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SeniorSecondary School ,Term II Examination2022

Marking Scheme – PHYSICS (SUBJECT CODE — 042)

(PAPER CODE — 55/3/1)

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.

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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 totalled 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 35answer 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 un assessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong totalling 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 totalling on the title page.
    - Wrong totalling 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.

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15. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

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MARKING SCHEME

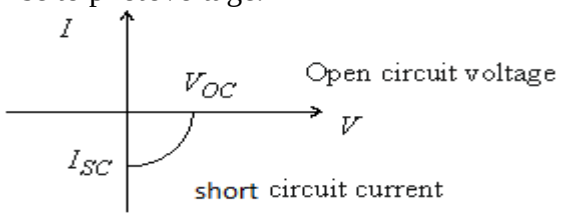
Senior Secondary School Examination TERM–II, 2022

PHYSICS (Subject Code — 042)

[Paper Code — 55/3/1]

Maximum Marks : 35

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total marks
	SECTION—A		
1.	Meaning of doping 1 Two types of atom 1 Doping is the process of adding some external impurity atoms in an intrinsic semiconductor to increase its conductivity. Dopant atoms may be pentavalent or trivalent.	1 ½+½	2
2.	**a)** Distinction between isotopes and isobars 1 Explanation 1 (i) Isotopes – These are the atoms having same atomic number (Z) but different atomic mass(A). Isobars – The atoms of different element having same atomic masses. (ii) No the mass number of a nucleus is the sum of number of proton(Z) and number of neutrons (N) / $A = Z + N$ / Two nuclei with different mass numbers A_1 and A_2, may have , have different Z . ***OR*** **b)** Two factors 1 Definition of threshold frequency 1 (i) Factors (a) Frequency of incident radiation (b) Work function of the surface (ii) The minimum frequency of the incident radiation below which photoelectric emission does not take place.	½ ½ ½ ½ ½ ½ 1	2 2
3.	Explanation of movement of charge carriers / diffusion 1 Formation of the barrier potential 1 The diffusion of electrons from n-region to p-region and that of the holes from p-region to n-region creates positive charge on the n-side and negative charge on the p-side which causes a difference of potential across the junction. This potential, setup across the junction tends to prevent the movement of electrons from the n-region to p-region .This is called barrier potential.	1 1	2

	SECTION—B		
4.	Statement of Bohr's 2nd postulate 1 Derivation of speed 2		
	(i) An electron can revolve around the nucleus in an orbit in which its angular momentum is an integral multiple of $\frac{h}{2\pi}$.	1	
	(ii) Proof		
	$\frac{mv^2}{r} = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{r^2}$	½	
	$mvr = \frac{nh}{2\pi}$	½	
	Eliminating r we get		
	$v = \frac{e^2}{2\varepsilon_0 h}\cdot\frac{1}{n}$	½	
	$\therefore v \propto \frac{1}{n}$	½	3
5.	Generation of emf 2 *I* - *V* characteristics 1		
	Three processes due to which emf is generated in a solar cell are .		
	(i) Generation of electron-hole pairs due to light incident close to the junction.	½	
	(ii) Separation of electrons and holes due to electric field of the depletion region. Electrons swept to *n*-side and holes to *p*-side.	½	
	(iii) The electrons reaching the *n*-side are collected by the front contact and the holes reaching the *p*-side are collected by the back contact.	½	
	• Thus *p*-side becomes positive and *n*-side becomes negative giving rise to photovoltage.	½	
	• 	1	3
6.	(i) Calculation of speed 1 ½ (ii) Calculation of the distance of closest approach 1 ½		

	(i) $\frac{1}{2}mv^2 = 4\cdot1\times1\cdot6\times10^{-13}\text{J}$ $v = \sqrt{\frac{2\times4\cdot1\times1.6\times10^{-13}}{1\cdot673\times10^{-27}}}$ $= 2\cdot8\times10^{7}$ m/s (ii) $d = \frac{Ze^2}{4\pi\varepsilon_0\times E_k}$ $= \frac{9\times10^{9}\times82\times1\cdot6\times10^{-19}\times1\cdot6\times10^{-19}}{4\cdot1\times1\cdot6\times10^{-13}}$ $= 2.88 \text{ X } 10^{-14}$ m	½ ½ ½ ½ ½ ½	3
7.	Effect on angular width of central maximum in the three cases 1 ½ Justification for the three cases 1 ½ In diffraction pattern the angular width of central maximum $= \frac{2\lambda}{a}$ where a is the slit width and λ is the wavelength. (i) Increases As $\theta = \frac{2\lambda}{a}$ and $\lambda_{orange} > \lambda_{green}$ (ii) No change / no effect As θ does not depend upon the distance of the screen from the slit(D) (iii) Increases As θ is inversely proportional to the slit width(a). (Note :- Give ½ mark , if only the formula $\theta = \frac{2\lambda}{a}$ is given.)	½ ½ ½ ½ ½ ½	3

8	**a)**		

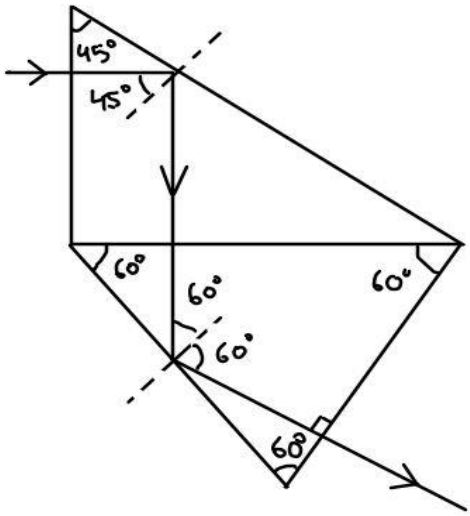
(a) Two necessary conditions	2
(b) Tracing the path of the ray	1

a) Two conditions

(i) The light must travel from an optically denser medium to a rarer medium. — 1

(ii) Angle of incidence should be greater than the critical angle. — 1

(b)



1

3

OR

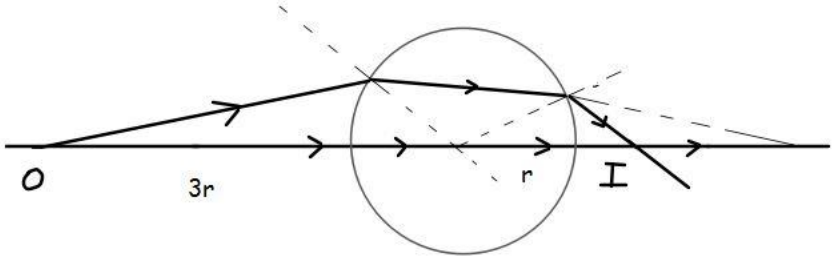
b)

(a) Obtaining conditions for two cases	2
(b) Formation of image	1

(a) Two conditions $m = \frac{h'}{h} = \frac{v}{u}$ — ½ + ½

(i) For real images / when object is placed beyond F, As u is negative and v is positive..

(ii) for virtual image / when object is kept between F and the optical centre of the lens. As u and v both are negative. — ½ + ½



1

3

9.	(i) Finding Wavelength 1 (ii) Finding Momentum 1 (iii) Finding Velocity 1		
	(i) $\lambda = \frac{1\cdot 23}{\sqrt{V}}$ nm $= \frac{1.23}{\sqrt{100}}$ $= 0\cdot 123$ nm	½ ½	
	(ii) $p = \frac{h}{\lambda}$ $= \frac{6\cdot 63\times 10^{-34}}{0\cdot 123\times 10^{-9}}$ $= 5.4\times 10^{-24}$ kg m s^{-1}	½ ½	
	(iii) $v = \frac{p}{m}$ $v = \frac{5.4\times 10^{-24}}{9\cdot 1\times 10^{-31}}$ $= 5\cdot 9\times 10^{6}$ m/s Alternative method $v = \sqrt{\frac{2eV}{m}}$ $v = \sqrt{\frac{2 \times 1.6\times 10^{-19}\times 100}{9.1 \times 10^{-31}}}$ $= 5.9 \times 10^{6}$ m/s	½ ½ ½	3
10.	(i) Calculating Fringe width 1 (ii) Calculating distances of fringes 1+1		
	(i) $\beta = \frac{\lambda D}{d} = \frac{600\times 10^{-9}\times 1.2}{8\times 10^{-4}} = 1.2mm$	½+½	
	(ii) (*a*) $x_3 = \frac{5}{2}\frac{\lambda D}{d} = \frac{5}{2}\times 1.2\,mm = 3\,mm$	½+½	
	(iii) (*b*) $x_5 = \frac{5\lambda D}{d} = 2\times 3\,mm = 6\,mm$	½+½	3

11	**a)** (i) Identification of the three em waves 1 ½ (ii) Sources of the three em waves 1 ½		
	EM Waves — Sources		
	$\lambda_1 \rightarrow$ Microwaves — magnetron valve / klystron valve / gun diodes	½+ ½	
	$\lambda_2 \rightarrow$ Ultra Violet — high voltage gas discharge tube	½+ ½	
	$\lambda_3 \rightarrow$ Infra red — hot bodies and molecules	½+ ½	3
	OR		
	b) (i) Two conditions 1 (ii) Two points of difference 2		
	(i) The two sources should emit the waves in the same phase or with a constant phase difference .	½	
	The two sources must continuously emit light wave of the same wavelength.	½	
	(ii)		
	Interference: 1) Intensity of all bright bands are nearly same; 2) All fringes are of same width.		
	Diffraction: 1) Intensity of bright bands decreases rapidly on both sides of central maxima. 2) All the fringes are not of same width / the width of central maximum is double that of the width of secondary maxima.	1+1	3
	Or any other two differences.		
	SECTION—C		
12.	(I) (B) real , virtual	1	
	(II) (A) The aperture of the objective and the eye piece	1	
	(III) (D) The microscope can be used as a telescope by interchanging the two lenses.	1	
	(IV) (D) 200	1	
	(V) (C) 200	1	5

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(PAPER CODE — 55/3/2)

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[Paper Code — 55/3/2]

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	SECTION—A		
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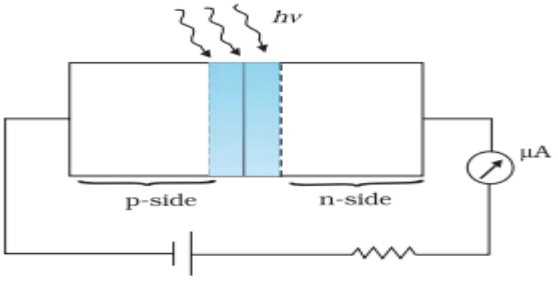
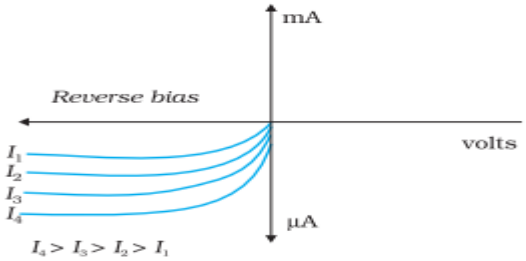
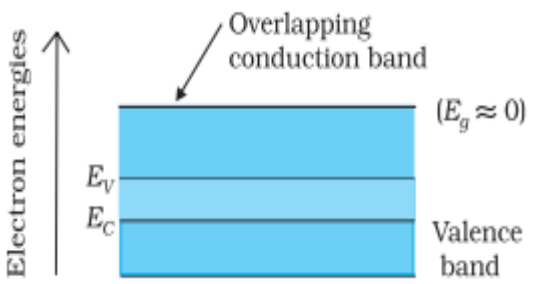
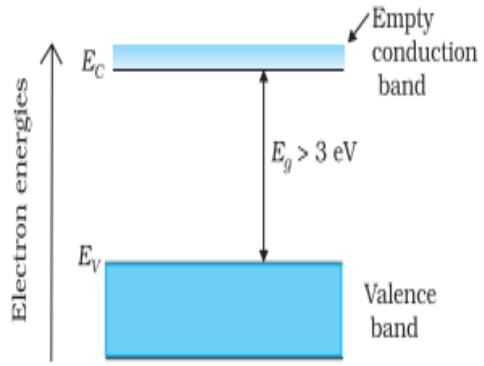
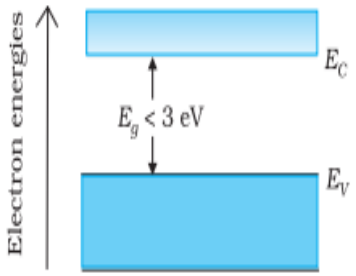
2.	(a) Circuit diagram and *I*- *V* characteristic 1 (b) To measure the light intensity using photodiode 1 (a)  (a)  (b) (b) Photo current flows in an illuminated photodiode under reverse bias. The magnitude of photocurrent varies linearly as the intensity of incident light.This fact is used to measure the light intensity.	½ ½ ½ + ½	2
3.	**a)** Distinction between isotopes and isobars 1 Explanation 1		

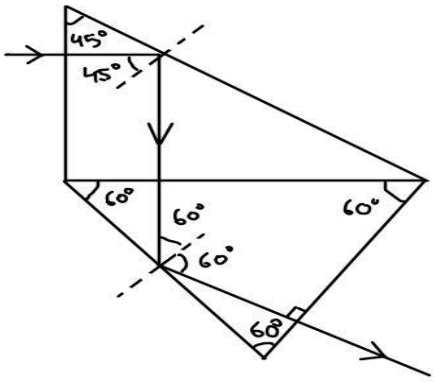
	(i) Isotopes – These are the atoms having same atomic number (Z) but different atomic mass(A). Isobars – The atoms of different element having same atomic masses. (ii) No The mass number of a nucleus is the sum of number of proton(Z) and number of neutrons (N) / $A = Z + N$ / Two nuclei with different mass numbers A_1 and A_2 , may have , have different Z . ***OR*** **b)** Two factors 1 Definition of threshold frequency 1 (i) Factors (a) Frequency of incident radiation (b) Work function of the surface (ii) The minimum frequency of the incident radiation below which photoelectric emission does not take place.	½ ½ ½ ½ ½ ½ 1	2 2
	SECTION B		
4.	a) Calculation of frequency 1 b) Determination of energy for electron emission 2 $E = h\nu$ $\nu = \frac{E}{h} = \frac{6.5 \times 10^{-19}}{6.63 \times 10^{-34}}$ $= 9.8 \times 10^{14}$ Hz b) Energy of photon in eV $E = 6.5 \times 10^{-19}$ J = 4.06 eV $\because$ $E > \emptyset_0$ There will be photoelectric emission. K.E of photoelectron $E_k = E - \emptyset_0$ = 4.06 – 2.14 = 1.92 eV	½ ½ ½ ½ ½ ½	3
5.	(i) Finding wavelength ,frequency and speed of reflected light 1 ½ (ii) Finding wavelength ,frequency and speed of refracted light 1 ½ (a) Reflected high $\lambda' = \lambda = 600$ nm. *No change in wavelength* c = 3 x 10^8 m/s in air	½ ½	

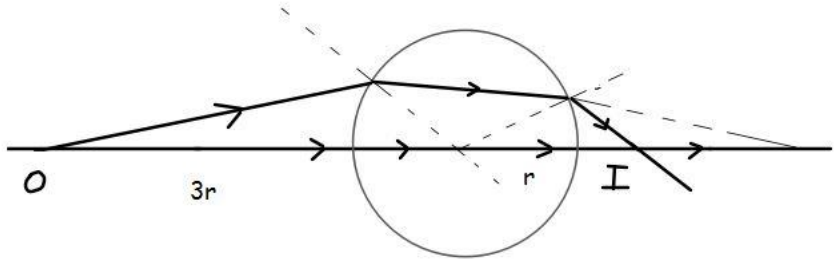
	$\upsilon = \frac{c}{\lambda} = \frac{3 \times 10^8}{5 \times 10^{14}}$ Hz Refracted light $\lambda' = \frac{\lambda}{\mu} = \frac{600}{1.33} = 451.1$ nm $\simeq 450$nm $\upsilon = \frac{c}{\mu} = \frac{3\ X10^8}{1.33}$ $= 2.26 \times 10^8$ m/s $= 5 \times 10^{14}$ Hz	½ ½ ½ ½	3
6.	**a)** (i) Identification of the three em waves 1 ½ (ii) Sources of the three em waves 1 ½ EM Waves — Sources $\lambda_1 \rightarrow$ Microwaves — magnetron valve / klystron valve / gun diodes $\lambda_2 \rightarrow$ Ultra Violet — high voltage gas discharge tube $\lambda_3 \rightarrow$ Infra red — hot bodies and molecules **OR** **b)** (i) Two conditions 1 (ii) Two points of difference 2 i) The two sources should emit the waves in the same phase or with a constant phase difference . The two sources must continuously emit light wave of the same wavelength. ii)	½+ ½ ½+ ½ ½+ ½ ½ ½ 1+1	3 3

Interference	Diffraction
1) Intensity of all bright bands are nearly same	1) Intensity of bright bands decreases rapidly on both sides of central maxima.
2) All fringes are of same width.	2) All the fringes are not of same width / the width of central maximum is double that of the width of secondary maxima.

Or any other two differences.

7.	Statement of Bohr's 2nd postulate 1 Derivation of speed 2 (i) An electron can revolve around the nucleus in an orbit in which its angular momentum is an integral multiple of $\frac{h}{2\pi}$. (ii) Proof $\frac{mv^2}{r} = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{r^2}$ $mvr = \frac{nh}{2\pi}$ Eliminating r we get $v = \frac{e^2}{2\varepsilon_0 h}\cdot\frac{1}{n}$ $\therefore v \propto \frac{1}{n}$	1 ½ ½ ½ ½	3
8	Energy band diagrams for three cases 1 ½ Bandwidth determination for conductivity ½ Effect of temperature 1    Conduction band determines electrical conductivity As temperature of a semiconductor rises, the carrier concentration (electron-hole pair) increases due to breaking of covalent bonds and the conductivity of the semiconductor increases.	½ ½ + ½ ½ 1	3

9.	(i) Calculation of speed 1 ½ (ii) Calculation of the distance of closest approach 1 ½		
	(i) $\frac{1}{2}mv^2 = 4\cdot1\times1\cdot6\times10^{-13}\,\text{J}$	½	
	$v = \sqrt{\frac{2\times4\cdot1\times1.6\times10^{-13}}{1\cdot673\times10^{-27}}}$	½	
	$= 2\cdot8\times10^{7}$ m/s	½	
	(ii) $d = \frac{Ze^2}{4\pi\varepsilon_0\times E_k}$	½	
	$= \frac{9\times10^{9}\times82\times1\cdot6\times10^{-19}\times1\cdot6\times10^{-19}}{4\cdot1\times1\cdot6\times10^{-13}}$	½	
	$= 2.88 \text{ X } 10^{-14}$ m	½	3
10.	Effect on spacing between fringes 1 ½ Justification 1 ½		
	Spacing between fringes in Young's doubles slit experiment $\beta = \frac{\lambda D}{d}$		
	1) β decreases as d increases as $\beta \propto \frac{1}{d}$	½ + ½	
	2) $\lambda_{blue} < \lambda_{red}$ as $\beta \propto \lambda$ $\therefore$ fringe width decreases.	½ + ½	
	3) $\beta' = \frac{\beta}{\mu}$ $\therefore$ β decreases as $\mu > 1$ [$\therefore$ $\mu = 1.2$]	½ + ½	3
11.	**a)** (a) Two necessary conditions 2 (b) Tracing the path of the ray 1		
	a) Two conditions		
	(i) The light must travel from an optically denser medium to a rarer medium.		
	(ii) Angle of incidence should be greater than the critical angle.	1	
	(b) 	1 1	3

	OR **b)** (a) Obtaining conditions for two cases 2 (b) Formation of image 1 (a) Two conditions $m = \frac{h'}{h} = \frac{v}{u}$ (i) For real images / when object is placed beyond F, As u is negative and v is positive.. (ii) for virtual image / when object is kept between F and the optical centre of the lens. As u and v both are negative.  	½ + ½ ½ + ½ 1	3
	SECTION—C		
12.	(I) (B) real , virtual (II) (A) The aperture of the objective and the eye piece (III) (D) The microscope can be used as a telescope by interchanging the two lenses. (IV) (D) 200 (V) (C) 200	1 1 1 1 1	5

* * *

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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 totalled 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 35answer books per day in other subjects (Details are given in Spot Guidelines). f the This is in view o .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 un assessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong totalling 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 totalling on the title page.
    - Wrong totalling 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 un assessed portion, non-carrying over of marks to the title page, or totalling 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 totalled 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

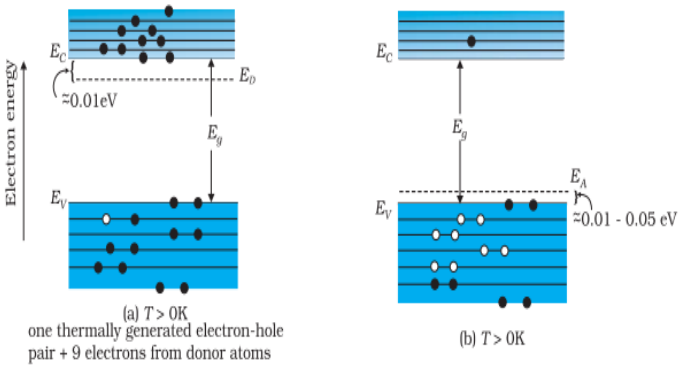
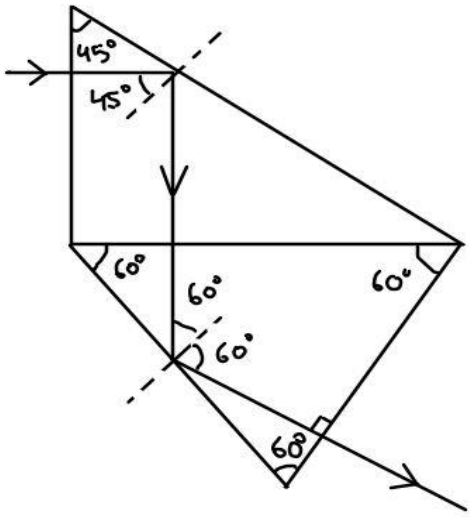
Senior Secondary School Examination TERM–II, 2022

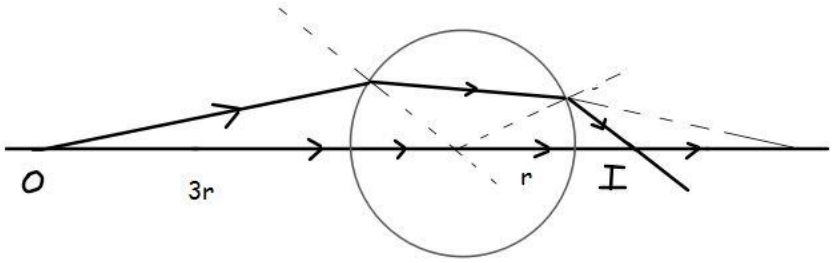
PHYSICS (Subject Code — 042)

[Paper Code — 55/3/3]

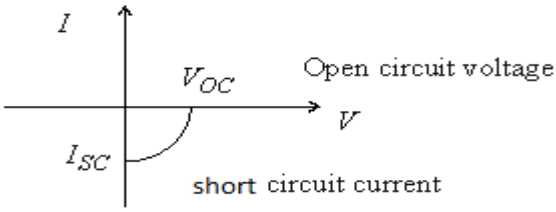
Maximum Marks : 35

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total marks
	SECTION—A		
1.	**a)** Distinction between isotopes and isobars 1 Explanation 1		
	(i) Isotopes – These are the atoms having same atomic number (Z) but different atomic mass(A).	½	
	Isobars – The atoms of different element having same atomic masses.	½	
	(ii) No, the mass number of a nucleus is the sum of number of proton(Z) and number of neutrons (N) / $A = Z + N$ / Two nuclei with different mass numbers A_1 and A_2 , may have , have different Z .	½ + ½	2
	OR		
	b) Two factors 1 Definition of threshold frequency 1		
	(i) Factors		
	(a) Frequency of incident radiation	½	
	(b) Work function of the surface	½	
	(ii) The minimum frequency of the incident radiation below which photoelectric emission does not take place.	1	2
2	Explanation of movement of charge carriers / diffusion 1 Formation of the barrier potential 1		
	The diffusion of electrons from n-region to p-region and that of the holes from p-region to n-region creates positive charge on the n-side and negative charge on the p-side which causes a difference of potential across the junction.	1	2
	This potential, setup across the junction tends to prevent the movement of electrons from the n-region to p-region .This is called barrier potential.	1	
3	(a) Naming of semiconductor ½ + ½ (b) Drawing of energy band diagram ½ + ½		

	a) (i) p-type semiconductor (ii) n-type semiconductor **b)**  	½ ½ ½ + ½	2
	Section B		
4.	**a)** (a) Two necessary conditions 2 (b) Tracing the path of the ray 1 a) Two conditions (i) The light must travel from an optically denser medium to a rarer medium. (ii) Angle of incidence should be greater than the critical angle. (b)  **OR** **b)** (a) Obtaining conditions for two cases 2 (b) Formation of image 1	 1 1 1	3

	(a) Two conditions $m = \frac{h'}{h} = \frac{v}{u}$ (i) For real images / when object is placed beyond F, As u is negative and v is positive.. (ii) for virtual image / when object is kept between F and the optical centre of the lens. As u and v both are negative.  	½ + ½ ½ + ½ 1	3
5.	(i) Calculation of energy - 1 (ii) Maximum kinetic energy - 1 (iii) Stopping potential - 1 i) E = $h\nu$ $= 6.63 \times 10^{-34} \times 6.4 \times 10^{14}$ $= 4.24 \times 10^{-19}$ J =2.65 eV ii) $K_{max} = E - \emptyset_0$ = 2.65 – 2.31 = 0.34eV iii) $eV_o = K_{max}$ $V_o = 0.34$ V	½ ½ ½ ½ ½ ½	3
6.	(i) Distance of bright fringe for central maxim 1 ½ (ii) Least distance from central maxima where bright fringes due to both wavelength coincide 1 ½ i) $x_n = n\frac{\lambda D}{d}$ $x_2 = \frac{2 \times 500 \times 10^{-19} \times 0.60}{10^{-3}}$ = 0.6 mm ii) $n_1\lambda_1 = n_2\lambda_2$	½ ½ ½ ½	

	$n \times 600 = (n + 1)\, 500$ $n = 5$ $x_5 = \dfrac{5\lambda D}{d}$ $x_5 = \dfrac{2x600x10^{-9}x0.60}{10^{-3}}$ $= 1.8$ mm	½ ½	3
7.	**a)** (i) Identification of the three em waves 1 ½ (ii) Sources of the three em waves 1 ½ EM Waves — Sources $\lambda_1 \rightarrow$ Microwaves — magnetron valve / klystron valve / gun diodes $\lambda_2 \rightarrow$ Ultra Violet — high voltage gas discharge tube $\lambda_3 \rightarrow$ Infra red — hot bodies and molecules **OR** **b)** (i) Two conditions 1 (ii) Two points of difference 2 (i) The two sources should emit the waves in the same phase or with a constant phase difference . The two sources must continuously emit light wave of the same wavelength. (ii) **Interference**: 1) Intensity of all bright bands are nearly same; 2) All fringes are of same width. **Diffraction**: 1) Intensity of bright bands decreases rapidly on both sides of central maxima. 2) All the fringes are not of same width / the width of central maximum is double that of the width of secondary maxima. Or any other two differences.	½+ ½ ½+ ½ ½+ ½ ½ ½ 1+1	3 3
8.	Effect on angular width of central maximum in the three cases 1 ½ Justification for the three cases 1 ½		

	In diffraction pattern the angular width of central maximum $=\frac{2\lambda}{a}$ where a is the slit width and λ is the wavelength. (i) Increases As $\theta=\frac{2\lambda}{a}$ and $\lambda_{orange} > \lambda_{green}$ (ii) No change / no effect As θ does not depend upon the distance of the screen from the slit(D) (iii) Increases As θ is inversely proportional to the slit width(a). (Note :- Give ½ mark , if only the formula $\theta=\frac{2\lambda}{a}$ is given.)	½ ½ ½ ½ ½ ½	3
9.	Generation of emf 2 I - V characteristics 1 Three processes due to which emf is generated in a solar cell are . (i) Generation of electron-hole pairs due to light incident close to the junction. (ii) Separation of electrons and holes due to electric field of the depletion region. Electrons swept to n-side and holes to p-side. (iii) The electrons reaching the n-side are collected by the front contact and the holes reaching the p-side are collected by the back contact. • Thus p-side becomes positive and n-side becomes negative giving rise to photovoltage.  	½ ½ ½ ½ 1	3
10	(a) Explanation for conclusion by James Chadwick 1 ½ (b) Explanation for same radius of nuclei 1 ½ a) If the neutral radiation consisted of photons then from the conservation of energy and momentum, the energy of photons would have to be much higher than the energy available from the bombardment of beryllium nuclei with α- particles. He assumed that the neutral radiation consists of a new type of neutral particles called neutron	1 ½	

	b) Radius R of a nucleus depends on mass number A, $R \alpha A^{\frac{1}{3}}$ Where $A = N + Z$ In case of Isobars mass number is same but N and Z are not equal.	½ ½ ½	3
11	(a) Finding the Kinetic and potential energy of electron 1+1 Calculation of fraction of volume occupied by nucleus 1 E= -1.51eV $K = - E$ =1.51 eV $U = 2E$ = -3.02eV Fraction of volume occupied by the nucleus $= \frac{\frac{4}{3}\pi r^3 nucleus}{\frac{4}{3}\pi r^3 atom}$ $= \left(\frac{r_{nucleus}}{r_{atom}}\right)^3$ $= \left(\frac{0.5 x10^{-15}}{5.3x10^{-11}}\right)^3$ = 8.3 x 10 $^{-16}$	½ ½ ½ ½ ½ ½	3
	SECTION—C		
12.	(I) (B) real , virtual (II) (A) The aperture of the objective and the eye piece (III) (D) The microscope can be used as a telescope by interchanging the two lenses. (IV) (D) 200 (V) (C) 200	1 1 1 1 1	5

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