بسم اللہ الرحمن الرحیم

(IN THE NAME OF GOD
WHO IS MERCIFUL
AND BENIFICIARY)

SECTION - B

Q.No; 2

PART — (VIII)

EFFECT OF DOUBLING FREQUENCY

AN INDUCTOR is

As inductance of coil is given by

$$X_L = 2\pi f L \quad \text{—(i)}$$

Now if we double the frequency (i) becomes

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

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

$$\boxed{X_L' = 2X_L}$$

∴ Doubling the frequency increases the inductance by factor of 2

A CAPACITOR :-

As capacitance is given by $X_C = \frac{1}{2\pi f C}$ — (ii)

Now if we double the frequency equation (ii) becomes

$$X_C' = \frac{1}{2\pi \cdot 2fC}$$

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

$$\boxed{X_C' = \frac{1}{2} X_C}$$

∴ Doubling the frequency decreases the capacitance by factor of $\frac{1}{2}$.

PART —— (xi)

$\alpha = \frac{I_C}{I_E}$ —— (i) $\beta = \frac{I_C}{I_B}$ —— (ii)

$I_E = I_C + I_B$

$I_B = I_E - I_C$ —— (iii)

Put (iii) in (ii)

$\beta = \frac{I_C}{I_E - I_C}$ —— (iv)

Multiply divide (iv) by I_E

$\beta = \frac{I_C / I_E}{I_E / I_E - I_C / I_E}$

$\beta = \frac{\alpha}{1-\alpha}$ $\quad \therefore \alpha = \frac{I_C}{I_E}$

PART — (ii)

As voltage is given as $\Delta V = \frac{W}{q}$ — (i)

As $W = F \cdot \Delta r$ — (ii)

Put (ii) in (i)

$\Delta V = \frac{F \cdot \Delta r}{q}$

$\frac{\Delta V}{\Delta r} = \frac{F}{q}$

$\therefore \boxed{\frac{F}{q} = E}$

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

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

This is called electric potential gradient.

$\therefore$ (−) Negative sign shows that work is done against the direction of electric field.

PART — (V)

OHM's LAW:

"It is stated that current in wire is directly proportional to voltage supplied by the source".

MATHEMATICAL FORM:

$$I \propto V$$

$$I = VR$$

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

Resistance is proportionality constant.

Ohm's law is obeyed as long as resistance is constant.

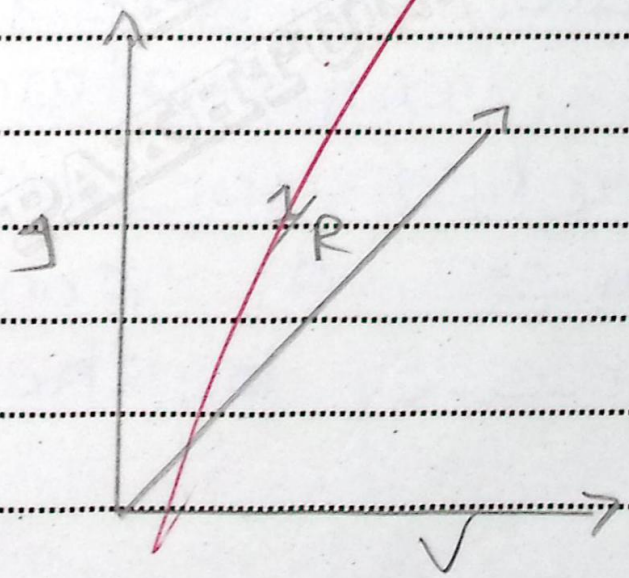
OHMIC DEVICES:

Those devices which obey ohm's law and voltage - current proportionality is always there.

It means they have constant slope.

EXAMPLE:
Ohmic device is ideal one because almost all devices obey ohm's law upto certain time. After that resistance changes.

GRAPH:



slope is constant for ohmic device.

NON-OHMIC DEVICES:

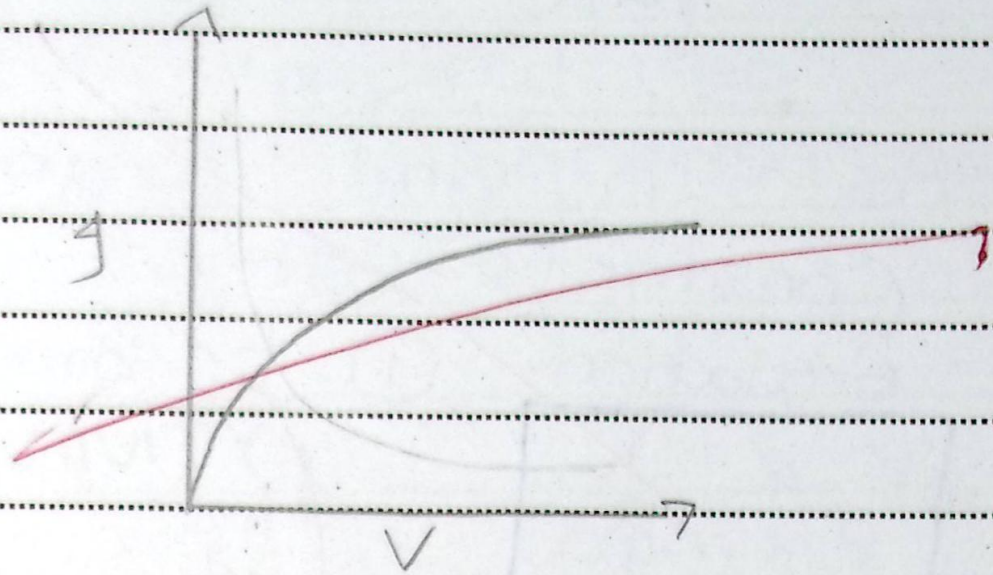
Non-ohmic devices do not follow current - voltage proportionality.

They have curved slope

EXAMPLE:

Tongsten Bulb which dont follow ohm's law after certain temperature is reached because resistance of conductor is increased by heating.

GRAPH :}



PART — (xii)

ANSWER :}

Electron will have greater speed.

EXPLAINATION :}

As de-broglie wavelength is $\lambda = \frac{h}{mv}$

$$v = \frac{h}{\lambda m} \quad \text{——} (1)$$

As h and λ are constants so Equation (1) becomes

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

∴

As electron have smaller mass than proton, so it will have greater speed.

PART — (x)

STEEL REQUIRE GREATER COERCIVE FORCE:)

COERCIVITY:- It is amount of reverse magnetic field required to terminate magnetism in material.

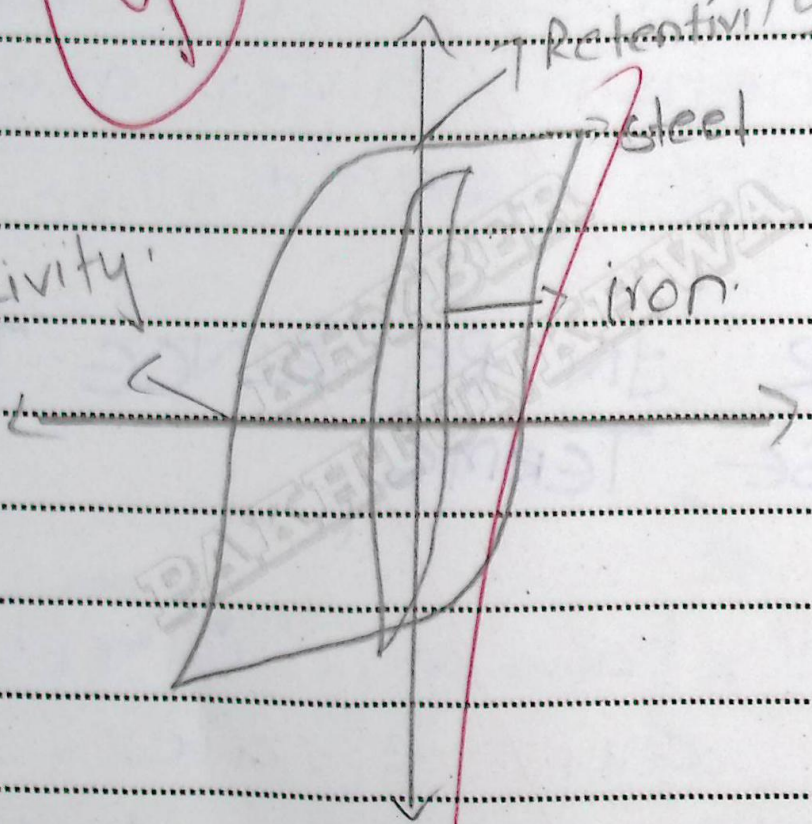
RETENTIVITY:-
It is capacity of material to retain magnetism after magnetic field is removed.

ANSWER IN REFERENCE TO THOSE TERMS:-

Steel has greater retentivity thats why greater coercive force will be required to end its magnetism.

IN TERMS OF GRAPH:

Iron has narrow hysteresis loop while steel has broad hysterisis loop because of its greater retentivity.



∴ ((Coercive force of steel is greater as shown) --

PART — (IV)

RELATION BETWEEN VOLTS AND ELECTRON VOLTS:

Volts and electron volts are different terminologies. They are different from each other.

VOLT:

Volt is unit of potential difference or voltage. 1 Volt is amount of work done on charge by moving it against electric field.

The difference of potential between two points is measured in volts.

ELECTRON - VOLT:

It is amount of energy acquired or lost by an electron moving in electric field.

1 eV is amount of energy gained or lost by electron of charge 1.6×10^{-19} when moving through 1 volt.

CRITICAL DIFFERENCE:

Volts can be used for anycharge while electron volt is energy which involves only electron.

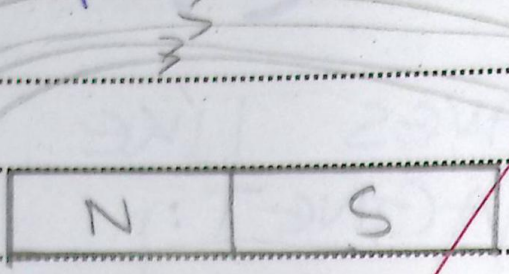
PART — (vii)

COIL BEHAVES LIKE BAR MAGNET:

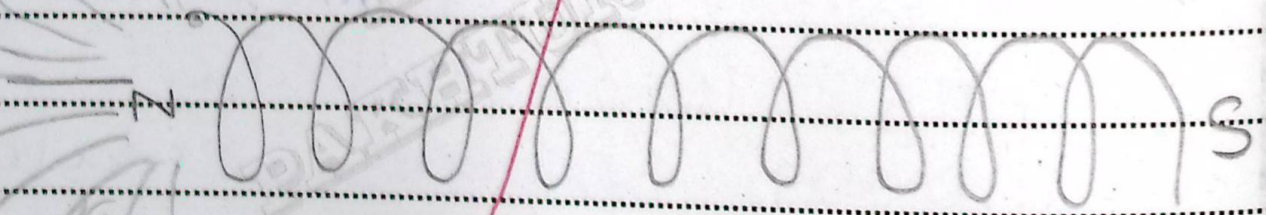
Bar magnet has two poles. Magnetic field is created from North pole to South pole.

Similarly when current is allowed to flow through coil, magnetic field is created. Moving charges create magnetic fields around them. When the whole coil is full of moving current, Magnetic fields are created which resembles bar magnet.

DIAGRAMATIC REPRESENTATION;



Bar magnet



(Two poles are created in current carrying coil)

PART — (i)

GIVEN:

$d = 0.3\,m$

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

REQUIRED:

$E = ?$

SOLUTION:

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

Put values

$$= \frac{9 \times 10^9 \times 3 \times 10^{-6}}{(0.3)^2}$$

$$E = \frac{27 \times 10^3}{0.09}$$

$$E = 300 \times 10^3\ N/C$$

PART — (xiii)

PAIR PRODUCTION:

Pair production is phenomenon of photon hitting nucleus results in creation of two opposite charges electron and positron.

GENERAL FORM:

(3+1)

$$\text{Photon} + \text{Nucleus} \rightarrow e^+ + e^-$$

PRESENCE OF NUCLEUS IS NECESSARY:

Presence of Nucleus is necessary for conservation of Energy

As " According to Einstien mass-Energy relation mass of subtituents are greater than bound mass of nucleus because some of mass is converted into energy while creating electron and positron to conserve energy on both sides.

Explaination in reference to $E = mc^2$

SECTION-"C"

Q.NO: 4

PART — (a)

BOHR's POSTULATES:

→ Energy of electrons moving in orbits is quantized and is integral multiple of $\frac{h}{2\pi}$

→ Electron radiates or absorbs energy during excitation or de-excitation jumps. It cannot radiate

or absorb energy when remain is same orbit.

Energy difference is given $\Delta E = E_2 - E_1$

→ The motion of electron in an orbit is due to centripetal force which is equal to coloumb electric force.

DERIVATION FOR RADII :-

$$F_{coloumb} = F_{centripetal}$$

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

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

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

As angular momentum is given by

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

$$v = \frac{nh}{2\pi r m}$$

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

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

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

$$\frac{n^2h^2}{4\pi^2 ke^2} = \text{constant}$$

$$\boxed{r = n^2 \times 0.5 \times 10^{-10}\ m}$$

6

PART — (b)

GIVEN:
$n = 4$ — do —

SOLUTION:

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

As $p = n - 1$

$R = 1.097 \times 10^7\ m^{-1}$

Put values

$$\frac{1}{\lambda} = 1.097 \times 10^7 \left(\frac{1}{3^2} - \frac{1}{4^2}\right)$$

$$\frac{1}{\lambda} = 1.097 \times 10^7 \left(0.0486\right)$$

$$\frac{1}{\lambda} = 0.0533 \times 10^{7}$$

$$\lambda = \frac{1}{0.0533 \times 10^{7}}$$

$$\boxed{\lambda = 1.876 \times 10^{-7}\ m}$$

Q. NO – 5

PART – (a)

8

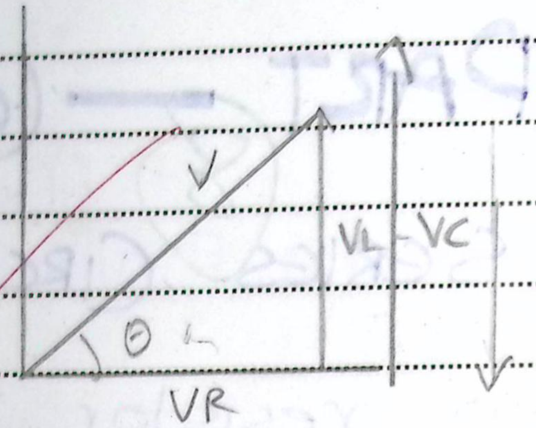
RLC- SERIES CIRCUIT:

When resistor, inductor and capacitor are connected in series then circuit is called RLC-series circuit.

PHASE RELATIONSHIPS:

V_R is taken common as it is in phase with current, V_L will be greater than I by amount less than 90° and V_C will be less than I by amount less than 90°.

DIAGRAM



DERIVATION:

If we consider $V_L > V_C$ than impedance is given by

$$V^2 = V_R^2 + (V_L - V_C)^2$$

$$V^2 = IR + (IX_L - IX_C)^2$$

$$V^2 = I^2R^2 + I^2(X_L - X_C)^2$$

$$V = I\sqrt{R^2 + (X_L - X_C)^2} \quad \text{--- (i)}$$

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

Equation (i) becomes

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

(Σ)

PHASE ANGLE DETERMINATION:

$$\tan\theta = \frac{V_L + V_C}{V_R}$$

$$\tan\theta = \frac{I(X_L - X_C)}{IR}$$

$$\tan\theta = \frac{X_L - X_C}{R}$$

POWER FACTOR:

Power factor $= IV\cos\theta$

THREE CASES:

(i) If $X_C > X_L$ then circuit will be capacitive

(ii) If $X_C < X_L$ then circuit will be inductive.

(iii) If $X_L = X_C$ then circuit will be purely resistive.

(b)

(U) Atomic mass unit:

"One "U" is $\frac{1}{12}$ of mass of carbon atom"

In standard terms

mass of carbon atom is taken = 12

mass of carbon atom = 1.66×10^{-24}

mass of 1 carbon atom = $\frac{1.66 \times 10^{-24}}{12}$ g

i.e.

As one U is $\frac{1}{12}$ of mass of carbon atom

$U = \frac{1}{12}\left(\frac{1.66 \times 10^{-24}}{12}\right)$

$U = 1.49 \times 10^{13}$]

$1 eV = \frac{1}{1.66 \times 10^{-19}}$

$U = \frac{1.49 \times 10}{1.6 \times 10^{-19}}$

$U = 931.5 MeV$

Q.NO 6

PART — (a)

WHEATSTONE BRIDGE:

PRINCIPLE:

It is used to find unknown resistance by help of variable resistance.

CONSTRUCTION AND WORKING:

Consider circuit where there are fixed resistors P and Q. There is variable resistor R and unknown resistance X. Current is allowed to flow through circuit. Current is divided into two path; along fixed Resistance Q and Variable resistance R. Galvanometer is also connected. Same amount of potential will be at B and D if galvanometer shows zero deflection. So we can write

$$I_Q = I_R \quad \text{——— (i)}$$

$$I_P = I_X \quad \text{——— (ii)}$$

Divide (i) by (ii)

$$\frac{\Delta Q}{\Delta P} = \frac{\Delta R}{\Delta X}$$

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

3+1

NUCLEAR FISSION:

The splitting of large nucleus into two smaller nuclei with release of energy.

EXPLAINATION:

Neutron drives this reaction. When heavy Uranium nuclei is splitted into two small radium and Barium nuclei.

REACTION:

$$3\,{}^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{236}_{92}U^{*} \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr$$

It is chain reaction as neutrons are needed to drive this.

3.5