

Phys 2426

2017-12-05

Lec 26

Last Class!!

Final Exam: Tue 12/12 11am - 1:30 pm

- 25% } • Electrostatics
- 25% } • DC Circuits
- 25% } • Magnetism
- 50% } • AC Circuits
- 50% } • Waves & Optics

DC Circuits

Parallel - Multiple Branches

Split and Merge

Branch Currents Add

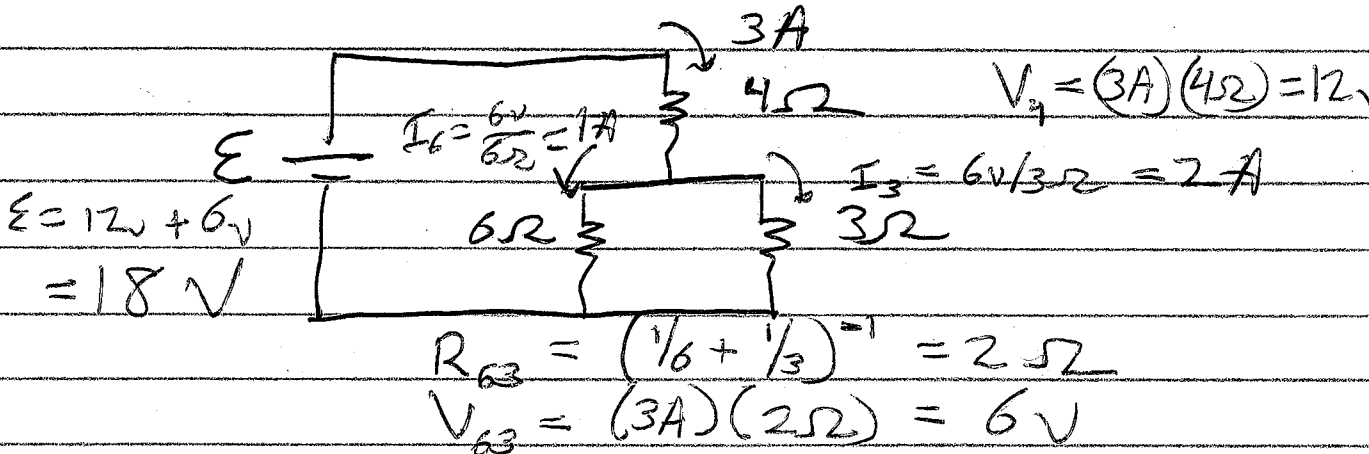
Same Voltage across each branch

Series - One current Path

Consecutive components

Voltages Add

Same Current in each



②

Big Laws of Electrostatics

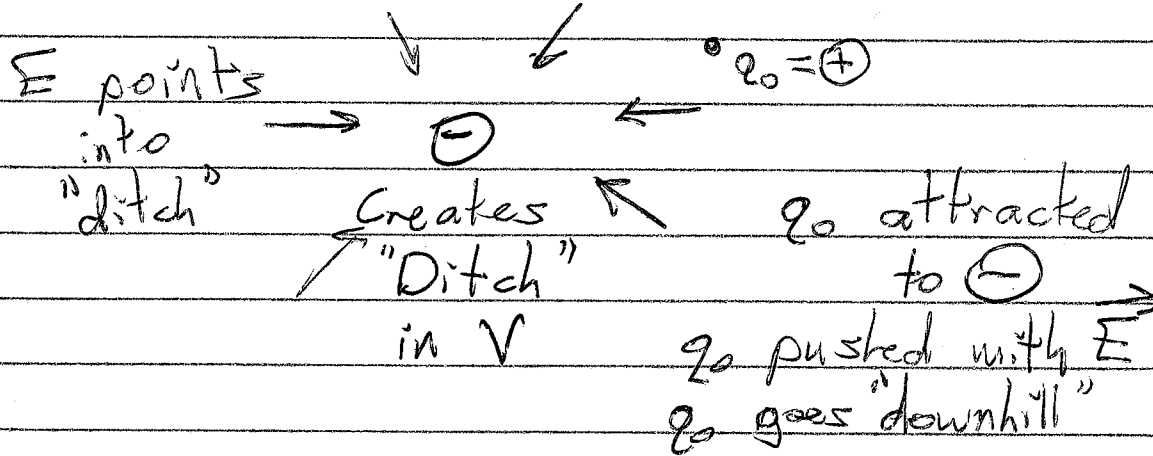
$$E = k \frac{Q}{r^2}$$

Away from \oplus source
toward \ominus source

$$\vec{F}_E = q_0 \vec{E}$$

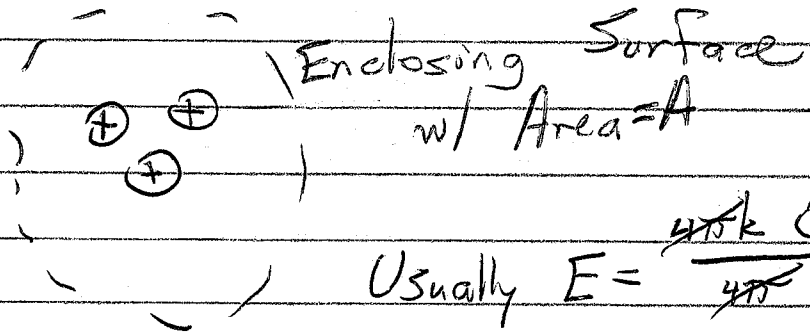
$$E_x = - \frac{dV}{dx}$$

Potential vs. E-Field
 \vec{E} points "downhill"



Electric Flux - Gauss's Law

$$E_{\text{avg}} A = \oint \vec{E} \cdot d\vec{A} = \Phi_E = \frac{Q_{\text{enc}}}{\epsilon_0} = 4\pi k Q_{\text{enc}}$$

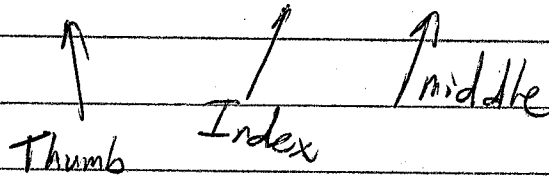


Usually $E = \frac{4\pi k Q_{\text{enc}}}{r^2}$

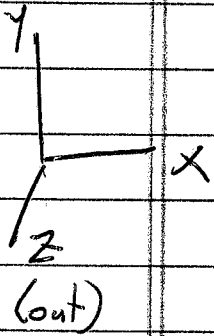
3

Magnetic Forces on Particles

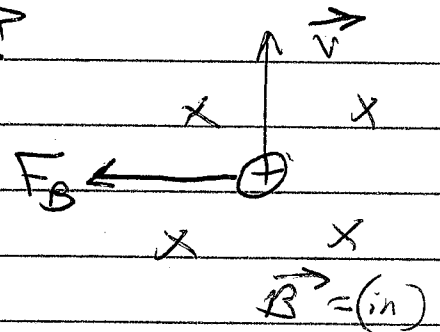
$$\vec{F}_B = q \vec{v} \otimes \vec{B}$$



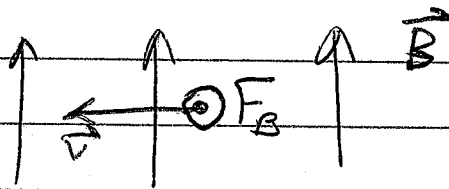
Ex: \oplus charge moving in $+\hat{y}$ direction.
 Want force in $-\hat{x}$ direction.
 What magnetic field?



Middle finger = $-\hat{z}$
 \oplus , so $\vec{B} = -\hat{z}$

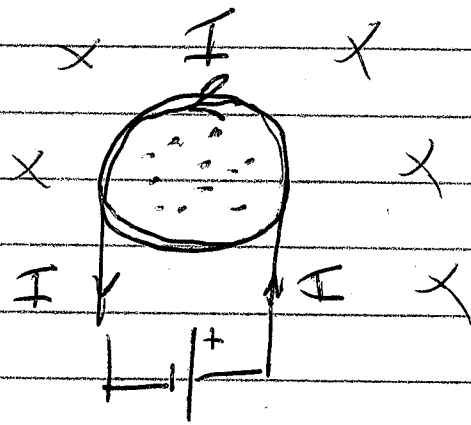


Ex: B points North
 What \vec{v} to levitate electron?



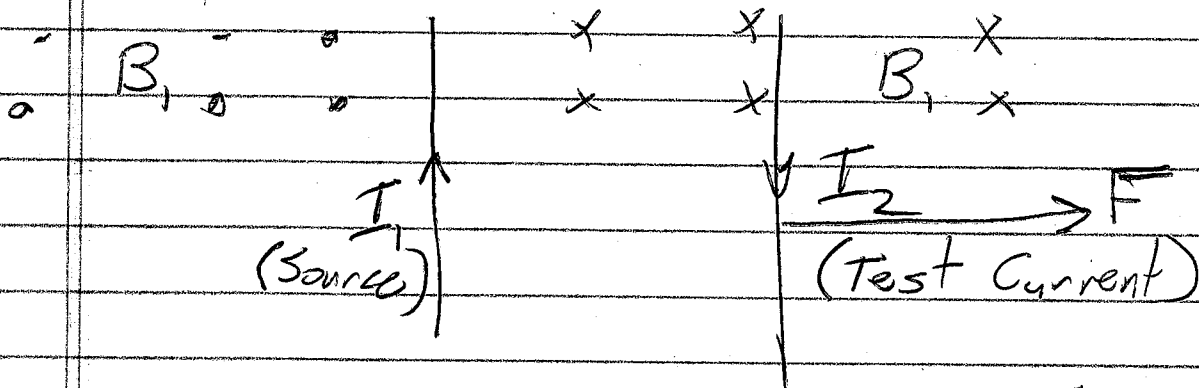
Index = East
 \ominus , so $\vec{v} = \text{West}$

4



$B =$ out inside coil
in outside coil

Force Between two wires



I_2 feels :

$$F_B = I_2 l B_1$$

Index, Middle

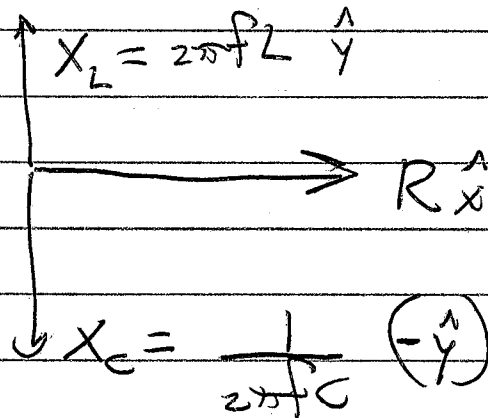
Thumb points right so $F =$ (right)

$$B_1 = \frac{\mu_0 I_1}{2\pi r}$$

$$\frac{F_B}{l} = \frac{\mu_0 I_1 I_2}{2\pi r}$$

5)

- Series RLC
- Same Current in each.
 - Voltages add like vectors
 - Impedances add like vectors,



Total x : Just R Resistance

Total y : $X_L - X_C = X$ Reactance

Magnitude $Z = \sqrt{R^2 + X^2}$ Impedance

Ex: $\Sigma = 120 \text{ V}$ $\Sigma = I Z$

$Z = 240 \Omega$

$R = 80 \Omega$ $V_R = I R$

What is V_R ?

$$I = \frac{120 \text{ V}}{240 \Omega} = 0.5 \text{ A}$$

$$V_R = (0.5 \text{ A}) (80 \Omega) = 40 \text{ V}$$

What is X ?

$$X = \sqrt{240^2 - 80^2} = \pm 226 \Omega$$

⑥

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$M = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

Magnifying Glass w/ max mag:

$$m = \frac{25 \text{ cm}}{f} + 1$$

Image @ 25 cm from lens

$$d_i = -25 \text{ cm}$$

Ex: $f = 5 \text{ cm}$

$$\text{max mag} = \frac{25 \text{ cm}}{5 \text{ cm}} + 1 = 6$$

$$\frac{1}{d_o} + \frac{1}{-25 \text{ cm}} = \frac{1}{5 \text{ cm}}$$

$$\frac{1}{d_o} = \frac{1}{5} + \frac{1}{25} =$$

$$d_o = \frac{25}{6} = 4.17 \text{ cm}$$