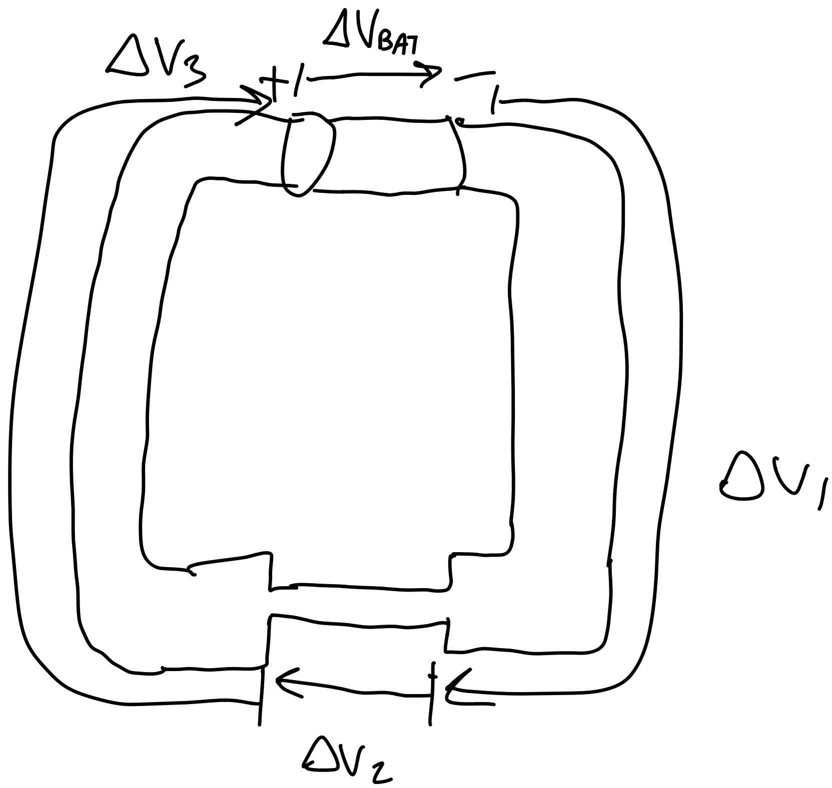
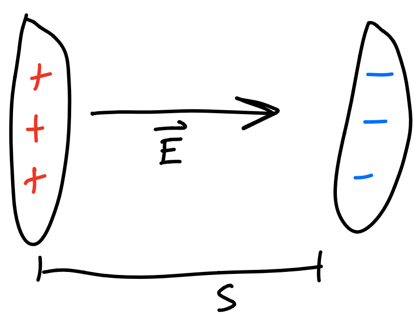
Last class:



$|\Delta V_{BAT}| = \mathcal{E}$ ← "emf"



$\Delta V_{BAT} = -|\vec{E}|\, s \cos(0)$
$= -|\vec{E}|\, s$

$\Delta V_{BAT} = -\mathcal{E}$

$$\boxed{\Delta V_1 + \Delta V_2 + \Delta V_3 - \varepsilon = 0}$$

Loop Rule

$$\sum \Delta V_{loop} = 0$$

$$\Delta V_1 + \Delta V_2 + \Delta V_3 + \Delta V_{BAT} = 0$$

$$\Delta V_1 + \Delta V_2 + \Delta V_3 - \varepsilon = 0$$

$$E_1 L_1 + \frac{A_1}{A_2} E_1 L_2 + E_1 L_1 = \varepsilon$$

$$E_1 \left(2L_1 + \frac{A_1}{A_2} L_2 \right) = \varepsilon$$

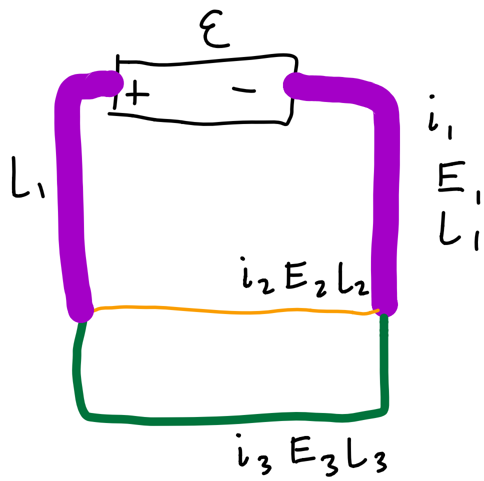
$$E_1 = \frac{\varepsilon}{2L_1 + \frac{A_1}{A_2} L_2}$$

$$i = nAuE$$

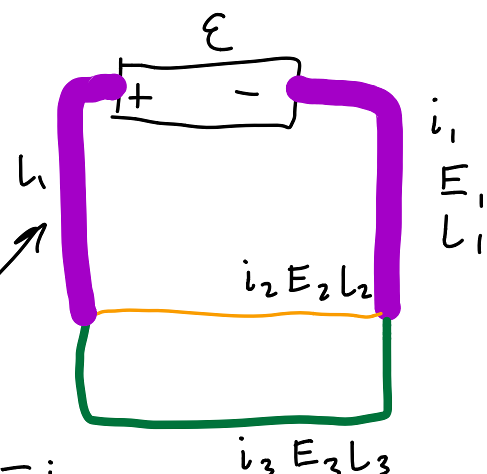
CQ 18.9.C

Consider

Copy

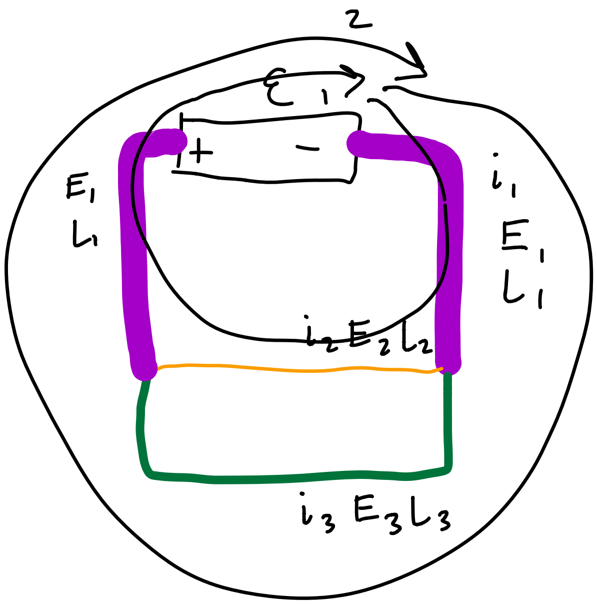


what is i



$i = i_2 + i_3 = i_1$

Two loops



1: $E_1L_1 + E_2L_2 + E_1L_1 - \varepsilon = 0$

2: $E_1L_1 + E_3L_3 + E_1L_1 - \varepsilon = 0$

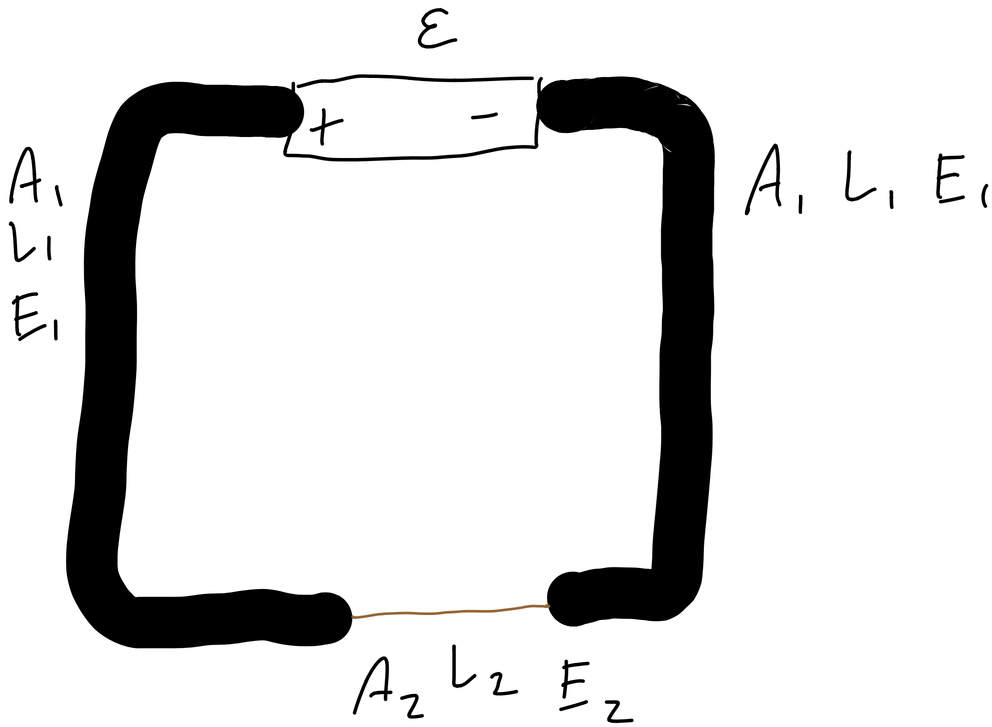
1: $2E_1L_1 + E_2L_2 = \varepsilon$

2: $2E_1L_1 + E_3L_3 = \varepsilon$

$\cancel{2E_1L_1} + E_2L_2 = \cancel{2E_1L_1} + E_3L_3$

$E_2L_2 = E_3L_3$

Consider:



$i_{in} = i_{out}$

$n_1 A_1 u_1 E_1 = n_2 A_2 u_2 E_2$

$$E_2 = \frac{n_1 A_1 u_1}{n_2 A_2 u_2} E_1$$

if $n_1 A_1 u_1 >> n_2 A_2 u_2$

$$E_2 >> E_1$$

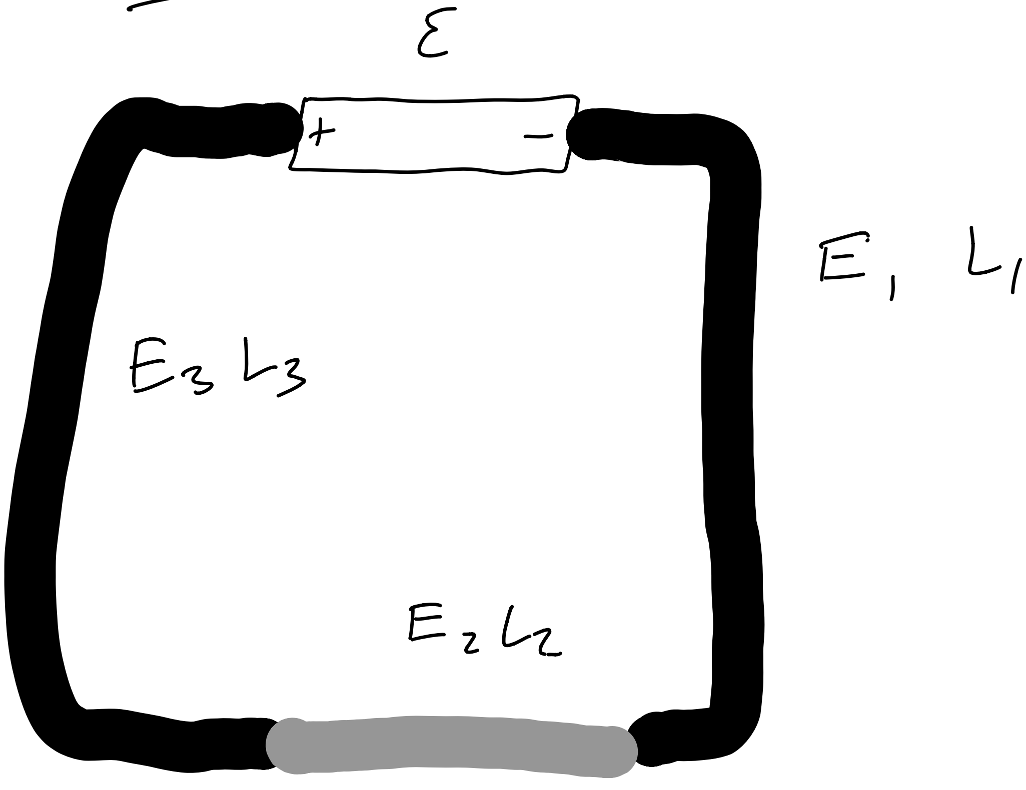
Loop rule

$$E_1 L_1 + E_2 L_2 + E_1 L_1 - \mathcal{E} = 0$$

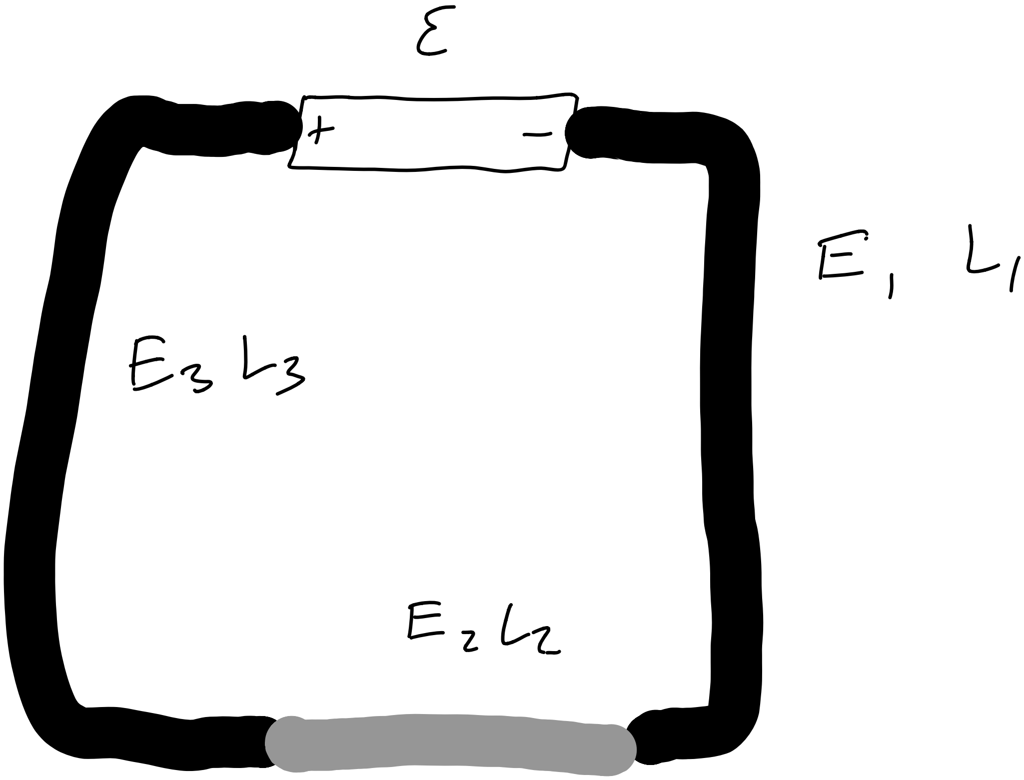
$$E_2 \gg E_1$$

$$E_2 L_2 = \mathcal{E}$$

<u>Resistor</u>



same A, different material



$i_{in} = i_{out}$

$n_1 A E_1 u_1 = n_2 A E_2 u_2$

$$E_2 = \frac{n_1 u_1}{n_2 u_2} E_1$$

$n_1 >> n_2$

$u_1 >> u_2$

$E_2 >> E_1$

$\mathcal{E} = E_2 L_2$

$$\Delta V_{Resistor} = E_2 L_2$$

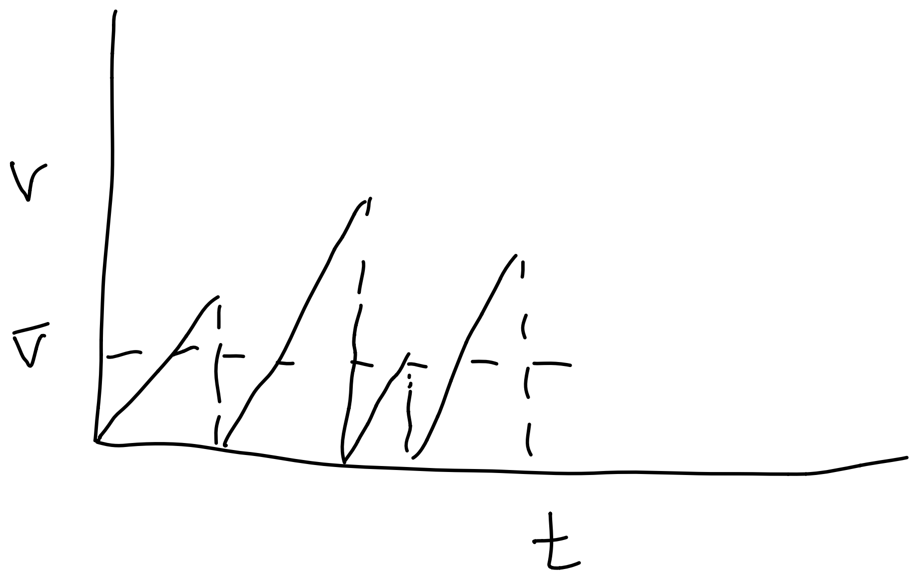
$$\Delta U = q\Delta V = -e E_2 L_2$$
$$= -e\mathcal{E}$$

$\Delta U < 0$

ΔK ?

$\bar{v}$ does not change

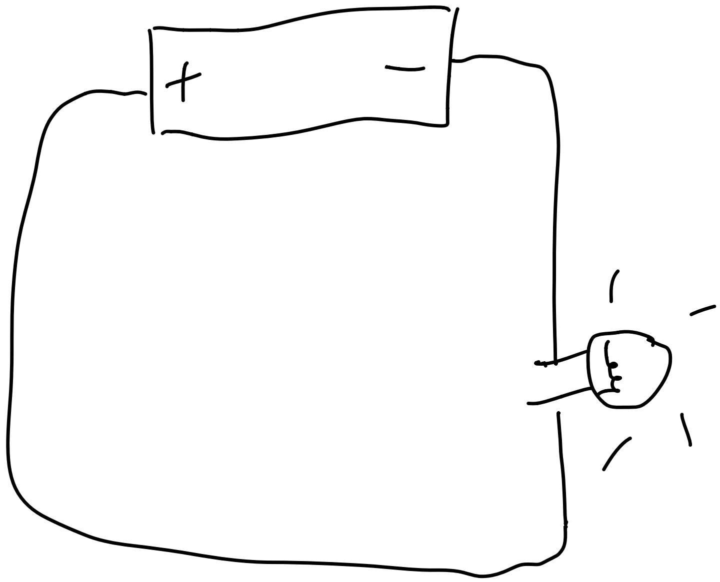
ΔK is dissipated by frequent collisions



ΔK converted into thermal energy in the wire.

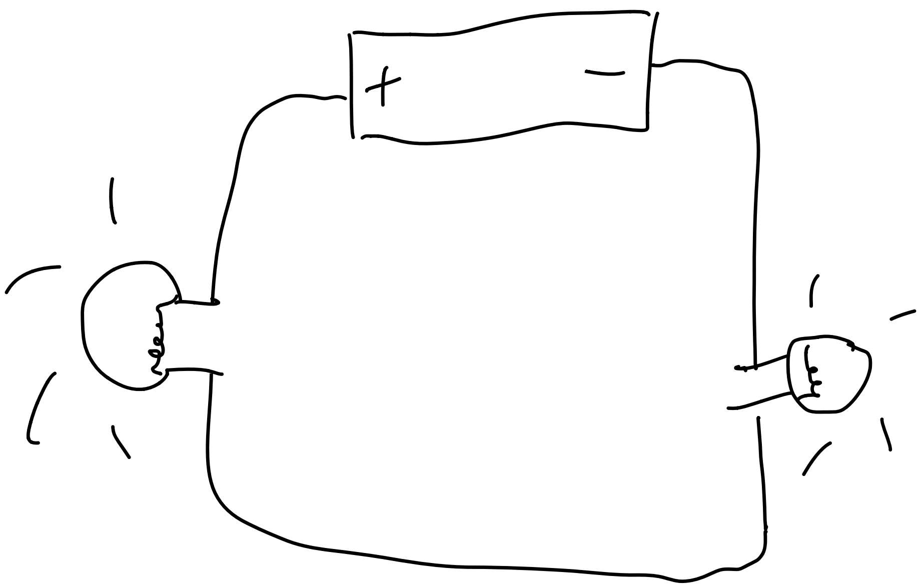
If wire gets hot enough, it emits light

Light bulb



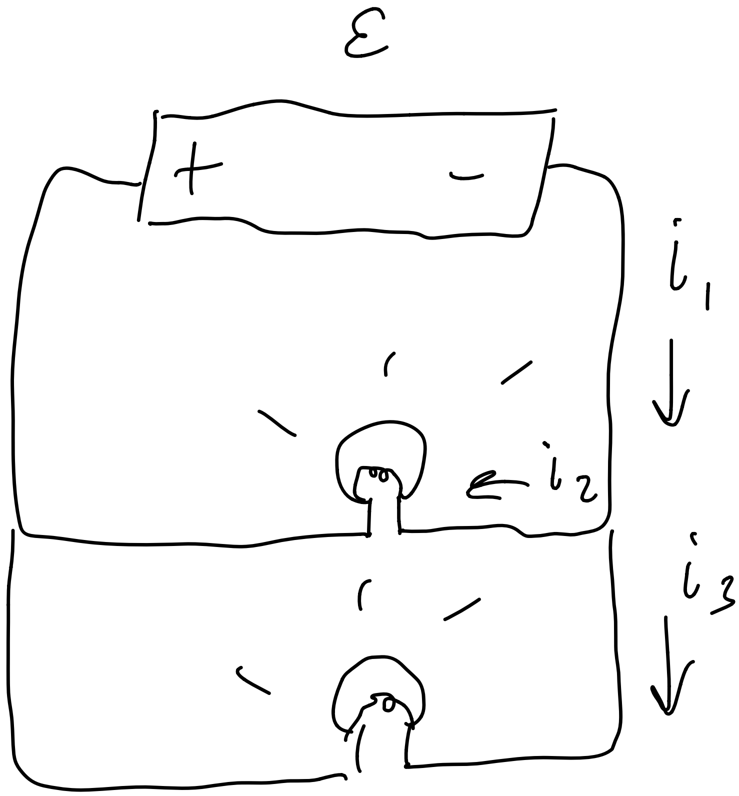
$$\mathcal{E} = EL$$

$$i = nAu\underline{E} = nAu\frac{\mathcal{E}}{L}$$



$$\mathcal{E} = 2EL$$

$$i = nAuE = \frac{1}{2} nAu \frac{\mathcal{E}}{L}$$



$$\mathcal{E} = E_1 L$$

$$\mathcal{E} = E_2 L$$

$$E_1 = E_2$$

$$i_2 = nAuE = nAu\frac{\varepsilon}{L}$$

$$i_3 = nAu\frac{\varepsilon}{L}$$

$$i_1 = i_2 + i_3$$

$$i_1 = 2nAu\frac{\varepsilon}{L}$$