$\bar{v} \perp \bar{B}$ → Path → Circular

$R = \frac{mv}{qB} = \frac{\sqrt{2m\,K.E}}{qB}$

$T = \frac{2\pi m}{qB}$

$\omega = \frac{qB}{m}$

$f = \frac{qB}{2\pi m}$

NEET 2019) Ionized hydrogen atom & α-particles with same momentum enters perpendicular to magnetic field B. The ratio of their radii of their path $r_H : r_\alpha$

H → Proton

(a) 4 : 1

(b) 1 : 4

(c) 2 : 1

(d) 1 : 2.

$R = \frac{mv}{qB}$ $R = \frac{P}{qB}$

$R_\alpha = \frac{P}{2e^+ B}$

$R_H = \frac{P}{eB}$

$R_\alpha : R_H = \frac{P}{2eB} \times \frac{eB}{P} = 1 : 2$

$\frac{R_H}{R_\alpha} = 2 : 1$

AIPMT 2007/2009) Under the influence of a uniform magnetic field a charge particle move with a constant speed v in the circle of Radius R. The time period of rotation of particle

(a) depend on R and not on v.

(b) is independent of both v & R.

(c) depends on both v & R.

(d) depends on v & not R.

$$R = \frac{mv}{qB}$$

$$T = \frac{2\pi m}{qB}$$

$$T = \frac{2\pi R}{v} = \frac{2\pi \times mv}{v \times qB}$$

$$T = \frac{2\pi m}{qB}$$

AIPMT An electron having mass m & Kinetic Energy E enter in uniform magnetic field B perpendicular then its frequency will be.

(a) $\frac{eE}{qvB}$

(b) $\frac{2\pi m}{eB}$

(c) $\frac{eB}{2\pi m}$ ✓

(d) $\frac{2m}{eBE}$

$$f = \frac{1}{T} = \frac{1}{\frac{2\pi m}{qB}} = \frac{qB}{2\pi m}$$

$$f = \frac{eB}{2\pi m}$$

$$T = \frac{2\pi m}{eB}$$

$$f = \frac{1}{T}$$

(1991) AIPMT

Q) A Uniform magnetic field acts right angle to the dirn of motion of electrons. As a result, the electron move in a circular path of radius 2cm. If the speed of electron is doubled then the radius of the circular path will be.

(a) 2cm.

(b) 0.5 cm.

~~(c)~~ 4 cm.

(d) 1.0 cm.

$$R = \frac{mv}{qB}$$

$$R \propto v$$

$$R_f = 2R_i$$

$$= 2 \times 2\,cm = 4\,cm$$

$$R = \frac{mv}{qB}$$

$$R \propto v$$

(2023, AIIMS) A charged particle move through a magnetic field in a dir^n perpendicular to it. Then the

(a) Speed of the particle remains unchanged.

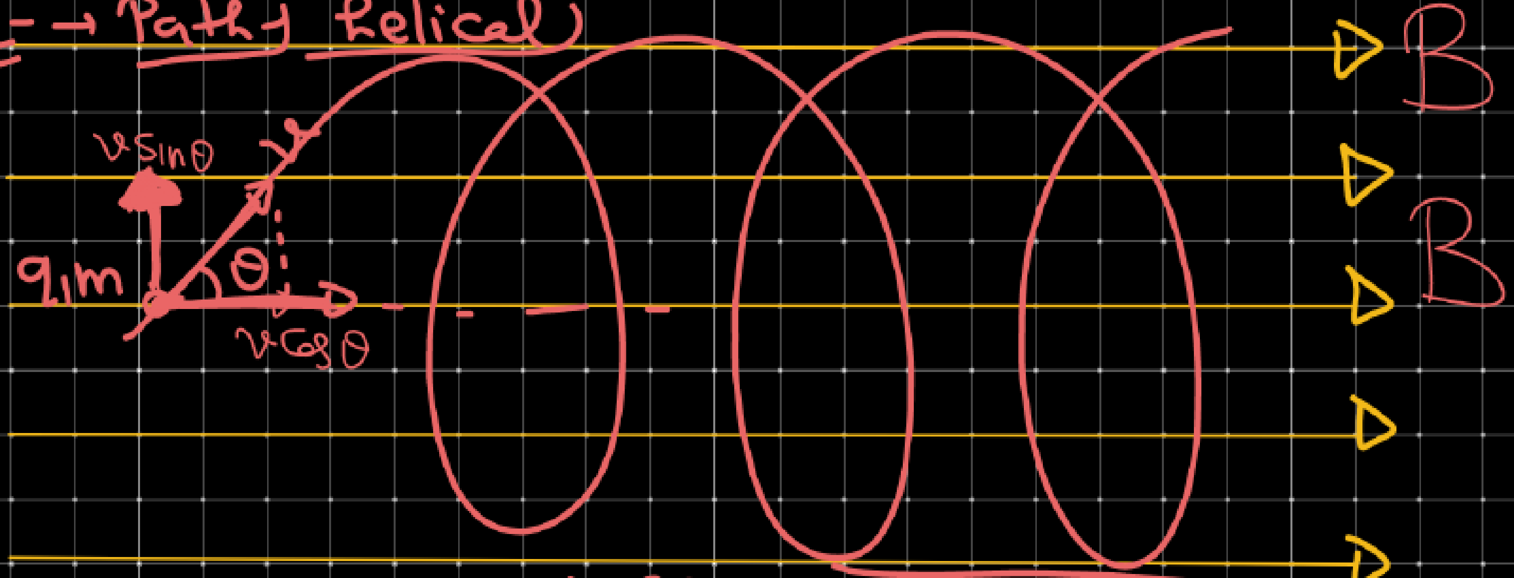
(b) dir^n of the particle remains unchanged.

(c) acceleration remains unchanged.

(d) Velocity remains unchanged.

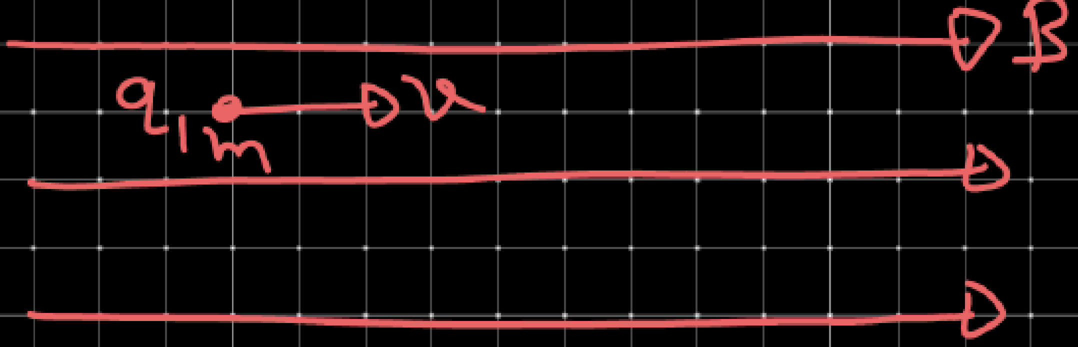
# $\theta \neq 0, \theta \neq 180, \theta \neq 90$

$\theta \to$ Path → helical




$v\sin\theta \perp B \Rightarrow R = \frac{mv_\perp}{qB} = \frac{mv\sin\theta}{qB}$

$v\cos\theta \parallel B$




$$\theta = 0$$

$$\vec{v} \parallel \vec{B}$$

$$\vec{F}_m = q(\vec{v} \times \vec{B})$$

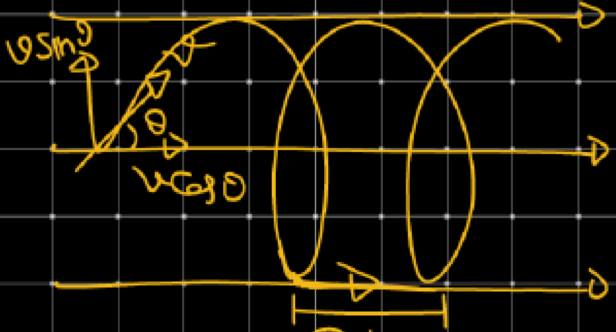
$$= q[vB\sin\theta]$$

$$= qvB\sin 0$$

$$F_m = 0$$

θ → other than 0°, 90°, 180°

Path → helical.




Pitch

(i) $R = \frac{m v_{\perp}}{qB} = \frac{m v \sin\theta}{qB}$

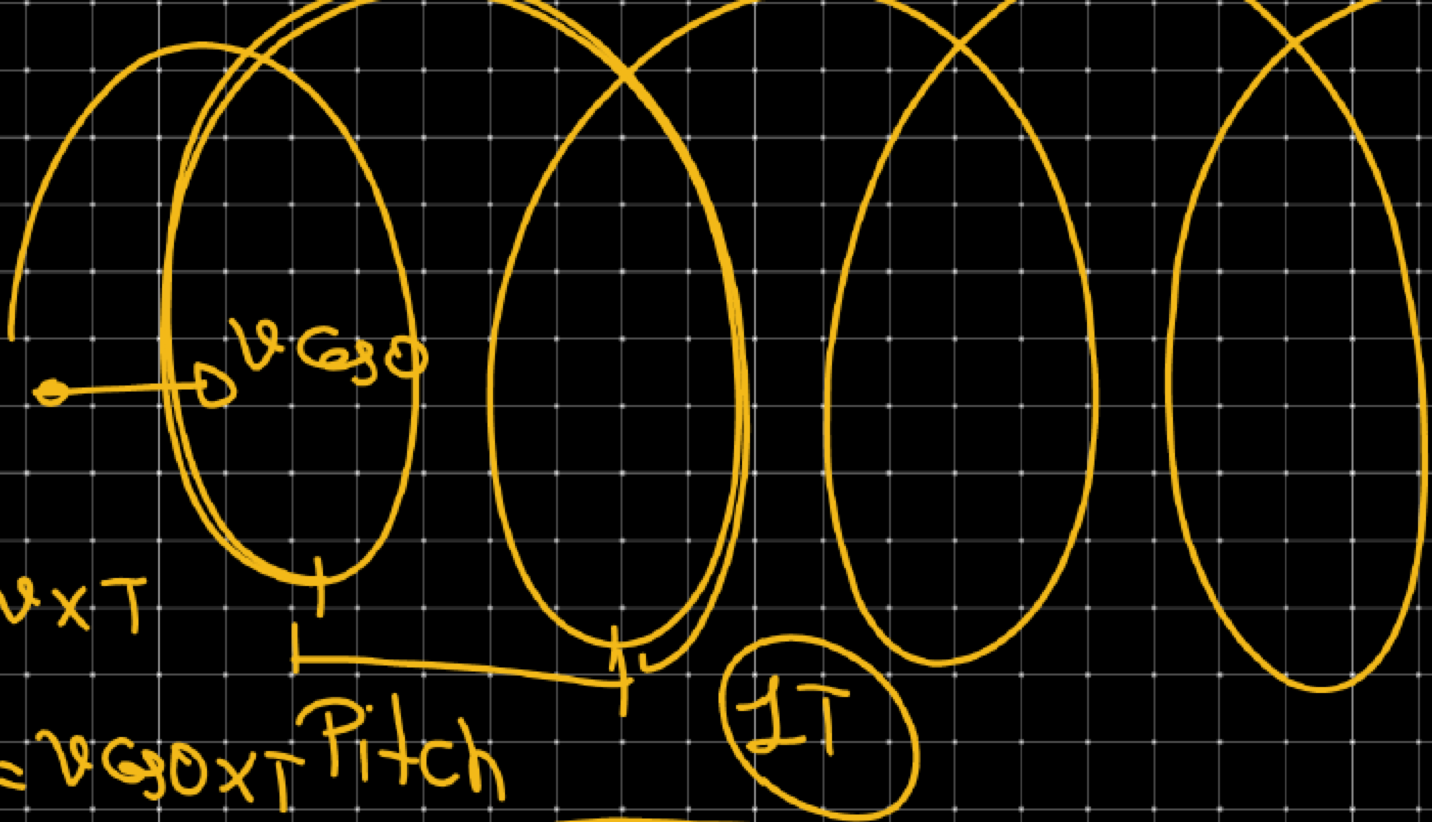
(ii) $T = \frac{2\pi R}{v_{\perp}} = \frac{2\pi \left(\frac{m v \sin\theta}{qB}\right)}{v \sin\theta}$

$$T = \frac{2\pi m}{qB}$$

(iii) $\omega = \frac{2\pi}{T} = \frac{2\pi}{\frac{2\pi m}{qB}} = \frac{qB}{m}$

(iv) $f = \frac{1}{T}$

$$\text{Pitch} = v\cos\theta \times \frac{2\pi m}{qB}$$




$$d = v \times T$$

$$\Downarrow$$

$$\text{Pitch} = v\cos\theta \times T$$

$$= v\cos\theta \times \frac{2\pi m}{qB} = \frac{2\pi m v\cos\theta}{qB}$$

Q1) A charge having e/m equal to $10^8$ C/kg & velocity $3 \times 10^5$ m/s enters into a uniform magnetic field $B = 0.3$ Tesla at an angle $30^\circ$ with dirn of field. The radius of curvature will be. [HW]

(a) 0.01cm (b) 0.5cm (c) 1 cm (d) 2cm.

Q2) A 10 eV, electron is circulating in a plane at right angle to uniform magnetic induction $10^{-4}$ ($Wb/m^2 = T$). The orbit radius of electron

(a) 11cm (b) 18cm (c) 12cm (d) 16cm