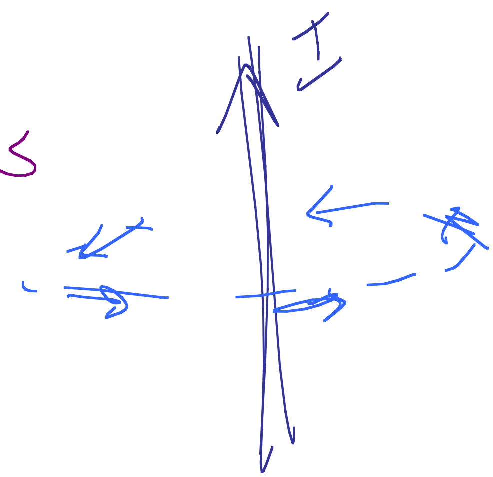
Phys 2120-4 10/10/12

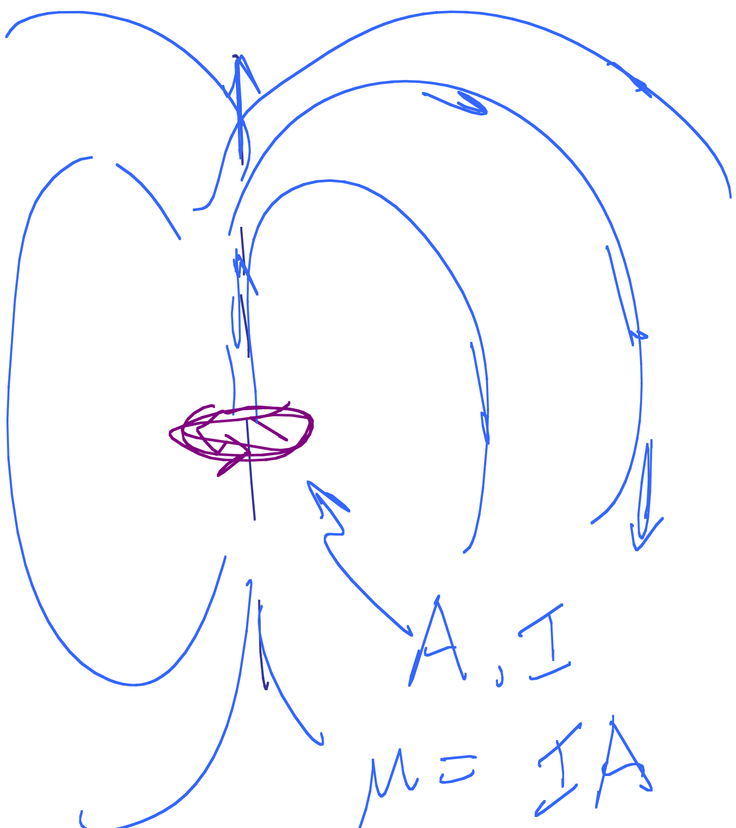
Note Title 10/10/2012

Chap 26 Magnetism

$\vec{B}$ field exerts force on moving charge

$\vec{B}$ field is created by currents





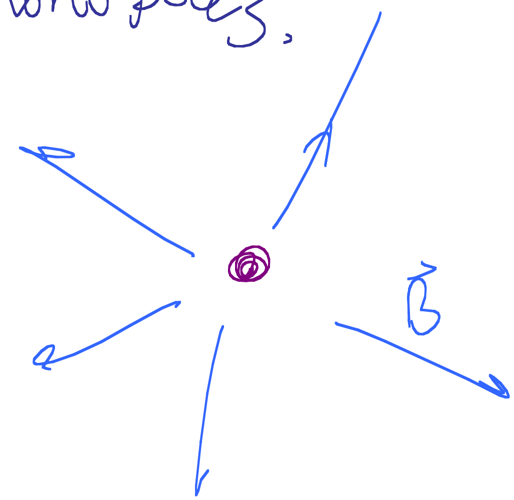
$\mu = IA$

magnetic moment

By distances $B_x = \frac{\mu_0}{2\pi} \frac{\mu}{x^3}$

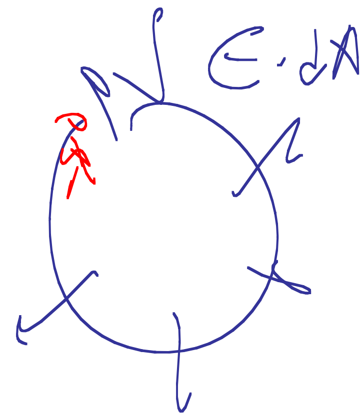
Are there mag. monopoles.

So far, none seen.

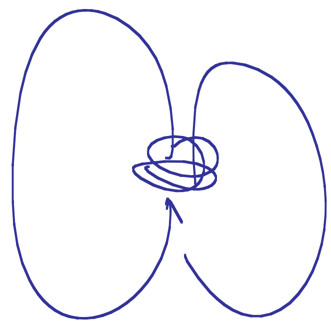


$$\oint \vec{E} \cdot d\vec{A} = \frac{q_{encl}}{\epsilon_0}$$

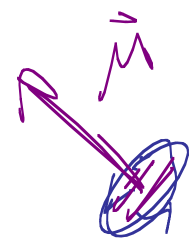
Gauss.



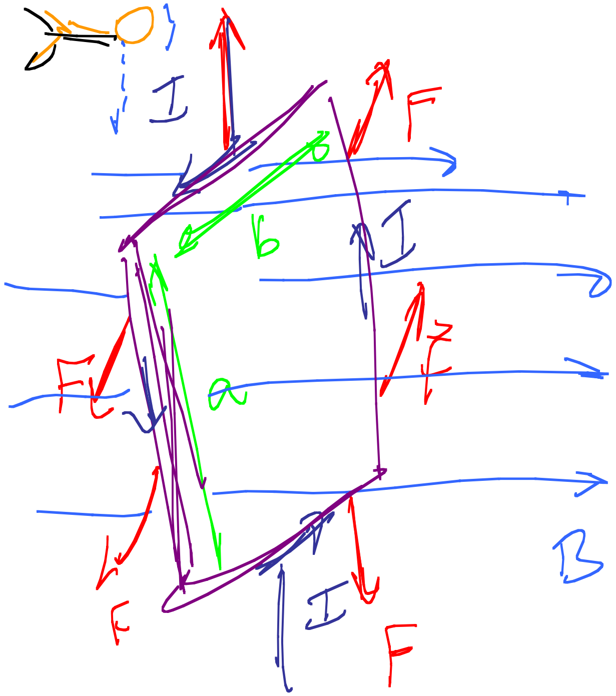
$$\oint \vec{B} \cdot d\vec{A} = 0$$



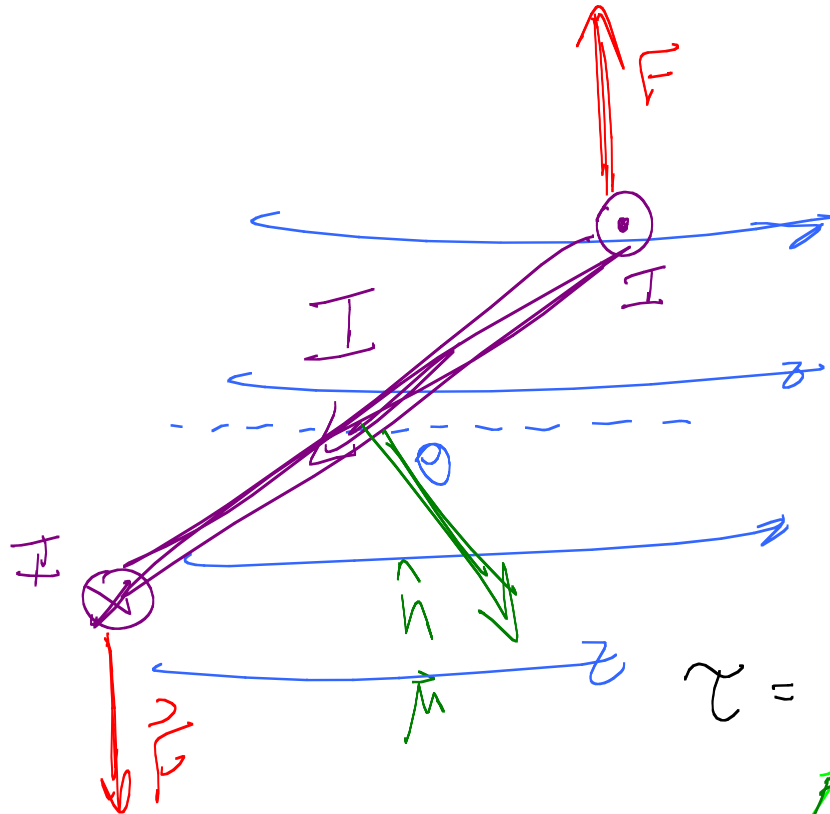
Dipole experiences
a torque when placed
in external mag field



$$|\vec{\mu}| = IA$$



$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

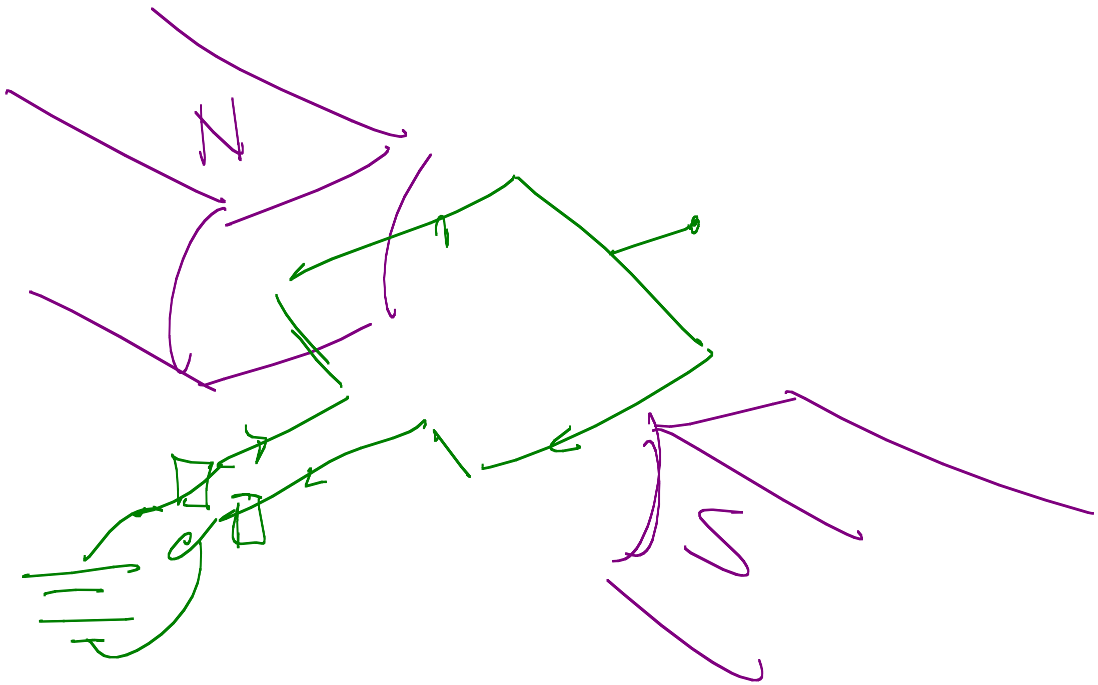


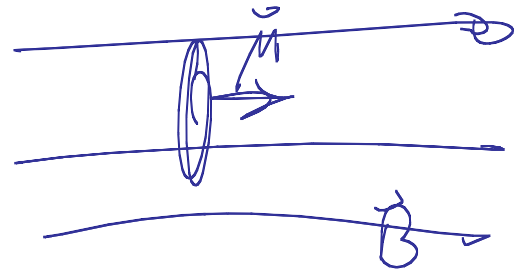
Torque

$$\tau = I \underline{ab} \sin\theta$$

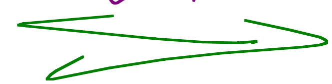
$I \qquad \text{Area} \qquad \mu$

$U = -\vec{\mu} \cdot \vec{B}$ Low en

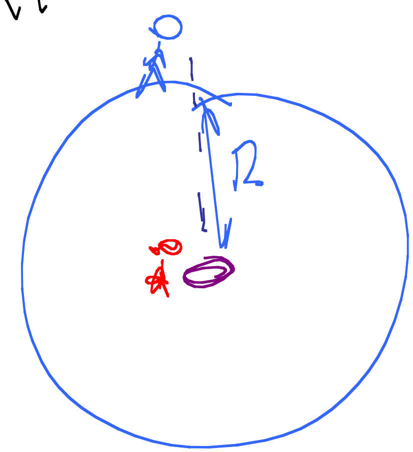




Motors



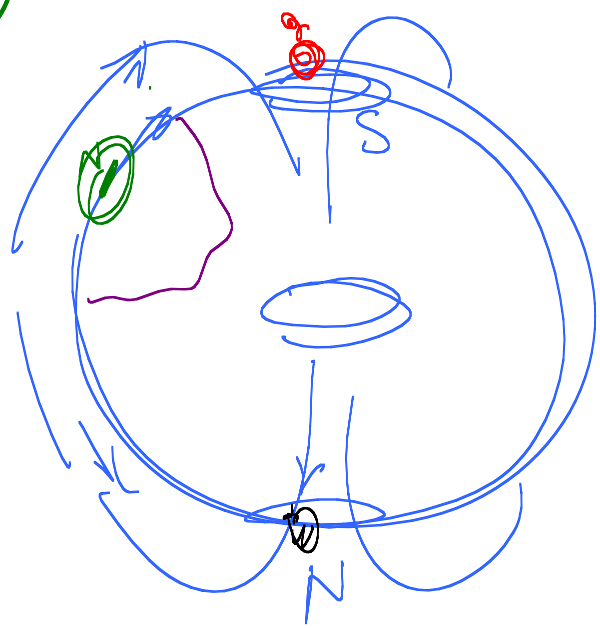
6.34 Earth's magnetic dipole moment 8.0×10^{22} A m^2 Find mag. field strength at Earth's magnetic poles

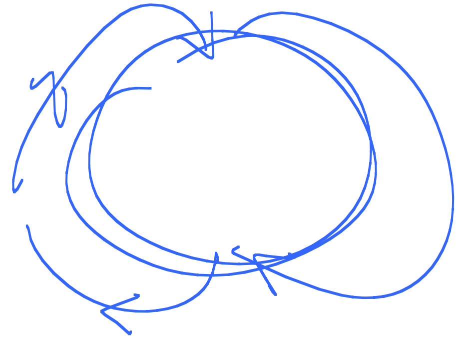


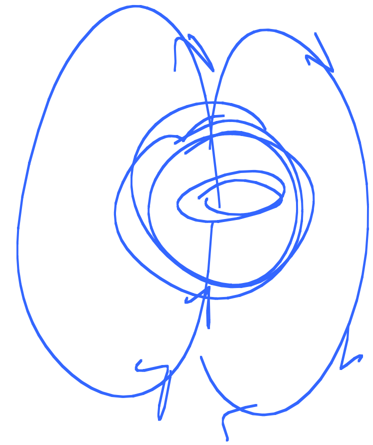
$$B = \frac{\mu_0}{2\pi}\frac{\mu}{x^3} = \frac{4\pi\times10^{-7}}{2\pi}\frac{(8\times10^{22})}{(6.37\times10^{6})^3} = 6.2\times10^{-5}\ \mathrm{T}$$

$= 2\ 62\ 6$


N
S


S
N





26.35 A single-turn square wire 5.0 cm on a side carries 450 mA current.

a) What is mag. dipole moment

b) If loop is in uniform 1.4 T mag field with $\vec{\mu}$ vector at 40° to the field, magnitude of torque

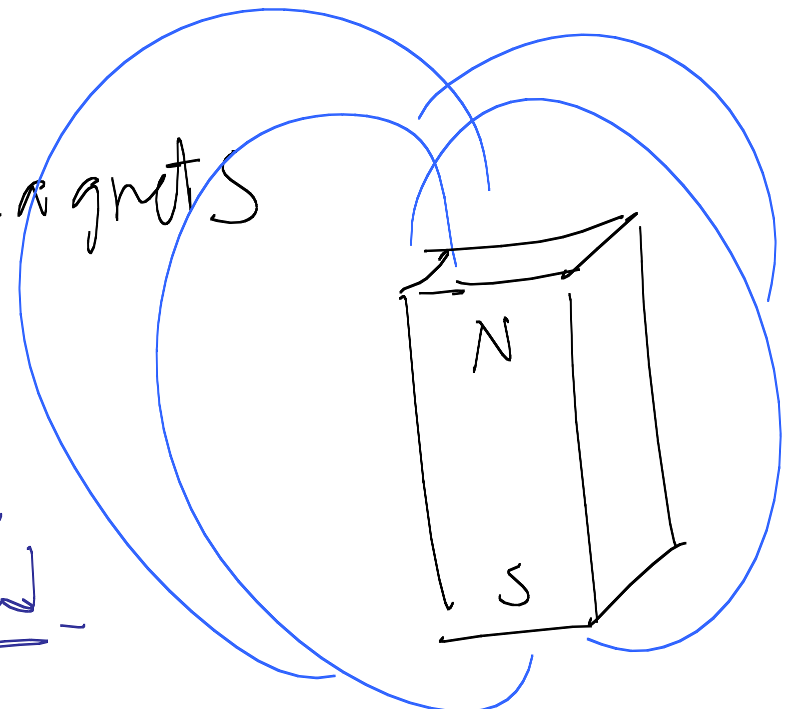
$\theta = 40^\circ$

$A = (0.050\,m)^2$ $\quad |\vec{\tau}| = \mu B \sin\theta$

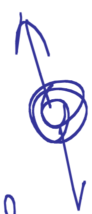
$\mu = IA = 1.12\times10^{-3}\ Am^2$ $\quad \vec{\tau} = \vec{\mu}\times\vec{B}$ $\quad = 1.0\times10^{-3}\ N\cdot m$

Magnetic Matter

Can make permant magnets



Atomic.



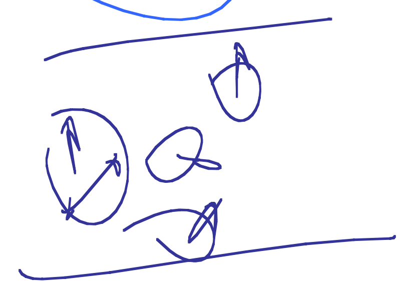
spins can be aligned.

Iron, Nickel cobalt.

Magnetized

Little groups

Domains are aligned.



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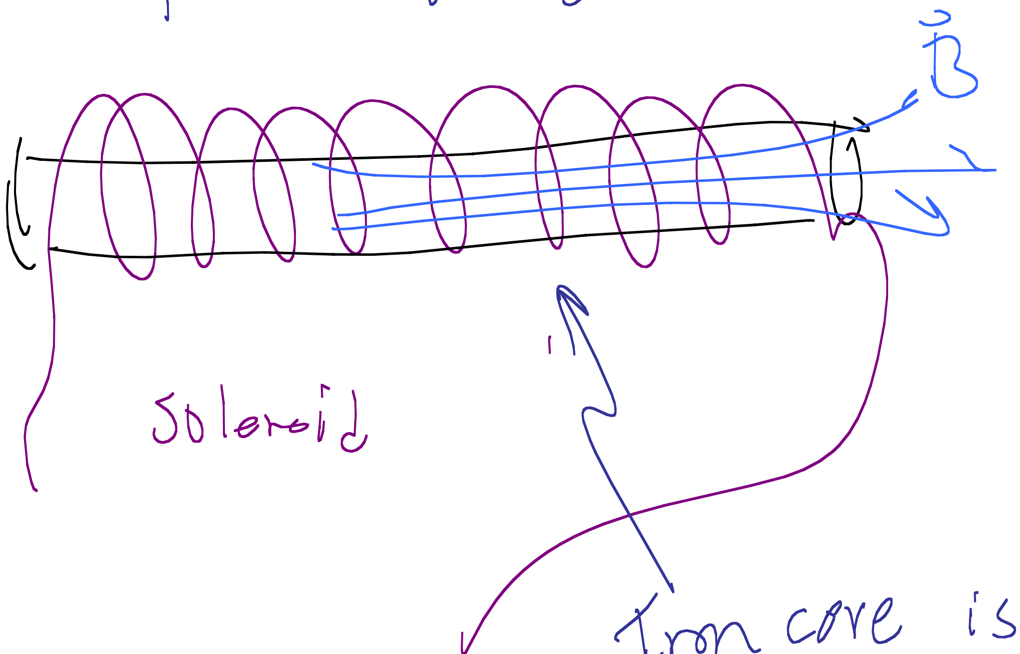
Large magnetizations are gotten by



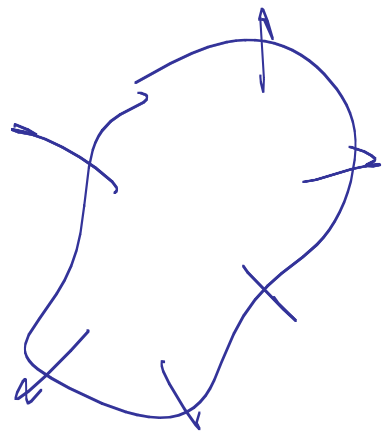
ferromagnetic

Iron core is mag'd by coil

$\vec{B}$ enormously increased

Ampère's Laws

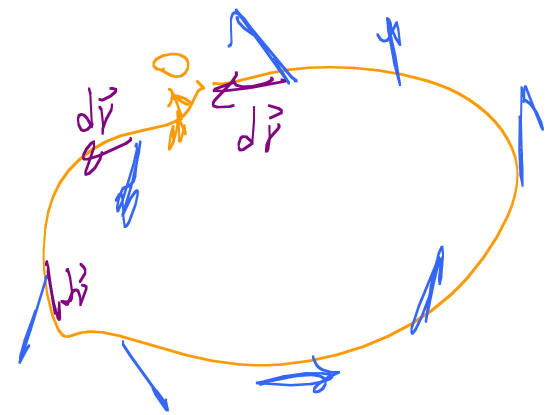
Review



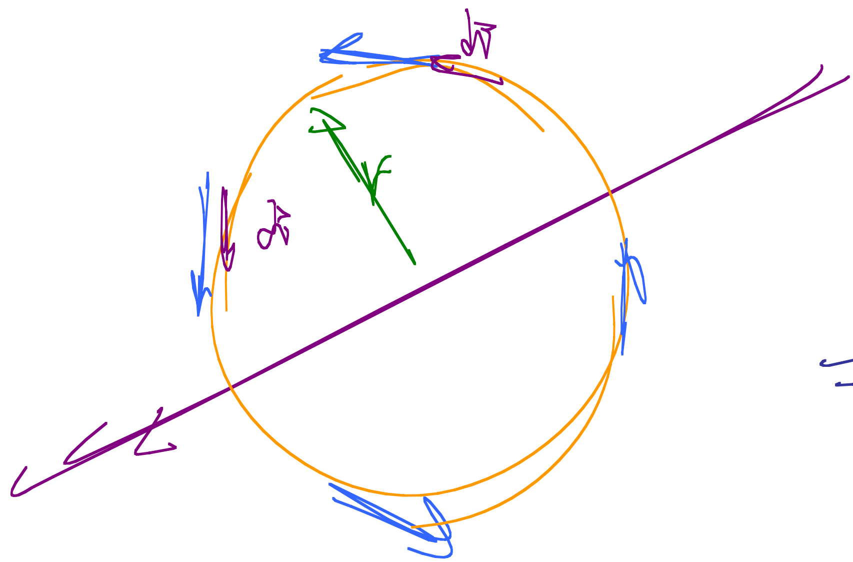
$$\oint \vec{E} \cdot d\vec{A} = \frac{q_{enc}}{\epsilon_0}$$

Calc $\vec{E}$ field from this.

Line integral of $\vec{B}$ closed loop:



$$\oint_{loop} \vec{B} \cdot d\vec{r} = \sum \vec{B}_i \cdot \Delta\vec{r}_i$$



$$\oint \vec{B} \cdot d\vec{r}$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$= \frac{\mu_0 I}{2\pi r} \oint dr$$

$$= \frac{\mu_0 I}{\cancel{2\pi r}} \cancel{2\pi r}$$

$$= \mu_0 I$$