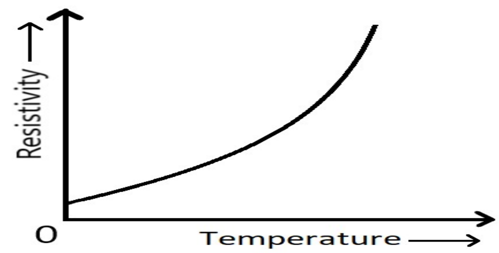
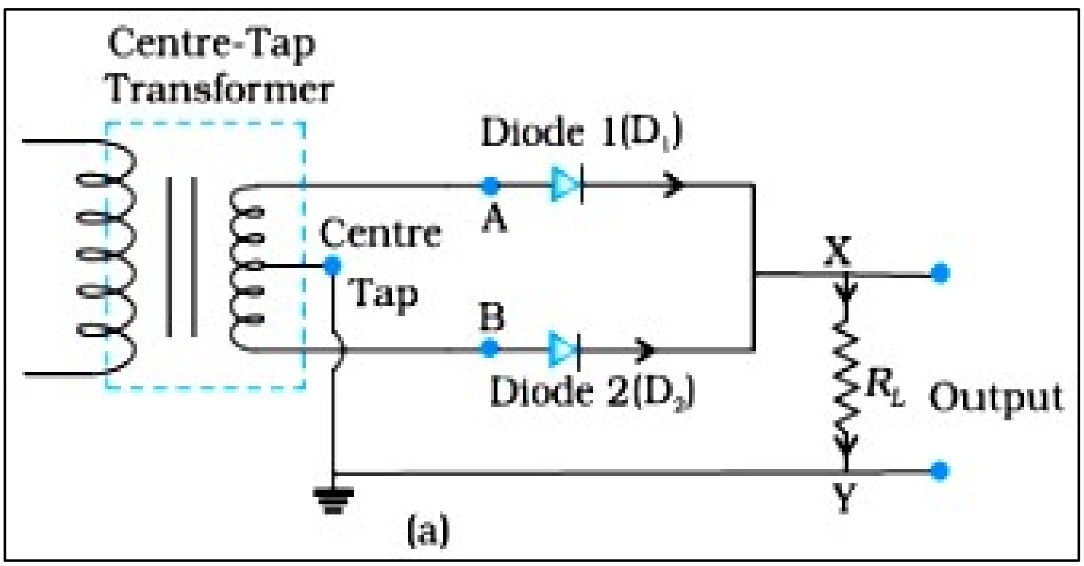
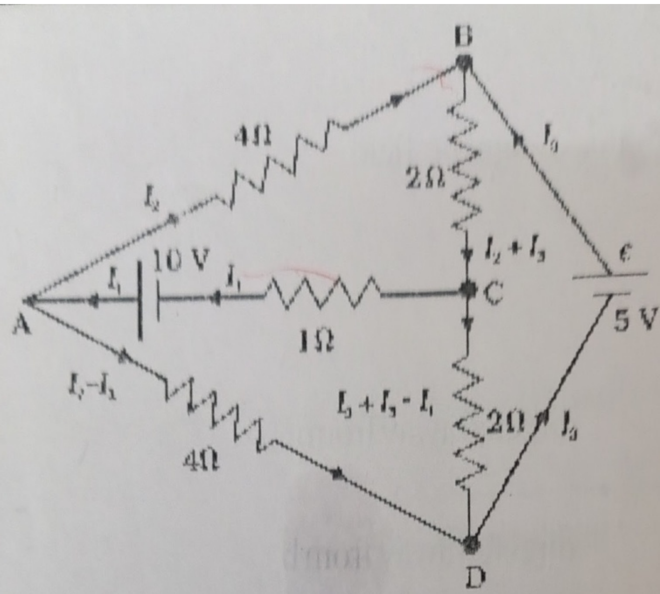
MARKING SCHEME CLASS 12Th PHYSICS (SET-2)		
Section-A		
1.	(a)no net charge is enclosed by the surface	1
2.	(c)4W	1
3.	(d)	1
4.	(b)Along-z axis	1
5.	(d)	1
6.	(a)	1
7.	(c)	1
8.	(d)	1
9.	(c)	1
10	(a)	1
11	(c)	1
12	(a)	1
13	(c)Assertion is true Reason is false	1
14	(d)Assertion is false but reason is true	1
15	(c)A is true but R is false	1
16	(a)	1
Section-B		
17.	The collision of free electrons with ions or atoms while drifting towards the positive end of the conductor becomes more frequent, resulting in a decrease in relaxation time. Thus resistivity of conductor increases with increase in temperature.	1

		1
18.	Here angle of prism A = 60°, angle of incidence i = angle of emergence e and under this condition angle of deviation is minimum $\therefore$ i = e = $\frac{3}{4}$A = $\frac{3}{4}$ x 60° = 45° and i + e = A + D, hence D_m = 2i – A = 2 × 45° – 60° = 30° $\therefore$ Refractive index of glass prism $n = \frac{sin(\frac{A+D_m}{2})}{sin(\frac{A}{2})} = \frac{sin(\frac{60^\circ+30^\circ}{2})}{sin(\frac{60^\circ}{2})}$ $= \frac{sin\ 45^\circ}{sin\ 30^\circ} = \frac{1/\sqrt{2}}{1/2}$ $= \sqrt{2}$	½ 1 ½
19.	(a) Rectifier (b) Circuit diagram of full wave rectifier 	½ ½ 1

20.	Net $I = I_1 + I_2 + 2\sqrt{I_1}\sqrt{I_2}\cos\Phi$ Since, $I_1 = I_2 = I$ Net $I = I + I + 2I\cos\Phi$ $= 2I(1 + \cos\Phi)$ $= 2I(2\cos2\varnothing)/2$ For path difference $\lambda/4$, phase difference is $\pi/2$ Net $I = 4I\cos2\pi/4$ Net $I = 2I$	½ ½ ½ ½
21.	same. 20. As $K_{max} = h\nu = W_0$ or $eV_0 = \frac{hc}{\lambda} - W_0$ or $V_0 = \frac{hc}{e\lambda} - \frac{W_0}{e}$ $\therefore \Delta V_0 = (V_0)_2 - (V_0)_1$ $= \left[\frac{hc}{e\lambda_2} - \frac{W_0}{e}\right] - \left[\frac{hc}{e\lambda_1} - \frac{W_0}{e}\right]$ $= \frac{hc}{e}\left[\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right]$ $= \frac{6.6\times10^{-34}\times3\times10^{8}}{1.6\times10^{-19}}\left[\frac{1}{4\times10^{-7}} - \frac{1}{6\times10^{-7}}\right]$ $= 1.03$ $(V_0)_2 = (V_0)_1 - 1.03 = 6 - 1.03 = 4.97$ V	½ ½ ½ ½

Section -C

22.



For closed loop ADCA ,

$10-4(I_1-I_2)+2(I_2+I_3-I_1)-I_1=0$ ½

$7I_1-6I_2-2I_3=10$ -------(i)

For closed loop ABCA ,

$10-4I_2-2(I_2+I_3)-I_1=0$ ½

$I_1+6I_2+2I_3=10$ --------(ii)

For closed loop BCDED ,

$5-2(I_2+I_3)-2(I_2+I_3-I_1)=0$

$2I_1-4I_2-4I_3=-5$ -------(iii) ½

Current in branch AB $= I_2 = \frac{5}{8} A$ ½

½

Current in branch AC $= I_1 = 2.5A$ ½

Current in branch BC $= I_2 + I_3 = 2.5A$

23.

(*i*) **Expression for the emf induced in the conductor**

When the conductor PQ moves through the magnetic field, free charge carriers of the conductor experience a Lorentz force.

Consider a free charge q, in the conductor moving with speed v in the magnetic field. Lorentz force will act on the charge towards end Q of the conductor.

Its magnitude is given by

$$F = qBv \qquad (\because \theta = 90°)$$ ½

Work done in moving the charge from P to Q,

$$W = qvBl$$ ½

Since, emf is the work done per unit charge

$$\varepsilon = W/q = Blv$$ ½

(*ii*) Force required to move the rod, $F = IlB$

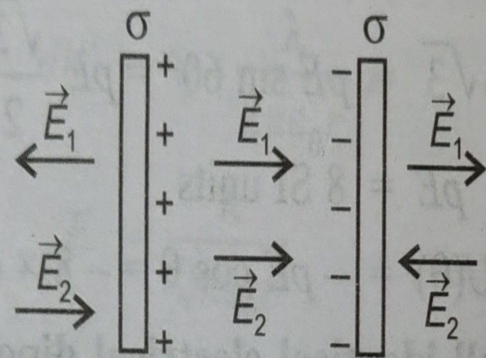
when $I = \dfrac{\varepsilon}{R} = \dfrac{Blv}{R}$ then, ½

$$F = \frac{B^2 l^2 v}{R}$$ ½

(*iii*) The direction of induced current is determined by Faraday's right hand rule. It is from P to Q. ½

24.

Ans. Electric field due to positively charged plate is given by



½

$$E_1 = \frac{\sigma_1}{2\varepsilon_0}$$ ½

Electric field due to negatively charged plate is given by

$$E_2 = \frac{\sigma_2}{2\varepsilon_0}$$ ½

For $\sigma_1 = \sigma_2 = \sigma$

(*i*) Net electric field in the outer region is calculated as ½

$$E = \frac{\sigma}{2\varepsilon_0} - \frac{\sigma}{2\varepsilon_0} = 0$$

(*ii*) Net electric field in the interior region is calculated as

$$E = \frac{\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0} = \frac{\sigma}{\varepsilon_0}$$ ½

½

$$\therefore \quad E = \frac{20 \times 10^{-12}\ \mathrm{Cm^{-2}}}{8.85 \times 10^{-12}\ \mathrm{C^2N^{-1}m^{-2}}} = 2.26\ \mathrm{NC^{-1}}$$

<table>
<tr>
<td>25.</td>
<td>
(a) $k = \dfrac{2\pi}{\lambda}$
$\lambda = \dfrac{2\pi}{K} = \dfrac{4\pi}{3}\,\text{m} = 4.18\,\text{m}$
$\omega = 2\pi\upsilon$
$\nu = \dfrac{\omega}{2\pi} = \dfrac{4.5\times10^{8}}{2\pi}\,\text{Hz}$
$\nu = \dfrac{9}{4\pi}\times10^{8}\,\text{Hz}$
$\nu = 7.16\times10^{7}\,\text{Hz}$
(b) $B_0 = \dfrac{E_0}{c}$
$B_0 = \dfrac{6.3}{3\times10^{8}} = 2.1\times10^{-8}\,\text{T}$
(c) $\vec{B} = 2.1\times10^{-8}[(\cos 1.5\,\text{rad/m})\,y + (4.5\times10^{8}\,\text{rad/s})\,t]\,\hat{k}\,\text{T}$
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<td>26.</td>
<td>
(i)The main importance of using radial, magnetic field is that maximum torque is obtained and torque is uniform in all the positions of the moving coil galvanometer. The angle between the plane of the coil and magnetic field is zero in every position of coil.
(ii)soft iron core is especially used in galvanometer because Soft iron is ferromagnetic in nature which in turn strengthen the magnetic field lines, and stronger the magnetic field lines passing through the coil larger …

(c)Current sensitivity of a galvanometer is defined as deflection per unit current flowing through it.

Current sensitivity=θ/I =nAB/k
Factors:
Number of turns on coil, magnetic field intensity,Area of coil, torsional constant(any two)

Or
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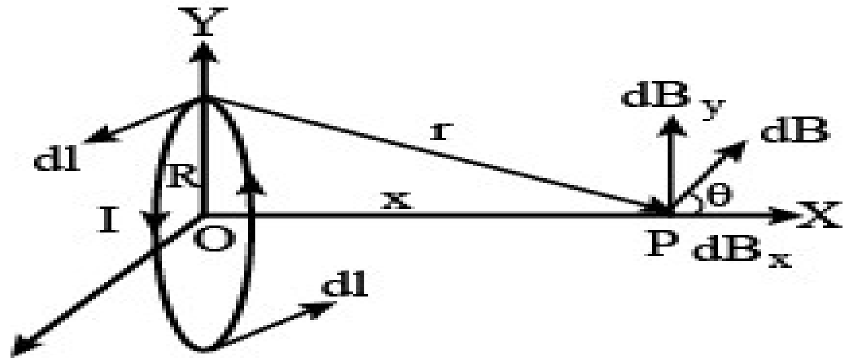
	 According to Biot-Savart's law, the magnetic field at Point P will be $dB = \frac{\mu_0 I}{4\pi} \times \frac{\lvert dl \times r \rvert}{r^3}$ where, $r^2 = x^2 + R^2$ $\lvert dl \times r \rvert = rdl$ [∵ Both are perpendicular] Here, r is the position vector of point O from the current element. dB has two components i.e.,dB_x and dB_y. dB_y is cancelled out and only the x-component remains. $\therefore dB_x = dB\cos\theta$ $\cos\theta = \frac{R}{\sqrt{x^2+R^2}}$ $dB_x = \frac{\mu_0 I dl}{4\pi} \cdot \frac{R}{(x^2+R^2)^{\frac{3}{2}}}$ But, $\int dl = 2\pi R$ So, $B = \frac{\mu_0 I R \times 2\pi R}{4\pi(x^2+R^2)^{\frac{3}{2}}}$	½ ½ ½ ½ ½ ½
27.	**Bohr's first postulate** An electron in an atom revolves in certain stable orbits without the emission of radiant energy. **Bohr's second postulate** Electron revolves around the nucleus only in those orbits for which the angular momentum is integral multiple of h/π,	½ ½

centripetal force for revolution is produced by electrostatic attraction between the electron and the nucleus. ½

$$\frac{mv_n^2}{r_n} = \frac{1}{4\pi\varepsilon_0} \frac{Ze^2}{r_n^2} \qquad \ldots (i)$$ ½

From Bohr's postulate for quantization of angular momentum of nth orbit.

$$mv_n r_n = \frac{nh}{2\pi} \Rightarrow v_n = \frac{nh}{2\pi m r_n}$$ ½

Substituting this value in equation (i), we get

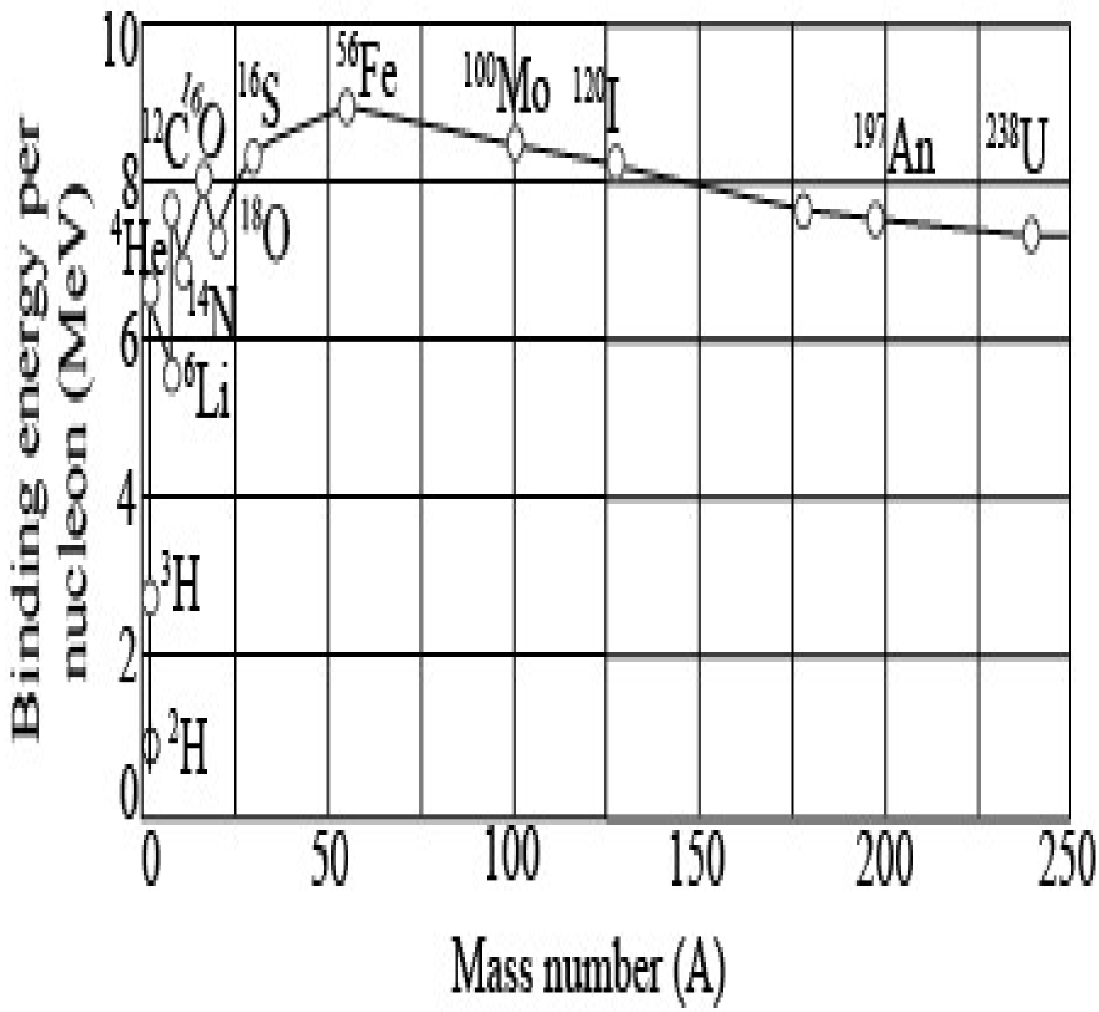
$$\frac{m}{r_n}\left[\frac{nh}{2\pi m r_n}\right]^2 = \frac{1}{4\pi\varepsilon_0} \frac{Ze^2}{r_n^2}$$ ½

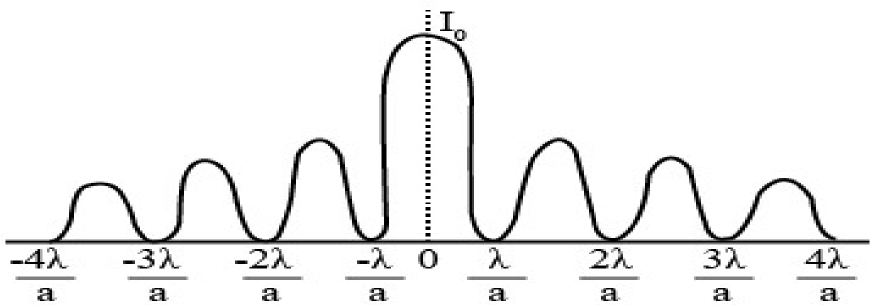
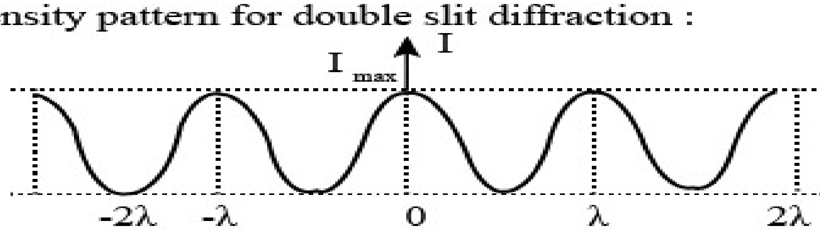
$$\text{or } r_n = \frac{\varepsilon_0 n^2 h^2}{\pi m Ze^2}$$ ½

For Bohr's radius n = 1,

$$r_1 = \frac{\varepsilon_0 h^2}{\pi m Ze^2}$$

This is the expression for Bohr's radius.

28.	 (i) The force is attractive and strong enough to produce a binding energy of few MeV per nucleon. (ii) The constancy of the binding energy in the range 30 <A<170 is a consequence of the fact that the nuclear force is short range force. **Nuclear fission** : A very heavy nucleus (say, A = 240) has lower binding energy per nucleon as compared to the nucleus with A = 120. Thus, if the heavier nucleus breaks to the lighter nucleus with high binding energy per nucleon, nucleons are tightly bound. This implies that energy will be released in the process which justifies the energy release in fission reaction. **Nuclear fusion** : When two light nuclei (A<10) are combined to form a heavier nuclei, the binding energy of the fused heavier nuclei is more than the binding energy per nucleon of the lighter nuclei. Thus the final system is more tightly bound than the initial system.	½ ½ 1 1

	Section-D	
29.	(i)-26.7 cm (ii)(b) (iii)(b) (iv)(d) (v)(c)-26.66 cm	1 1 1 1 1
30.	(i) c (ii)a (iii)c (iv)d (v)c	1 1 1 1 1
	Section -E	
31.	(a) **Intensity pattern for single slit diffraction :**  **Intensity pattern for double slit diffraction :**  Difference between interference and diffraction patterns: (1) Interference fringes are of the same width while diffraction fringes are not of the same width. (2) In interference pattern, all bright bands are of same intensity while in diffraction pattern, all bright bands are not of same intensity.	½ ½ 1 1 ½

For 1st minimum of red light, $a \sin\theta = n\lambda_r$ ½

For 1st maximum of light of wavelength λ',

$$a \sin\theta' = (2n+1)\frac{\lambda'}{2} \qquad [\because n = 1]$$ ½

i.e. $$a \sin\theta' = \frac{3}{2}\lambda'$$ ½

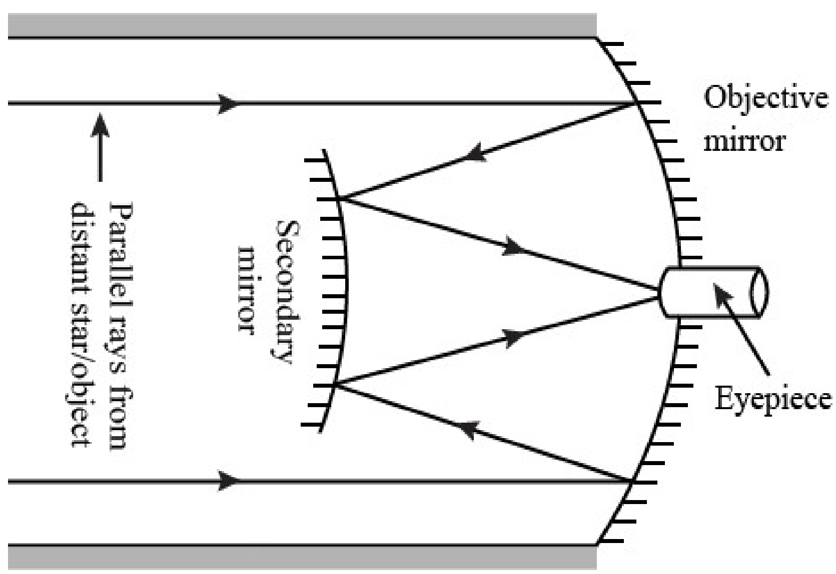
According to the question, $\sin\theta' = \sin\theta$

$$\therefore \quad \frac{3\lambda'}{2a} = \frac{\lambda_r}{a}$$

$$\Rightarrow \quad \lambda' = \frac{2}{3}\lambda_r = \frac{2}{3} \times 660 = 440 \text{ nm}$$

(b)

Or

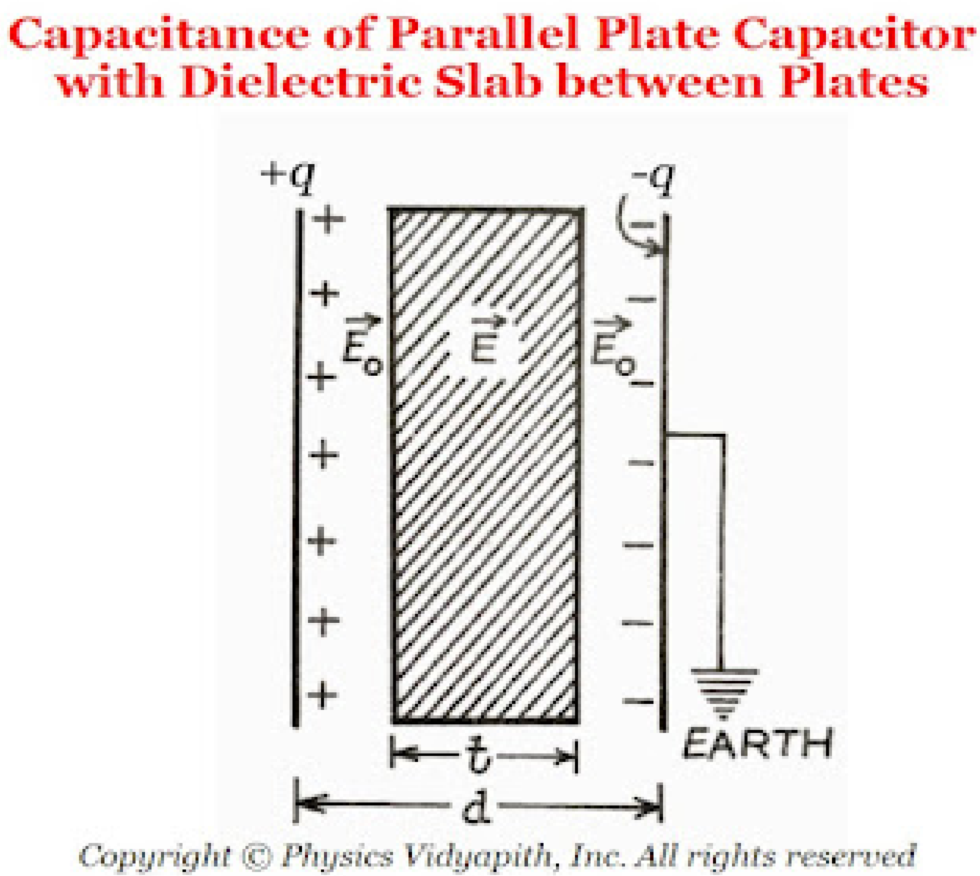


1

(b) Advantages of a reflecting telescope over a refracting telescope- 2

(1) The image is free from chromatic aberration.

(2) Spherical aberration can be eliminated by using parabolic mirror.

	(c) $m = \frac{f_o}{f_e}$ $= \frac{140}{5}$ $= 28$ **(b)** When the final image is formed at d, the magnifying power of the telescope is given as: $\frac{f_o}{f_e}\left[1 + \frac{f_e}{d}\right]$ $= \frac{140}{5}\left[1 + \frac{5}{25}\right]$ $= 28[1 + 0.2]$ $= 28 \times 1.2$ $= 33.6$	½ ½ ½ ½
32.		½

The field strength E_0 between the plates of a parallel plate capacitor in vacuum is

$$E_0 = \frac{V}{d} = \frac{\sigma}{\varepsilon_0} \qquad (1)$$ ½

where V is the applied voltage, σ the charge density (charge per unit area) and ε_0 the permittivity in vacuum. Now $\sigma = q/A$. Therefore the capacitance in air or vacuum will be

$$C_0 = \frac{q}{V} = \frac{A\varepsilon_0}{d} \qquad (2)$$ ½

With the introduction of the dielectric slab the electric field in the slab will be E_0/K, and the potential across the capacitor becomes

$$V = E_0(d - K) + \frac{E_0 t}{K} = E_0\left[(d-t) + \frac{t}{K}\right]$$ ½

$$= \frac{q}{A\varepsilon_0}\left[(d-t) + \frac{t}{K}\right]$$

$$\therefore \quad C = \frac{q}{V} = \frac{\varepsilon_0 A}{d - t\left(1 - \frac{1}{K}\right)} \qquad (3)$$ ½

If a metal of thickness t is to be introduced, the effective distance between the capacitor plates is reduced and the capacitance becomes

$$C = \frac{\varepsilon_0 A}{d - t} \qquad (4)$$ ½

a result which is obtained by putting $K = \infty$ in (3).

(b)

Given: $q_1 = 4\ \mu C = 4 \times 10^{-6}$ C,

$q_2 = -6\ \mu C = -6 \times 10^{-6}$ C, $r = 20$ cm

Let the electric potential be zero at a point P, a distance x (in cm) from q_1. Then 1

$$\frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1}{x} + \frac{1}{4\pi\varepsilon_0} \frac{q_2}{(r-x)} = 0$$ 1

$$\Rightarrow \quad \frac{q_1}{x} = -\frac{q_2}{(r-x)}$$

$$\therefore \quad \frac{4}{x} = -\frac{(-6)}{(20-x)}$$

$$\Rightarrow \quad 4(20-x) = 6x$$

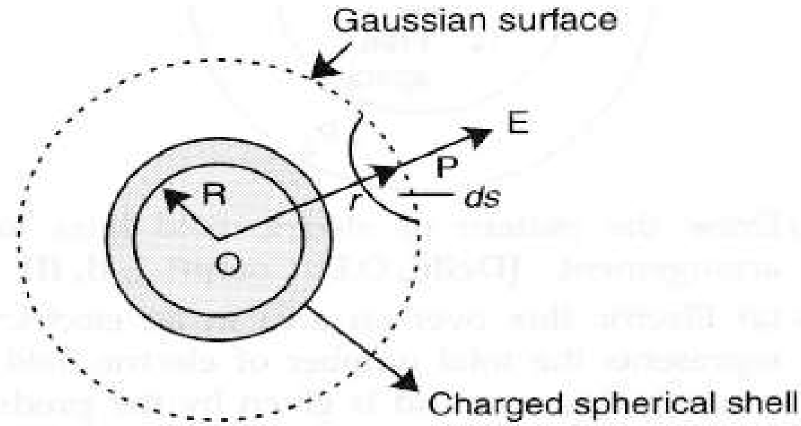
$$x = 8 \text{ cm}$$

i.e. 8 cm from 4 μC charge.

Or

(a) The electric flux through an area is defined as the electric field multiplied by the area of the surface projected on a plane, perpendicular to the field. Its S.I. unit is voltmeters (Vm) or Newton metres square 1

(b)(i) When point P lies outside the spherical shell : Suppose that we have to calculate electric field at the point P at a distance r (r > R) from its centre. Draw the Gaussian surface through point P so as to enclose the charged spherical shell. ½



½

Let $\vec{E}$ be the electric field at point P, then the electric flux through area element is $\vec{dS}$ given by, ½

$$\Delta\phi = \vec{E} \cdot \vec{\Delta S}$$

Since $\vec{\Delta S}$ is also along normal to the surface,

$$\Delta\phi = E.\,dS$$

$\therefore$ Total electric flux through the Gaussian surface is given by.

$$\phi = \oint_s E dS = E\oint_s dS$$

½

Now, $\oint_s dS = 4\pi r^2$

$$\therefore \quad \phi = E \times 4\pi r^2 \qquad \ldots(i)$$

Since the charge enclosed by the Gaussian surface is q, according to the Gauss's theorem,

$$\phi = \frac{q}{\varepsilon_0} \qquad \ldots(ii)$$

½

From equations (i) and (ii), we obtain

$$E \times 4\pi r^2 = \frac{q}{\varepsilon_0}$$

$$E = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{r^2} \qquad (\text{for } r > R)$$

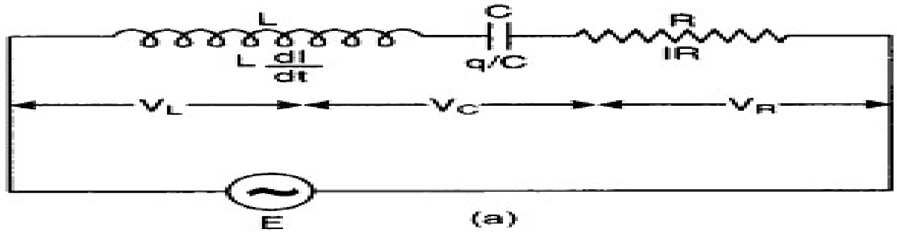
½

(ii) When point P lies inside the spherical shell : In such a case, the Gaussian surface encloses no charge. According to the Gauss's law, 1

$$E \times 4\pi r^2 = 0$$

i.e., $E = 0\ (r < R)$

33.



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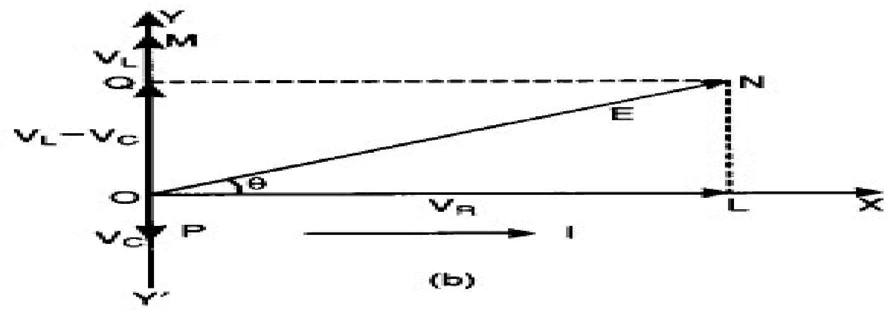


1

From the phasor diagram, we find that

$$ON = \sqrt{(OL)^2 + (OQ)^2}$$

or $$E = \sqrt{V_R{}^2 + (V_L - V_C)^2}$$ ½

$$= \sqrt{I^2 R^2 + (IX_L - IX_C)^2}$$

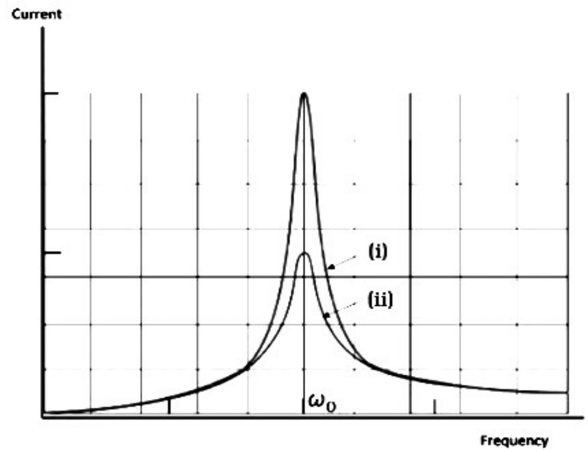
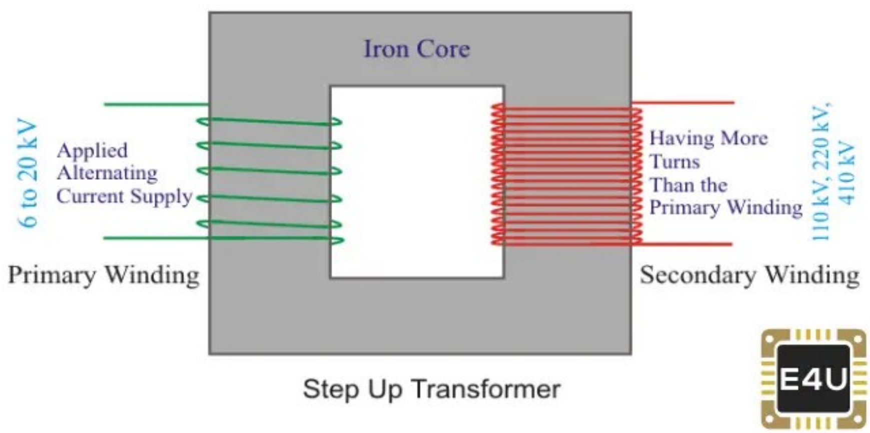
$$E = I\sqrt{R^2 + (X_L - X_C)^2}$$

or $$I = \frac{E}{\sqrt{R^2 + (X_L - X_C)^2}}$$ ½

or $$I = \frac{E}{\sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}}$$ ½

or $$I = \frac{E}{Z},$$

where Z = $\sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}$ is the effective opposition offered by L, C and R and is called the impedance of LCR-circuit. ½

		1
	 Principle: It is based on the principle of mutual inductance and transforms the alternating low voltage to alternating high voltage and in this the number of turns in secondary coil is more than that in primary coil. (i. e.,NS > Np). Working: When alternating current source is connected to the ends of primary coil, the current changes continuously in the primary coil; due to which the magnetic flux linked with the secondary coil changes continuously, therefore the alternating emf of same frequency is developed across the secondary. (b) Reasons for energy losses in a transformer:(any two) (a) Joule Heating: Energy is lost in resistance of primary and secondary windings as heat . (b) Flux Leakage: Energy is lost due to coupling of primary and secondary coils not being perfect, i.e., whole of magnetic flux generated in primary coil is not linked with the secondary coil. (c) When output voltage increases, the output current automatically decreases to keep the power same. Thus, there is no violation of conservation of energy in a step up transformer.	1 1 1 1 11