{SECTION "B"}

{QUE 2}

(i)

Given:

$d = 30\,cm = 3 \times 10^{-2}\,m$

$r = d/2$

$= 30/2$

$r = 15\,cm \Rightarrow 0.15\,m$

$q = 3\,uC \Rightarrow 3 \times 10^{-6}\,C$

$K = 9 \times 10^{9}\,Nm/C^2$

Required:

$\vec{E} = ?$

Solution:

As we know that;

$$\vec{E} = \frac{kq}{r^2}$$

$$= \frac{(9\times10^{9})(3\times10^{-6})}{(3\times10^{-2})^2}$$

$$= \frac{29\times10^{3}}{9\times10^{-6}}$$

$$= 3\times10^{3+6}$$

$$= 3\times10^{9}\ N/C$$

(ii)

ANSWER:

POTENTIAL GRADIENT:

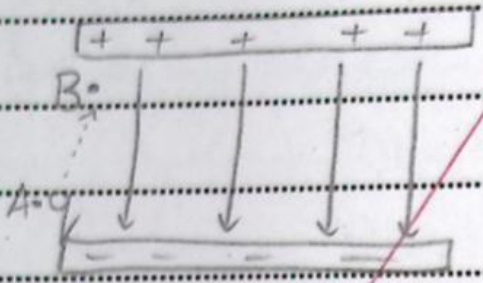
Def:

The rate of change of electric potential to the displacement change is called electric potential gradient."

Mathematically:

$$\vec{E} = -\frac{\Delta V}{\Delta r}$$

Proof:



Consider the uniform electric field between two oppositely charged plates. Let A and B be the point in the electric field, the work done on the charge q that is present in the electric field is;

$$W = F.\Delta r$$

$$= F\Delta r \cos\theta$$

$$W = F\Delta r \quad \because \cos\theta = 0°$$

The electric force $q\vec{E}$ is done

on the charge, to move the charge against the electric field, equal and opposite force must be applied on 'q', so;

$$W = -qE\Delta r$$

$$\frac{W}{q} = -E\Delta r$$

$$\Delta V = -E\Delta r$$

$$E = -\frac{\Delta V}{\Delta r}$$

The negative sign shows that electric potential decrease in the direction of electric field.

Units:

$$E = \frac{\Delta V}{\Delta r}$$

$$= V/m$$

(iv)

ANSWER:

VOLTS:

- Volt is the unit of electric potential.
- 1 volt is the potential difference between two points when work done of 1 J is done in moving charge q of 1C from one point to another.

ELECTRON VOLTS:

- Electron volts is the unit of energy.
- It is the smallest unit used for the subatomic particle.

Relation:

Relationship between volt and electron volt is;

$1eV = qV$

$= (1.6 \times 10^{-19} C)(1\,V)$

$1eV = 1.6 \times 10^{-19} eV$

Difference:

volt and electron volt are two different physical quantities. Volt is associated with electric field while electron volt is associated with the charge that is present inside the electric field.

(v)

ANSWER:

OHM'S LAW:

Statement:

The current in a conductor is directly proportional to the potential difference across the terminals

of battery.

Mathematical:

$$I \propto V$$

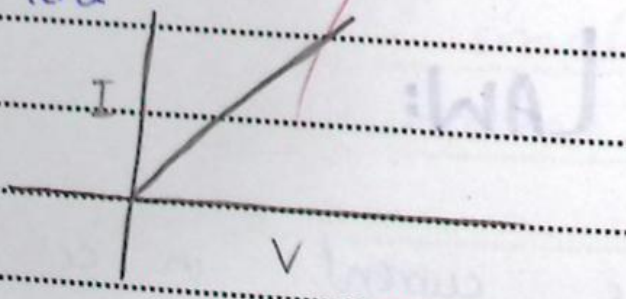
$$I = \frac{1}{R} V$$

$$I = \frac{V}{R}$$

R is the resistance of the conductor.

Graph:

For ohmic conductors, the graph of I & V is a straight line.



Ohmic Conductors:

Those materials which obey ohm's law are called ohmic conductors.

Example:

Metals are ohmic conductors for which the slope of graph is straight.

Non-Ohmic Materials:

Those materials which do not obey the ohm's law are called non-ohmic material.

Example:

Diode and tungsten filament for which the slope of graph is not straight.

(vi)

ANSWER:

INDUCTANCE:

The ability of the induce emf to oppose the change in the current

FACTORS AFFECTING INDUCTANCE:

The factors that affect inductance is given below.

Shape & No. of Turns:

Greater the number of turns in coil, greater will be the inductance and vice versa.

Permibillity of the core:

Greater

the permibility of the core on which the coil is wrapped, greater will be the inductance.

Distance b/w coils:

Greater the distance between coils, lesser will be the inductance and vice versa.

Dimensions:

Inductance is directly proportional to length and inversely proportional to area.

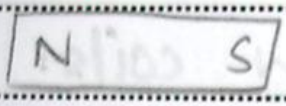
(vii)

ANSWER:

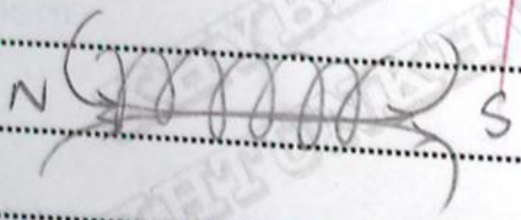
A current carrying coil behave like a bar magnet because;

Reason:

Bar magnet is a permanent magnet which have north and south pole.



The current carrying coil have a magnetic field around it and it also have north and south pole which can be determined by right hand rule ||



(viii)

ANSWER:

AFFECT OF DOUBLED FREQUENCY ON REACTANCE OF INDUCTOR:

Reactance of inductor is given by;

$$X_L = 2\pi f L$$

When $f' = 2f$

$$X_L' = 2\pi(2f)L$$

$$= 2(2\pi f L)$$

$$X_L' = 2X_L$$

So doubling the frequency doubles the reactance of the inductor.

AFFECT OF DOUBLED FREQUENCY ON REACTANCE OF CAPACITOR:

Reactance of capacitor is given by

$$X_C = \frac{1}{2\pi f C}$$

When $f' = 2f$

$$X_C' = \frac{1}{2\pi(2f)C}$$

$$X_c' = \frac{1}{2(2f)C}$$

$$X_c' = \frac{1}{2} X_c$$

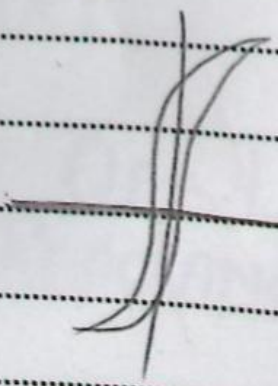
So doubling the frequency decrease the reactance of capacitor.

(ix)

ANSWER:

SOFT MAGNETIC MATERIAL:

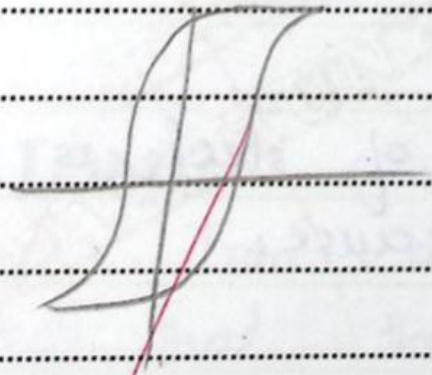
The materials which can easily magnetize and demagnitize are called soft magnetic materials.



The hysterisis loop of soft material is narrow because when magnitizing force is applied, they easily get magnitized and when removed they easily get demagnitized.

HARD MAGNETIC MATERIAL:

The materials which can not be easily magnetize and demagnetize are called hard magnetic material.



The hysteris loop of hard material is wide because when magnetizing force is applied, they don't easily get magnitize & when removed

they don't easily get demagnitize.

(X)

ANSWER:

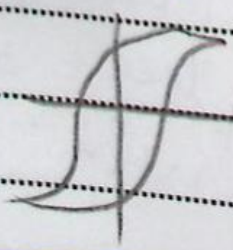
COERCICTIVITY:

The amount of magnetizing force that is required to null the magnetization in the material is known as coercive force and the phenomenon is known as coerctivity.

Coecive force of steel is greater than iron because;

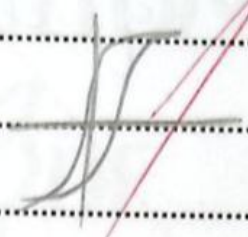
REASON:

The hysterisis loop for steel is



From hysterisis loop, it is clear that the coercive force i.e coecivity of the steel is very large.

The hysterisis loop for iron is;



It have narrow loop means that the coercive force i.e coecivity of iron is low.

CONCLUSION:

From above discussion, it is clear that the steel coercive force is larger than that of iron.

(xii)

ANSWER:

If an electron and a proton have same d-Broglie wavelengths, the electron has greater speed than that of electron.

REASON:

As we know that;

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

it is the de-Broglie wavelength equation.

From the equation

$$\lambda \propto \frac{1}{m}$$

The wavelength is inversely proportional to mass.

since proton is 1836 times heavier than electron ,so the electron will have greater speed.

{SECTION C}

{QUE 3}

(a)

ANSWER:

AC-GENERATOR:

Def:

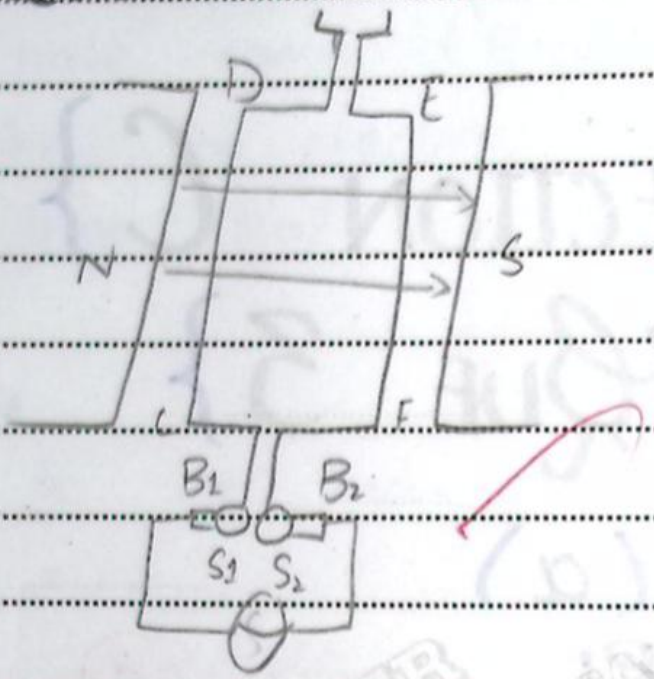
The device which convert the mechanical energy into electrical energy.

Principle:

A.C generator work on the principle of Faraday's law of

elektromagnetic induction.

Construction:



The AC generator consist of two permanent magnets, a coil, that forms the loop CDEF, two slip rings S_1, S_2 connected to the coil and with slip ring two carbon brushes are connected B_1 and B_2.

WORKING:

During the first half revolution, the sible CD of the

coil is perpendicular to the magnets so induce current is produce in the direction from C to D and comes out at the B_1.

During the next half revolution, FE is now perpendicular to the magnets, so induce current is produce in the direction from F to E and comes out at B_2, in this way AC current is produced.

MATHEMATICAL EQUATION:

From Faraday's law of electromagnetic induct

$$\mathcal{E} = -\frac{N\Delta\Phi}{\Delta t}$$

$$= -\frac{N\Delta(B \cdot A)}{\Delta t}$$

$$= -\frac{N\Delta BA\cos\theta}{\Delta t}$$

$$= -\frac{NBA\,\Delta\cos\theta}{\Delta t}$$

$$= -\frac{NBA(-w\sin wt)}{\Delta t} \quad \because \Delta\cos\theta = -w\sin wt$$

$$\varepsilon = NBA\,w\sin wt$$

When $\sin wt = 1$, then

$$\boxed{\varepsilon_{max} = NBAw}$$

For instantaneous ε

$$\boxed{\varepsilon = \varepsilon_{max} NBAw}$$

(b)

GIVEN:

$I_1 = 5A$

$I_2 = 0$

$\Delta I = 0 - 5 \Rightarrow 5A$

$\Delta t = 0.1s$

$\varepsilon = 200V$

REQUIRED:

$L = ?$

SOLUTION:

As we ~~know~~;

$$L = -\frac{\Delta \mathcal{E} \Delta t}{\Delta I}$$

Putting values

$$L = \frac{(200)(0.1)}{(5)}$$

$$L = 4\,H$$

{QUE 4}

(a)

BOHR'S POSTULATES ABOUT HYDRON ATOM:

The bohr's postulates about hydrogen atom is;

The electrons moves around the nucleays in orbits or shells, these shells have specific energy.

The electron can not reside b/w the orbits, they are only present in the orbits.

Electrons moves from lower orbit to higher orbit only if it absorb energy which is equal to

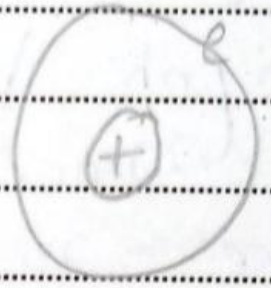
$$E = h\nu$$

The angular momentum of these electron revolving around the nucleos is the integral multiple of $h/2\pi$

$$mvr = \frac{nh}{2\pi}$$

The bohr also derive radius, energy for the hydrogen atom.

Derivation Of Radius:



$$F_c = F_{coloumb}$$

$$\frac{mv^2}{r} = \frac{ke^2}{r^2}$$

$$mv^2 = \frac{ke^2}{r}$$

$$r = \frac{ke^2}{mv^2} \rightarrow eq\,i$$

From bohr's postulate;

$$mvr = nh$$

$$2\pi$$

$$v = \frac{nh}{2\pi mr}$$

Taking square on b.s

$$v^2 = \left(\frac{nh}{2\pi mr}\right)^2$$

Putting in eq i

$$r = ke^2$$

$$m\left(\frac{nh}{2\pi mr}\right)^2$$

$$r = \frac{ke^2}{m\frac{n^2h^2}{4\pi^2m^2r^2}}$$

$$r = \frac{4\pi^2mr^2ke^2}{n^2h^2}$$

$$r = \frac{n^2h^2}{4\pi^2me^2\left(\frac{1}{4\pi\varepsilon_0}\right)} \quad \because k = \frac{1}{4\pi\varepsilon_0}$$

$$r = \frac{n^2h^2\varepsilon_0}{m\pi e^2}$$

$$\boxed{r = n^2\alpha} \qquad \alpha = \frac{h^2\varepsilon_0}{m\pi e^2}$$

(b)

GIVEN:

$n = 4$

$p = 1$

Rydberg const = 1.09×10^{-7}

REQUIRED:

$\lambda = ?$

SOLUTION:

As we know

$$\frac{1}{\lambda} = R\left(\frac{1}{n^2} - \frac{1}{p^2}\right)$$

$$\frac{1}{\lambda} = 1.09 \times 10^{-7}\left(\frac{1}{4^2} - \frac{1}{1^2}\right)$$

$$\lambda = 1.02 \times 10^{-7}\ m$$

{QUE 6}

08

(a)

ANSWER:

EXPRESSION FOR CAPACITANCE OF PARALLEL PLATE CAPACITOR

Consider a parrallel plate capacitor having uniform electric field.

$$E = -\frac{\Delta V}{\Delta r}$$

One plate is at V_1 & the other is at V_2,

$$E = -\frac{(V_2 - V_1)}{\Delta r}$$

$$E = \frac{V_1 - V_2}{r}$$

$$E = \frac{V}{r} \longrightarrow eq\ i$$

Fic. No. 9/10

(صرف بورڈ کے استعمال کیلئے) اُمیدوار یہاں کچھ نہ لکھیں

As

$E = \frac{\sigma}{\varepsilon_0}$

$E = \frac{q}{A\varepsilon_0}$ → eq ii $\because \sigma = \frac{q}{A}$

From eq i & ii

$\frac{V}{r} = \frac{q}{A\varepsilon_0}$

$\frac{q}{V} = \frac{A\varepsilon_0}{r}$

$C = \frac{A\varepsilon_0}{r}$

(b)

ANSWER:

WHEATSTONE BRIGE:

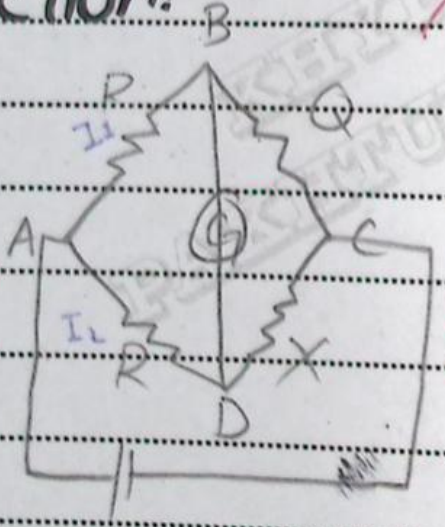
Def:

A device which is used to find the unknown resistance of a resistor is known as wheatstone bridge.

Principle:

It work on the principle of balancing the bridge.

Construction:



Wheatstone bridge consist of four resistor in which PRQ are known & X is unknown, the R resistor is variable and PQ are fixed

When current passes as the switch is on, the I_1 passes through AB & the I_2 passes through AD the galvanometer starts the deflection, the R is adjusted & the deflection in galvanometer stops as the potential difference is same across B & D.

$$X = \frac{PQ}{R}$$

Thus by knowing the values of P, Q & R X can be known.