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Senior Secondary School Term II Examination, 2022

Marking Scheme – PHYSICS (SUBJECT CODE – 042)

(PAPER CODE – 55/5/1)

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 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.

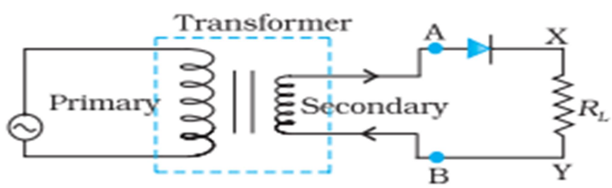
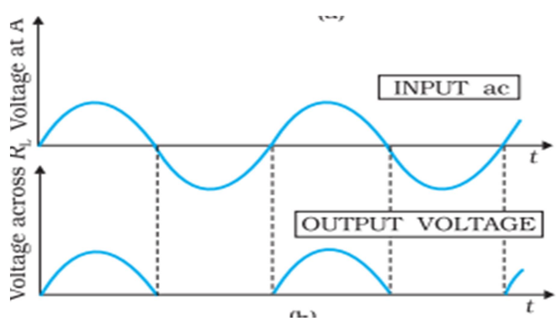
17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

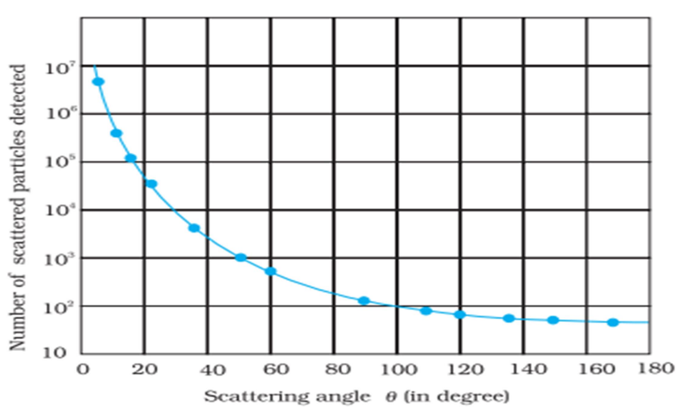
MARKING SCHEME

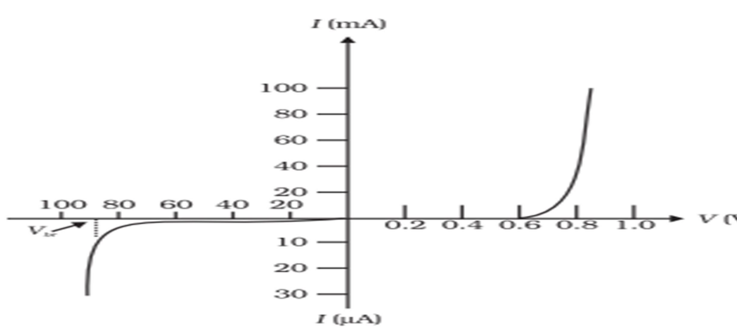
Senior Secondary School Examination TERM–II, 2022

PHYSICS (Subject Code–042)

[Paper Code : 55/5/1]

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks
	SECTION—A		
1.	Circuit Diagram of p-n junction diode as half wave rectifier 1 Explanation of its Working 1		
		1	
	• When voltage at A is positive, diode is forward biased and it conducts and when voltage at A is negative, diode is reverse biased and it does not conduct, so output is zero.	1	
	<u>Alternatively:</u>		
			2
2.	**a)**		
	Writing of the result 1 Explanation 1		
	There would be no large angle scattering / Size of nucleus can't be determined.	1	
	As hydrogen atom which is a target nucleus has only one proton whereas approaching α particle is more massive than the target nucleus.	1	
	<u>Alternatively</u>: Repulsive force between target nucleus (Hydrogen) and α–particles will be very less.		
	(Note: Give full credit for other correct explanations.)		

	OR **b)** Explanation 2 According to the photon picture of light the emission of photoelectrons depend on the energy of photon incident on the metal surface which is determined by the frequency not by the intensity.	2	2
3.	Explanation 1 Two uses ½ + ½ It is easier to observe the change in current with change in light intensity if a reverse bias is applied. **Alternatively:** The fractional change due to photo effect on the minority carrier dominated reverse bias current, is more readily measureable than the fractional change in the forward bias current. **Uses:** (Any two uses) • Smoke detector • Remote control • Medical devices • Optical signal detection (Any other uses)	1 ½+½	2
	SECTION—B		
4.	Graph 1 Reason 1 Two Limitations ½ + ½  (**Note :** Full credit if values on the axis are not mentioned)	1	

	Due to the large empty space available in an atom, α particles heading towards the nucleus are less, therefore, small fraction of particles are scattered at $\theta > 90^0$ **<u>Alternatively:</u>** For angle $\theta > 90^0$, the impact parameter is very small. **Limitations** • Could not explain the stability of the atom • Could not explain the existence of line spectra	1 ½ ½	 3
5.	*V-I* characteristics 1 Difference between threshold voltage and breakdown voltage 1 Property of junction diode 1 i)  (**Note :** Full credit if values on the axis are not mentioned) ii) **<u>Threshold Voltage</u>:** Forward bias voltage at which the current increases significantly (exponentially) even for a very small increase in voltage. **<u>Alternatively:</u>** Forward bias voltage at which the width depletion layer and barrier potential decreases significantly. **<u>Alternatively:</u>** The voltage at which resistance of junction decreases significantly. **<u>Break down voltage:</u>** Reverse bias voltage at which current increases suddenly **<u>Alternatively:</u>** Large number of covalent bonds present in the depletion layer break suddenly iii) Junction Diode conducts when it is forward biased and does not conduct when reverse biased.	 1 ½ ½ 1	 3

6.	Calculation of mass defect 2 Calculation of Q value 1 Δm = total mass of the reactants – total mass of the products $=[m(^{238}_{92}\text{U})+m_n-m(^{140}_{58}\text{Ce})-m(^{99}_{44}\text{Ru})]$ $=[238\cdot05079+1\cdot008665-139\cdot90543-98\cdot90594]u$ $=[239\cdot059455-238\cdot81137]u$ $=0\cdot248085\,u$ Q-value $=0\cdot248085$ x 931.5 MeV = 231.09 MeV **(Note: Award this 1 mark even if Q-value is not calculated)**	½ ½ ½ ½ 1	3
7.	Difference in the pattern of fringes due to single slit and double slits 1 Derivation of angular position of (i) Bright fringe and (ii) Dark fringe 1+1 In the pattern of fringes produced by a single slit, the central fringe (band) is brighter as compared to other fringes i.e intensity goes on decreasing as the order (n) of the maxima increases, while in the fringe pattern produced by double slits all bright fringes including central fringe are of same intensity. **<u>Alternatively:</u>** In the fringe pattern produced by single slit, the fringe at the centre is wider as compared to the width of other bright fringes, while in the fringe pattern produced by double slits all bright fringes are of equal width. (**Note :** Give full credit, for the differentiation by drawing intensity distribution curves of the patterns produced by single slit and double slits) **Calculation of angular position** For the slit of width 'a ' and angle of diffraction 'θ' Path difference (Δp) = a sin θ (i) Condition for Bright Fringe, Δp = $(2n+1)\frac{\lambda}{2}$ ∴ a sin θ = $(2n+1)\frac{\lambda}{2}$	1 ½	

	$\sin\theta = \frac{(2n+1)\lambda}{2a}$ (n = 1,2 ….)		
	for small angle, $\sin\theta \approx \theta$	½	
	$\theta = \frac{2n+1)\lambda}{2a}$		
	(ii) Condition for dark fringe , $\Delta p = n\lambda$	½	
	$a\sin\theta = n\lambda$ (n = 1, 2…)		
	$\therefore \sin\theta = \frac{n\lambda}{2a}$		
	for small angle, $\sin\theta \approx \theta$	½	
	$\theta = \frac{n\lambda}{a}$		3
8.	**a)** Definition 1 Calculation of focal length 1 Nature and position of image 1		
	(i) Dioptre is the reciprocal of focal length of lens in metre.	1	
	<u>Alternatively:</u>		
	Dioptre = $\frac{1}{\text{focal length (m)}}$		
	<u>Alternatively:</u>		
	One dioptre is the power of a lens of focal length of one metre		
	$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$	½	
	$R_1 = \infty,\ R_2 = -25\text{ cm},\ \mu = 1\cdot5$		
	$\frac{1}{f} = (\mu - 1)\left(\frac{1}{\infty} + \frac{1}{25}\right)$		
	$or\ \frac{1}{f} = 0\cdot5 \times \frac{1}{25}\ or\ f = 50\text{ cm}$	½	
	(ii) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$		

	$\frac{1}{50} = \frac{1}{v} - \frac{1}{-50}$		
	$\frac{1}{v} = 0$		
	$\therefore \quad v = \infty$,	½	
	Thus the image will be real and inverted	½	
	(Note: Award only ½ mark if a student draws ray diagram showing correct position of the image.)		
	OR		
	b)		
	Calculation of (i) distance of second bright fringe 1 ½ (ii) least distance 1 ½		
	(i) $\sin\theta \simeq \theta = \frac{x}{D} = \frac{5\lambda}{2a}$	½	
	$\therefore x = \frac{5\lambda D}{2a} = \frac{5\times600\times10^{-9}\times1}{2\times0\cdot6\times10^{-3}}$	½	
	$= 2.5\text{mm}$	½	
	(ii) $(2n+1)\frac{\lambda}{2} = \frac{(2(n+1)+1)\lambda'}{2}$	½	
	$(2n+1)$ x $600 = (2n+3) \times 480$		
	$\therefore \; n = 3.5$	½	
	$x_n = \frac{(2n+1)\lambda D}{2d} = \frac{(2\times3.5+1)\times600\times10^{-9}\times1}{2\times0\cdot6\times10^{-3}}$	½	
	$= 4$ mm		3
	(**Note:** Give full credit for finding the position by taking $n = 3$ or $n = 4$ for $n = 3$, $x_n = 3.5$mm and for $n = 4$, $x_{n,} = 4.5$mm)		
9.	Calculation of energy and momentum 1+1 Calculation of speed 1		
	(a) Energy of photon, $E = h\nu$		
	$E = h\frac{c}{\lambda} = \frac{6\cdot63\times10^{-34}\times3\times10^{8}}{331\cdot5\times10^{-9}}$	½	
	$E = 6\times10^{-19}$ J	½	

	momentum(p)		
	$p = \frac{h}{\lambda}$	½	
	$= \frac{6 \cdot 63 \times 10^{-34}}{331 \cdot 5 \times 10^{-9}}$	½	
	$p = 2 \times 10^{-27}$ kg ms^{-1}		
	(b) Momentum of H atom = momentum of the photon $= 2 \times 10^{-27}$ kg ms^{-1}	½	
	$p = mu$		
	$u = \frac{p}{m} = \frac{2 \times 10^{-27}}{1 \cdot 67 \times 10^{-27}}$ ms^{-1}		
	$u = 1 \cdot 20$ ms^{-1}	½	3
10.	Calculation of $\angle r_2$ 1 ½ Calculation of angle of minimum deviation 1 ½		
	(i) As the emergent ray grazes along the side AC, therefore		
	$\frac{1}{\sqrt{2}} = \frac{\sin r_2}{\sin 90^0}$	1	
	$\therefore r_2 = 45°$	½	
	(ii) $\mu = \frac{\sin(\frac{A + \delta m}{2})}{\sin \frac{A}{2}}$	½	
	$\sqrt{2} = \frac{\sin(\frac{60^0 + \delta m}{2})}{\sin 30^0}$	½	
	$\therefore \delta_m = 30^0$	½	3
11. **(a)**	Arranging the e-m radiations in ascending order of frequency 1 Uses of any two radiation ½ + ½ + ½ + ½		

(i) Radio waves < microwaves < X-rays < gamma rays 1

(ii) Two uses each of any two of the radiation

Radio waves-

- TV transmission
- Radio broadcast
- Mobile communication
- Radio telescope

Microwaves-

- Microwave oven
- Speed of automobiles
- Radar
- Air craft navigation

Gamma rays-

- Treatment of cancer
- Sterilisation and disinfection

X rays-

- Diagnostic tool in medicine
- Treatment for certain forms of cancer 2

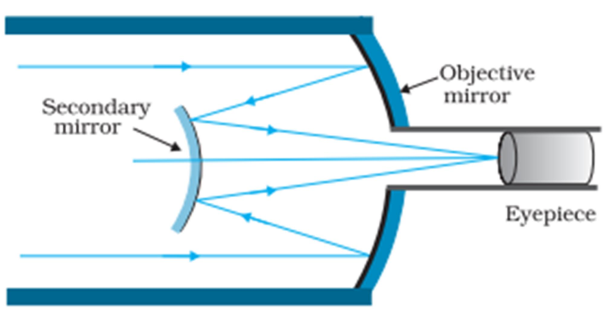
(Two uses of any two of these radiations)

OR

(b)

Ray Diagram and explanation of working	2
Advantages	½ + ½

Ray diagram of reflecting telescope Working



1 ½

Working: Parallel beam of light gathered by objective mirror is reflected to the secondary mirror, which further forms the image in front of the eyepiece. ½

(**Note:** Deduct ½ marks for not showing the direction of propagation of rays and give full credit for the ray diagram of Newtonian telescope)

	Two Advantages (Any Two) • High resolving power • No chromatic aberration • Reduced spherical aberration • Brighter image is formed • Easy mechanical support • Large magnifying power	½ + ½	3
	SECTION—C		
12.	(i)—a (ii)—b (iii)—c (iv)—b (v) —b	1 1 1 1 1	5

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