11) a) 1.414×10^{-8} T

12) a) −190V

2

13) a) 0.5Ω

14) d) 2N

15) d) 1.4V

II

16) * The incident ray, reflected ray and normal to the reflecting surface all are coplanar ie, lie in the same plane

b) The angle of incidence i is equal to the angle of reflection r. i = r

17) The current comes into play in the region in which the electric field and the electric flux are changing with time.

18) it is defined as "the ratio voltage across L(or) C to the applied voltage".

$$Q\text{-factor} = \frac{\text{voltage across } L \text{ (or) } C}{\text{Applied voltage}}$$

19) the line integral of magnetic field over a closed loop is μ_0 times net current by the loop

$$\oint_C \vec{B} \cdot \vec{dl} = \mu_0 I_{enclosed}$$

3

directly as the sine of the angle between $\vec{dl}$ and $\hat{r}$

inversely as the square of the distance between the point P and length element $\vec{dl}$

$$dB = K \frac{I dl}{r^2} \sin\theta \quad \left(K = \frac{\mu_0}{4\pi}\right)$$

in vector notation, $\vec{dB} = \frac{\mu_0}{4\pi} \frac{I \vec{dl} \times \hat{r}}{r^2}$

20) the ability of certin metals and their compounds to conduct electricity with zero resistance at very low temprature

Since R=0 current once induced in a Superconductor persists without any potential difference.

21) the force on the point charge q_2 exerted by another point charge q_1 is

$$\vec{F}_{21} = K \frac{q_1 q_2}{r^2} \hat{r}_{12}$$

$\hat{r}_{12}$ = unit vector directed from charge q_1 to q_2

K = proportionality constant

r = two point charges separated by a distance.

22) inductor is a device used to store energy in a magnetic field when an electric current flows through it

eg, coil, toroids, solenoids.

23) $Q = 10\Omega$

4

$$\frac{P}{Q} = \frac{l_1}{100 - l_1} = \frac{l_1}{l_2}$$

$$P = Q \times \frac{l_1}{100 - l_1}$$

$$P = \frac{10 \times 55}{100 - 55}$$

$$P = \frac{550}{45} = 12.2\Omega$$

24) Given focal length $f_1 = -70$ cm

the focal length $f_2 = 150$ cm

contact, $\frac{1}{F} = \frac{1}{F_1} + \frac{1}{F_2}$

Sub the val

$$\frac{1}{F} = \frac{1}{-70} + \frac{1}{150} = \frac{1}{70} + \frac{1}{150}$$

$$\frac{1}{F} = \frac{-150 + 70}{70 \times 150} = \frac{-80}{70 \times 150} = \frac{80}{10500}$$

$$F = \frac{-1050}{8} = 131.25 \text{ cm}$$

$$P = \frac{1}{F} = \frac{1}{1.3125 \text{ m}} = -0.76 \text{ diopter}$$

5

III

25) i) An Ammeter: By connecting an ammeter with a low resistance in parallel with the given galvanometer

ii) A Voltmeter: By connecting a voltmeter with a high resistance (Ra) in series with the given galvanometer.

26) The electromagnetic waves are produced by any accelerated charge

They do not require any medium for propagation So, electromagnetic wave is a non-Mechanical wave

They are transverse in nature

Electromagnetic wave travel with the speed of light in vacuum (or) free space

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = 3\times10^8 ms^{-1}$$

ϵ_0 = permittivity of free space

μ_0 = permeability of free space

They are not deflected by electric field (or) Magnetic field

it can show interference, diffraction and polarization

These wave also carry energy and Momentum and angular Momentum

6

27) The expression for the electric field due to an infinite plane sheet of charge is

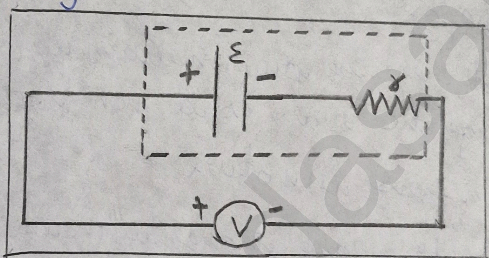
$E = \sigma {}^{2}\varepsilon_0$

E = electric field

σ : surface charge density

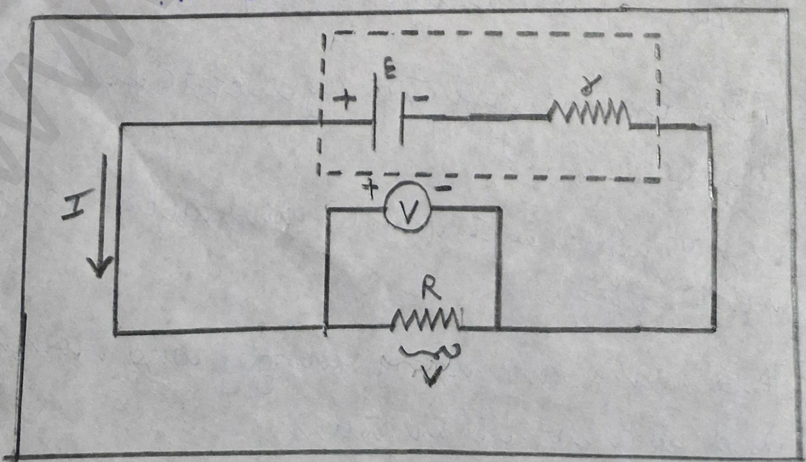
ε_0 : absolute electrical permittivity of free space.

28) the emf of cell 'ε' is measured by connecting a high resistance voltmeter across it without connecting the external resistance R



* the external resistance 'R' is include in the circuit and current 'I' is established in the circuit
* the potential difference across R is equal to the potential difference across the cell (V)

∴ V=IR .....(1)



* eddy current loss: Alternating magnetic flux in the core induces eddy currents in the core induces eddy currents in it There is energy loss due to the flow of eddy current

Minimized by: Using very thin laminations of transformer core

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ii) copper loss:

Transformer windings have electrical resistance when an electric current flows through amount of energy is dissipated due to joule heating

Minimized by: using wires of larger diameter

iii) flux leakage:

it happens when the magnetic lines of primary coil are not completely linked with secondary coil

Minimized coil: winding coils one over the other.

3

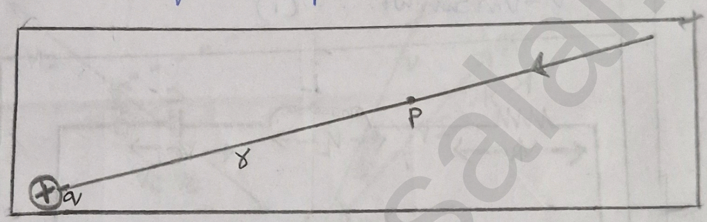
30) consider a positive charge 'q' kept fixed at the origin Let 'P' be a point distance 'r' from the charge 'q'

9

the electric potential at the point P is

$$V = \int_{\infty}^{r} (-\vec{E})\cdot \vec{dr} = -\int_{\infty}^{r} \vec{E}\cdot\vec{dr}$$

electric field at point P



$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}, \quad V = \frac{-1}{4\pi\varepsilon_0}\int_{\infty}^{r} \frac{q}{r^2}\hat{r}\cdot\vec{dr}$$

The infinitesimal displacement vector, $\vec{dr} = dr\,\hat{r}$ and using $\hat{r}\cdot\hat{r} = 1$

$$V = -\frac{1}{4\pi\varepsilon_0}\int_{\infty}^{r} \frac{q}{r^2}\hat{r}\cdot dr\,\hat{r} = \frac{-1}{4\pi\varepsilon_0}\int_{\infty}^{r} \frac{q}{r^2}\,dr$$

After the integration,

$$V = \frac{-1}{4\pi\varepsilon_0}\, q \left\{\frac{1}{-r}\right\}_{\infty}^{r} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$

Hence the electric potential due to a point charge q at a distance r is

$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$