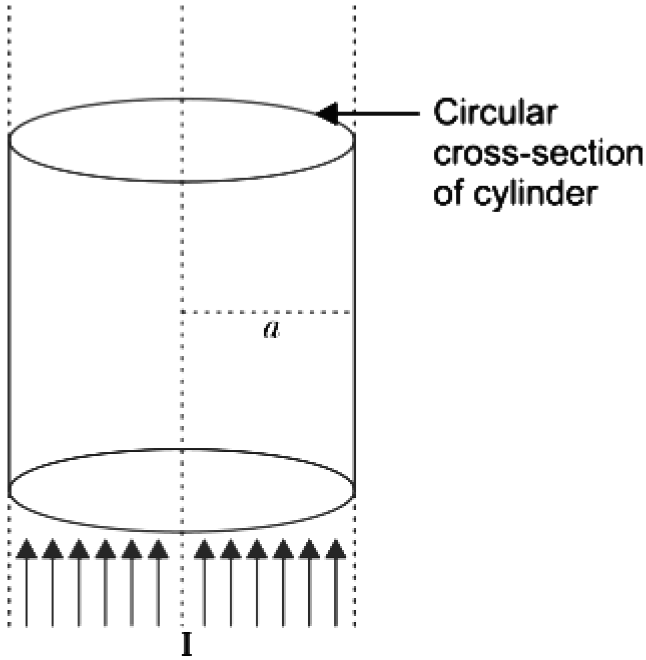
Answer key Pre board 2022-23

1.	(c)$-qLE$	1
2.	(c)Neutral or positively charged	1
3.	(c)Increases for conductor, decreases for semiconductor	1
4.	(d)4:π	1
5.	(c)	1
6.	(b)	1
7.	(a)	1
8.	(c)	1
9.	(d)	1
10.	(b)	1
11.	(d)2486 Å	1
12.	(c) -1/4 : -1/9	1
13.	(a) Is not important because nuclear forces are short-ranged	1
14.	(c) 25V	1
15.	(a) Both A and R are true and R is the correct explanation of A	1
16.	(d) A is false and R is also false	1
17.	(a) Both A and R are true and R is the correct explanation of A	1
18.	(d) A is false and R is also false	1
19.	(i)λ_1 : Microwaves λ_2: Ultraviolet (UV) λ_3: Infrared (IR) λ_4: Infrared (IR) (ii)$\lambda_2(UV)<\lambda_4(IR)\approx\lambda_3(IR)<\lambda_1$(Microwaves)	1 1
20.	(i) **Pole Strength:** Unchanged — each piece has the same pole strength as	1

	the original. (ii) **Magnetic Moment (M):** $M = m \times l$ Length is halved, so **magnetic moment is halved**.	1
21.	Lens is less optically dense than medium. In this case, concave lens behaves like a converging lens.	1 1
22.	(i) Isotopes vs Isobars: Isotopes: Same atomic number ,different mass number A Isobars: Same mass number , different atomic numbers (ii) If nuclei have different mass numbers, they are not necessarily isotopes. Isotopes must have the same atomic number, regardless of A.	1 1
23.	Reverse bias → majority carriers pulled away from junction. This increases barrier potential and widens depletion region. Or **Type of Majority Charge Carrier:** **n-type Semiconductor:** Electrons are the majority charge carriers. **p-type Semiconductor:** Holes are the majority charge carriers. **Doping Element:** **n-type:** Doped with pentavalent atoms (e.g., phosphorus, arsenic). **p-type:** Doped with trivalent atoms (e.g., boron, gallium).	1 1 1 1

24.	**Fringe width** $\beta = \frac{y}{n} = \frac{1.2\times10^{-2}}{4}$	1
	Wavelength:	1
	$\lambda = \frac{\beta d}{D} = \frac{3 \times 10^{-3} \times 2.8 \times}{1.4}$	
	Answer: $\lambda = 600\,\mathrm{nm}$	

25.	**Given:** • Surface charge density: $\sigma =$ $10^{-22}\ \mathrm{C/m^2}$ • Use $\varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{C}$ **(i) Outside the plates:** Electric field outside two opposi plates is **zero**, since fields cance **Answer:** $E_{\text{outside}} = 0\ \mathrm{N/C}$ **(ii) Between the plates:** $E = \dfrac{\sigma}{\varepsilon_0} = \dfrac{17.7 \times 10^{-22}}{8.85 \times 10^{-12}} \approx 2$	1 1
26.	Magnetic field at external points (r > a): We consider a circular path of radius r (> a) passing through external point P concentric with circular cross-section of wire. By symmetry the strength of magnetic field at every point of circular path is same and the direction of magnetic field is tangential to path at every point. So line integral of magnetic field → B B → around the circular path.	½ ½

		1/2 1/2 1

CALCULATION:

From Ampere's circuital law

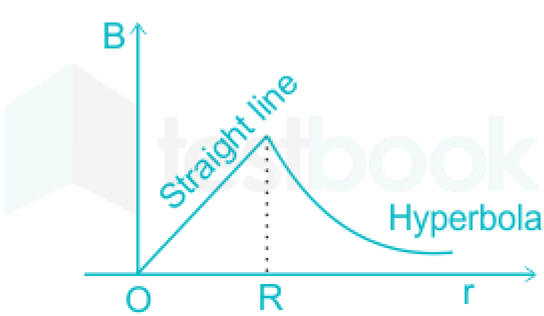
$$B = \frac{\mu_0 I}{2\pi R^2} . r \text{ if r < R}$$

$\Rightarrow$ Binside ∝ r ----- (1)

$$B = \frac{\mu_0 I}{2\pi r} \text{ if r ≥ R}$$

$\Rightarrow$ Boutside ∝ $\frac{1}{r}$ ----- (2)

Hence, magnetic field B wit
the axis of the cable is give

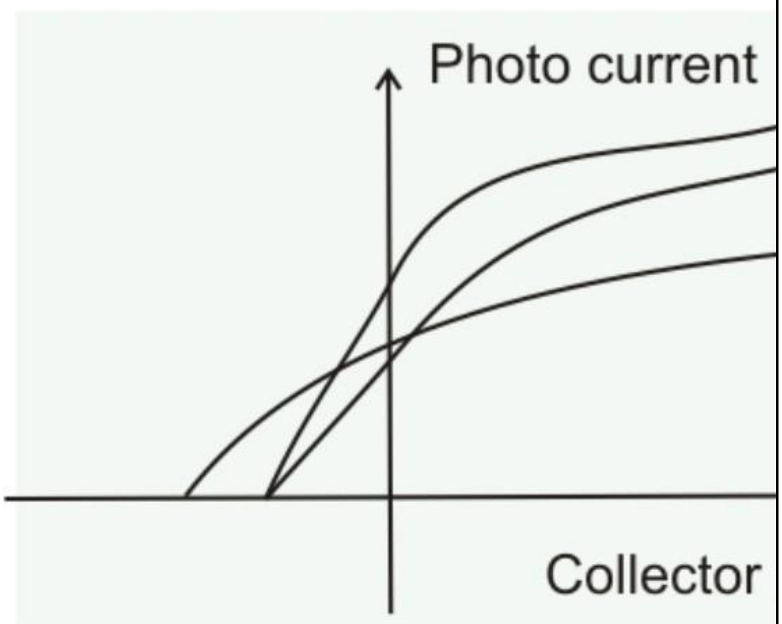


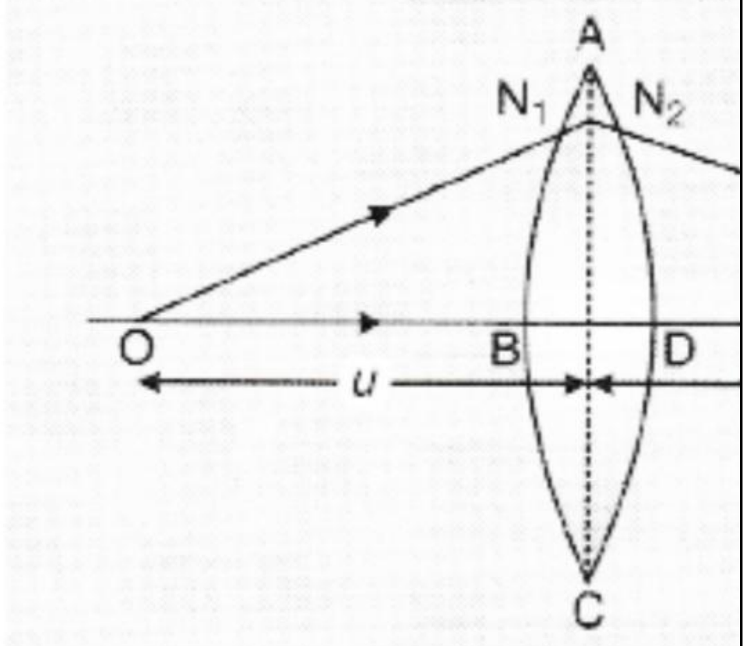
27.	If a rod of length 'l' rotat speed ω in uniform magneti	½
	$$\varepsilon = \frac{1}{2} B l^2 \omega$$	½
	In case of earth's magnetic fiel and $B_V = \lvert B_e \rvert \sin \delta$	
	$$\therefore \quad \varepsilon = \frac{1}{2} \lvert B_e \rvert \cos \delta . l^2 \omega$$	½ ½
	$$= \frac{1}{2} \times 0.4 \times 10^{-4} \cos 60^\circ \times$$	½ ½
	$$= \frac{1}{2} \times 0.4 \times 10^{-4} \times \frac{1}{2} \times (0.5$$ $$= 10^{-5} \times 0.25 \times 2 \times 3.14 \times$$ $$= 3.14 \times 10^{-5} \text{ volt}$$	
	Induced emf is independen of spokes i.e., it remain same	

28.	(a) $I_v = \dfrac{E_v}{\sqrt{R^2 + (\omega L)^2}} = -$ $= \dfrac{240}{\sqrt{100^2 + (2\pi \times 50 \times 0.50}}$ $= \dfrac{240}{\sqrt{10.000 + 24,674}} = \dfrac{2}{18}$ $I_0 = \sqrt{2}\ I_v = \sqrt{2} \times 1.289 =$ (b) For LR circuit $\tan\phi = \dfrac{\omega L}{R} = \dfrac{2\pi FL}{R} = \dfrac{2\pi \times}{}$ $= 1.5708$ or $\phi = 57^0 31'$ (emf leads c Or The principle of transformer is based upon the principle of mutual induction which states that due to continuous change in the current in the primary	1 1 1 1 2

	coil an emf gets induced across the secondary coil. At the power generating station the step up transformers step up the output voltage which reduces the current through the cables and hence reduce resistive power loss. Then at the consumer end a step down transformer step down the voltage.Hence the large scale transmission of electric energy over long distances done with the use of transformers is taken place.	

29.	**de Broglie wave length**	
		1
	$\lambda = \frac{h}{\sqrt{2mE}} = \frac{h}{\sqrt{2mqV}}$	½
		½
	For α-particle, λ_α	½
	For proton, λ_p	
		½
	$\therefore \quad \frac{\lambda_\alpha}{\lambda_p}$	
	But $\frac{m_\alpha}{m_p} = 4, \frac{q_\alpha}{q_p} = 2$	
	$\therefore \quad \frac{\lambda_\alpha}{\lambda_p}$	

30.	(a) Intensity is the number of photon unit time. (b)  (c) According to Einstein's photoelec $eV_0 = h\nu - h\nu_0$ Since frequency for I_1, I_2 are the sam remains the same. Since photocurrent depends on inter $I_1 > I_2 > I_3$	1 1 1

31.	Lens maker's formula :	
		1
	The first refracting surfa image I_1 of the object O. T	½
	a virtual object for the surface ADC which forms shown in the diagram.	½
	∴ For refraction at ABC,	1/2
	$$\frac{n_2}{v_1} - \frac{n_1}{u} = \frac{n_2 -}{R}$$	½
	For refraction at ADC, $$\frac{n_1}{v} - \frac{n_2}{v_1} = \frac{n_1 -}{R}$$	

	(Ii)	
		½
		½
		½
		½
		1

$$\text{Since } \frac{1}{f} = \left(\frac{\mu_2}{\mu_1} - 1\right)\Big[$$

1

In first case, $\mu = 1$, $\mu_2 = 1.6$

$$\therefore \quad \frac{1}{20} = (1.6 - 1)\Big[$$

1

$$= 0.6\left[\frac{1}{R_1} - \right.$$

In second case,

$$\mu_1 = 1.3$$

$$\therefore \quad \frac{1}{f} = \left(\frac{16}{13} - 1\right)\Big($$

½

$$\frac{1}{f} = \frac{3}{13}\left(\frac{1}{R_1} - \right.$$

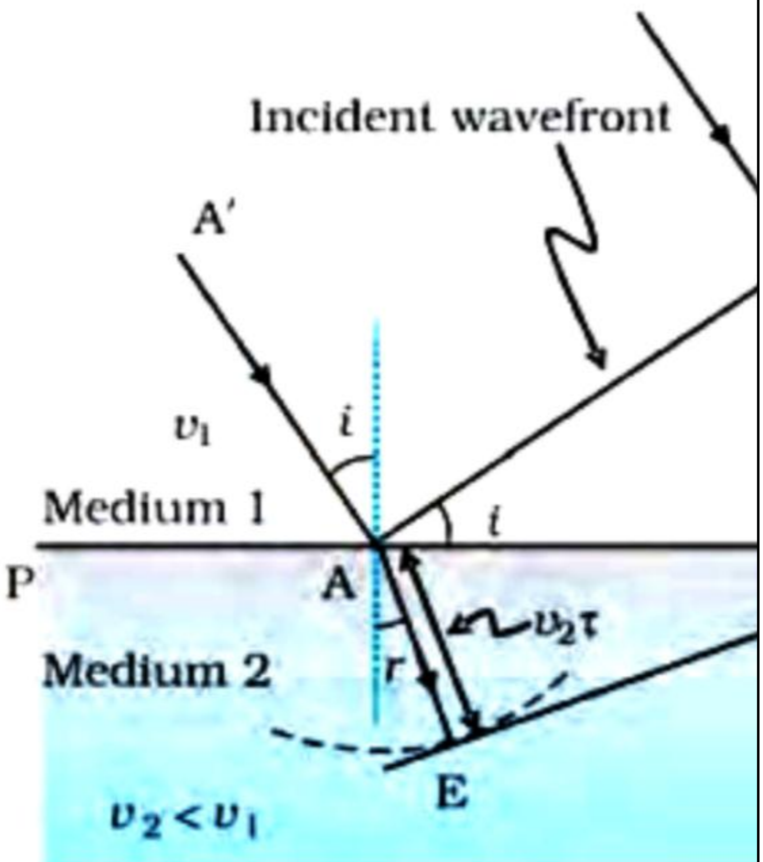
½

From (1) and (2), we get

½

f = 52 cm

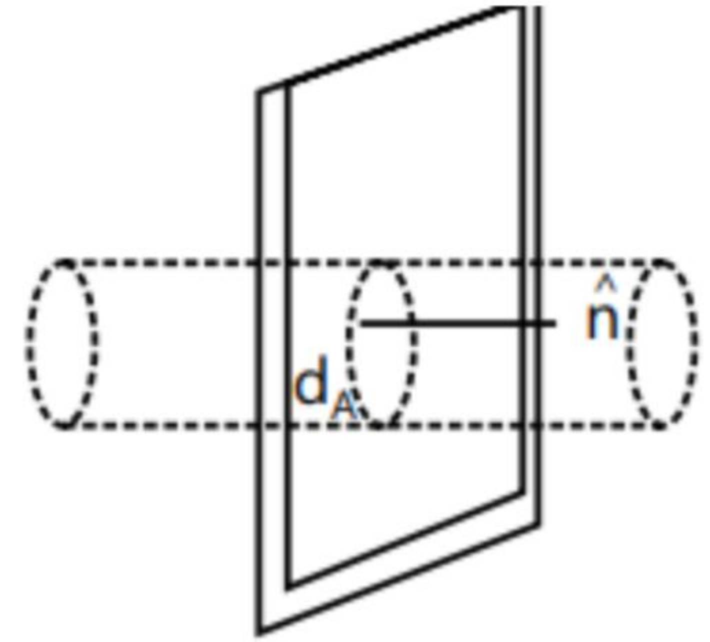
	Or **(i)**	½

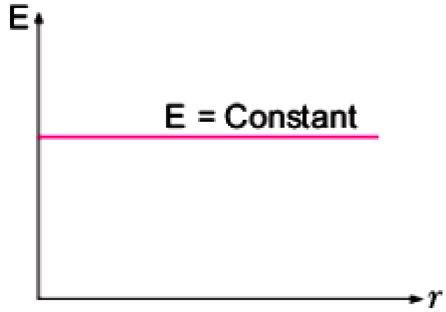
	A locus of points, which osci phase is called a wave front. **OR** A wave front is defined as a constant phase.  **Diagram** **Proof:** $n_1 \sin i = n_2 \sin r$ (Der	

	(ii)	

	Given: $m = 30, f_0 = 1.25cm, f_e$ When image is formed at le distinct vision, D = 25 cm Angulas magnification of e $m_e = \left(1 + \frac{D}{f_e}\right) = 1 + \frac{25}{5} = 6$ Total Angular magnificatio $\Rightarrow m_0 = \frac{m}{m_e} = \frac{30}{6} = 5$ As the objective lens forms $m_0 = \frac{v_0}{u_0} = -5$ $\Rightarrow v_0 = -5u_0$ Using lens equation, we ge $u_0 = 1.5cm, v_0 = -5 \times (-1.5)$ Given $v_e = -D = -25cm, f_e$ Using again lens equation, Thus, object is to be place	

32.	(a)	
		1
		1
		1
		1
		1

		1 ½ ½
	$\text{flux} = E.\ \pi r^2 = \dfrac{q_{enclosed}}{\epsilon_0}$ (g	½
	$\Rightarrow E = \dfrac{\sigma}{\varepsilon_0}\ (\because \sigma = \dfrac{q}{\pi r^2})$	
	electric field as in direction (	½
	$\Rightarrow \vec{E} = \dfrac{\sigma}{\varepsilon_0} \cdot \hat{n}$	½ 1

	(b)  As it is independent of distance. So, it represents a straight line parallel to distance axis. Or	

(a) Gauss's law in electros

The surface integral of elec
produced by any sources o
surface s enclosing a volum
total electric flux (ϕ_E) over
surface s in vacuum is $\frac{1}{\epsilon_o}$ tim
charge (Q) contained inside

$\phi_E = \int_s \vec{E}.\vec{ds} = \frac{Q}{\epsilon_o}$

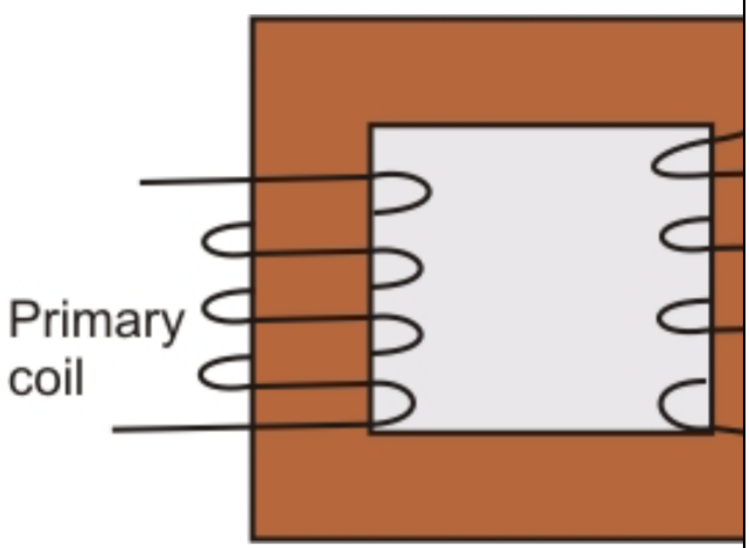
$d\phi = \vec{E}.\vec{ds}$

$= \frac{Kq}{r^2}\hat{r}.\vec{ds}$

$= \frac{Kq}{r^2}\hat{r}.ds.d\hat{s}$

$\therefore \int_s d\phi = \int_s Kq\left(\frac{ds}{r^2}\right)\hat{r}.d\hat{s}$

$\phi = \int_s Kq\left(\frac{ds}{r^2}\right).1$ as
$(\hat{r}.d\hat{s} = |\hat{r}||d\hat{s}|\cos 0^o = 1$

	(b)Electric flux ϕ = 1/ε0 x (net charge enclosed by surface S) ϕ =1/ε0 x (2q - q) = q/ε0.	
33.	(a) (a) A device which is used to decrease h known as a step- down transformer, It works on the principle of mutual inducti current is changing through the primary c change in magnetic flux in the secondary flux induces an emf in the secondary coil.  The four sources of energy loss in the dev Flux leakage, eddy currents, Resistance o hysteresis loss. (b)	1/2 1/2 1 1 ½

	Total resistance of the wire R = 0.5(20 + 20) = 20 Ω. Town gets power from a ste transformer of rating 4000– Thus, the input voltage is 40 Output voltage is 220 V = V Therefore, the rms current i $I_{\text{rms}} = \frac{P}{V_{\text{in}}} = \frac{1200 \times 10^3}{4000} =$ Power loss in the form of he $I_{\text{rms}}^2 R = (300)^2 \times 20$ $= 9 \times 10^4 \times 20 = 180 \times 1$	1 ½ 1 1 1 1

	Or	
		½
		½

(a) X is capacitor.

(b) B → Voltage.

C → Current

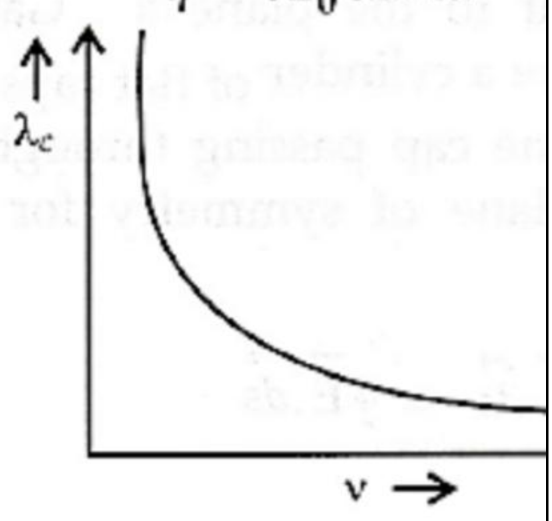
A → Power Consumed

(c) $X_c = \frac{1}{\omega c} = \frac{}{2\pi}$

$x_c \propto \frac{1}{\nu}$

(d) Voltage in circuit $V = \frac{q}{c}$

$q = cE_0 \sin \omega t$



34.	(i)An image formed at infinity is considered most suitable for viewing because the eye lens remains in a relaxed state while observing such an image. This minimizes eye strain, as the ciliary muscles do not need to accommodate (adjust) to focus. (ii)reduce optical aberrations ,enhance magnification and resolution. (iii) Compound Microscope:- Used to observe very small nearby objects,Short focal length objective lens. Astronomical Telescope:-Used to observe distant celestial objects,Long focal length objective lens. (iv)No chromatic aberration,large aperture.	1 1 1 1
35.	(i) (a) Adding pentavalent impurity (ii) (b) Concentration of electrons is more than that of holes. (iii) (c) Both (a) and (b) (iv) (c) Both (a) and (b)	1 1 1 1