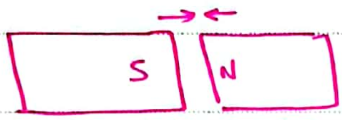
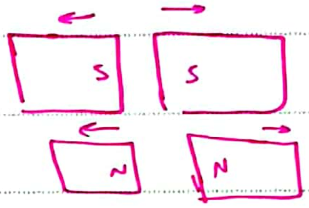
Ch 29 Magnetic Fields

magnet has two Poles



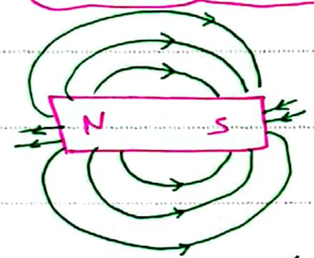
unLike attract

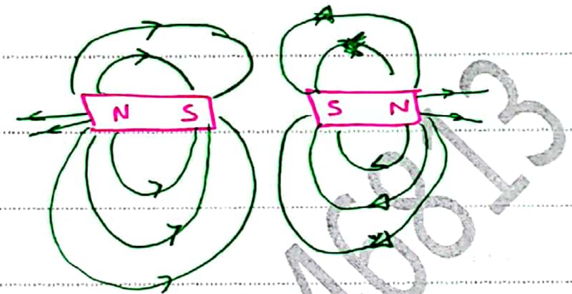


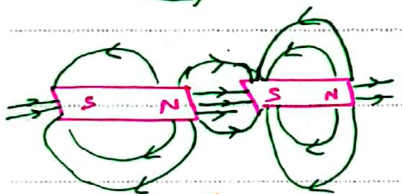
Like Poles repel

* Magnetic field Lines

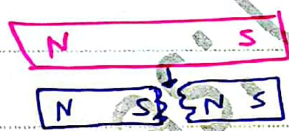
Magnet







كسر دائم مغناطيس
* Broken Permanent magnet



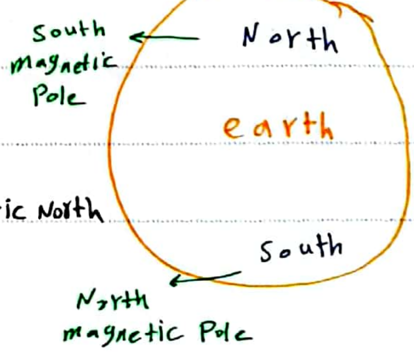
مغناطيس كسر نحصل جديد مغناطيس كل له
* If we break magnet we get two new magnet each with
شمال جنوب
its own north and south Pole

ما مصدر المغناطيسي المجال
* what is the source of magnetic field?
الشحنة في الحركة
electric charge in motion

التيار سلك في ملف حلزوني ينتج
* Current in wire surrounding cylinder (solenoid) Produces very
مجال
similar field to that of magnet

مجال مغناطيسي متجه
* magnetic field is vector

المغناطيسي للمجال للأرض
Magnetic field of earth



الجغرافي شمال يكافئ
- geographic north corresponds to South
قطب مغناطيس جنوب
magnetic Pole and geographic South to magnetic North

Electric Field مجال كهربي	Magnetic Field مجال مغناطيسي
- Acts in same direction of force (تؤثر، اتجاه، القوة)	Acts prependicular to magnetic force (تؤثر، عموديا، القوه المغناطيسيه)
- Acts on charged object If it move or not (المشحون، الجسم، حركه، او، لا)	- Acts on charged object during motion only (تؤثر، المشحون، الجسم، فقط، أثناء الحركه)
$F = qE$	$F_B = q\,v \times B$
electric Field force does work	magnetic Field work = 0 at steady Force

* magnetic force is proportional to (القوه المغناطيسيه، تتناسب، مع)

$$F_B = q\,v \times B$$

① Field مجال ② Velocity of Particle سرعه ③ charge الشحنه

④ sine of the angle between Field and direction of motion (sin، الزاويه، بين، المجال، اتجاه، الحركه)

$$F = q\,v\,B\sin\theta$$

N ← F قوه

q → C شحنه

v → m/s سرعه

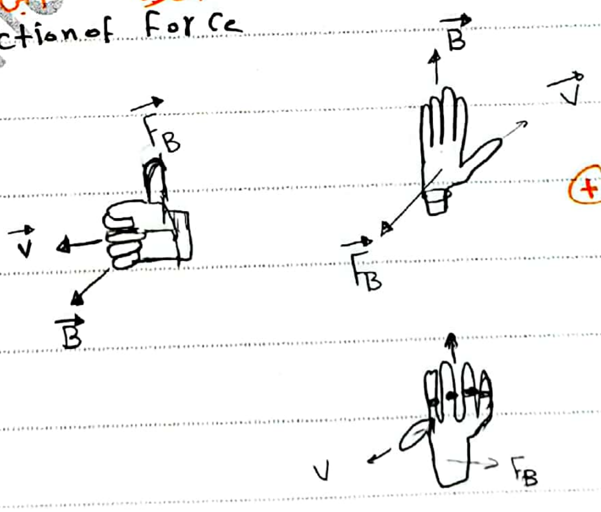
B → T = wb/m² (magnetic Field)

$N\,s\,m^{-1}\,C^{-1}$

$= N\,A^{-1}\,m^{-1}$

$1\,T = 10^4\,G \rightarrow$ C.G.S unit

* Right hand rule: Used to detect direction of Force (قاعده اليد اليمنى، تستخدم، لتحديد، اتجاه، القوه)



+ Positive charge

$F_B = 0$ when $\vec{v}, \vec{B}$ (Parallel or anti Parallel) $(\theta = 0, 180^\circ)$

F_B = maximum when $\vec{v}, \vec{B}$ (Prependicular) $(\theta = 90^\circ)$

مجال مغناطيسي خلال يتحرك الجسم مشحون طاقة الحركة

* Kinetic energy of charged particle moving through magnetic field

لا تتغير بالمجال المغناطيسي

Can't altered by magnetic field alone.

لا يتغير اتجاه سرعته direction — بل تتغير سرعته not speed, kinetic energy

$$T = \frac{N}{C \cdot m/s} = \frac{N}{A \cdot m} \qquad 1\,T = 10^4\,G \text{ gauss}$$

Ex 29-1

* An electron in an old-television moves towards front of tube with speed 8.0×10^6 m/s along x axis, coils of wire creat magnetic field with 0.25 T directed at angle $60°$ to the x axis. Calculate the magnetic force on electron.

الكترون تلفاز قديم يتحرك اتجاه أنبوب — سرعته خلال محور ملف السلك ينشأ — مجال مغناطيسي بحيث — احسب القوة المغناطيسية

ans

$$F_B = |q|\, vB\sin\theta$$

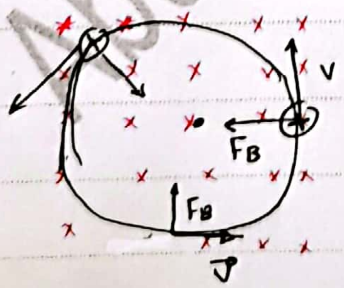
$$1.6 \times 10^{-19} \times 8 \times 10^6 \times 0.25 \times \sin 60$$

$$= 2.8 \times 10^{-14}\ N$$

* motion of charged particle in a uniform magnetic field

magnetic field out of page

magnetic field into page



$$F_B = qvB = \frac{mv^2}{r}$$

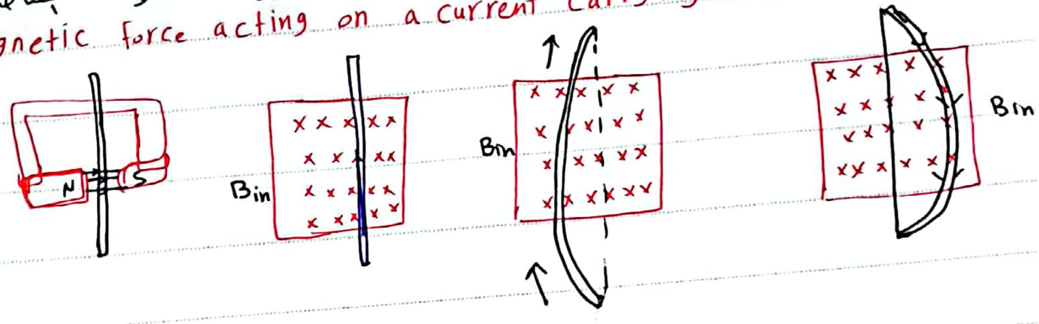
نصف القطر $r = \frac{mv}{qB}$

السرعة الزاوية $\omega = \frac{v}{r} = \frac{qB}{m}$

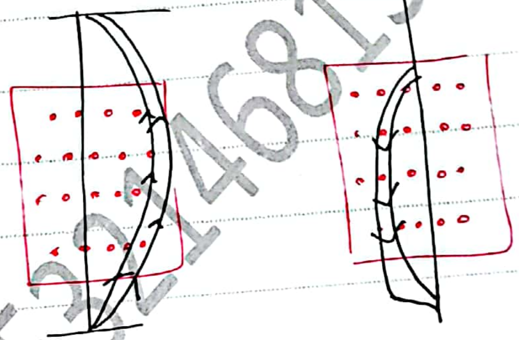
Period ← $T = \frac{2\pi r}{v} = \frac{2\pi}{\omega} = \frac{2\pi m}{qB}$

* Magnetic force acting on a current carrying conductor

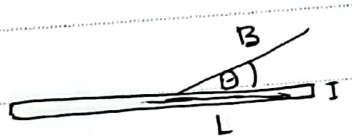
المغناطيسية القوه المؤثرة تيار



القوه المؤثره على سلك $F_B = I\vec{L} \times \vec{B}$



$F = ILB\sin\theta$

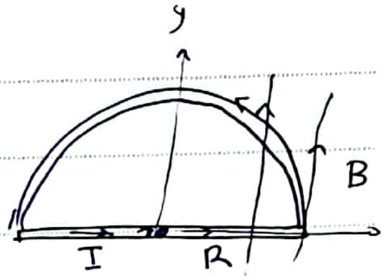


* A wire carries current of 22A from east to west magnetic field of earth is horizontal directed from north to South has magnitude 0.50×10^{-4} T Find the magnetic force on 3.6 m- length

$F_{max} = ILB$

$22 \times 3.6 \times .5 \times 10^{-4} = 4 \times 10^{-2}$ N

* Force on a semiconductor



$$F_1 = I \int_{-R}^{R} ds \times B$$

$$= 2IRB\hat{k}$$

$$F_2 = \int_0^{\pi} IRB \sin\theta \, d\theta$$

$$IRB(\cos\pi - \cos 0)$$

$$= -2IRB\hat{k}$$

$$F_{net} = f_1 + f_2 = 0$$

Torqu on current Loop

$$F_1 = F_2 = BIb$$

$$\tau_{max} = BIba = BIA$$

$$\tau = BIA\sin\theta$$

عدد مرات اللفات $\tau_0 = NIAB\sin\theta$

dipole moment $\mu = NIA$ $\quad \tau = \mu B$

* Example

Circular Loop of radius 50cm is oreinted by angle 30° to magnetic field of 0.50 T The current in the loop is 2 A find the magnitude of torque.

$$\tau = NBIA\sin\theta$$

$$1 \times 0.5 \times 2 \times [\pi(0.5)^2] \sin 30$$

$$= 0.39 \text{ N.m}$$

rectangular coil of diamension 5.40 cm x 8.50 cm consists of 25 turns of wire carries a current of 15 mA A 0.35T magnetic field is parallel to plane of coil

(A) Calculate the magnitude of the magnetic dipole moment of the coil

$$\mu_{coil} = NIA$$

$$= 25 \times 15\times10^{-3} \times 0.054 \times 0.085)$$

$$= 1.72\times10^{-3}\ A\cdot m^2$$

$$\tau = \mu_{coil} \cdot B$$

$$= 1.72\times10^{-3} \times 0.350$$

$$= 6.02\times10^{-4}\ N\cdot m$$