Strictly Confidential: (For Internal and Restricted use only)
Senior Secondary School Examination September-2020
Marking Scheme – SUBJECT: PHYSICS THEORY (042)
CODE: 55/C/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 70 (example 0-70 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 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).
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.

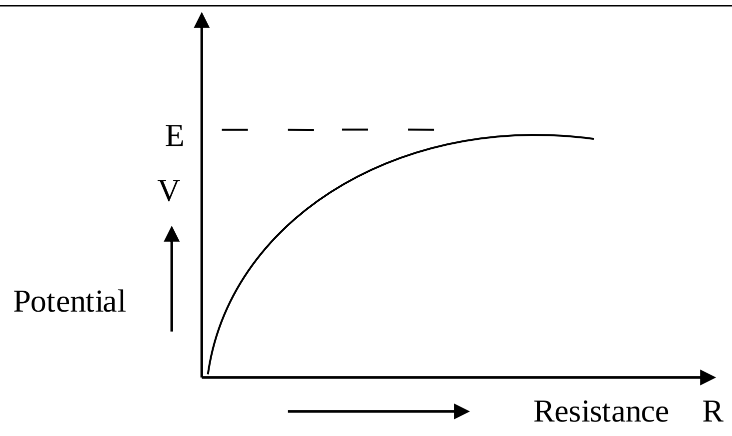
13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.

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.

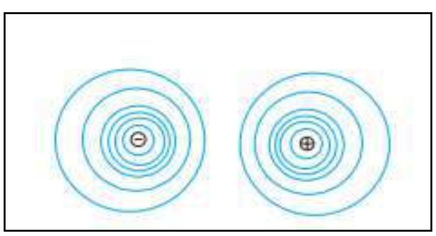
15. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

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: Physics (042)			
Code :55/C/3			
Q. No.	**VALUE POINTS/ EXPECTED ANSWERS**	**Marks**	**Total Marks**
	SECTION A		
1	(D) Number of both the free electrons and holes increases equally.	1	1
2	(C) III	1	1
3	(c) $\frac{F}{2}$	1	1
4	(A) + $\frac{d}{4}$	1	1
5	(C) 1	1	1
6	(C) $(\frac{r_1}{r_2})^2$	1	1
7	(A) charge on the capacitor will increase	1	1
8	(A) Linear momentum	1	1
9	(D) 2:1	1	1
10	$(A)\ \pi: 4$	1	1
11	90°	1	1
12	2π	1	1
13	$\frac{h}{\pi}$ OR 9×10^{14}J	1	1
14	Red	1	1
15	electrons	1	1
16		1	

	Alternatively V= E - Ir $V=E - \left(\frac{E}{R+r}\right)r$ (Award half mark of this question to the student if he/she write just formula.)		1
17	X is α-particle (Note: Award half mark when a child finds out the correct atomic number and mass number of D_2 i.e 70 & 176) OR curves 1 & 2	1	1
18	Virtual (Note: Award half mark if a child shows that focal length will become negative using Lens maker formula and does not conclude about nature of image.)	1	1
19	X Alternatively Slope = $\frac{1}{R}$ $R= \rho \frac{l}{A}$ $R_x > R_y$ (Award half mark of this question, if a student writes the correct answer in terms of Resistance.)	1	1
20	When a charge of one coulomb develop potential of one volt between the plates of capacitor its capacity is said to be one farad.	1	1
	SECTION B		
21	(a) Identification 1/2 One Application 1/2 (b) Identification 1/2 (c) One Application 1/2 (a) X-rays Application:1. To detect fracture in the bone 2. To study crystal structure	1/2 1/2	

	3. In the treatment of cancer(Any one application) Give full credit to any other correct application. (b) Gamma rays Application: Used in cancer and tumor treatment	 1/2 1/2	 2
22	Definition of quality factor — 1 Two methods to double the quality factor — 1/2 + 1/2 It is the ratio of resonant angular frequency to the bandwidth of a series LCR circuit **Alternatively** Q-factor = $\frac{\omega o}{2\Delta\omega}$ **Alternatively** It is the ratio of potential difference across inductor or capacitor to the potential difference across resistor at resonance. **Alternatively** Q-factor $= \frac{1}{R}\sqrt{\frac{L}{C}}$ **Alternatively** It is the factor which determines the sharpness/ selectiveness of series LCR circuit. **Methods** 1. By reducing the resistance to half its initial value 2. By doubling the value of inductance and reducing the value of capacitance to half	 1 1/2 1/2	 2
23	(a) Depiction of equipotential surfaces — 1 (b) Finding the amount of work done — 1 **(a)**  (b) W=q_0 Δ V	 1	

	As a small test charge q_o is moving along x-axis which is equipotential line for a given system, therefore $\Delta V = 0$ Hence W=0	$1/2$ $1/2$	2
24	(a) Sequence of color bands 1 (b) Two properties of wire $(\frac{1}{2}+\frac{1}{2})$ (a) Yellow , Violet, Orange and Silver (Note: if student does not write silver award half mark of this part.) (b) **(**1) Low temperature coefficient of Resistivity. (2) High Resistivity	1 $1/2$ $1/2$	2
25	Reason for part (a) 1 Reason of part (b) 1 (a) Zener diode is fabricated by heavy doping of both p-side, and n-side of the junction. Due to this, depletion region formed is very thin and the electric field of the junction is extremely high. (b) It is easier to observe the change in the current with change in the light intensity, if reverse bias is applied. OR Circuit Diagram $1/2$ Working of p-n junction 1 I-V Characteristics $1/2$	1 1 $1/2$	

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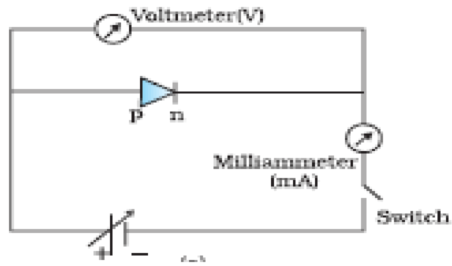
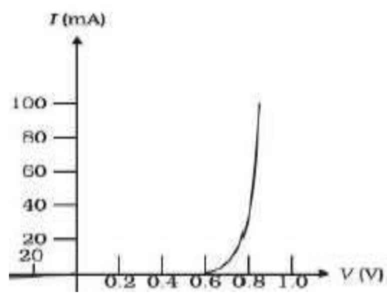
<td>

In the forward bias the width of depletion layer decreases and barrier height is reduced.
It supports the movement of majority charge carriers across the junction.
As soon as supply voltage exceeds barrier potential instantaneously current begins to
flow through junction and increases exponentially with forward biasing voltage.
(Note: Accept any other relevant explanation for working)
I-V characteristics

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$^1/_2$</td>
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<td>26</td>
<td>Formula for half life $^1/_2$
Calculation of half life 1
Calculation of Critical mass $^1/_2$

$N = N_o \left(\frac{1}{2}\right)^n$
$\frac{1}{16} N_o = N_o \left(\frac{1}{2}\right)^n$
$n = 4$
$t = n \times T_{1/2}$
$T_{1/2} = \frac{t}{n} = \frac{4}{4} = 1$ day</td>
<td>$^1/_2$
$^1/_2$
$^1/_2$</td>
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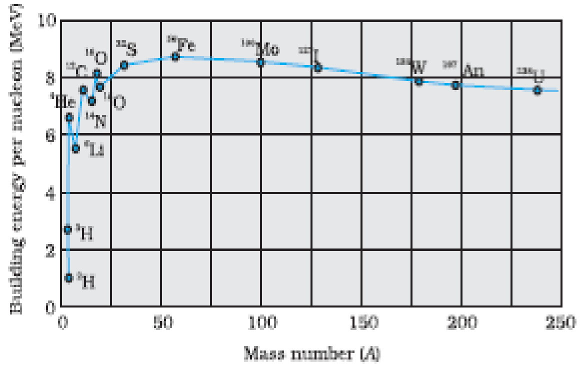
	N= $N_o \left(\frac{1}{2}\right)^n$ = $N_o \left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}}$	$^1/_2$	
	4= $N_o \left(\frac{1}{2}\right)^6$		
	N_o = 256 g		
	Alternative Method	$^1/_2$	
	N= $N_o\, e^{-\lambda t}$		
	$\frac{1}{16} N_o = N_o\, e^{-\lambda 4}$		
	16= $e^{4\lambda}$		
	4 $\log_e 2$ = 4 λ	$^1/_2$	
	4x 2.303 x 0.3010 = 4 λ		
	λ = 0.693 per day		
	Half life	$^1/_2$	
	$T_{1/2} = \frac{0.693}{\lambda} = \frac{0.693}{0.693}$ = 1 day	$^1/_2$	
	4= $N_o\, e^{-\lambda t}$		
	N_o = 256 g		
	(Note: Give full credit of this part, if student substitutes values correctly and is not able to calculate final answer.)		
	OR		
	Formula $^1/_2$		
	Conversion of kinetic energy in Joule $^1/_2$		
	Finding the distance of closest approach 1	$^1/_2$	
	$d = \frac{q_1 q_2}{4\pi\epsilon_0\, K}$	$^1/_2$	
	kinetic energy= 5.12 MeV		
	= 5.12 × 1.6×10^{-13} J		
	= 8.192×10^{-13} J	$^1/_2$	
	d = $\frac{q_1 q_2}{4\pi\epsilon_0\, K} = \frac{9\times10^9\times2e\times79e}{8.192\times10^{-13}}$ m	$^1/_2$	
	= 4.443× 10^{-14} m		
	= 44.4 × 10^{-15} m		2
27			

Binding energy curve	1
Explanation of middle flat portion of the curve	1



1

Note: please don't deduct marks if student does not mark all the nuclei on the curve.

The nuclei lying at the middle flat portion are more stable because their binding energy per nucleon is large and shows more stability. 1

Total: 2

SECTION C

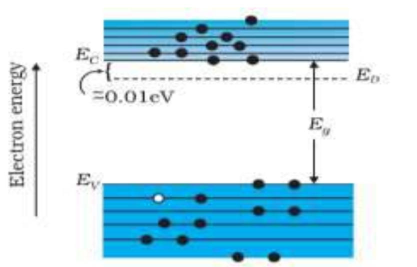
28

(a) Explanation of energy bands	1
(b) (i) conversion into p-type	½
(ii) conversion into n-type	½
c) Diagram	½ +1/2

(a) In silicon semiconductor there are two energy bands,conduction band and valence band separated by energy band gap.balance band is filled completely or partially with electron while conduction band is empty 1

(b) (i) by adding trivalent /13th Group element ½

(ii) by adding pentavalent /15th Group element 1/2



1/2

(a) $T > 0K$
one thermally generated electron-hole pair + 9 electrons from donor atoms

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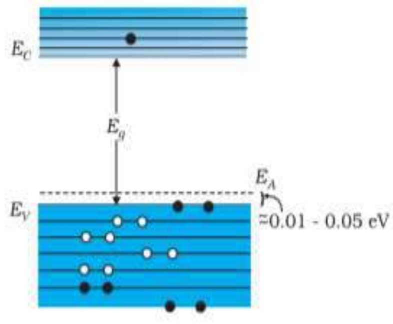
<tr><td></td><td>

(b) T > 0K</td><td>1/2</td><td>3</td></tr>
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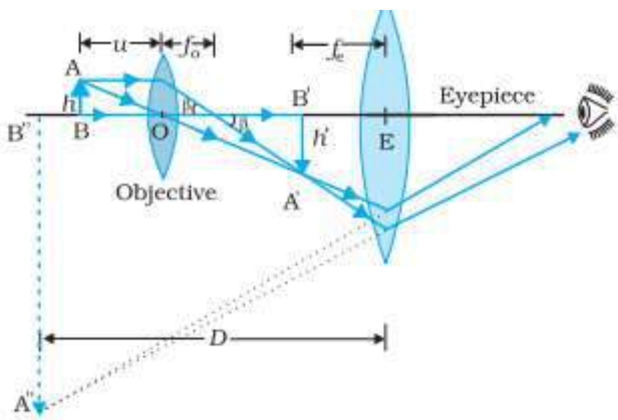
(a) Ray Diagram	$1\,^1/_2$
(b) Expression of magnifying power	$1\,^1/_2$

Ray diagram



Note: deduct half mark, if a student does not mark the direction of propagation of the

rays)

Expression for magnification

$m_o = \frac{h'}{h} = \frac{L}{fo}$

where we have used the result

$\tan\beta = \left(\frac{h}{fo}\right) = \frac{h'}{L}$

$m_e = \left(1 + \frac{D}{fe}\right)$

Magnifying power of microscope at near point.

$m = m_o\, m_e$</td><td>$1^1/_2$

$^1/_2$

$^1/_2$</td><td></td></tr>
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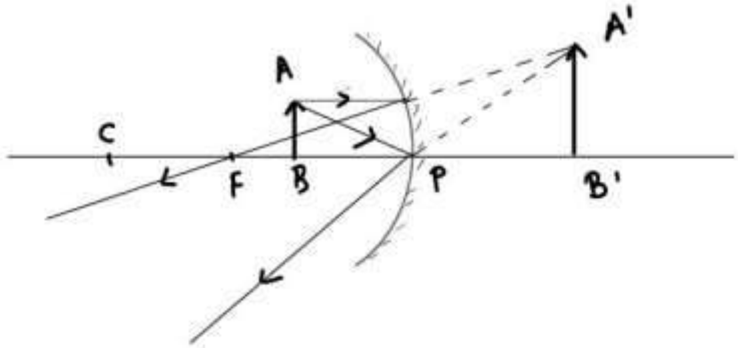
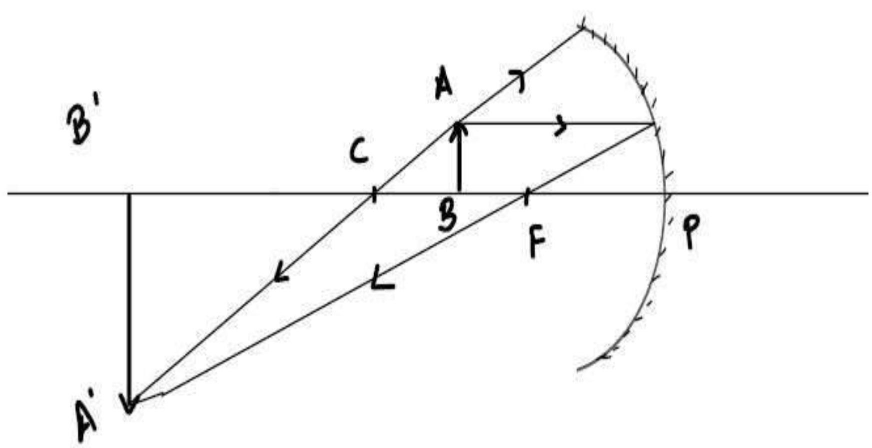
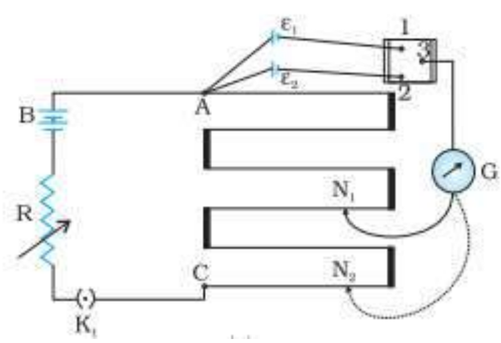
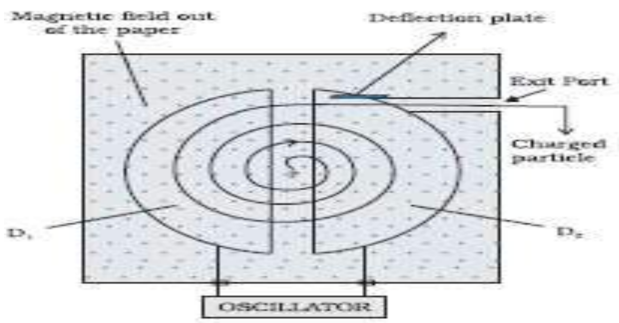
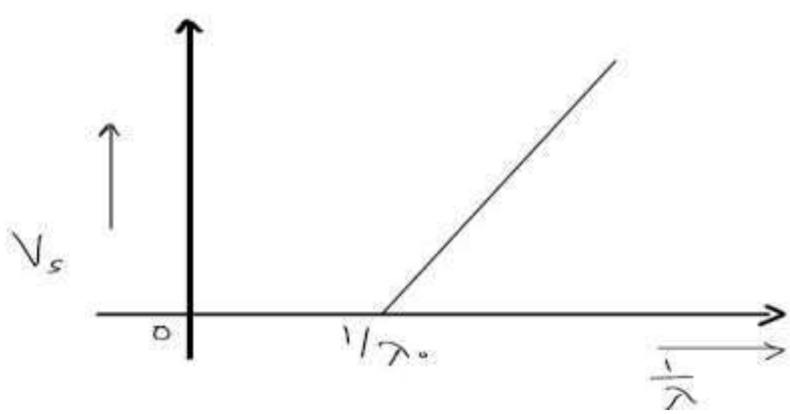
	$m = \frac{L}{f_o}(1+\frac{D}{f_e})$	$^1/_2$	3
Q30	a) Diagram 1 ½ Diagram 2 ½ b) For formula $\frac{1}{f} = \frac{1}{V} + \frac{1}{u}$ For formula $\frac{v}{u} = m$ } ½ Calculation of distance of object for two cases ½ + ½ Calculation of distance ½		
		½	
	a) 	½	
	For three times enlarged virtual image f = -12 cm m = 3 $m = -\frac{v}{u}$ v = -3u	½	

	$\frac{1}{-12} = \frac{1}{-3u} + \frac{1}{u}$ $3u = -24$ $u = -8$ cm For three times enlarged real image $f = -12$ cm $m = -3$ $m = -\frac{v}{u}$ $v = 3u$ $\frac{1}{f'} = \frac{1}{v'} + \frac{1}{u'}$ $\frac{1}{-12} = \frac{1}{3u'} + \frac{1}{u'}$ $3u^1 = -48$ $u' = -48$ $u' = -16$ cm Distance between two positions of objects $d = u' - u = 8$ cm	½ ½ ½	3
Q31	Circuit diagram — 1 Working for comparing e.m.f — 1½ Preference potentiometer over voltmeter (Reason) — 1/2  **Working :-** A current I flows through wire which can be varied by a variable Resistance (Rheostat ,R) in the circuit. Since the wire is uniform, the potential difference between A and any point at a distance l from A is $E_1 = \varphi l$ Where φ is the potential drop per unit length Circuit shows an application of the potentiometer to compare the emf of the two cells of emf E_1 and E_2 . The points marked 1,2,3 form a two way key. Consider first a position of key where 1 and 3 are connected so that the galvanometer is	1 ½	

	connected to E_1. The jockey is moved along the wire till at a points N_1 , at a distance l_1 from A , there is no deflection in the galvanometer. We can apply Kirchhoff's loop rule to the closed loop AN_1G31A and get $\Phi l_1 + 0 - E_1 = 0$ -----------------------(1) Similarly , if another emf E_2 is balanced against l_2 (AN_2) $\Phi l_2 + 0 - E_2 = 0$ -----------------------(2) From last two equation $\frac{E_1}{E_2} = \frac{l_1}{l_2}$ We prefer potentiometer because it does not draw any current from the voltage source being used.	½ ½ ½	3
Q32	(a) Labeled diagram 1 Explanation of Working 1 (b) Explanation of motion on ions 1 (a)  Working: The charged particle is allowed to move under the influence of crossed electric and magnetic field, the magnetic field provides the circular path to the particle and Rotate it inside two semi circular discs, when it jumps from one disc to another disc particle is accelerated by the electric field and each time the acceleration increases the energy of the particle. (b) Ions will not get accelerated.	1 1 1	3
Q33	(a) Working Principle of ac generator 1 Derivation of expression for induced emf 1 (b) Function of Slip Rings 1		

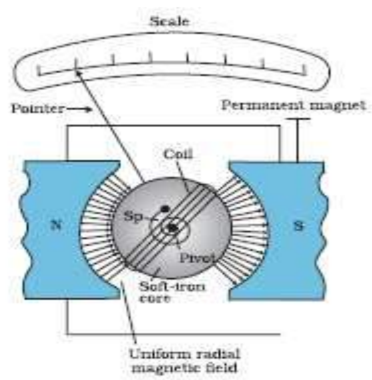
	(a) It is based upon the principle of electromagnetic induction. Magnetic Flux $\Phi = \text{NBA} \cos\theta$ $\Phi = \text{NBA} \cos \omega t$ According to Faradays law Emf e= $\frac{-d\Phi}{dt} = \frac{-d(\text{NBA}\cos\omega t)}{dt}$ e = NBA ω sin ωt (b) it helps current to change its direction after every half rotation. OR Explanation of parts (a),(b) & (c) (1+1+1) (a) As power P=V I, In step-up voltage transformer output voltage (V) is more than the input voltage. Hence output current is less than the input current. (b) To minimize the eddy currents. (c) Input power is more than the output power because in actual transformer small energy loses occur due to flux leakage, resistance of winding, eddy current and hysteresis etc.	1 $1/2$ $1/2$ 1 1 1 1	 3
Q34	a) Expression for stopping potential 1 b) Graph 1 c) Determination of Planck's constant ½ Determination of work function ½ a) $V_s = \frac{hc}{e}\left(\frac{\lambda o - \lambda}{\lambda\lambda o}\right)$  b) **c)** h $= \frac{e}{c} \times$ *Slope of line*	 1 1	

	φ_o = hc × intercept of the line on X –axis or φ_o = e × intercept of the line on y –axis	½ ½	3
	SECTION -D		

Q35

(a) Diagram of moving coil galvanometer	1
Working	1
Justification for using radial magnetic field	$^1/_2$
(b) Calculation of Resistance	2 $^1/_2$

(a)



1

Working: when a current flow through the coil, a torque acts on it.

τ=NIAB

Where symbols have their usual meaning. since the field is radial by design, we have taken $\sin\theta$ =1 in the above expression for torque. The magnetic torque NIAB tends to rotate the coil. A spring provide a counter torque k∅ that balances the magnetic torque NIAB; resulting in a steady angular deflection ∅. In equilibrium

$$k\,\emptyset = NIAB$$

Where k is the tensional constant of the spring. The deflection ∅ is indicated on the scale by a pointer attached to the spring. We have $^1/_2$

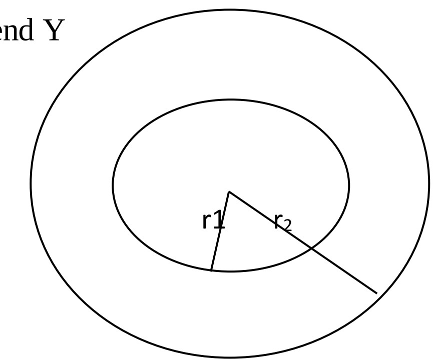
$$\emptyset = \left(\frac{NAB}{k}\right)I$$

To calibrate the scale of galvanometer/to make scale linear $^1/_2$

(b) $R = \frac{V}{I_g} - G$ $^1/_2$

$R_1 = \frac{V}{I_g} - G \quad = 2000 = \frac{V}{I_g} - G$ ……… (1)

	$R_2 = \frac{V}{I_g} - G \quad = 5000 = \frac{2V}{I_g} - G$ ……….(2) $R = \frac{V}{2I_g} - G$ ……….(3) from equation 1 & 2 $3000 = \frac{V}{I_g}$ From equation (1) 2000=3000-G G= 1000 Ω $R = \frac{3000}{2} - 1000$ R= 1500 – 1000 R= 500 Ω	$^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$	
	OR (a) (i) Expression for emf induced and polarity — $1\,^1/_2 + ^1/_2$ (ii) Magnitude and direction — $^1/_2 + ^1/_2$ (b) Calculation of mutual inductance — 2 (a) (i) Magnetic flux linked with the loop at any instant of time is $\emptyset_B = B(lx)$ $\left\|\frac{d\emptyset_B}{dt}\right\| = Bl\frac{dx}{dt}$ $\left\|\frac{d\emptyset_B}{dt}\right\| = Bl_v \qquad \because (\frac{dx}{dt} = v)$ According to Faradays Law of Electromagnetic induction $\left\|\frac{d\emptyset_B}{dt}\right\| = e$ Hence e= B*l*v **Alternative Method** (i) When rod moves outwards, according to Lorentz magnetic force $\overrightarrow{F_m} = q(\vec{V} \times \vec{B})$ Free electrons inside the conductor experience force towards the end X. the positive charge moves towards end y of the conductor due to accumulation of charges emf is developed across the conductor. Consider a charge 'q' at the end X, work done by magnetic field in moving it through the length '*l*' of the conductor is $W = F_m l$	$^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$	

	$= (qvB \sin\theta)\, l$ $W = qvBl \quad (\therefore \theta = 90°)$ According to definition of emf $e = \frac{W}{q} = vBl$ Hence, emf $e = vBl$ The end X of coil be at lower potential and Y will be at higher potential. (ii) $I = \frac{e}{r}$ $I = \frac{Bvl}{r}$ Direction of induced current is from end X to end Y  (b) $M = \frac{\mu_0 \pi r_1^2}{2r_2}$ $= \frac{4\pi\times10^{-7}\times\pi\times0.5^2\times10^{-4}}{2\times11\times10^{-2}}$ H $= 2 \times (0.25) \times 10^{-9} \times \frac{\pi^2}{11}$ H $= 4.49 \times 10^{-10}$ H	½ ½ ½ ½ ½ ½ ½ ½ ½	5
Q36	(a) (i) Ray diagram of TIR in optical fiber 1 (ii) Ray diagram for TIR in prism 1 (b) Calculation for value of μ 3 (a) (i)		

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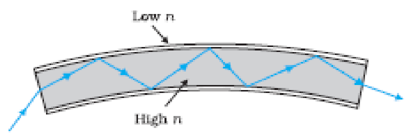

FIGURE 9.16 Light undergoes successive total internal reflections as it moves through an optical fibre.
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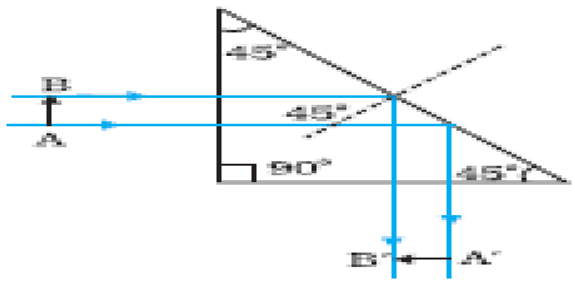
(ii)



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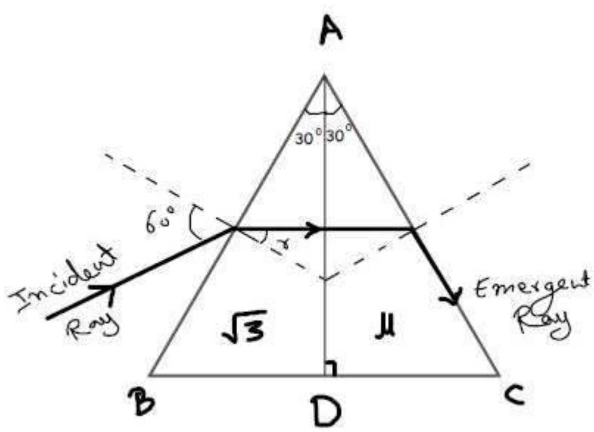
(b)



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<td>From Snell's Law</td>
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$\mu = \dfrac{\sin i}{\sin r}$

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i =60° , $\mu = \sqrt{3}$

$\sqrt{3} = \dfrac{\sin 60°}{\sin r} \quad = \dfrac{\sqrt{3}}{2(\sin r)}$

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<td>$^1/_2$</td>
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sin r= $\frac{1}{2}$ = sin 30° $\frac{1}{2}$

r= 30°

So, ray will go perpendicular to AD For II[nd] prism $\frac{1}{2}$

i_c = 30°

∴ sin i_c = $\frac{1}{\mu}$ $\frac{1}{2}$

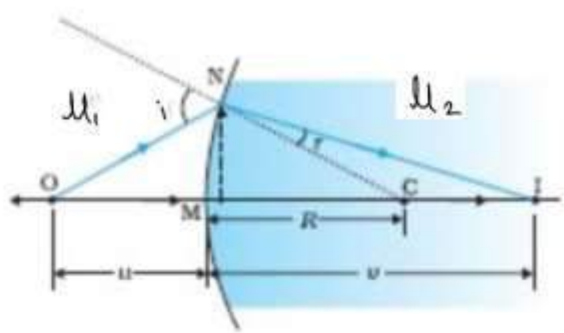
Sin 30° = $\frac{1}{\mu}$

$\mu = 2$

OR

(a) Derivation of the relation between μ_1 , μ_2 and R	3
(b) Find the intensity of light transmitted by P_1 and P_2	2

(a) $\frac{1}{2}$



$\frac{1}{2}$

$\tan \angle NOM = \frac{MN}{OM}$

$\tan \angle NCM = \frac{MN}{MC}$

	$\tan \angle NIM = \frac{MN}{MI}$		
	Now, for Δ NOC, L_i is the exterior angle	$^1/_2$	
	Therefore, $\angle i = \angle NOM + \angle NCM$		
	$\angle i = \frac{MN}{OM} + \frac{MN}{MC}$ ……..(1)		
	Similarly,	$^1/_2$	
	$r = \angle NCM - \angle NIM$		
	i.e $r = \frac{MN}{MC} - \frac{MN}{MI}$ ………..(2)		
	By snells law		
	$\mu_1 \sin i = \mu_2 \sin r$		
	For small angle		
	$\mu_1 i = \mu_2 r$	$^1/_2$	
	Substituting i and r from equation 1 & 2, we get		
	$\frac{\mu_1}{OM} + \frac{\mu_2}{MI} = \frac{\mu_2 - \mu_1}{MC}$ ………..(3)		
	Here		
	OM= -u, MI=+v, MC= +R	$^1/_2$	
	On substituting in equation 3, we get		
	$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$	$^1/_2$	
	Note: Give full credit of this part, if a student takes medium of μ_1 as denser and μ_2 as rarer	$^1/_2$	

	(b) According to Malus's law, intensity of light transmitted from P_2 $I_{p_2} = I_o \cos^2\theta$ Where $I_o = \frac{2}{2}$ mW = 1mW Here $\theta = 60°$ I_{p_2} = (1 mW) $\cos^2 60°$ $I_{p_2} = \frac{1}{4}$ mW = 0.25 mW	$^1/_2$ $^1/_2$	5
Q37	(a) Derivation of expression for Capacitance 2 (b) Expression for the Force experienced 1 (a) Electric field believes the plates of parallel plate capacitor. $E = \frac{\sigma}{\in_0} = \frac{Q}{A\in_0}$ We know $V = Ed = \frac{\sigma}{A\in_0} d$ As capautance $C = \frac{Q}{V}$ $C = \frac{\in_{0A}}{d}$ (b) Electric Field due to the positive plate on the negative plate $E = \frac{\sigma}{2\in_0} = \frac{\sigma}{2A\in_0}$ Hence Force experienced by negative plate due to positive plate $F = -qE = -q\times \frac{q}{2A\in_0} = -\frac{q2}{2A\in_0}$ -ve sign shows attractive force. (c) C_2 , C_3 and C_4 are connected in series. $\frac{1}{Cs} = \frac{1}{C_2}+\frac{1}{C_3}+\frac{1}{C_4} = \frac{1}{12}+\frac{1}{12}+\frac{1}{12}$ Cs =4 µF Equivalent capacitance of the Network $C = C_s + C_4$ = 4µF + 12 µF = 16 µF	 $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$	

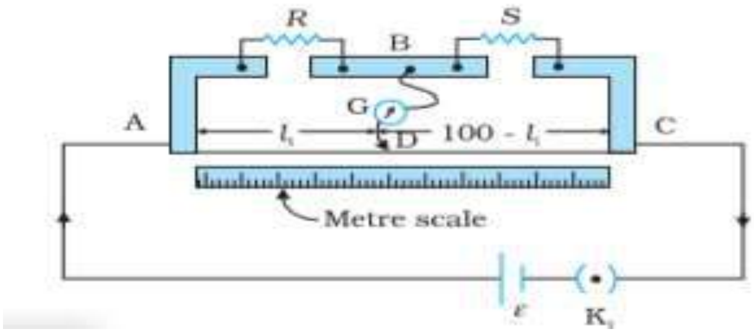
	Total charge Q=CV $=16 \times 10^{-16} \times 100$ $Q=1600\ \mu C$	$1/2$ $1/2$	

OR

a)	Principle of Wheatstone Bridge	1
	Circuit Diagram	1
	Determination of specific resistance	1
b)	Calculation of potential difference between A & C	2

(a) Principle: If four resistors R_1, R_2, R_3 and R_4 are connected in the four sides of a quadrilateral. The galvanometer is connected in one of the diagonal and battery is connected across another diagonal then the conductors. 1

$\frac{R_1}{R_2} = \frac{R_3}{R_4}$ provides no current flows through the galvanometer



1

For specific resistance when no current flows in galvanometer

$\frac{R}{S} = \frac{R_{AD}}{R_{DC}}$ ……….. 1

$\frac{R_{AD}}{R_{DC}} = \frac{l}{100-l}$ ……….. 2

$1/2$

From equation 1 & 2

$\frac{R}{S} = \frac{l}{100-l}$

$R = S\left(\frac{l}{100-l}\right)$

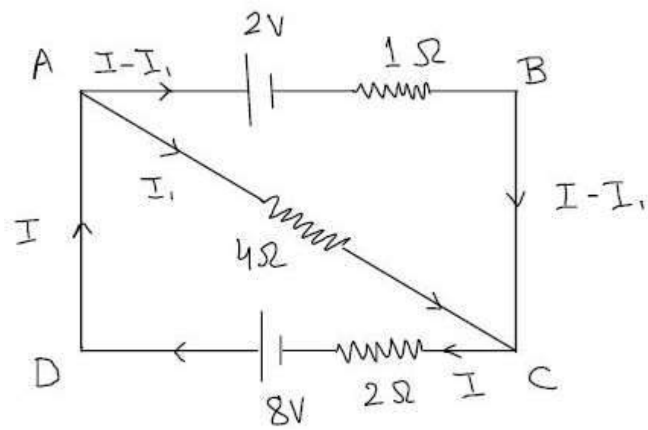
Resistivity of the wire

$\rho = \frac{RA}{L} = R\frac{\pi r^2}{L}$ ½

where L = Length of unknown resistance wire

r = radius of unknown resistance wire

(b)



In loop ACDA

$4I_1 + 2I = 8$

$2I_1 + I = 4$ ……….. (1)

½

In loop ABCA

$(I-I_1) \times 1 - 4I_1 = -2$

$I - I_1 - 4I_1 = -2$

$I - 5I_1 = -2$

$5I_1 - I = 2$ ……….. (2)

½

By adding Equation (1) & (2)

$5I_1 - I = 2$

$\underline{2I_1 + I = 4}$

$7I_1 = 6$

$I_1 = \frac{6}{7}A$ ½

$V = I_1R = \frac{6}{7} \times 4$

$V = \frac{24}{7}$ volt

½ 5