Phys 1402 2017-07-27 Lec 15

#14 Induced EMF needs change.
- Rotating Magnet
- Rotating Coil
- Moving Magnet to/from coil
- Transformer with AC input

No EMF from
- No magnetism at all
- Steady magnetism w/ no motion.

#20 Velocity Selector → Mass Spec

$E = vB$

Doubled ↑ ↓ doubled ↑ no change

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

Doubled ↑ ↓ Doubles ↑ no other change

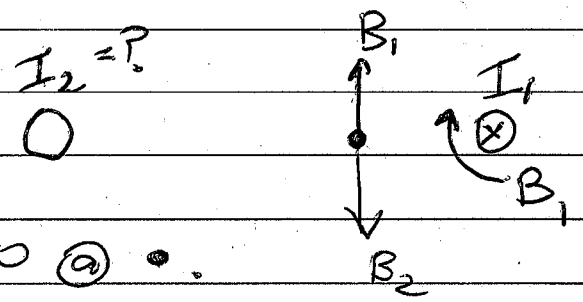
#19

$$r = \frac{mv}{qB} = \frac{(7.64\times10^{-26}\,kg)(3000\,m/s)}{(1.6\times10^{-19}\,C)(0.5\,T)}$$

$$= 2.87\times10^{-3}\,m$$

$$\approx 2.9\,mm$$

②



We want $B = 0$ @ •.

I_1 makes CW Field.

@ • B_1 is up.

Need B_2 to be down.

∴ I_2 makes CW B Field.

I_2 is into page.

#16 $$B_1 = B_2$$

$$\frac{\mu_0 I_1}{2\pi r_1} = \frac{\mu_0 I_2}{2\pi r_2}$$

r_2 is twice as big as r_1.

I_2 must be $2\times$ I_1

$$I_1 = 3A \Rightarrow I_2 = 6A$$

#12 Solenoid $B = \mu_0 n N I/\ell = 3.1\,mT$

#13 flux $\Phi = NBA = (1000)(3.1\times10^{-3})(0.0785)$

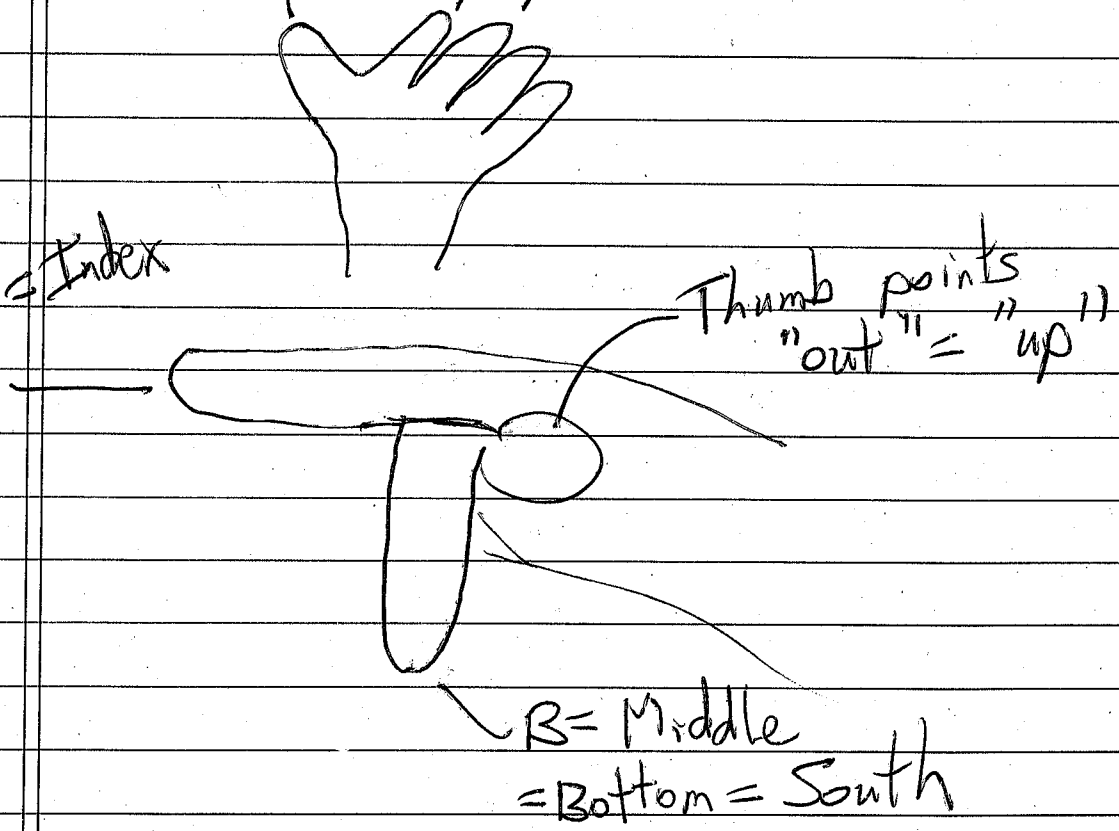
$= 0.247\ T\cdot m^2$

$\approx 0.2\ Wb$

#10 $B_{coil} = \dfrac{\mu_0 N I}{2R}$

#8 To levitate $F_B = \sim$ (up)

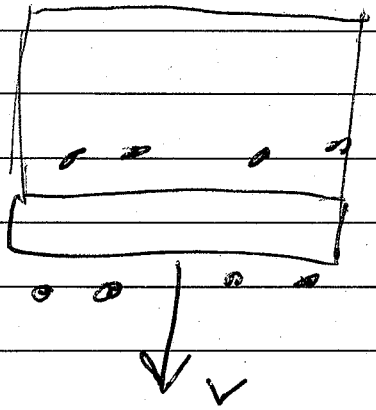
$F_B = I \ell B$



#9:

$F = qvB$

Thumb I Mid



Thumb = Left = direction charges are pushed

To complete circuit, charges move CW around loop.

Two general categories of waves

- Transverse - displacement oscillates perpendicular to "ray"
- Longitudinal - motion is parallel to the "ray" = velocity of wave

Sound is Longitudinal
Strings carry Transverse

Choice of oscillation direction for transverse waves is called polarization.

Water waves are mixed (Long. & Trans.)

Electromagnetic Waves are Transverse.
$\vec{E}$ and $\vec{B}$ are each perpendicular to the ray of light.
$\vec{E} \perp \vec{B}$ also
Polarization is direction of $\vec{E}$.

Reflection off water is mostly horizontally polarized.
Radio antennas are polarized.

$v = f\lambda$

$\frac{v}{f} = \lambda$

Types of EM Radiation

- Described by frequency or Wavelength

Low Freq = Long Wavelength

- Radio, Microwave, IR
- 0 to 400 THz
- Cell phones 700 MHz – 5 GHz
- Low energy unless "bright"

Light ~ Visible to eyes

- 400 – 750 THz
- Also 400 – 750 nm

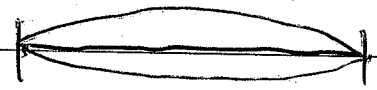
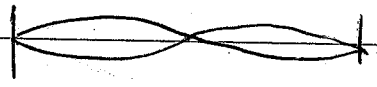
High Freq = Short Wavelength

- UV, X-Rays, Gamma
- Over 750 THz
- High energy per particle, even at low intensities
- Ionizing Radiation – can break chemical bonds

Standing Waves

Formed when waves reflect back and forth. ↑Motion along wave disappears.

Similar Ends

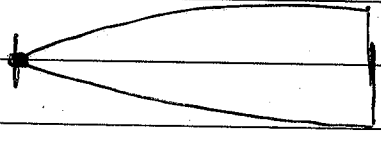
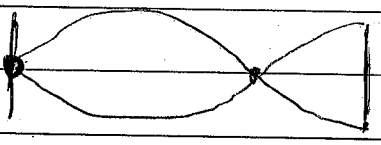
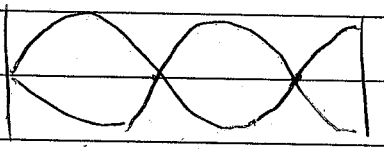
	λ	f
	$\lambda_1 = 2L$	$f_1 = \frac{v}{\lambda_1} = \frac{v}{2L}$
	$\lambda_2 = L$	$f_2 = \frac{v}{L} = 2f_1$
	$\lambda_3 = \frac{2}{3}L$	$f_3 = \frac{3v}{2L} = 3f_1$

General; $\lambda_m = \frac{2L}{m}$ $\quad f_m = mf_1$

m = any integer

m = harmonic #

Different Ends (open-closed Tube)

	$\lambda_1 = 4L$	$f_1 = \frac{v}{4L}$
	$\lambda = \frac{4}{3}L$	$f_3 = 3f_1$
	$\lambda = \frac{4}{5}L$	$f_5 = 5f_1$

only odd harmonics!