Phys 1402 2017-07-20 Lec 11

Quiz 2 #6

protons $\oplus \rightarrow \vec{v}$ $\rightarrow I$

electrons $\leftarrow \ominus$ $\rightarrow I$

#10 Need $3 savings
Energy costs $0.12/kwh

$$\frac{\$3}{\$0.12/kwh} = 25\ kWh \quad \text{needed savings}$$

$$\frac{Energy}{P} = \cancel{P}\Delta t = \frac{25\ kwh}{50\ W}$$

$$\Delta t = \frac{25000}{50}\ hours = 500\ hours$$

$\times$ 20 days

Amount = Rate (P) Time
Cost = Rate Amount
Rate = Cost/item

#8 Cylindrical Wire

ℓ doubles

r doubles

R ?

$R = \rho \frac{\ell}{A}$ ← ℓ doubles

$A = \pi r^2$ ← up 4 times

→ 4x increase

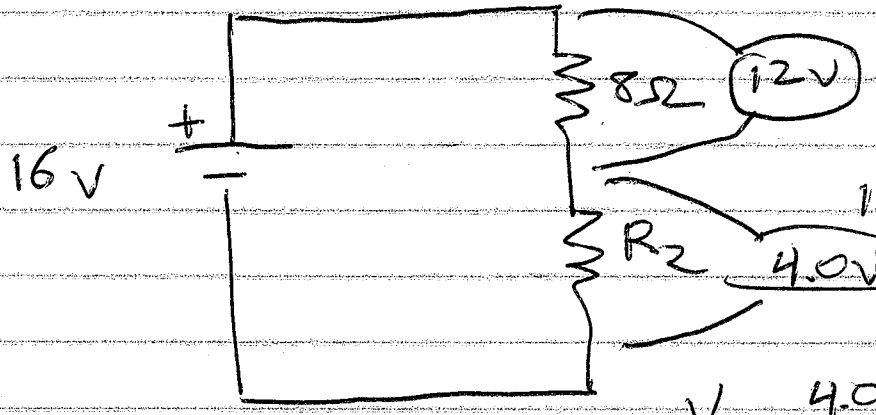
Initial: $R = \frac{1 \cdot 1}{1} = 1$

Final: $R = \frac{1 \cdot 2}{4} = \frac{2}{4} = \frac{1}{2}$

This is a decrease.

#18-20

$I = \frac{V}{R} = \frac{12}{8} = 1.5\,A$

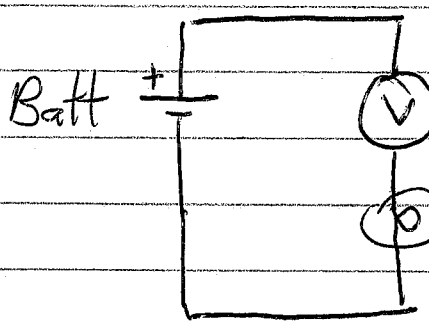


$R_2 = \frac{V}{I} = \frac{4.0\,V}{1.5\,A}$

$= 2.7\,\Omega$

③

#7 Voltmeter in series – blocks current.



No current!

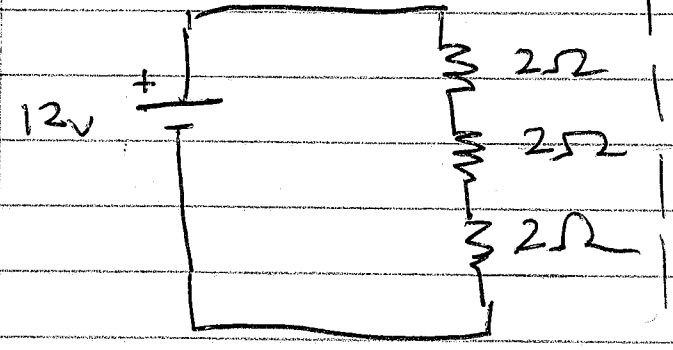
Bulb is off.

$V_{Batt} = V_{meter} + V_{Bulb}$

$\mathcal{E} = V_{meter} + 0$

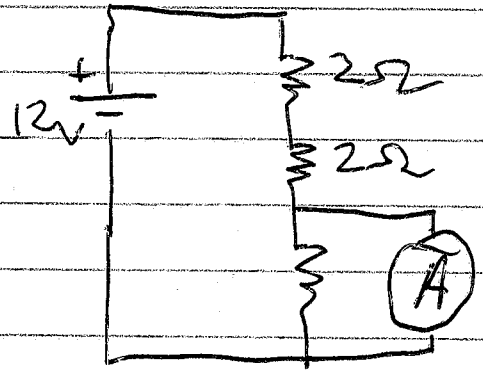
$\because V = IR = 0$

What if an ammeter is hooked up wrong?



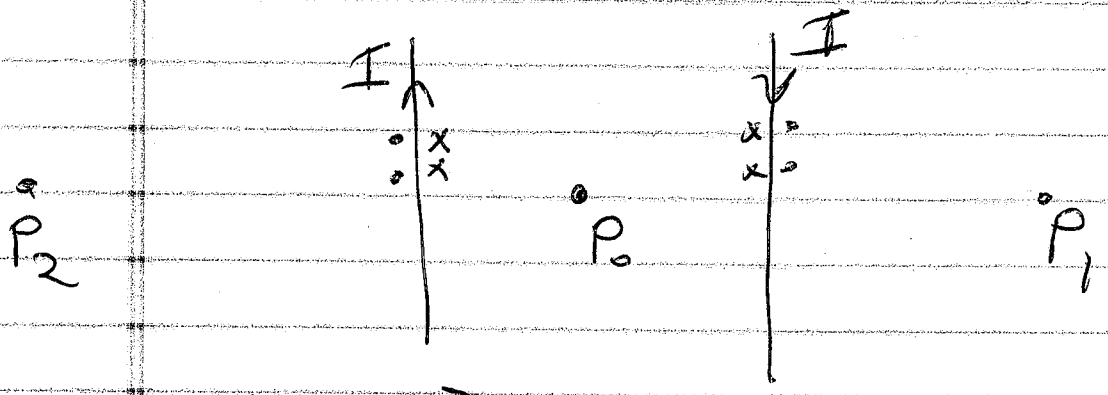
$R_{eq} = 6\Omega$

$I = \frac{12v}{6\Omega} = 2.0A$



$R_{eq} = 4\Omega$

$I = \frac{12v}{4\Omega} = 3A$



What is $\vec{B}$ @ each point.

P_0: x from left B's add
x from right result is x

P_1: x from left current B's subtract
• From right current result is •

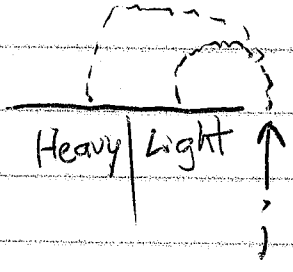
P_2: B's subtract
result is •

#11 - Step-by-step is important!

Velocity Selector: $F_E = F_B$

$qE = qvB$

Magnetic circular motion: $r = \frac{mv}{qB}$



Lenz's Law

This tells us the direction of induced voltage.

Coils & Loops don't like change.

- If there is already magnetic flux, the coil tries to maintain it.
- If there is no flux, the coil will oppose any new magnetism.

Dramatic example: Magnetic drag due to eddy currents.

Last Magnetism Topic – Inductors

An inductor is just a coil.
- They have low resistance (Ideally, zero.)
- They don't like current to change.
  - Increasing current takes effort.
  - Decreasing current causes a "kick".
- They store energy in magnetic field.

Inductor Formulas

$$V_L = L\frac{\Delta I}{\Delta t}$$

L = inductance in henries

$\frac{\Delta I}{\Delta t}$ = rate of change of current

$$\text{Energy} = \frac{1}{2}LI^2$$

$$\Phi_B = LI$$

$\Phi_B = NBA$ = magnetic flux

Solenoid: $B = \frac{\mu_0 NI}{\ell}$

$$\Phi_B = NBA = \frac{N\mu_0 NIA}{\ell} = \frac{\mu_0 N^2 A}{\ell} I$$

L

IF $\Phi = 12$ Wb when $I = 3$ A,
$L = 4.0$ H