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Physics 194 - Lecture 7

Welcome!

Have a question during class? Please ask it right away, even if it means interrupting in the middle of a thought. I want you to!

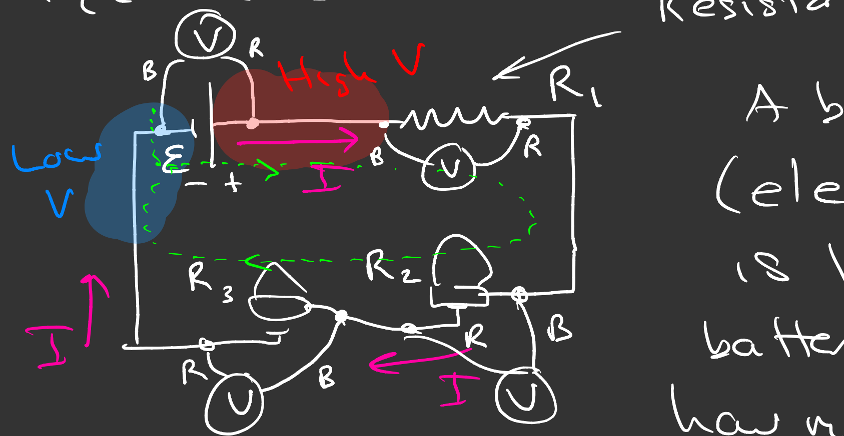
Agenda

- Mathematical analysis of simple circuits
- Power
- Intro to the magnetic interaction

Class starts @2:15 pm

What you learned from using a voltmeter to analyze a circuit...

$\mathcal{E} = 9V$



A battery's EMF (electromotive force) is how "strong" the battery is. More or less how much energy it gives each charge that passes through it.

ΔV

Potential difference between 2 points in the circuit.

1) $\Delta V_{\mathcal{E}} + \Delta V_{R_1} + \Delta V_{R_2} + \Delta V_{R_3} = 0$

(+) (−) (−) (−)

Kirchhoff's loop rule.

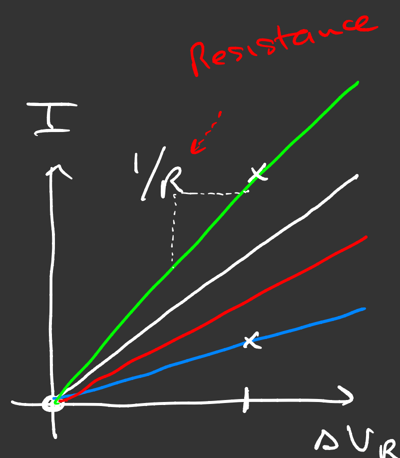
$\sum \Delta V = 0$

How do you represent a battery mathematically?

$\Delta V_\varepsilon = \varepsilon$

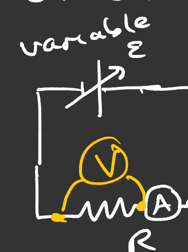
What about a resistive device?

$\Delta V_R =$



Ohm's law

$I = \frac{1}{R}\Delta V_R$



How does ΔV_R depend on I through it?

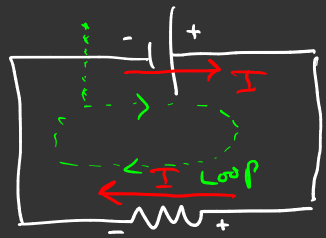
- vary ε, that will vary ΔV_R.

$\Delta V_\varepsilon + \Delta V_R = 0$

$\Delta V_R = IR$ ($V/A = \Omega$, the "ohm")

(V) (A)

$\mathcal{E} = 120\ V$



$R = 72\ \Omega$

$$\sum_{loop} \Delta V = 0$$

$$\Delta V_\mathcal{E} + \Delta V_R = 0$$

$$+\mathcal{E} - IR = 0$$

$$I = \frac{\mathcal{E}}{R} = \frac{120V}{72\Omega} = 1.67\ A$$

Power

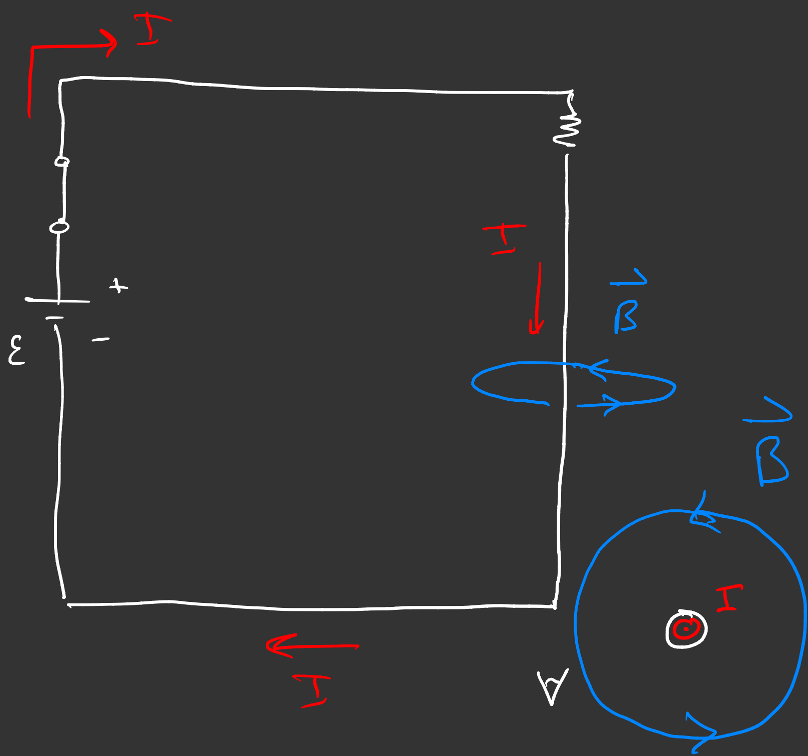
$P = I\Delta V$ (A) (V)

(W = J/s)

$$P_R = I_R \Delta V_R = (1.67A)(120V)$$

$$= 200W$$

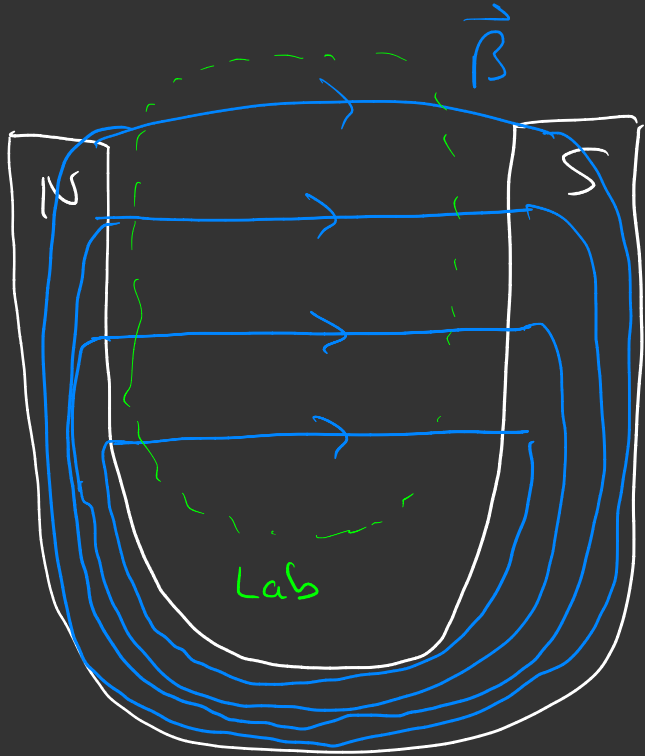
When the current is flowing the compass no longer pointed north!

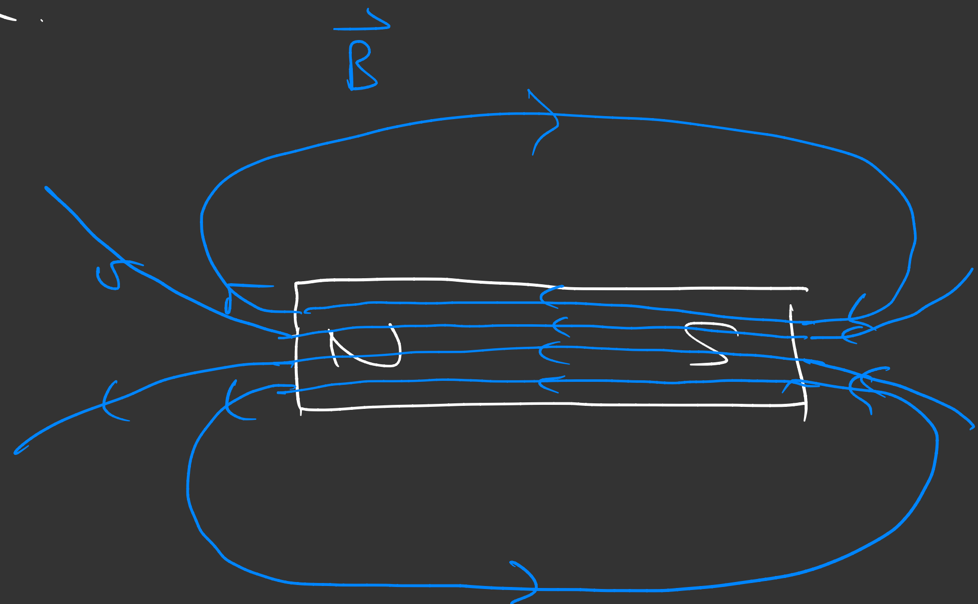


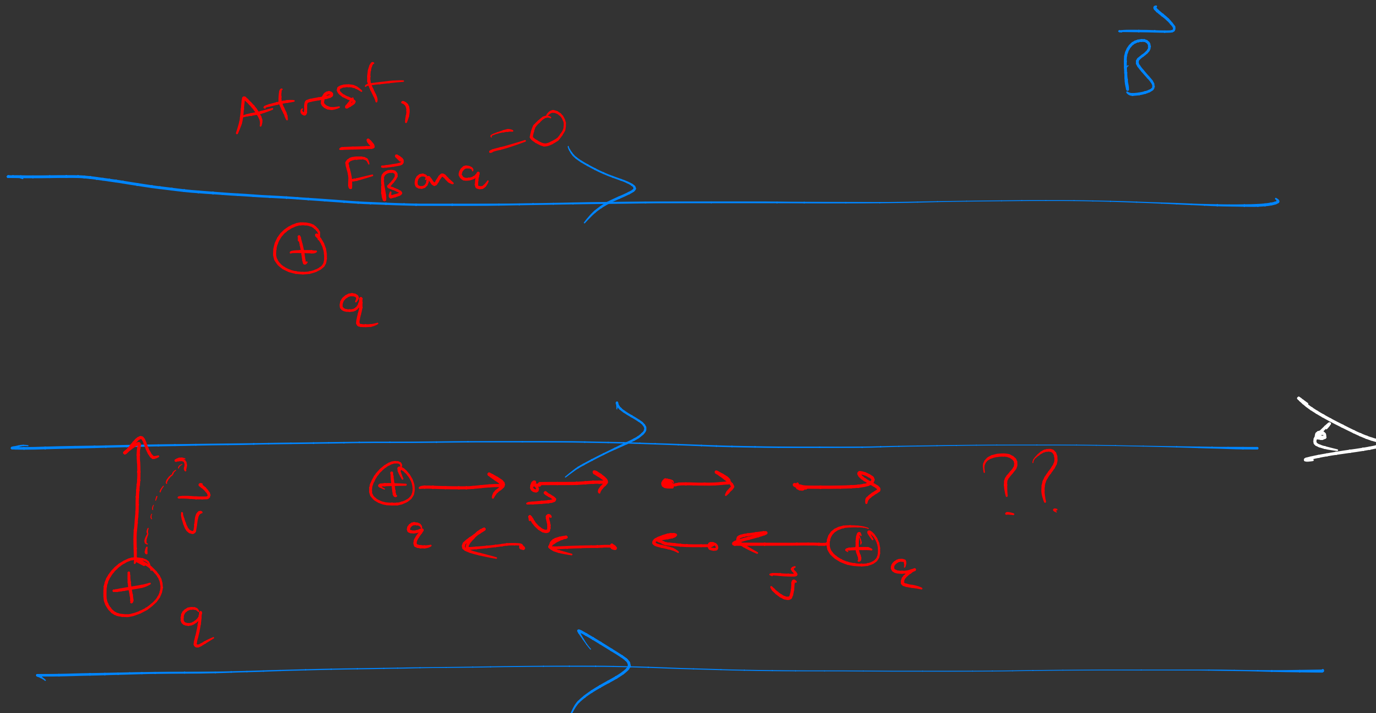
Electric currents produce a magnetic field!

Fundamentally, a moving charged object produces a magnetic field!

We need to start investigating the magnetic interaction.

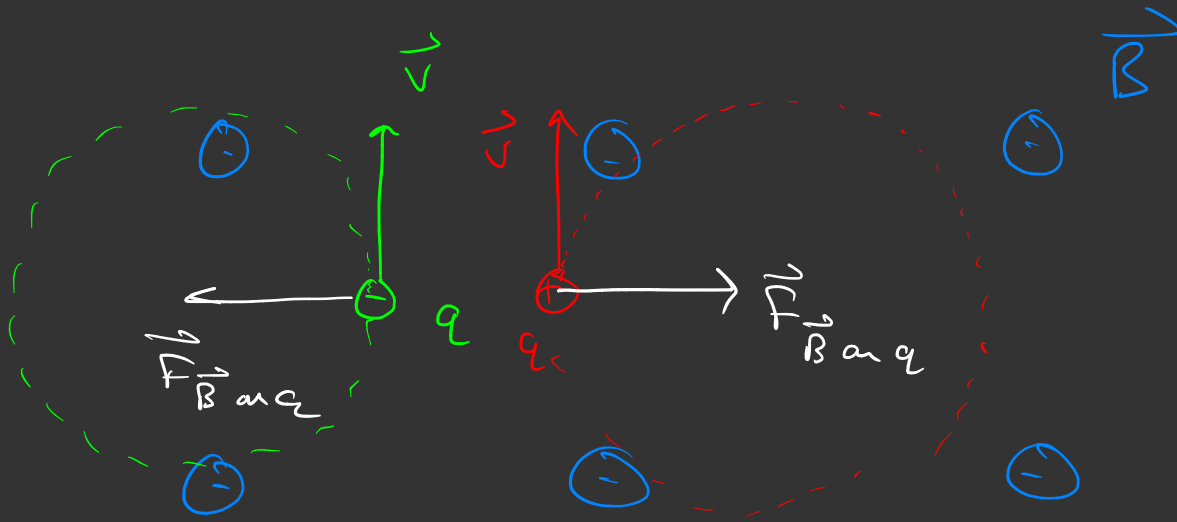






$\vec{B}$
At rest,
$\vec{F}_{\vec{B}}$ on $q = 0$
q
$\vec{v}$
q
$\vec{v}$
q
$\vec{v}$
q
??

Right hand rule



Fingers : $\vec{B}$

Thumb : $\vec{v}$

Palm : $\vec{F}_{\vec{B} \text{ on } q}$ ↙ +

Knuckles : $\vec{F}_{\vec{B} \text{ on } q}$ ↙ −