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SeniorSecondary School Term II Examination, 2022

Marking Scheme – PHYSICS (SUBJECT CODE — 042)

(PAPER CODE — 55/2/3)

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.

2. **"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its' leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc may invite action under IPC."**

3. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them. In class-X, while evaluating two competency based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, marks should be awarded.**

4. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.

5. Evaluators will mark(√) 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.**

6. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.

7. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

8. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.

9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks _35_(example 0-40 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

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.

12. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    - Leaving answer or part thereof unassessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong totaling of marks awarded on a reply.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - 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.

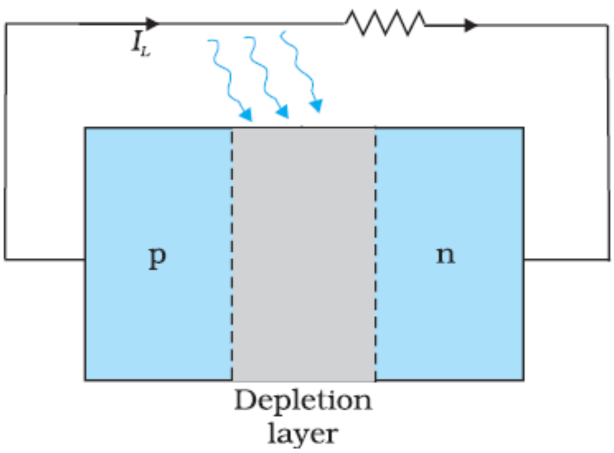
17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

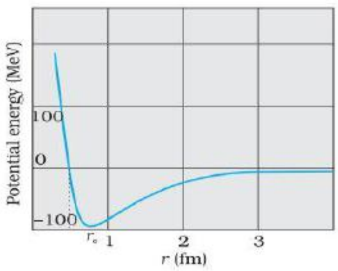
MARKING SCHEME

Senior Secondary School Examination TERM–II, 2022

PHYSICS (Subject Code — 042)

[Paper Code — 55/2/3]

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks
	SECTION—A		
1.	Significance of P and Q 1 Circuit diagram 1 a) Point P: open circuit Potential difference or emf Point Q : short circuit current b) 	½ ½ 1	2
2.	Explanation of Formation of Depletion region 2 When p-type semiconductor is chipped with n-type semiconductor, e^- from the n-side diffuse towards p-side and holes from p-side diffuse towards n-side leaving behind a layer of immobile +ve ions on n-side and immobile –ve ions on p-side leading to formation of depletion layer. **(Note : Award 1 mark, if a student draws a diagram showing depletion region)**	2	2
3.	(a) Definition of impact parameter & distance of closest approach Values ½ + ½ Value of Impact parameter for (I) & (II) ½ + ½		

	i. **Impact Parameter** : It is the perpendicular distance of the initial velocity vector of the approaching α-particle from the centre of the nucleus.	½	
	Distance of closest approach : It is the minimum distance of the approaching α-particle and the target gold nucleus	½	
	$d = \frac{2Ze^2}{4\pi\varepsilon_0 K}$; Where K is the kinetic energy		
	Alternatively : Distance of closest approach is the distance of the alpha particle from the centre of gold nucleus where its whole kinetic energy is converted into potential energy		
	ii. $\theta = 0°$; b = maximum / almost of atomic size	½	
	$\theta = 180°$; b = minimum = zero	½	
	(Note: Allot ½ Mark for only formula.)		
3.	**OR**		
	(b)		
	Expressions for kinetic energy ½ + ½ Expression for threshold Frequency 1		
	$K = h\nu_1 - \phi_0$ and $2K = h\nu_2 - \phi_0$	½+½	
	$\Rightarrow 2(h\nu_1 - \phi_0) = h\nu_2 - \phi_0$		
	$\Rightarrow 2h\nu_1 - 2\phi_0 = h\nu_2 - \phi_0$	½	
	$\Rightarrow h(2\nu_1 - \nu_2) = \phi_0 = h\nu_0$		
	$\Rightarrow (2\nu_1 - \nu_2) = \phi_0 = \nu_0$		
	$\Rightarrow \nu_0 = 2\nu_1 - \nu_2$	½	2
4.	(a) Graph 1½ (b) Mass Difference 1 Conclusion ½		
	(a)		
		1 ½	

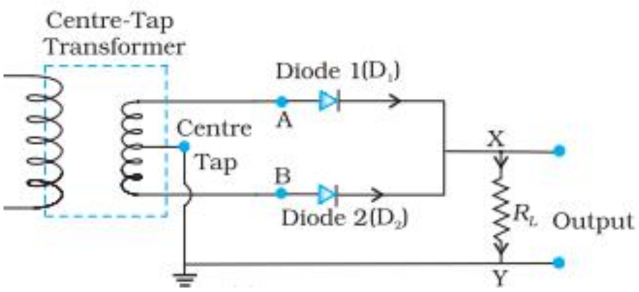
<table>
<tr><td></td><td>(b)Mass Difference = 55.93494 – 2 X 27.98191

= - 0.02442 u

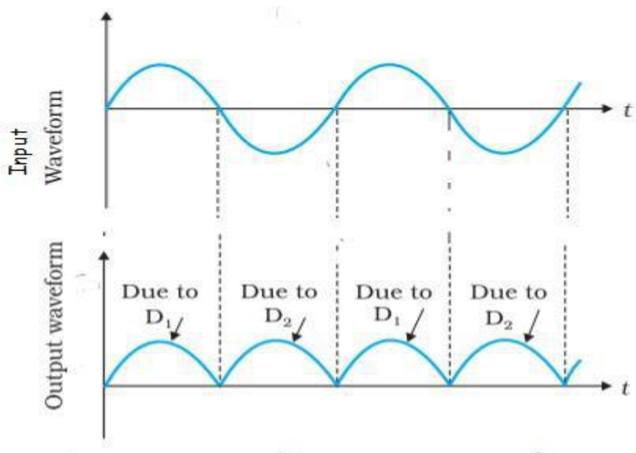
Fission not possible.</td><td>1

½</td><td>2</td></tr>
<tr><td>**5.**</td><td>

Explanation of working	1
Circuit Diagram of full wave rectifier	1
Input & Output Waveform	½ + ½



Let input voltage at A w.r.t. the centre tap at any instant is positive, then voltage at B will be negative. So, diode D_1 gets forwarded biased & D_2 gets reverse biased. Hence output current is obtained. When voltage at A becomes –ve ; then voltage at B would be + ve , hence D_1, gets reverse biased & D_2 gets forwarded biased . So output current is again obtained as shown in the figure.



(Note: If the student takes inverted input waveform full credit to be given.)</td><td>1

1

½

½</td><td>3</td></tr>
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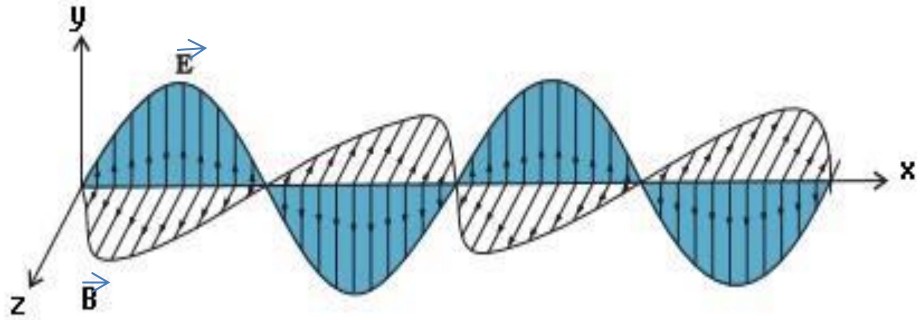
6.	Finding the position of the image 2 ½ Nature ½		
	$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$	½	
	$\frac{1}{f} = \frac{1}{32} + \frac{1}{16} = \frac{1+2}{32} = \frac{3}{32}$	½	
	$f = \frac{32}{3} cm$	½	
	When lens is cut into two equal halves the new focal length = $f' = 2f = \frac{64}{3}$ cm		
	$\frac{1}{f'} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{3}{64} = \frac{1}{v} + \frac{1}{16}$	½	
	$\frac{1}{v} = \frac{3}{64} - \frac{1}{16} = \frac{3-4}{64} = \frac{-1}{64}$		
	v = - 64 cm	½	
	Image formed is virtual & erect.	½	3
7.	Critical Angle 1 Angle of Refraction 2		
	a)		
	$\mu = \frac{1}{\sin i_c} \Rightarrow \sqrt{2} = \frac{1}{\sin i_c}$	½	
	$i_c = 45°$	½	
	b)		
	$r_2 = 45° = i_c$	½	
	$A = r_1 + r_2$	½	
	$60 = r_1 + 45°$	½	
	$r_1 = 15°$	½	3
8.	**SECTION—B**		
	a) (i) Depiction of plane EM wave ½ Expression for electric field ½ Expression for magnetic field ½ (ii) Characteristics of EM waves ½ + ½ + ½		

(i)



½

$$E_y = E_0 \sin (kx - \omega t)$$ ½

$$B_z = B_0 \sin (kx - \omega t)$$ ½

(ii) The three characteristics are:

a) They travel with velocity of light. ½
b) They carry energy and momentum. ½
c) They are transverse in nature. ½

(Or any other characteristic given)

OR

8. **b)**

Naming of EM waves	½ + ½ + ½
Uses of EM waves	½ + ½ + ½

(a) Gamma Rays - Used for cancer treatment

(b) Ultraviolet/Visible/Infrared (either) – Use of anyone of these three. ½ + ½

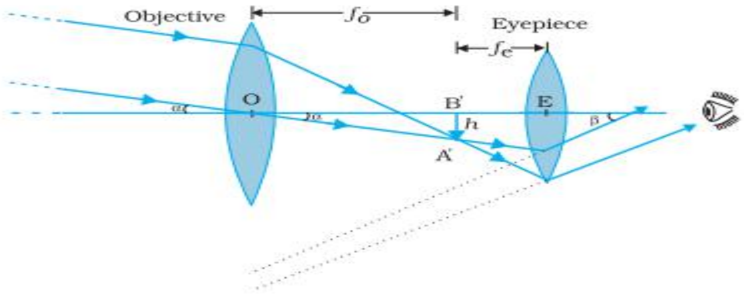
(c) Infrared Rays – Used in night vision camera, bolometer & thermopiles ½ + ½

(Note: Give full credit to any other use written.) ½ + ½

3

9. **a)**

Labelled Ray Diagram of refracting telescope for normal arrangement	1 ½
Derivation of Expression of magnifying power	1 ½



1½

$$m = \frac{\tan\beta}{\tan\alpha} \approx \frac{\beta}{\alpha} \text{ (as } \alpha, \beta \text{ are small angles)}$$ ½

$$\approx \frac{h}{f_e} x \frac{f_0}{h}$$ ½

½

$$= \frac{f_0}{f_e}$$

(Note: ½ mark to be deducted if arrows not shown or labelling is not done)

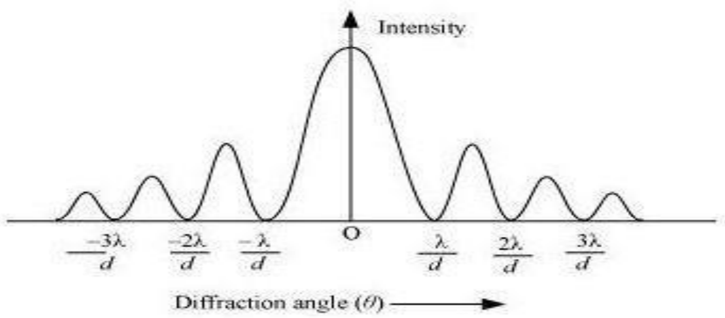
9.

OR

b)

(i)Intensity distribution curve for diffraction	1½
(ii)Expression of first maximum from the central maximum	1½

(i) Intensity distribution curve



1½

For maximum ½

$$a\sin\theta = (n + \frac{1}{2})\lambda$$

For first Maximum ; n = 1 ½

	For small θ; $a\theta = \frac{3\lambda}{2}$ => $\theta = \frac{3\lambda}{2a}$ $\therefore \frac{x}{D} = \frac{3}{2}\frac{\lambda}{a}$ $\therefore x = \frac{3}{2}\frac{\lambda D}{a}$	½	3
10.	Finding the ratio when a) Speed is same 1 b) K.E. is same 1 c) Potential difference is same 1		
	(a) $\lambda = \frac{h}{p}$	½	
	$\frac{\lambda_\alpha}{\lambda_p} = \frac{h}{m_\alpha v_\alpha} \times \frac{m_p v_p}{h} = \frac{1}{4}$	½	
	(b) $p = \sqrt{2mK.E}$	½	
	$\frac{\lambda_\alpha}{\lambda_p} = \frac{h}{\sqrt{2m_\alpha (\mathrm{K.E.})_\alpha}} \times \frac{\sqrt{2m_p (\mathrm{K.E.})_p}}{h} = \sqrt{\frac{m_p}{m_\alpha}} = \frac{1}{2}$	½	
	(c) $\mathrm{v} = \sqrt{\frac{2\mathrm{qV}}{\mathrm{m}}}$	½	
	$\frac{\lambda_\alpha}{\lambda_p} = \frac{h}{m_\alpha v_\alpha} \times \frac{m_p v_p}{h} = \frac{m_p}{m_\alpha}\sqrt{\frac{2q_p V}{m_p}} \times \sqrt{\frac{m_\alpha}{2q_\alpha V}}$ $= \frac{m_p}{m_\alpha} \times \sqrt{\frac{m_\alpha}{m_p}} \times \sqrt{\frac{q_p}{q_\alpha}} = \frac{1}{2\sqrt{2}}$	½	3
11.	a) Number of spectral lines 1 b) Minimum wavelength 2		
	(a) 6	1	

	(b) $hv = \frac{hc}{\lambda} = E_4 - E_1$ $= -0.85 + 13.6$ $= +12.75ev$ $\frac{hc}{\lambda} = 12.75 \times 1.6 \times 10^{-19}$ $\lambda = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{12.75 \times 1.6 \times 10^{-19}}$ $\lambda = 975nm = 9.75 \times 10^{-11} m$	½ ½ ½ ½	3
12.	a) (iii) b) (iv) c) (ii) d) (iii) e) (iv)	1 1 1 1 1	5