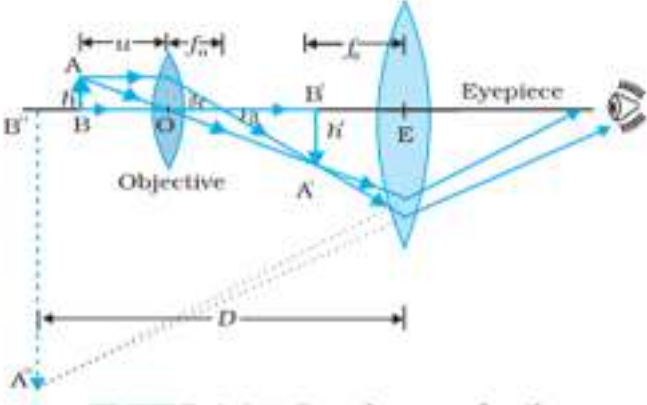
$\frac{1}{2}$

$\frac{1}{2}$

3

OR

b) (i) Labelled Diagram –	1
(ii) (I) Position of image calculation	1
(II) Calculation of linear magnification	1

	(b) (i)  Ray diagram of image formation by a compound microscope (ii) Given $u = -3 \text{ cm}$ $f = 4 \text{ cm}$ (I) Using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ $\frac{1}{v} = \frac{1}{u} + \frac{1}{f} = \frac{1}{-3.0} + \frac{1}{4.0}$ $\frac{1}{v} = \frac{-4 + 3}{12} = -\frac{1}{12} \quad v = -12 \text{ cm}$ (II) Linear magnification $m = \frac{v}{u}$ $m = \frac{-12}{-3} = 4$	1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
8.	- Finding de- Broglie wavelength $1\frac{1}{2}$ - Finding the momentum of α particles $1\frac{1}{2}$ $\lambda_p = \frac{h}{\sqrt{2q_p m_p V}},$ $\lambda_\alpha = \frac{h}{\sqrt{2 \cdot 2q_p \cdot 4m_p V}}$ $\frac{\lambda_\alpha}{\lambda_p} = \frac{1}{2\sqrt{2}}$ $\lambda_\alpha = \frac{h}{p_p}, \quad \lambda_\alpha = \frac{h}{p_\alpha}$ $\frac{p_\alpha}{p_p} = \frac{1}{2\sqrt{2}},$ $p_\alpha = 2\sqrt{2} p_p$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3

	We consider, refracted wavefront CE and triangles ABC & AEC. From the triangles we obtained $\sin i = \frac{BC}{AC} = \frac{v_1 \tau}{AC}$ $\sin r = \frac{AE}{AC} = \frac{v_2 \tau}{AC}$ Thus $\frac{\sin i}{\sin r} = \frac{v_2}{v_1}$ We know $n = \frac{c}{v}$, So $\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$ which is the Snell's law.	1	
11.	• Calculation of critical angle 1 • Calculation of radius circle $1\frac{1}{2}$ • Calculation of Area $\frac{1}{2}$ $\sin C = \frac{1}{\mu}$ $\sin C = \frac{3}{4}$ $\sin C = \frac{R}{\sqrt{R^2 + 7}}$	$\frac{1}{2}$	

	$\frac{3}{4} = \frac{R}{\sqrt{R^2 + 7}}$ $R = 3\text{m}$ $\text{Area} = \pi R^2$ $= 3.14 \times (3)^2$ $= 28.26 \text{ m}^2$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
12.	(a) (iv) $\frac{n_1}{v} - \frac{n_2}{u} = \frac{(n_1 - n_2)}{R}$ (b) (iv) virtual and formed in air (c) (i) real and of the size of the object (d) (ii) +5D (e) (iii) f	1 1 1 1 1	5

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