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Gr. H. Raisoni College of Engineering & Management
Wagholi Pune
CAE - 1
Winter TERM - 2020 (Online)
Department - I T
Term / Section - 2020 Date of Examination - 02/03/2021
Subject Name / Code - Engineering Physics (UBSL 101)
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CO SubQ.

CO1 a.) ~~State~~ give formula for

(i) Coulomb force in case of electron and proton :

The force of attraction or repulsion between two charged bodies is directly proportional to the product of their charges and inversely proportional to the square of the distance between them.

The protons and electron have intrinsic property called charge.
$q_{proton} = 1.602 \times 10^{-19} C$
$q_{electron} = -1.602 \times 10^{-19} C$.

Formula of Coulomb force = $F = K \frac{q_1 q_2}{r^2}$ OR $F = \frac{q_1 q_2}{4\pi \varepsilon_0 r^2}$

where F = electric force, K = Coulomb Constant, q_1, q_2 = Charge
r = distance of separation.

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(ii) Lorentz force in case of charge 'q'.

Soln: The force exerted on a charged particle q moving with velocity v through an electric field E and magnetic field B is known as Lorentz force.

$F = qv \times B$ where q is charge, v is velocity and B is magnetic field density.

OR

$F_L = e(\vec{v} \times \vec{B}) = evB\sin\theta$.

(b) Show that the path of electron entering an uniform electric field at right angle to the field lines and travelling through the field is parabolic.

Ans: Let the electric field be E with potential V and electron entering at 90° and distance travelled d, and 2 points are d distance far.

$F = eE = \frac{eV}{d} \rightarrow (1)$ and $F = ma \rightarrow (2)$.

From Eq (1) & (2).

$\frac{eV}{d} = ma \rightarrow (3)$.

A force is applied thus electron must accelerate in its direction and $a = \frac{2y}{t^2} \rightarrow (4)$ [used $y = ut + \frac{1}{2}at^2$].

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Therefore Eq (3) becomes.

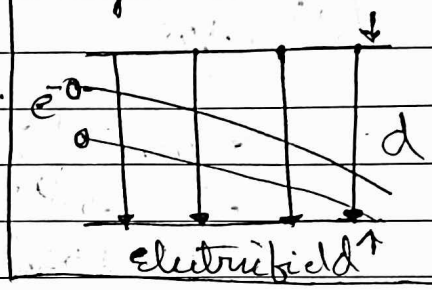
$$\frac{eV}{d} = ma = \frac{2my}{t^2} = \frac{2myV^2}{x^2} \longrightarrow (5)$$

Using $t = \frac{V}{x}$

From Eq (5), We get

$$y = \left[\frac{eV}{2dmV^2}\right] x^2$$ Thus the path followed by e⁻ is parabolic

Diagram:



c) Prove that, for small value of angle, the pitch of helix followed by an electron is independent of the angle.

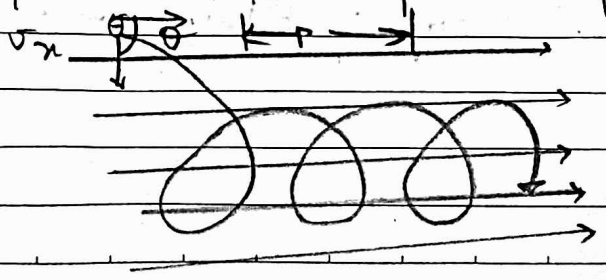
Answer: Pitch of helix is the distance covered by e⁻ in one revolution with along field.

Pitch of helix is given by,

$$P = v_1 T = v_z T$$

$$P = (v\cos\theta)\left(\frac{2\pi m}{eB}\right) = \frac{2\pi m v \cos\theta}{eB}$$

This shows that for small values of angle, the pitch of helix followed by an e⁻ is independent of angle θ.



$F_{1z} = 0$, $F_{1x} = ev_x B$.

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(d). Given.

Electric field of intensity $= 0.24\,KV/C = 240\,V/C$.
$e^- = 1.6 \times 10^{-19} C$, $m = 9.1 \times 10^{-31} kg$.
$E = 240\,V/C$.

1.) Force $= eE$
$= 1.6 \times 10^{-19} \times 240 = 3.84 \times 10^{-17} N$.

2.) Acceleration, $a = F/m = \frac{3.84 \times 10^{-17} N}{9.1 \times 10^{-31} kg} = 4.219 \times 10^{14} m/s^2$.

3.) $K.E = 1/2\, mv^2 = eV = 1.44 \times 10^{-17} J$.

4.) Velocity, $v = 5.625 \times 10^6 m/s$.

Q2. a)(i) The two sources of light must be coherent.

(ii) The amplitudes of ~~two~~ waves must be equal i.e. the brightness of the two sources should be the same.

(iii) The sources of light should be narrow.

(iv) The sources should emit light waves in nearly the same direction. The source of light must be monochromatic.

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(b) Destructive interference takes place when waves come together in such a manner they completely cancel each other out. When two waves destructively interfere, they must have the same amplitude in opposite directions.

The condition for constructive interference is that the phase difference between the two waves should be an even integral multiple of π or 180°.

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