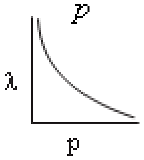
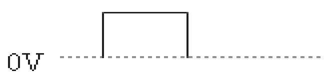
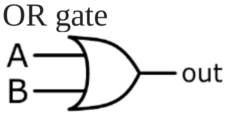
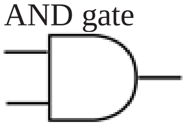
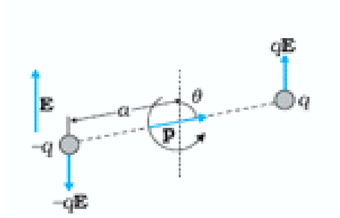
CBSE Class 12 Physics Question Paper Solution

55/5/1

Sr. No.	Value Points / Expected Answers	Marks	Total Marks
	SECTION - A		
1.	E = 0 inside the conductor & has no tangential component on the surface. ∴No work is done in moving charge inside or on the surface of the conductor. &Potential is constant. [Even if a student writes “because E = 0 inside the conductor” - award full marks Or No work is done in moving a charge inside the conductor - award full marks.]	½ ½	1
2.	Any one property of paramagnetic materials. (e.g. (i) It attracts field lines, weakly. (ii) It moves from weaker towards stronger field. or any other property.) OR No.	1 1	1
3.	$\lambda = \frac{h}{p}$  [If only the graph is drawn by the student, award full one mark]	½ ½	1
4.		1	1
5.	OR gate  OR AND gate 	½ ½ ½ ½	1
6.	Diagram - ½ Expression for torque - 1 Direction of torque - ½		



Force on either charge F = qE (½)

Magnitude of torque = Either of force X ⊥ distance between them.

$\tau = qE\ 2a \sin\theta$ (½)

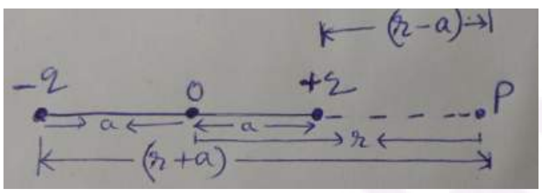
$\tau = pE \sin\theta$ (½)

$\vec{\tau} = \vec{p} \times \vec{E}$

Direction is normal to the paper coming out of it. (½) (2)

OR

Expression for field at an axial point - 1½ Field at large distance - ½



(½)

$$E_- = \frac{q}{4\pi\varepsilon_0 (r+a)^2}\ along\ (-)\vec{p}$$ (½)

$$E_+ = \frac{q}{4\pi\varepsilon_0 (r+a)^2}\ along\ \vec{p}$$

$$\therefore Total\ \ field\ at\ P,\ E = E_- - E_+$$

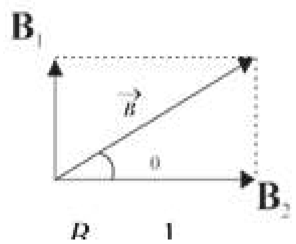
$$= \frac{q}{4\pi\varepsilon_0}\left[\frac{1}{(r-a)^2} - \frac{1}{(r+a)^2}\right]$$ (½)

$$= \frac{q}{4\pi\varepsilon_0}\frac{2pr}{(r^2-a^2)^2}$$

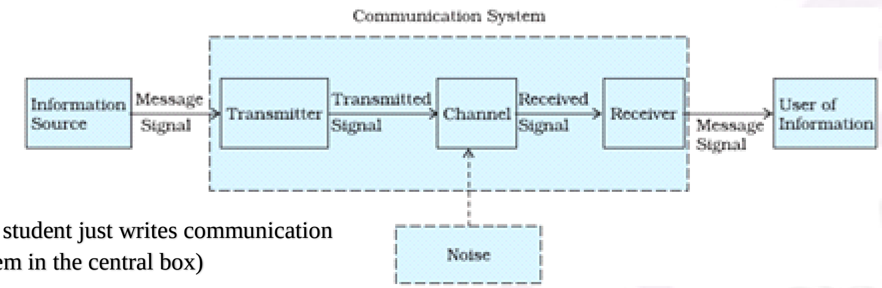
For

$r \rangle\rangle a$

$$E = \frac{1}{4\pi\varepsilon_0}\frac{2p}{r^3}$$ (½) (2)

7.	Energy stored in series combination - 1 Energy stored in parallel combination - 1 $C_s = 6\ pF$ $E_s = \frac{1}{2} C_s V^2 = \frac{1}{2} \times 6 \times 10^{-12} \times 50 \times 50 = 7500 \times 10^{-12}$ J 2 $= 7.5 \times 10^{-9}$ J $C_p = 24\ pF$ $E_P = \frac{1}{2} C_p V^2 = \frac{1}{2} \times 24 \times 50 \times 50 \times 10^{-12}$ $= 3 \times 10^{-8}$ J	½ ½ ½ ½	2
8.	Expression for X - ½ Expression for Y - ½ Expression for product XY - 1 X= nR $Y = \frac{R}{n}$ XY= R^2	½ ½ 1	2
9.	Expression for resultant magnetic field - 1½ Direction of resultant field - ½ $B_1 = \frac{\mu_0 I}{2R}$ $B_2 = \frac{\mu_0 \sqrt{3} I}{2R}$ $B = \sqrt{B_1^2 + B_2^2}$ $= \sqrt{\left(\frac{\mu_0 I}{2R}\right)^2 + \left(\frac{\mu_0 \sqrt{3} I}{2R}\right)^2}$ $B = \frac{\mu_0 I}{R}$ *For Direction*  $\tan\theta = \frac{B_1}{B_2} \Rightarrow \theta = 30^0$	½ ½ ½ ½	2

10.	a) Condition for no deflection - 1 b) Conclusion for greater radius - 1 (a) No deflection if electron moves parallel or anti parallel to the magnetic field (b) $r = \frac{mv}{Bq}$ $\frac{r_1}{r_2} = \frac{B_2}{B_1}$ $As \quad B_1 \langle B_2 \qquad r_2 \langle r_1$ *Alternatively* $[r = \frac{l}{B}$ r_2 *is smaller because* $B]$	1 ½ ½ ½ ½	2
11.	Expression for frequency of side bands - ½ Carrier frequency - ½ Modulating frequency - ½ Band width - ½ $f_u = f_c + f_m = 660\ kHz$ $f_l = f_c - f_m = 640\ kHz$ $\therefore\ 2 f_c = 1300\ kHz$ $\therefore\ f_c = 650\ kHz$ and $2f_m = 20\ kHz$ $fm = 10\ kHz$ Band width = $f_u - f_l$ $= 2 f_m$ $= 20\ kHz$ **OR** Frequency of two side bands - ½ + ½ Amplitude of side bands - 1 $f_u = f_c + f_m = (10000 + 10)\ kHz$	½ ½ ½ ½	

	$= 10010\ kHz$ $f_l = f_c - f_m = (10000 - 10)\ kHz$ $= 9990\ kHz$ $$Amplitude\ of\ Side\ bands = \mu\frac{A_C}{2}$$ $$= 0.3 \times \frac{40}{2} = 6V$$	½ ½ ½ ½	2
12.	Block diagram - 1 Function of Transmitter - ½ Function of Receiver - ½  (Also accept if the student just writes communication system in the central box) Transmitter: A transmitter processes the incoming message signal so as to make it suitable for transmission through a channel and subsequent reception. Receiver: A receiver extracts the desired message signals from the received signals at the channel output.	1 ½ ½	2
13	Expression for total Q. – 1 Expression for common potential – 2		

$$Q = q_1 + q_2$$
$$= 4\pi\sigma\left(r^2 + R^2\right)$$ 1

Potential at common centre

$$V = \frac{1}{4\pi\varepsilon_0}\left[\frac{q_1}{r} + \frac{q_2}{R}\right]$$ ½

$$= \frac{1}{4\pi\varepsilon_0} \times \left[\frac{4\pi r^2\sigma}{r} + \frac{4\pi R^2\sigma}{R}\right]$$ ½

$$= \frac{\left(r+R\right)\sigma}{\varepsilon_0}$$ ½

$$= \frac{1}{4\pi\varepsilon_0}\left[\frac{Q\left(r+R\right)}{r^2+R^2}\right]$$ ½

3

OR

Expressions for potential of shells A,B,C –	1+1+1/2
Relation b/w a,b,c	½

(a)

$$V_A = \frac{kQ_A}{a} + \frac{kQ_B}{b} + \frac{kQ_C}{c}$$

$$V_A = \frac{1}{4\pi\varepsilon_0}\left[\frac{4\pi a^2\sigma}{a} - \frac{4\pi b^2\sigma}{b} + \frac{4\pi c^2\sigma}{c}\right]$$ ½

$$= \frac{\sigma}{\varepsilon_0}\left[a - b + c\right]$$ ½

$$V_B = \frac{kQ_A}{b} + \frac{kQ_B}{b} + \frac{kQ_C}{c}$$

$$V_B = \frac{1}{4\pi\varepsilon_0}\left[\frac{4\pi a^2\sigma}{b} - \frac{4\pi b^2\sigma}{b} + \frac{4\pi c^2\sigma}{c}\right]$$ ½

$$V_B = \frac{\sigma}{\varepsilon_0}\left[\frac{a^2 - b^2}{b} + c\right]$$ ½

$$V_C = \frac{kQ_A}{c} + \frac{kQ_B}{c} + \frac{kQ_C}{c}$$

$$V_C = \frac{1}{4\pi\varepsilon_0}\left[\frac{4\pi a^2\sigma}{c} - \frac{4\pi b^2\sigma}{c} + \frac{4\pi c^2\sigma}{c}\right]$$ ½

$$= \frac{\sigma}{\varepsilon_0}\left[\frac{a^2 - b^2 + c^2}{c}\right]$$

(b)

$V_A = V_C$ ½

$$a - b + c = \frac{a^2 - b^2}{c} + c$$ 3

$$c = a + b$$

14.

Principle -	1
Working & expression for deflection -	1
Current Sensitivity -	1

Principle - A current carrying coil experiences a torque in a magnetic field. 1

Working - When current is passed through the coil torque produced is ½

τ = NIAB sin θ = NIAB (θ=90°)

Restoring torque $\tau' = k\phi$ At equilibrium $\tau = \tau'$

NIAB = kϕ ½

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

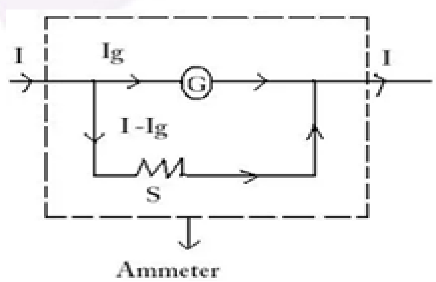
$$Current\ sensitivity: \frac{\phi}{I} = \frac{NAB}{k}$$ 1

[Alternatively: It is deflection per unit current]

OR PART

Conversion of galvanometer into ammeter -	1
Expression for shunt resistance -	1
Effective resistance of ammeter -	1

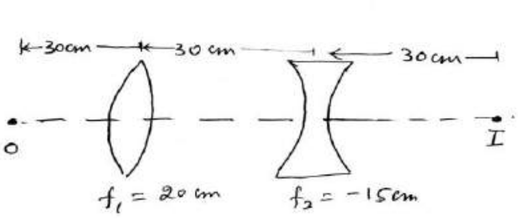
A galvanometer is converted into an ammeter when a suitable shunt resistance is connected in parallel with the galvanometer. ½



½

[Award full one mark even if no figure drawn or only the figure is drawn]

	$GIg = (I - Ig)S$ $S = (\frac{Ig}{I - Ig})G$ $R_{eq} = \frac{GS}{G+S}$	½ ½ 1	3
15.	Derivation of expression for average power - 1 Definition of Power factor and it's maximum value - 1 Wattless current and it's example - 1 $P_i = V_m \sin wt I_m \sin(wt + \Phi)$ $= V_m I_m \sin wt[\sin wt \cos\Phi + \cos wt \sin\Phi]$ $P = V\,I\ \sin^2 wt \cos\Phi + \frac{2V_m I_m}{2} \sin wt \cos wt \sin\Phi$ $V_m I_m \sin wt \cos\Phi + \frac{V_m I_m}{2} \sin 2wt \sin\Phi$ $P_{av} = \frac{\int_o^T P_i dt}{T}$ $= \frac{1}{T}[V_m I_m \int_O^T (\frac{1-\cos\Phi}{2}) \cos\Phi dt + \int_o^T V_m I_m \frac{\sin 2wt \sin\Phi dt}{2}]$ $P_{av} = \frac{V_m I_m \cos\Phi}{2T} \int_o^T dt = \frac{V_m}{\sqrt{2}} X \frac{I_m}{\sqrt{2}} \cos\Phi$ Power factor - $\cos\phi$ factor in P_{av} is power factor. [Alternatively: Factor $\cos\phi$ in P_{av} which decides power consumed by an ac circuit] A resistive circuit has maximum power factor. [Alternatively : $\cos\phi = \frac{R}{Z}$ $\cos\phi = 1$ $\Rightarrow\ R = Z$ Wattless Current - A current which has a phase difference of $\pi/2$ with voltage is called wattless current as there is no dissipation of power by this current. Current in purely inductive or purely capacitive circuit is wattless.	½ ½ ½ ½ ½ ½	3
16.	Definition of displacement current – 1 Expression for displacement current – 1 Value of displacement current - 1		

	Displacement current is the current due to the changing of electric flux.	1	
	It provides continuity of current in circuits containing capacitor.		
	$$I_d = \varepsilon_o \frac{d\phi_e}{dt}$$	1	
	Yes, the value of displacement is equal to the conduction current.	1	
	[Explanation not required]		3
17.	Value of v+ u ½ Value of v - u ½ Calculation of v and u 1 Calculation of f 1		
	v+u = 90	½	
	v-u = 20	½	
	v = 55 cm	½	
	u = 35 cm	½	
	$f = \frac{55x35}{55+35}$ = 21.4 cm	1	
	[or any other correct method used]		
	OR		
	Diagram ½ Image distance for convex lens 1 Image distance for concave lens 1 Explanation of the result change ½		
	 	½	
	For Image formed by convex lens:		
	$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$		
	$$\frac{1}{20} = \frac{1}{v} + \frac{1}{30}$$		

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$$v = \frac{20X30}{30-20} = 60cm$$

u for concave lens = + 30cm

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{-15} = \frac{1}{v} - \frac{1}{30}$$

$$v = \frac{15X30}{15-30} = -30cm$$

No, the result will not change from principle of reversibility

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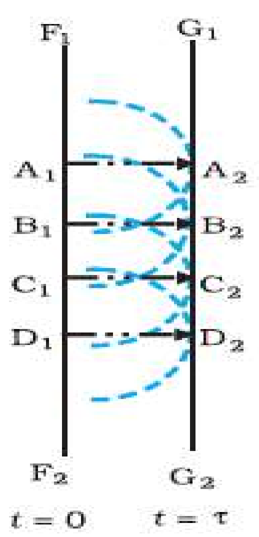
(a) Definition of Wave front	1
Geometrical Construction & explanation	½ + ½
(b) Shape of Wave front	1

(a) Wave front : It is the locus of the medium or points of a medium which are in the same phase of disturbance



Geometrical Construction :

The wave is propagating to the right. F_1F_2 is the plane wavefront at t=0 &G_1G_2 is the wave front at a later time t , the lines A_1,A_2, B_1B_2…..etc. are normal to both F_1F_2 and G_1G_2 represent rays. A_1A_2 = B_1 B_2 = cτ

(b)Spherical Wave front

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½

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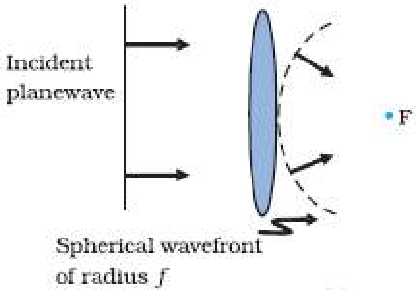
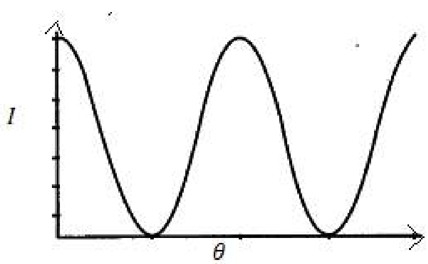
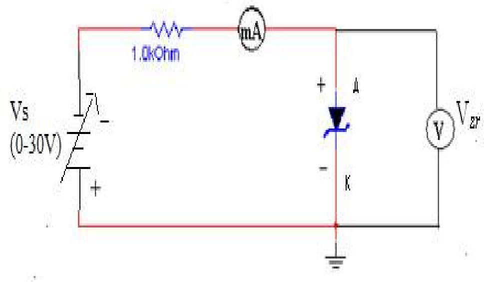
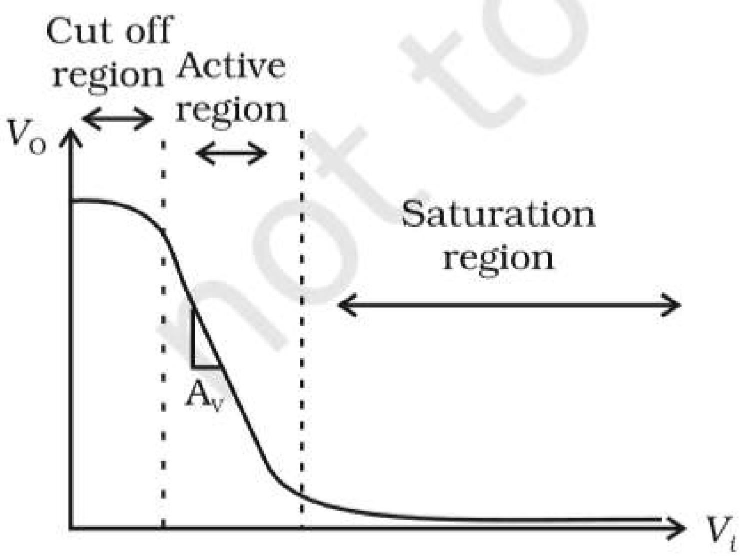
		½	3
19.	(a) Reason to use polaroid 1 (b) Explanation 1 (c) Graph 1 (a) Polaroid sunglasses are preferred over colored sun glasses, because they reduce intensity of light (b) Light in which vibrations of electric field vector are restricted to one plane containing direction of propagation (c) 	1 1 1	3
20.	(a) Einstein equation ½ Equation of line ½ Planck's constant ½ (b) Expression for work function 1 (c) Expression for threshold frequency ½ (a) Einstein, Photoelectric equation $K_{max} = \frac{1}{2} mv_{max}^2 = h\upsilon - \phi_0$ $V^2_{max} = \left(\frac{2h}{m}\right)v - \frac{2\phi_0}{m}$ Slope of the graph is $\frac{2h}{m} = \frac{l}{n}$	 ½ ½	

	Planck constant h = $\frac{lm}{2n}$ (b) Intercept on V^2_{max} , axis, $\frac{2\phi_0}{m} = l$ Work function $\phi_0 = \frac{ml}{2}$ (c) Threshold frequency is the intercept on υ axis i.e. v_0 = n	½ 1 ½	3
21.	(i) Radius of 1st orbit of muonic hydrogen atom 1½ (ii) Expression for Energy 1St orbit 1½ In Bohr's Model of hydrogen atom the radius of nth orbit is given by $r_n = \frac{n^2h^2}{4\pi^2e^2 \; m_e}$ $r_1 \; \alpha \; \frac{1}{m_e}$ (as n=1) Similarly $r_\mu \propto \frac{1}{m_u}$ $\frac{r_\mu}{r_e} = \frac{m_e}{m_\mu} = \frac{1}{207}$ $\therefore r_\mu$ = 2.56 x 10^{-13} m Energy of electron in nth orbit $E_n = \frac{-2\pi^2me^4}{n^2h^2}$ $E_n \; \alpha \; m_e$ (as n=1) $\therefore \frac{E_\mu}{E_e} = \frac{m_\mu}{m_e} = 207$ $\therefore E_\mu = 207 \, E_e$ = - 207 x 13.6 eV = - 2.8 keV **[Even if a student writes correct expressions for r_n and E_n or correct proportionality relation $r_n \; \alpha \; n^2$ and $E_n \; \alpha \; 1/n^2$ award full mark]**	½ ½ ½ ½ ½ ½	3
22.	(a) Defining Isotopes and example ½ + ½ Defining Isobars and example ½ + ½ Example of each (b) Mass of nuclear & example ½ + ½		

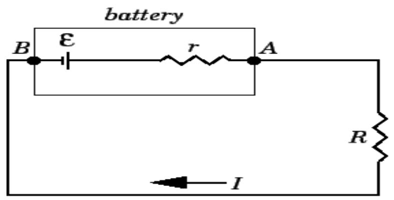
	(a) Isotopes have same atomic number & isobars have same mass number Examples of Isotopes ${}^{12}_{6}C$, ${}^{14}_{6}C$ Examples Isobars ${}^{3}_{2}He$, ${}^{3}_{1}H$ (b) Mass of a nucleus is less than its constituents because in the bound state. some mass is converted into binding energy which is energy equivalent of mass defect e.g. mass of ${}^{16}_{8}O$ nucleus is less than the sum of masses of 8 protons and 8 neutrons **OR** (a) Classification of nuclides — ½ +½ + ½ (b) Non dependence of nuclear density on size of nucleus — 1½ (i) Isotones: ${}^{198}_{80}Hg$ & ${}^{197}_{79}Au$ (ii)Isotopes: ${}^{12}_{6}C$, ${}^{14}_{6}C$ (iii) For Isobars: ${}^{3}_{2}He$, ${}^{3}_{1}H$ The radius of a nucleus having mass number A is $R = r_o A^{1/3}$ r_o is constant. Volume of the nucleus= $\frac{4}{3}\pi R^3 = \frac{4}{3}\pi (r_o A^{1/3})^3$ $= \frac{4}{3}\pi (r_o)^3 A$ If 'm' be the average mass of a nucleon then mass of the nucleus= mA Nuclear density = $\frac{mass}{Volume} = \frac{mA}{\frac{4}{3}\pi (r_o)^3 A} = \frac{3m}{4\pi r_o^3}$ i.e. nuclear density is independent of the size of the nucleus.	½ + ½ ½ + ½ ½ + ½ ½ ½ ½ ½ ½ ½	
23. (a)	(a)Identification of diode — 1 (b)Circuit diagram — 1 (c)One use — 1 The diode used is Zener diode	1	

(b)		1	
(c)	The Zener diode can be used as a voltage regulator n its breakdown region. The Zener voltage remains constant even when the current through the Zener diode changes. [Award this one mark even if the student just writes" the Zener diode can be used as voltage regulator"] [This one mark can also be awarded if student draws only the circuit diagram of a Zener diode as a voltage regulator]	1	3
24.	(a) Three segments of transistor — ½ + ½ + ½ (b) Graph and required portion — 1+ ½ i) Emitter : It is of moderate size and heavily doped semi conductor. ii) Base – It is very thin and lighly doped. iii) Collector – It is moderately doped and larger in size than the emitter.  In the graphs the active region of the transfer characteristics is used for the amplification purpose. This is because in this region I_C increases almost linearly with the increase of V_i.	½ ½ ½ 1 ½	3

25.

a) Relation between E, V, r	1
Graph V v/s I	1
Significance of graph	1
b) Current in voltmeter	1
Potential difference across voltmeter	½
Percentage Error	½

(a)

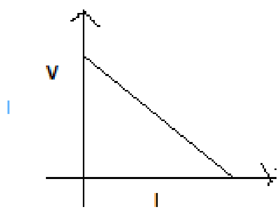


E- IR – rI = 0

E – V – Ir = 0

E = V + Ir ½

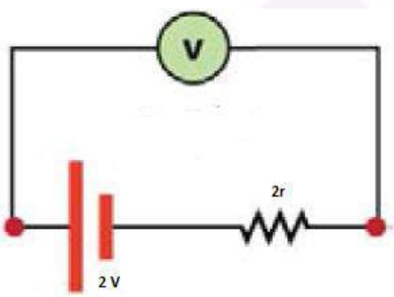
[Award 1 mark even if student writes the relation directly]



½

Significance of Graph – To find cmf and internal resistance of cell. 1

(b)



V = E – Ir

998 ×I = 2 – 2I

1000 ×I = 2

I = $\frac{2}{1000}$ = .002 A ½

V = .002 x 998 ½

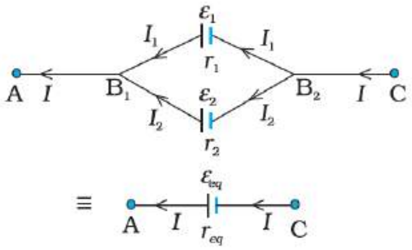
V = 1.996 V ½

% error = $\frac{.004}{2} \times 100 = 20\%$ 5

OR

a)	Expression of current in terms of E and V	1
	Expression of voltage in terms of emf and internal resistance	1
	Expression for Eeq and req	½ + ½
b)	Value of current & value of internal resistance	1+1

(a)



½

$I = I_1 + I_2$

Potential difference across $B_1 B_2$

$V = E_1 - I_1 r_1 \quad \Rightarrow \quad I_1 = \frac{E_1 - V}{r_1}$ ½

$V = E_2 - I_2 r_2 \quad \Rightarrow \quad I_2 = \frac{E_2 - V}{r_2}$

$I = I_1 + I_2$

$= \frac{E_1 - V}{r_1} + \frac{E_2 - V}{r_2}$ ½

$= \left(\frac{E_1}{r_1} + \frac{E_2}{r_2}\right) - V\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$

$V = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} - \frac{I r_1 r_2}{r_1 + r_2}$ ½

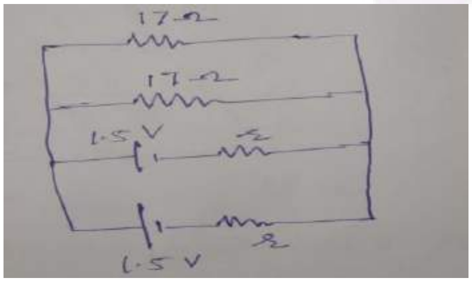
Compare with

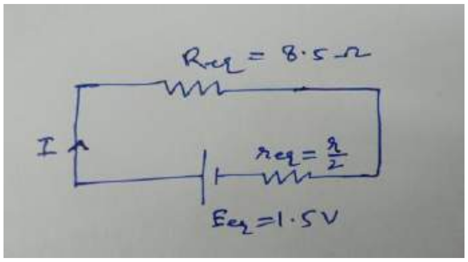
$V = E_{eq} - I r_{eg}$ ½

$$E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$$ ½

$$r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$$

(b)





Equivalent circuit 1

$$I = \frac{V}{R_{eq}} = \frac{1.4}{8.5}\ A$$

And

$$V = E_{eq} - I r_{eq}$$

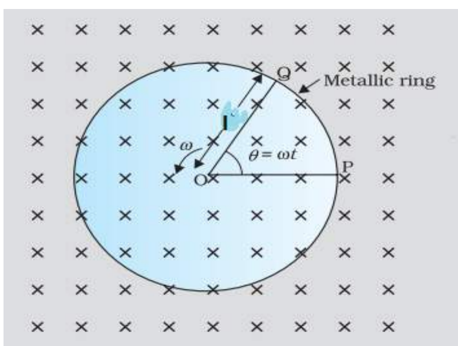
$$\Rightarrow 1.4 = 1.5 - \frac{1.4}{8.5} X \frac{r}{2}$$ 1

$$\Rightarrow r = 1.21\Omega$$ 5

26.

(a)	(i)Expression induced emf & current	1+1
	(ii)For force and its direction	1 ½
	(iii)Expression for power	1
(b)	Effect on the force	1/2

(a)



(i)

$$\varepsilon' = Blv$$

$$\varepsilon = Bl\frac{v}{2}$$

$$\varepsilon = Bl\left(\frac{l\omega}{2}\right)$$

$$\varepsilon = \frac{bl^2\omega}{2}$$ [Student may use any method to arrive at this result] 1

$$I = \frac{\varepsilon}{R} = \frac{bl^2\omega}{2R}$$ 1

(ii) F= I (l x b) ½

$$F = \frac{bl^3\omega B}{2R}$$ ½

Direction of force is perpendicular to both $\vec{l}$ and $\vec{B}$ ½

iii)

$$Power = i^2 R = \left(\frac{bl^2\omega}{2R}\right)^2 R$$ ½

$$= \frac{b^2 l^4 \omega^2}{4R}$$ ½

(b) Since induced current will reduce, it will be a little easier to remove the coil ½

[Even if student writes induced current decreases award ½ mark]

OR

(a) Expression for induced emf and current	1½ +1
Their peak values	½ + ½
Graph	1
(b) Nature of rod	½

(a)

$$\phi = N\vec{B}.\vec{A}$$ ½

$$\phi = NBA\cos\omega t$$ ½

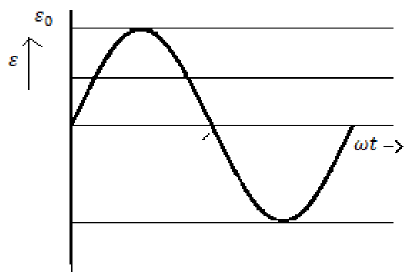
$$\varepsilon = \frac{-d\phi}{dt}$$ ½

$$\varepsilon = NBA\omega\sin\omega t$$ ½

$$here \quad \varepsilon_0 = NBA\omega$$

$$i = \frac{\varepsilon}{R} = \frac{NBA\omega}{R}\sin\omega t$$ ½

$$i_0 = \frac{NBA\omega}{R}$$ ½



1

(b)Bar is magnetic
<u>Reason:</u> Lenz's law/(Induced emf/current opposes its cause) ½

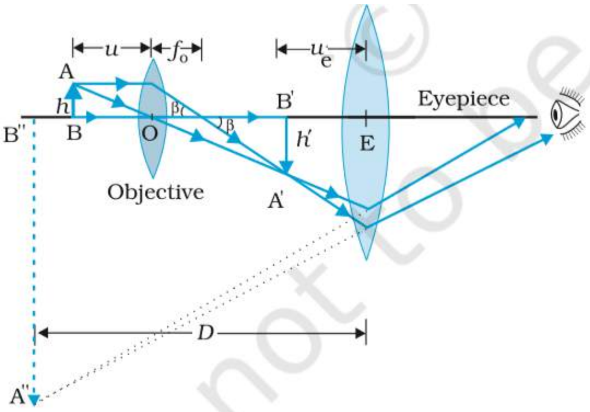
5

27.

(a)	Ray diagram	1
(b)	Reason for short 'f' and aperture	1
(c)	(i) Calculation of Magnifying power	2
	(ii) Length of microscope	1

ray diagram

(a)



1

The magnifying power of compound microscope

(b)

$$m = m_0 \times m_e = \frac{L}{f_0} \times (1 + \frac{D}{f_e})$$

To have high magnifying power and high resolution, the focal length of the objective and its aperture should be short.
Focal length of eyepiece is comparatively greater than the objective so that image formed by objective lens may form within the focal length of eyepiece and the final magnified image may be formed.
Aperture in short for higher resolution.

1

(c)

$u_0 = -6cm$

for objective lens

$$\frac{1}{f_0} = \frac{1}{v_0} - \frac{1}{u_0}$$

$$\frac{1}{v_0} = \frac{1}{f_0} + \frac{1}{u_0} \quad = \frac{1}{4} + \frac{1}{-6}$$

$v_0 = 12cm$

Since for eyepiece $v_e = -D = -25cm$

$$\frac{1}{u_e} = \frac{1}{v_e} - \frac{1}{f_e} = \frac{1}{-25} - \frac{1}{10}$$

$$u_e = -7.14\,cm$$

(i) For magnifying power of compound microscope 1

$$m = \frac{v_o}{u_o}\left(1 + \frac{D}{f_e}\right)$$

$$m = \frac{12}{6}\left(1 + \frac{25}{10}\right) = 7$$

(ii) Length of Microscope 1

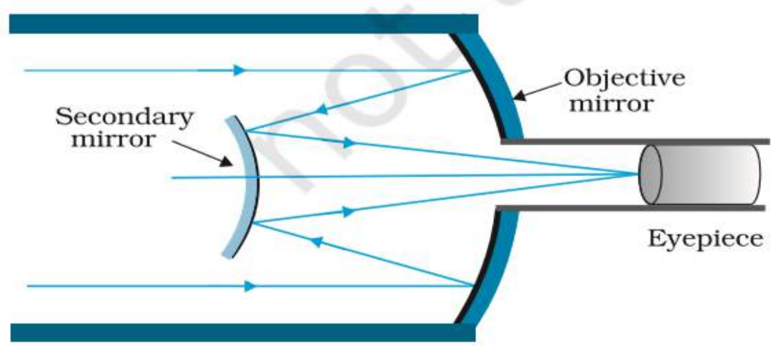
$$L = v_0 + |u_e| = 12 + 7.14$$

$$L = 19.14\,cm$$

OR

(a)	Ray diagram and explanation	2+1
(b)	Calculation of Sun's size	2

(a)



2

It consists for large concave (primary) paraboidal mirror having in its central part a hole. There is a small convex (secondary) mirror near the focus of concave mirror. Eye pieces if placed near the hole of the concave mirror . 1

The parallel rays from distance object are reflected by the large concave mirror . These rays fall on the convex mirror which reflects these rays outside the hole. The final magnified image in formed.

(b) For eyepiece.

$$\frac{1}{v_e} - \frac{1}{u_e} = \frac{1}{f_e}$$

$$or\ \frac{1}{u_e} = \frac{1}{v_e} - \frac{1}{f_e} = \frac{1}{40} - \frac{1}{10}$$ ½

$$u_e = \frac{40}{3}\,cm$$ ½

	Magnification produced by eye pieces is $m_e = \frac{v_e}{\lvert u_e \rvert} = \frac{40}{40/3} = 3$ Diameter of the image formed by the objective is d = 6/3 = 2cm If D be the diameter of the SUN then the angle subtended by it on the objective will be $\alpha = \frac{D}{1.5\times10^{11}} rad$ Angle subtended by the image at the objective = angle subtended by the SUN $\therefore \alpha = \frac{size\, of\ image}{f_o} = \frac{2}{200} = \frac{1}{100} rad.$ $\therefore \frac{D}{1.5\times10^{11}} = \frac{1}{100}$ *or* $D = 1.5\times10^{9} m$	½ ½	5