Class XII | Physics — Solutions (Set 1) | Session 2026-27

Section A

1.

(c) high temp.

Explanation:

A pure semiconductor behaves slightly as a conductor at high temperatures.

2.

(c) 0.4 V

Explanation:

To find the voltage across the resistor R_4, we need to analyze the circuit using Ohm's Law and the principles of series and parallel circuits. Assuming the resistors are arranged in a way that allows us to calculate the total resistance and the current flowing through the circuit, we can determine the voltage drop across R_4. If the total current flowing through the circuit is calculated, we can then use the formula $V = I \times R$ to find the voltage across R_4. Given the options, if the calculations lead to a voltage of 0.4 V across R_4, it indicates that the current and resistance values were correctly applied in the calculations. Thus, the solution provided is correct based on the analysis of the circuit.

3.

(d) Concave mirror

Explanation:

Concave mirror

4.

(c) $\frac{T_o}{3}$

Explanation:

Initial time period of magnet

$T_0 = 2\pi\sqrt{\frac{\mathrm{I}}{\mathrm{MB}}}$

I - moment of inertia of bar magnet

M- magnetic moment of bar magnet

when the magnet is cut into three equal pieces the magnetic moment of each piece of magnet becomes $= M' = \frac{\mathrm{M}}{3}$

New moment of inertia of each magnet = $I' = \frac{\mathrm{I}}{3^3} = \frac{I}{27}$

New time period of magnet is

$T' = 2\pi\sqrt{\frac{\mathrm{I'}}{\mathrm{M'B}}} = 2\pi\sqrt{\frac{\mathrm{I}/27}{(\mathrm{M}/3)\mathrm{B}}}$

$T' = \frac{T_0}{3}$

5.

(c) $100\mu C$

Explanation:

The capacitance C of a conductor is given as $1\mu F$ (microfarad), which is equal to $1 \times 10^{-6}F$. The potential V is given as $100V$. The relationship between charge Q, capacitance C, and potential V is described by the formula: $Q = C \times V$ Substituting the values: $Q = (1 \times 10^{-6}F) \times (100V) = 1 \times 10^{-4}C$ Converting $1 \times 10^{-4}C$ to microcoulombs: $1 \times 10^{-4}C = 100\mu C$

Thus, the charge required to raise the potential to 100 V is $100\mu C$.

6. **(a)** $[\mathrm{MT}^{-2}\,\mathrm{A}^{-1}]$

Explanation:

$F = qvB\sin\theta$ or $B = \frac{F}{qv\sin\theta}$

$\therefore \quad [B] = \frac{MLT^{-2}}{AT \cdot LT^{-1}} = [MT^{-2}A^{-1}]$

7. **(a)** along abc if I increases

Explanation:

In accordance with Lenz law.

8. **(a)** Copper

Explanation:

Magnetic field lines are repelled by diamagnetic substances and Copper is diamagnetic substance.

9.

(d) 4 : 1

Explanation:

$\frac{I_{\max}}{I_{\min}} = \left(\frac{r+1}{r-1}\right)^2 = \frac{9}{1}$

$\Rightarrow \frac{r+1}{r-1} = 3$

$\Rightarrow$ r + 1 = 3r - 3

$\Rightarrow$ r = 2

$\therefore \frac{I_1}{I_2} = \frac{a_1^2}{a_2^2} = r^2 = 4 : 1$

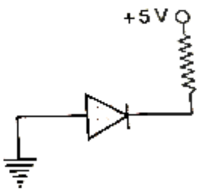
10.

(d) Zero

Explanation:

If a charge +q is placed outside, then the electric field lines incident on the conducting sphere induces -q charge on one surface whereas the opposite surface becomes oppositely charged (i.e. +q) and the total charge becomes zero.

11.

(d) 

Explanation:

The p-n junction is said to be reverse biased, when the positive terminal of the external battery in the circuit is connected to n-section and the negative terminal to p-section of the junction diode.

12.

(d) two images form, one at O' and the other at O''

Explanation:

two images form, one at O' and the other at O''

13. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

$\lambda = \frac{h}{mv}$

For constant v, $\lambda \propto \frac{1}{m}$

λ is significantly measurable only in case of microscopic or sub-microscopic particles.

14. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

15.

(d) A is false but R is true.

Explanation:

The beautiful colours are seen on account of interference of light reflected from the upper and lower surfaces of the thin film. As the conditions for constructive and destructive interference are dependent on wavelength of light, therefore, coloured interference fringes are observed.

16.

(d) A is false but R is true.

Explanation:

At resonance, $X_L = X_C$, so the circuit impedance becomes minimum and resistive and hence the current becomes maximum. So, the assertion is false.

At resonance, $X_L = X_C$, so the circuit impedance becomes resistive. In resistive circuit voltage and current are always in same phase. Hence, reason is true.

Section B

17. Given: Wavelength, $\lambda = 5.5\times10^{-5}$ cm $= 5.5\times10^{-7}$ m

1. Frequency, $\nu = \frac{c}{\lambda} = \frac{3\times10^{8} m/s}{5.5\times10^{-7} m} = 5.45\times10^{14}$ Hz $= 5.45 \times 10^{8} MHz$

   Time period, $T = \frac{1}{\nu} = \frac{1}{5.45\times10^{8}} = 1.83 \times 10^{-9} \mu s$
2. Wavelength of the light in the glass, $\lambda_g = \frac{\lambda}{\mu} = \frac{5.5\times10^{-7}}{1.5} = 3.67\times10^{-7}$ m

18. In the absence of aluminium,

$B_0 = \mu_0 H$

In the presence of aluminium,

$B = \mu H = \mu_0 (1 + \chi_m) H$

Increase in magnetic field induction

$= B - B_0 = \mu_0 \chi_m H$

Percentage increase $= \frac{B-B_0}{B_0} \times 100$

$= \frac{\mu_0 \chi_m H}{\mu_0 H} \times 100$

$= 2.1 \times 10^{-5} \times 100 = 2.1 \times 10^{-3}$

OR

Here $H = 1500$ Am^{-1}, $\phi = 2.4 \times 10^{-5}$ Wb, $A = 0.5 \times 10^{-4}$ m^2

Magnetic induction,

$B = \frac{\phi}{A} = \frac{2.4\times10^{-5}}{0.5\times10^{-4}} = 0.48$ Wbm^{-2}

Permeability,

$\mu = \frac{B}{H} = \frac{0.48}{1500} = 3.2 \times 10^{-4}$ TmA^{-1}

As $\mu = \mu_0 (1 + \chi_m)$

$\therefore$ Susceptibility,

$\chi_m = \frac{\mu}{\mu_0} - 1 = \frac{3.2\times10^{-4}}{4\times3.14\times10^{-7}} - 1$

$= 254.77 - 1 = 253.77$

19. Electric field, $E = \frac{v}{d} = \frac{0.60}{6.0\times10^{-7}}$

$= 1.0 \times 10^{6}$ Vm^{-1}

Let v_1 = velocity of the electron when enters the depletion layer. V_2 be the velocity of the electron emerging out of the depletion layer. Barrier voltage,

$V = 0.60$V, $v_1 = 5.0 \times 10^{5}$ m/s According to Principle of conservation of energy

$\frac{1}{2} m v_1^2 = eV + \frac{1}{2} m v_2^2$

or $\frac{1}{2} \times (9.1 \times 10^{-31}) \times (5.0 \times 10^{5})^2$

$= (1.6 \times 10^{-19}) \times 0.6 + \frac{1}{2} \times (9.1 \times 10^{-31}) \times v_2^2$

or $1.375 \times 10^{-19} = 0.96 \times 10^{-19} + 4.55 \times 10^{-31} v_2^2$

On solving, we get,

$v^2 = 1.975 \times 10^5\ ms^{-1}$

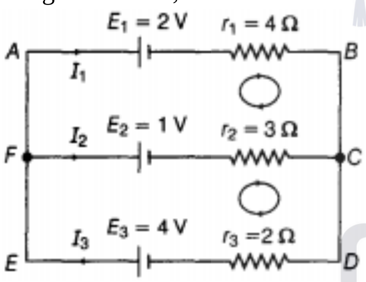
20. The nucleus of a hydrogen atom is a proton (mass $1.67 \times 10^{-27} kg$) which has only about one-fourth of the mass of an alpha particle $\left(6.64 \times 10^{-27} kg\right)$. Because the alpha particle is more massive, it won't bounce back in even a head on collision with a proton. It is like a bowling ball colliding with a ping pong ball at rest. Thus, there would be no large angle scattering in this case. In Rutherford's experiment, by contrast, there was large angle scattering because a gold nucleus is more massive than an alpha particle. The analogy there is a ping pong ball hitting a bowling ball at rest.

21. a. The charge q moves in the XY plane describing a circular path in the anticlockwise sense.
    b. The path of the charged particle will become helical.
    c. By Fleming's left hand rule, the magnetic Lorentz force acts on charge q in -Y direction
    ∴Applied electric field should be in the + Y direction to make the charged particle move along the original straight line path.
    $F_e = F_m$
    $qE = qvB \sin 90^\circ \quad$ or $\quad E = vB$

Section C

22. **Kirchhoff's first rule:** The algebraic sum of the electric currents at any junction of electric circuit is equal to zero, i.e. the sum of current entering into a junction is equal to the sum of current leaving the junction.
    $\Rightarrow \quad \Sigma I = 0$
    Kirchhoffs second rule or loop rule In any closed mesh of electrical circuit, the algebraic sum of emfs of cells and the product of currents and resistances is always equal to zero.
    i.e. $\Sigma E + \Sigma IR = 0$

    For given circuit,



At, F, applying junction rule,

$I_3 = I_1 + I_2$ ...(i)

In mesh ABCFA,

$-2 - 4I_1 + 3I_2 + 1 = 0$

$4I_1 - 3I_2 = -1$ ...(ii)

In mesh FCDEF,

$-1 - 3I_2 - 2I_3 + 4 = 0$

$3I_2 + 2I_3 = 3$

On solving, I_1, I_2 and I_3, we get

$I_1 = \frac{2}{13} A, \quad I_2 = \frac{7}{13} A$

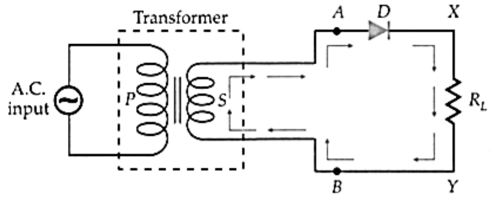
and $I_3 = \frac{9}{13} A$

Thus by using KCL & KVL, we can calculate the values of current flowing in each branch.

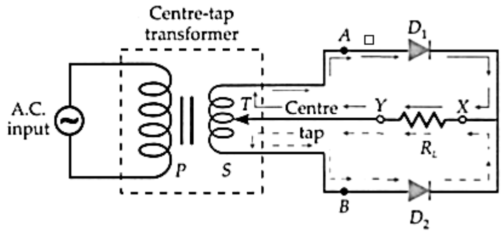
23. a. Purpose of Davisson Germer Experiment was to verify the wave nature of electron. It confirms the de Broglie relations for matter waves / Diffraction effect of electron beams from crystal
    b. de Broglie wavelength
    $\lambda = \frac{h}{\sqrt{2mqV}}$
    $\therefore \frac{h}{\sqrt{2\, m_p e V_p}} = \frac{h}{\sqrt{2\, m_\alpha e V_\alpha}}$
    $\therefore \frac{V_p}{V\alpha} = \frac{8}{1}$

24. we know that A half-wave rectifier **converts an AC signal to DC by passing either the negative or positive half-cycle of the waveform and blocking the other**. A *full wave rectifier* is defined as a rectifier that converts the complete cycle of alternating current into pulsating DC

Here, X, is a half-wave rectifier and Y is a full-wave rectifier.

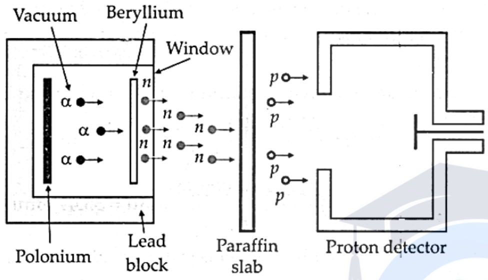


Half-wave rectifier circuit.



Full wave rectifier circuit.

25. The neutrons were discovered by James Chadwick in 1932. He was awarded the 1935 Nobel prize for physics for this discovery.



Experimental set up used by
Chadwick to discover neutrons.

In 1932, Chadwick performed an experiment in which α -particles from a radioactive Polonium source were used to bombard beryllium nuclei. Highly penetrating rays were found to come out of the beryllium metal, which could not be deflected by electric and magnetic fields. These radiations were used to bombard hydrocarbons like paraffin wax. High energy protons were knocked out from the paraffin wax. The energy of the ejected protons was found to be too high to be accounted for y-ray photons By using the laws of conservation of energy and momentum, Chadwick concluded that the penetrating radiation consisted of neutral particles, each having a mass nearly that of a proton. These particles were called neutrons.

A free or isolated neutron is unstable because A free neutron spontaneously decays into a proton, electron and antineutron.

26. Energy E = -3.4eV

a. $r = \frac{ke^2}{2E}$ as PE = 2 $\times$ E

$r = \frac{9\times10^9\times(1.6\times10^{-19})^2}{2\times3.4\times1.6\times10^{-19}}$

r = 2.11 $\times$ 10^{-10} m

b. $L = \frac{nh}{2\pi}$

$E = -\frac{13.6}{n^2}$

$-3.4 = \frac{-13.6}{n^2}$

n = 2

$L = \frac{2\times6.63\times10^{-34}}{2\times\pi}$

L = 2.11 $\times$ 10^{-34} js

c. KE = -E = 3.4 eV

PE = 2 $\times$ E = -2 $\times$ 3.4

= -6.8 eV

27. a. When width is doubled, then $\frac{\lambda}{a}$ reduces to half hence size of the central maximum will get halved and intensity of central maximum will become 4 times.

b. For red light width will be maximum because

$\beta = \frac{2\lambda D}{a}$

Wave length of blue is small as compared to red so width will be less when red is replaced by blue.

c. Interference pattern is observed by superposing two waves originating from the two narrow slits. The diffraction pattern is a superposition of a continuous family of waves originating from each point on a single slit.

28. i. The magnetic flux through the rectangular loop abcd increases, due to the motion of the loop into the region of a magnetic field According to Lenz's law, this increase in flux is opposed by the induced current. The induced current must flow along the path bcdab so that it opposes the increasing flux.

ii. Due to the outward motion, magnetic flux through the triangular loop abc decreases due to which the induced current flows along bacd, so as to oppose the change in flux.

iii. As the magnetic flux decreases due to motion of the irregularly shaped loop abcd out of the region of the magnetic field, the induced current flows along cdabc, so as to oppose change in flux. Note that there is no induced current as long as the loops are completely inside or outside the region of the magnetic field.

OR

A coil B kept near another coil A has magnetic flux passing through it when kept near coil A. The ratio of magnetic flux through the coil B to the current in the coil A is called as mutual inductance of coils. or **Mutual Inductance** is the interaction of one coils magnetic field on another coil as it induces a voltage in the adjacent coil

$M_{12} = \frac{\phi_2}{i}$

Let S_1 carries a current i.

Magnetic field inside S_1 will be $B = \frac{\mu_o N_1 i}{l}$

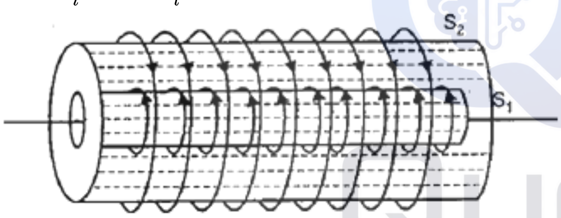
Flux through each turn of S_2 is $\phi = B \times \pi r_2^2$

$\phi = \frac{\mu_o N_1 \pi r_2^2 i N_2}{l}$

Flux through each turn of S_2 is $\phi_B = \phi N_2$

$\phi_B = \frac{\mu_o N_1 \pi r_2^2 i N_2}{l}$

$M = \frac{\phi_B}{i} = \frac{\mu_o N_1 N_2 \pi r_2^2}{l}$



Section D

29. **Read the text carefully and answer the questions:**

All the known radiations from a big family of electromagnetic waves which stretch over a large range of wavelengths. Electromagnetic wave include radio waves, microwaves, visible light waves, infrared rays, UV rays, X-rays and gamma rays. The orderly distribution of the electromagnetic waves in accordance with their wavelength or frequency into distinct groups having widely differing properties is electromagnetic spectrum.

(i) **(a)** infrared waves

Explanation:

Infrared rays can be converted into electric energy as in solar cell.

(ii) **(d)** radiowaves

Explanation:

Radiowaves have longest wavelength.

(iii) **(c)** cathode rays

Explanation:

Cathode rays are invisible fast moving streams of electrons emitted by the cathode of a discharge tube which is maintained at a pressure of about 0.01 mm of mercury.

OR

(d) microwave, infrared, ultraviolet, gamma rays

Explanation:

$\lambda_{\text{micro}} > \lambda_{\text{infra}} > \lambda_{\text{ultra}} > \lambda_{\text{gamma}}$

(iv) **(d)** γ-rays

Explanation:

γ-rays have minimum wavelength.

30. i. From, q = ne, n = $\frac{q}{e} = \frac{3.2\times10^{-18}}{1.6\times10^{-19}}$ = 20

Hence, the number of electrons on the body is 20.

ii. Charge on the body is q = ne

$\therefore$ No. of electrons present on the body is n = $\frac{q}{e} = \frac{1\times10^{-9}\mathrm{C}}{1.6\times10^{-19}\mathrm{C}}$ = 6.25 $\times$ 10^9

iii. Here, n = 10^9 electrons per second

The charge given per second, q = ne = 10^9 $\times$ 1.6 $\times$ 10^{-19} C

q = 1.6 $\times$ 19^{-10} C

Total charge, Q = 1 C ...(given)

$\therefore$ Time required = $\frac{Q}{q} = \frac{1}{1.6\times10^{-10}}s$ = 6.25 $\times$ 10^9 s

$\therefore \frac{6.25\times10^{9}}{3600\times24\times365}$year = 198.19 years

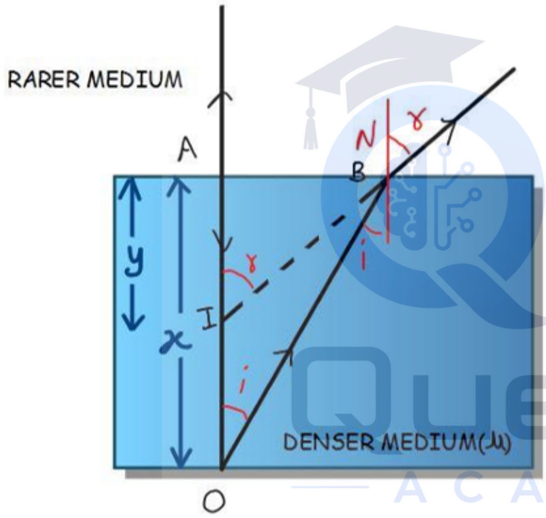
iv. As q = ne, n = $\frac{3.2\times10^{-7}}{1.6\times10^{-19}}$

$\Rightarrow$ n = 2 $\times$ 10^{12} electrons

$\therefore$ the number of electrons transferred will be 2 $\times$ 10^{12}

Section E

31. i. Due to refraction of light



In $\triangle$OAB,

sin i = $\frac{AB}{OB}$

In $\triangle$IAB, sin r = $\frac{AB}{IB}$

According to Snell's law

$\frac{1}{\mu} = \frac{\sin i}{\sin r} = \frac{IB}{OB}$ When angles are small, OB $\approx$ OA and IB $\approx$ IA

$\mu = \frac{OA}{IA} = \frac{x}{y}$

Height through which object is raised = x - y

= x - $\frac{x}{\mu}$

= x $\left(1 - \frac{1}{\mu}\right)$

ii. f_0 = 2 cm

f_e = 6.25 cm

L = v_0 + $|u_e|$ = 15 cm

v_e = -25 cm

$\frac{1}{V_e} - \frac{1}{u_e} = \frac{1}{f_e}$;

$\frac{1}{-25}$ - $\frac{1}{u_e} = \frac{1}{6.25}$

u_e = -5 cm

Now, L = v_0 + |-5| = 15 cm

V_o = 10 cm

Now, $\frac{1}{f_o}$ = $\frac{1}{V_o}$ - $\frac{1}{u_o}$

u_0 = 2.5 cm

MP = $\frac{V_o}{u_o}\left[1+\frac{D}{f_o}\right]$

= -20

OR

As is clear from figure and difference between waves reaching P_1 from A is

$=2d\sin\theta+(u-1)l$

For principal maximum, path difference = 0

i.e., $2d\sin\theta+(\mu-1)l=0$

$2\mathrm{d}=\sin\theta+(1.5-1)\frac{d}{4}=0, \sin\theta=\frac{-1}{16}$

$\therefore OP_1=(CO)\tan\theta\cong D\left(-\frac{1}{16}\right)$

For the first minimum, an angle θ_1, say,

path difference $=2d\sin\theta_1+0.5l=\pm\lambda/2$

$\sin\theta_1=\frac{\pm\lambda/2-0.5l}{2d}$

As diffraction occurs when d = λ,

$\therefore\sin\theta_1=\frac{\pm\lambda/2-\lambda/8}{2\lambda}=\pm\frac{1}{4}-\frac{1}{16}$

on the positive side, $\sin\theta_1=+\frac{1}{4}-\frac{1}{16}=\frac{3}{16}$, on the negative side,

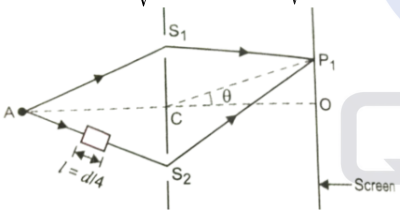
$\sin\theta_1'=-\frac{1}{4}-\frac{1}{16}=\frac{-5}{16}$

The first principal maximum on the positive side is at distance (above O)

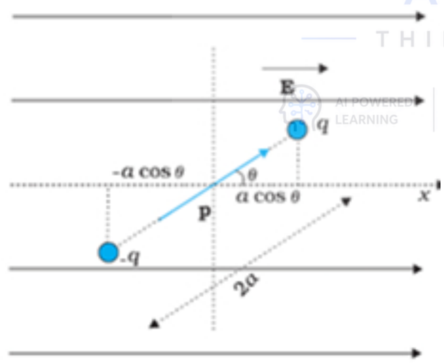
= D than $\theta_1=D\frac{\sin\theta_1}{\sqrt{1-\sin^2\theta_1}}=\frac{D.3/16}{\sqrt{1-9/256}}=\frac{3D}{\sqrt{16^2-3^2}}$

On the negative side, the distance of first principal maximum (below O) will be

$=D\theta_1'=D\frac{\sin\theta_1'}{\sqrt{1-\sin^2\theta_1}}=\frac{D(-5/16)}{\sqrt{1-(5/16)^2}}=\frac{-5D}{\sqrt{16^2-5^2}}$



32. i.



Consider a dipole with charges q1 = +q and q2 = -q is placed in a uniform electric field E, as shown in Fig The dipole experiences no net force; but experiences a torque $\boldsymbol{\tau}$ given by $\boldsymbol{\tau}$ = p × E

which will tend to rotate it (unless p is parallel or antiparallel to E). Suppose an external torque $\boldsymbol{\tau}_{ext}$ is applied in such a manner that it just neutralizes this torque and rotates it in the plane of paper from angle θ_o to angle θ_1 at an infinitesimal angular speed and without angular acceleration. The amount of work done by the external torque will be given by

W = $\int_{\theta_0}^{\theta_1}\tau_{\text{ext}}(\theta)d\theta$ = $\int_{\theta_0}^{\theta_1}pE\sin\theta d\theta$

W = U = pE $(\cos\theta_0-\cos\theta_1)$

ii. U = $\frac{1}{2}\frac{Q^2}{C_{\text{eff}}}$

$\frac{1}{C_{\text{eff}}}$ = $\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}$

$U = \frac{1}{2}\frac{Q^2}{C_1} + \frac{1}{2}\frac{Q^2}{C_2} + \frac{1}{2}\frac{Q^2}{C_3}$

$U = U_1 + U_2 + U_3$

iii. When battery is disconnected then charge (q) remains constant.

Capacitance is halved

$C' = \frac{\varepsilon_o A}{2d} = \frac{C}{2}$

Electric field (E) is unaffected.

$E = \frac{\sigma}{\varepsilon} = \frac{q}{\varepsilon_o A}$

Alternatively for effect on electric field.

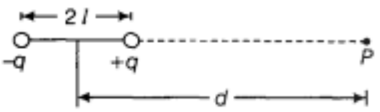
$E = \frac{V}{d}$

$V' = \frac{Q}{C'} = \frac{Q}{\frac{C}{2}} = 2V$

$E' = \frac{V'}{d'} = \frac{2V}{2d} = \frac{V}{d} = E$

OR

a. Let electric potential is to be determined at a point P lying on the axis of an electric dipole of dipole length 2l at a distance d from the centre of the dipole as shown in the figure.



Potential at P due to +q charge of the dipole $= \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{(d-l)}$

Potential at P due to -q charge of the dipole

$= \frac{1}{4\pi\varepsilon_0} \frac{-q}{(d+l)}$

Total potential at P due to both the charges of the dipole

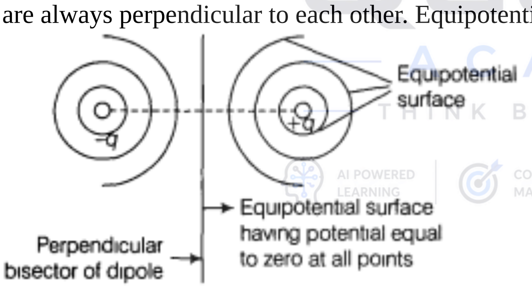
$= \frac{q}{4\pi\varepsilon_0}\left[\frac{1}{(d-l)} - \frac{1}{(d+l)}\right]$

$= q \times \frac{2l}{4\pi\varepsilon_0} \times \frac{1}{\left(d^2-l^2\right)} = \frac{p}{4\pi\varepsilon_0} \times \frac{1}{\left(d^2-l^2\right)}$

where, the scalar value of dipole moment (p) = q × 2l

If l << d, then neglecting l^2 we get, the final value of the electric potential to be, $V = \frac{1}{4\pi\varepsilon_0}\frac{p}{d^2}$

b. An electric dipole consists of two equal and opposite charges separated by some distance. Equipotential lines and electric field are always perpendicular to each other. Equipotential surfaces of a dipole are as shown below:



Potential of points lying on the perpendicular bisector surface will be zero.

33. Total electric power required,

Supply voltage, V = 220 V

The voltage at which electric plant is generating power, V' = 440 V

Distance between the town and power generating station, d = 15 km

The resistance of the two-wire lines carrying power = 0.5 Ω/km

Total resistance of the wires, R = (15 + 15) 0.5 = 15 Ω

A step-down transformer of rating 4000 - 220 V is used in the sub-station.

Input voltage is , V_1 = 4000 V

Output voltage is, V_2 = 220 V

Rms current in the wire lines is given as:

$I = \frac{P}{V_1}$

$= \frac{800\times10^3}{4000}$ = 200 A

a. Line power loss in the form of heat is given by = I^2R

$= (200)^2 \times 15$

$= 600 \times 10^3$ W

= 600 KW

b. Assuming that the power loss is negligible due to the leakage of the current:

hence Total power supplied by the plant = 800 KW + 600 KW

= 1400 KW

c. Voltage drop in the power line is given by = IR = 200 $\times$ 15 = 3000 V

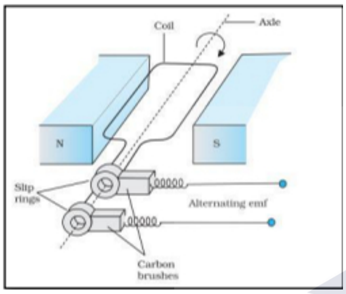
Hence, total voltage transmitted by the plant = 3000 + 4000

= 7000 V

Hence, the rating of the step-up transformer situated at the power plant is 440 V - 7000 V.

OR

i. Diagram



Principle - It is based on the principle of electromagnetic induction. Whenever there is a change in magnetic flux linked with a coil , an emf is induced in the coil.

Working - When a rectangular coil is rotated in a magnetic field, the magnetic flux changes continuously which induces an emf and the direction of current changes periodically.

$\varepsilon = \frac{-Nd\phi}{dt}$

$= -NBA\frac{d}{dt}(\cos\omega t)$

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

ii. $\varepsilon = NBA\omega$

$= 100 \times 0.8 \times 0.5 \times 60$

= 2400 V

hence, the maximum emf generated will be 2400 V.

Power dissipated, P = $\frac{\varepsilon_{rms}^2}{R}$

$= \frac{\left(\frac{2400}{\sqrt{2}}\right)^2}{100}$

= 28.8 kW