College Prep Physics II – Video Lecture Notes – Chapter 21
Video Lecture #1 – Chapter 21.1 - Introduction to Magnetic Poles and the Law of Poles
&
Video Lecture #2 – Chapter 21.1 - Introduction to Magnetic Field and the Magnetic Poles of the Earth
Thank You, Puja Patel, for these notes.

magnetic poles
North pole & South pole
Law of poles
like poles repel & unlike poles attract

Video Lecture #3 – Chapter 21.3 - Introduction to the Magnetic Force and Teslas

magnetic Field, B Field : is defined by the fact that a moving charge can experience a magnetic force, F_B.

$$\boxed{F_B = qvB\sin\theta}$$

magnitude only!!!!

q = charge
v = velocity
B = magnetic field
θ = angle between v & B

$$B = \frac{F_B}{qv\sin\theta} = \frac{N}{C\cdot\frac{m}{s}} = \frac{N}{\frac{C}{s}\cdot m} = \frac{N}{A\cdot m} = \text{Tesla, T.}$$

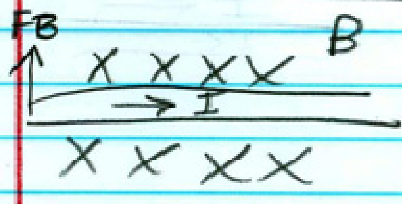
Video Lecture #4 – Chapter 21.3 - Introduction to the Right Hand Rule for the Direction of the Magnetic Force with Examples

The Right-hand rule
Fingers ⇒ point w/ direction of velocity
Fingers curl ⇒ direction of B (90°)
Thumb ⇒ points in F_B on a ⊕ charge
⊖ charge it is 180° from where your thumb is.

Video Lecture #5 – Chapter 21.3
Magnetic Force Right Hand Rule Examples using Cardinal Directions (North, South, East, West) (No Lecture Notes)

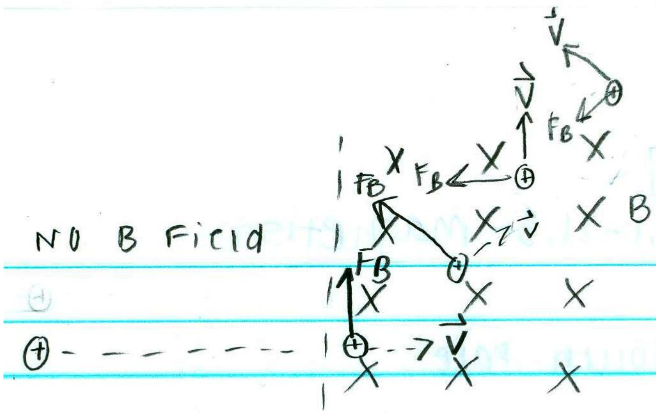
Video Lecture #6 – Chapter 21.3 - Introduction to the Magnetic Force on a Current Carrying Wire

$$F_B = ILB\sin\theta$$



I = current
L = length of wire
B = magnetic field
θ = angle between I & B

Video Lecture #7 – Chapter 21.3 - Introduction to the Path of a Charged Particle in a Constant Magnetic Field



* F_B is ⊥ to direction of $\vec{v}$
* F_B in the in-direction

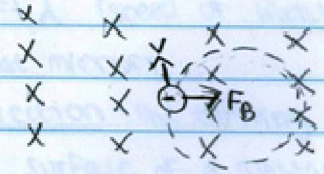
$$\sum F_{in} = F_B = ma_c$$

a charge moving ⊥ to a B-field will move in a circle
speed = const.
velocity ≠ const.

Video Lecture #8 – Chapter 21.3 - Example - An Electron Moving in a Constant Magnetic Field: Part a) Finding Speed
Thank You, Kallie Bergers, for these notes.

e^- R = 10.0 cm = 0.1 m

moving ⊥ to B = 470 μT = 470×10^{-6} T



a) what is the e^- speed?

$\Sigma F_{in} = F_B = m a_c$

$q v B\sin\theta = m\frac{v_t^2}{r}$

$q B\sin\theta = \frac{m v_t}{r}$

$q B \sin(90) = \frac{m v_t}{r}$

$q B = \frac{m v_t}{r}$

$v_t = \frac{qBr}{m}$

$v_t = \frac{(-1.6\times10^{-19})(470\times10^{-6})(0.1)}{9.11\times10^{-31}}$

$= -8254665.203$

$\boxed{\approx 8.3\times10^6 \frac{m}{s}}$

Video Lecture #9 – Chapter 21.3 - Example - An Electron Moving in a Constant Magnetic Field: Part b) Finding the Period

b) what is the time for 1 rev? (T=?)

$\omega = \frac{\Delta\theta}{\Delta t} = \frac{2\pi}{T}$

$v_t = r\omega = \frac{2\pi r}{T}$

$T = \frac{2\pi r}{v_t}$

$= \frac{(2\pi)(0.1)}{8.254665\times10^6}$

$= 7.61168\times10^{-8}$ sec

$\boxed{\approx 76.1 \text{ nsec}}$

Video Lecture #10 – Chapter 21.3 - Example - An Electron Moving in a Constant Magnetic Field: Part c) Finding Electric Potential Difference

c) $\Delta V = ?$

$\Delta V = \frac{\Delta PE_{elec}}{q}$

$\Delta PE_{elec} = \Delta V q$

$-\frac{1}{2}m v_f^2 = q\Delta V$

$\Delta V = \frac{-m v_f^2}{2q}$

$= \frac{-(9.11\times10^{-31})(8.254665\times10^6)^2}{2(-1.6\times10^{-19})}$

$= 193.9840227$

$\boxed{\approx 194 \text{ V}}$

COE ⇒ $ME_i = ME_f$

i ⇒ e^- @ rest f ⇒ e^- ⇒ v_f

$PE_{elec\,i} = KE_f + PE_{elec\,f}$

$PE_{elec\,i} - KE_f = PE_{elec\,f}$

$-KE_f = PE_{elec\,f} - PE_{elec\,i}$

$-KE_f = \Delta PE_{elec}$

$-\frac{1}{2}m v_f^2 = q\Delta V$