1. (v)

State Ohm's Law....

(Ans)

OHM'S LAW

Statement :- Ohm's Law states that when voltage is applied in a circuit, it produces current such that current is directly proportional to applied voltage provided temperature is constant.

Mathematically :-

$$V \propto I$$

$$V = IR$$

where 'R' is resistance.

Unit of R is Ohm (Ω)

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

$$1\,\Omega = \frac{1\,V}{1\,A}$$

Difference :

Ohmic	Non - Ohmic
→ The substances where resistance is constant.	Substances where resistance is not constant
→, Example :- metals	Example :- semi-conductor diode.
→ The obey Ohm's Law	They don't obey Ohm's Law.
→ IV Graph is a straight line	IV graph is curved

2. (vii)

How does.....

(Ans)

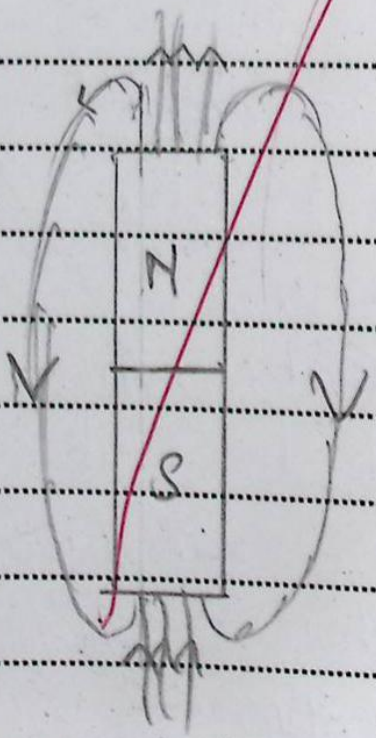
ANSWER

Current carrying coil behaves like a bar magnet when it is wound into a solenoid.

EXPLANATION

Whenever current is passed in a coil, it generates a magnetic field around it. But, when the coil is shaped like a solenoid, the magnetic field around the coil resembles the magnetic field of a bar magnet. The field is uniform

near the centre as magnetic field lines are essentially parallel to each other. Similarly, one end of the coil behaves like the north pole of a magnet. Magnetic field lines leave that end and terminate at the other end.



(Bar magnet)

(Solenoid)

3. (i) Find electric...

(Ans)

Given :

$r = 30\ cm$

$q = 30\ \mu C$

To Find :

$E = ?$

Formula :

$$E = k \frac{q}{r^2}$$

Solution :

$r = 30\ cm$

$r = 30 \times 10^{-2}\ m$

$q = 3\ \mu C$

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

$$E = \left(9 \times 10^{+9} \times \frac{3 \times 10^{-6}}{30 \times 10^{-2}} \right) \frac{N}{C}$$

$$E = 3 \times 10^{5} \ N/C$$

4a = 4b

---

4. (xiii)

Explain...

Ans

PAIR PRODUCTION

Definition: When a particle and its antiparticle are formed ~~after~~ the interaction of light photon with a nucleas, the phenomena is called pair production.

Explanation:

Consider an incoming light photon strikes a nucleas, it forms an electron and positron. The presence of nucleas is necessary in order to conserve ex. momentum. Electron and positron are of opposite charges to preserve obey laws of conservation of charges. The incoming photon must posses a minimum of $2m_0c^2$ energy. The excess energy is transformed into the kinetic energies of the two particles.

$$hf = 2m_0c^2 + K.E_e + K.E_p$$

If the photon has only $2m_0c^2$ energy, the particles will not have kinetic energies.

$$hf = 2m_0c^2 \quad (4)$$

Putting values of mass of electron and speed of light.

$$hf = 2 \times 9.1 \times 10^{-31} \times 3 \times 10^8$$

$$\boxed{hf = 1.02 \text{ MeV.}}$$

---

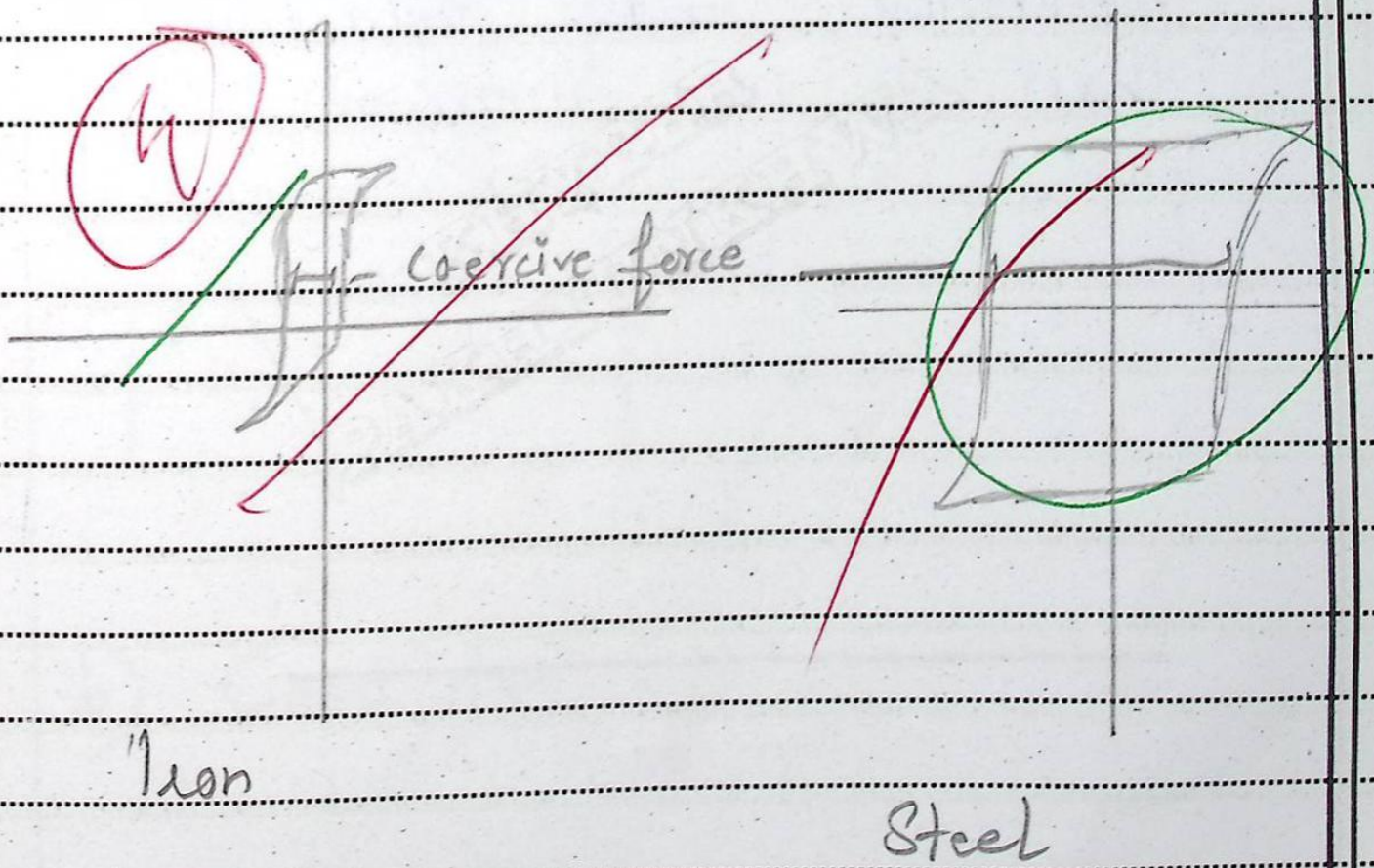
5. (x)

Coercive...

ANSWER

Co-ercive force of steel is greater than iron because it has a bigger hysteris loop due to higher resistivity reluctance and retentivity.

EXPLANATION



Co-ercive force refers to the amount of magnetizing force that is required to reduce the residual magnetic flux to zero. Steel has a bigger hysterisis loop, which shows that steel has a higher retentivity and reluctance than iron. Therefore, it has a higher co-ercive force than iron.

(viii)

6. How does...

Ans.

a) Inductor :-

As we know:

$$X_L = 2\pi f L$$

Put $f = 2f$

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

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

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

b) Capacitor :-

As we know:

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

Put $f = 2f$

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

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

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

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

(4)

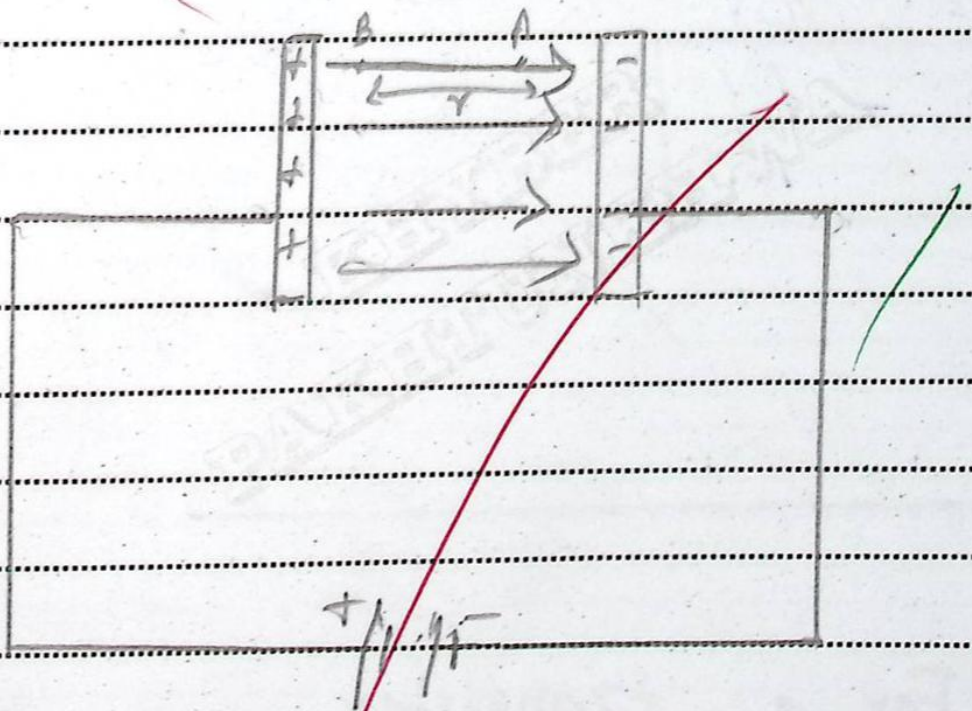
7. (ii)

Show ...

Ans

Proof of $E = -\frac{\Delta V}{\Delta r}$.

Consider two plates of a capacitor. When the plates are charged, an electric field is set up between them. the distance between A and B is r.



If we want to move the charge from point A to B, work done will be:

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

$W = F \Delta r \cos 180^\circ$

$W = -F \Delta r$

$W = -Eq \Delta r$ | Put $F = Eq$

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

Since $\frac{W}{q} = \Delta V$

$\Delta V = -E \Delta r$

$-E \Delta r = \Delta V$

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

---

8. (xi)

For a transistor...

Ans.

Proof that $\beta = \frac{\alpha}{1-\alpha}$

For a transistor, α is given by:

$$\alpha = \frac{I_C}{I_E} \quad \text{—— (1)}$$

β is given by:

$$\beta = \frac{I_C}{I_B} \quad \text{—— (2)}$$

Since

$$I_E = I_B + I_C$$

$$I_B = I_E - I_C$$

Put this value of I_B in (2)

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

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

Since $I_C / I_E = \alpha$

$$\beta = \frac{\alpha}{1 - \alpha}$$

4

9. (iv) How...

(Ans

Volt :- Volt is the unit of potential difference

$$V = \frac{W}{q}$$

$$V = \frac{J}{C}$$

Electron Volt :- Electron volt is the amount of energy gained or lost by an electron when it moves between two points having potential difference of one volt.

$eV = q.V$

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

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

Relation :- They are related in the sense that in order to calculate electron volt, you need to multiply the charge of electron with 1V as the electron has moved between two points having potential difference of 1V.

Difference :- Volt is the unit of potential difference. whereas electron volt is the amount of energy. Potential difference and energy are different physical quantities hence volt and electron volt are different.

(xii)

10. If an...

Ans

Answer :-

For the same De-Broglie's wavelength, speed of electron will be higher as its mass is less than that of protan.

Explanation :-

De-Broglie's wavelength is given by :-

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

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

$$h = \lambda mv$$

$$\lambda mv = h$$

$$v = \frac{h}{\lambda m}$$

Since h is constant and λ is taken the same.

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

Since, mass of ~~its~~ electron is less than mass of proton. Therefore, its speed will be greater.

LONG QUESTIONS

Fic. No. 482

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

Q.3

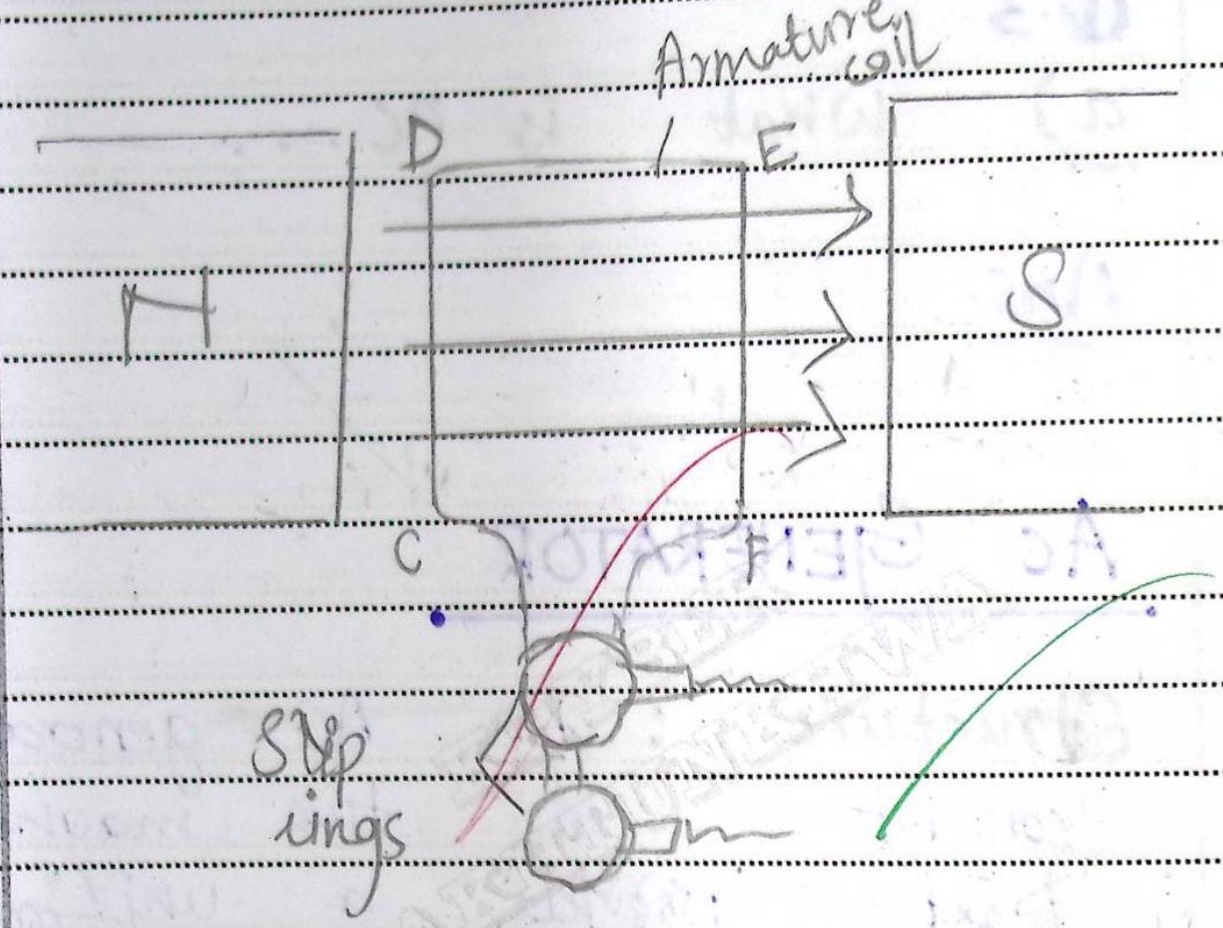
1. a) What is AC...

Ans.

AC GENERATOR

Structure : An AC generator consists of two magnets that provide a uniform magnetic field. It also consists of an armature coil attached to two slip rings which provide alternating current.

FUNCTION : Function of AC generator is to provide AC current.

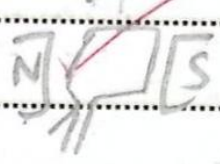


Working :- When armature coil is rotated, the magnetic flux through the coil changes due to which emf is induced and a current flows. When CD

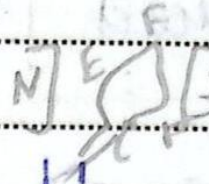
moves up, direction of current flows from C to D and E to F. Half a revolution later, EF occupies the place of AB. The direction of current is now reversed.

Point A

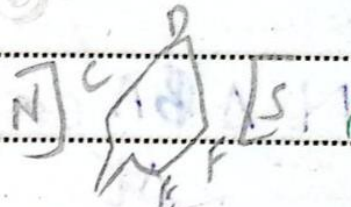
B



C



D



At point A, change in magnetic flux is 0, hence no current flows, At B, $\theta = 90^\circ$ and hence current flows, At point C, again no current flows. At point

D, current flows but in opposite direction to that of point B. After that at point E, coil returns to its original position.

Mathematical Derivation:

Induced Emf is given by:-

$$\mathcal{E} = N \frac{\Delta \Phi_B}{\Delta t}$$

Put $\Phi_B = BA\cos\theta$

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

$$\mathcal{E} = NBA \frac{\Delta \cos\omega t}{\Delta t}$$

Put $\frac{\Delta \cos\omega t}{\Delta t} = -\omega \sin\omega t$

$$\mathcal{E} = -NBA\omega \sin\omega t$$

Emf at any instant is given by :

$$\mathcal{E} = \mathcal{E}_{max} \sin \omega t$$

(b)

Numerical . . . .

Given :-

$$\Delta I = -5.0\,A, \quad \Delta t = 0.1\,s, \quad \mathcal{E} = 200\,V$$

To find :-

$$L = ?$$

Solution :-

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

$$L = -\varepsilon \frac{\Delta t}{\Delta I}$$

$$L = -200\ V \left(\frac{0.1}{-5.0} \right)$$

$$L = 4\ H$$

2. (d) 6.

b.

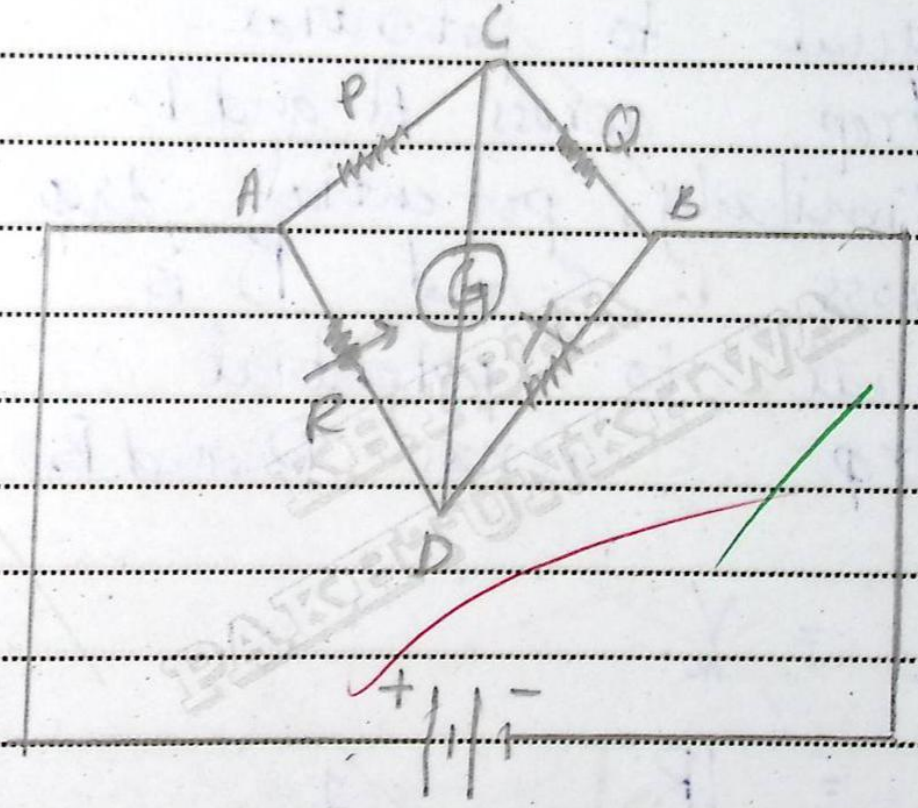
Wheatstone...

Ans.

WHEATSTONE BRIDGE

Construction: Wheatstone bridge consists of four resistors. Two fixed resistors P and Q. One known

variable resistor R and one unknown resistor X. Points A and B are connected two battery and C and D are connected to galvanometer.



Working :- When Voltage is applied, current divides unequally across two branches of A. At first C and D are at a different potential

and hence galvanometer shows current. By varying resistor, we will bring point C and D to the same potential. Now, potential drop across A and C is equal to potential drop across A and D. Similarly, potential drop across C and B is equal to potential drop across D and B.

$$V_{AC} = V_{AC}$$

$$IP = IR \quad \text{---(1}$$

$$V_{CB} = V_{DB}$$

$$IQ = IX. \quad \text{---(2}$$

Fic. No. 129²

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

Divide 1 by 2

$$\frac{1P}{1Q} = \frac{1R}{1X}$$

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

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

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

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

(b)

Nuclear Fission :-

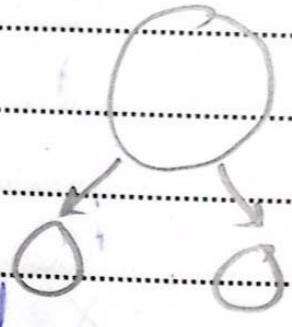
The reaction in which a larger nuclei breaks into two intermediate nuclei is called nuclear fission.

Energy Released :-

The total energy released is about 200 MeV

Fission Fragments :-

The two smaller nuclei are called fission fragments.



General Reaction :-

$$ {}^{1}_{0}n + X \longrightarrow X^{*} \longrightarrow A + Y + {}^{3}_{0}n + \gamma $$

Example :-

$$^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{236}_{92}U^{*} \longrightarrow ^{146}_{58}Ba + ^{87}_{36}Kr + 3^{1}_{0}n + \gamma$$

Discovery :-

It was discovered by Otto Han and Straussman in 1938.

Q.4 (a)

3. BOHR'S MODEL OF HYDROGEN ATOM :

Background :- After Ruthorford's experiments, Bohr presented his own model in order to correct the defects of Rutherford model.

Postulates:

→ There is electrostatic force of attraction between nucleas and electrons which provide centripetal force to electrons.

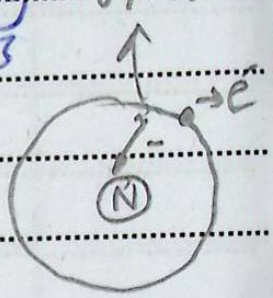
→ The electrons revolve only in those orbits for which angular momentum is given by

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

→ The electrons revolve around in fixed circular orbits.

→ Energy remains fixed as long as electron stays in an orbit.

When electron jumps from higher energy orbit E_2 to lower energy orbit E_1, it emits energy. The opposite is also true.



Expression for Radii :-

Electrons revolve around the nucleas in fixed orbits.

By 2nd postulate :-

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

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

By first postulate:-

As we know:-

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

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

Put value of v:

$$m\left(\frac{nh}{2\pi rm}\right)^2 = \frac{ke^2}{r_n}$$

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

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

$$r_n = n^2 \times \text{constant}$$

$$r_n = n^2 \times 0.53 \times 10^{-10}\ m$$

b

Numerical :-

Given :- $n = 4$

To find :- λ

Solution :-

$$v = \frac{2.16 \times 10^6}{n}$$

$$v = \frac{2.16 \times 10^6}{4}$$

$$v = 546694.064 \text{ m/s}$$

According to De Broglie's formula :-

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

$$\lambda = \frac{6.6268 \times 10^{-34}}{9.11 \times 10^{-31} \times 546694.064 \text{ m/s}}$$

$$\lambda = 1.33 \text{ nm}$$