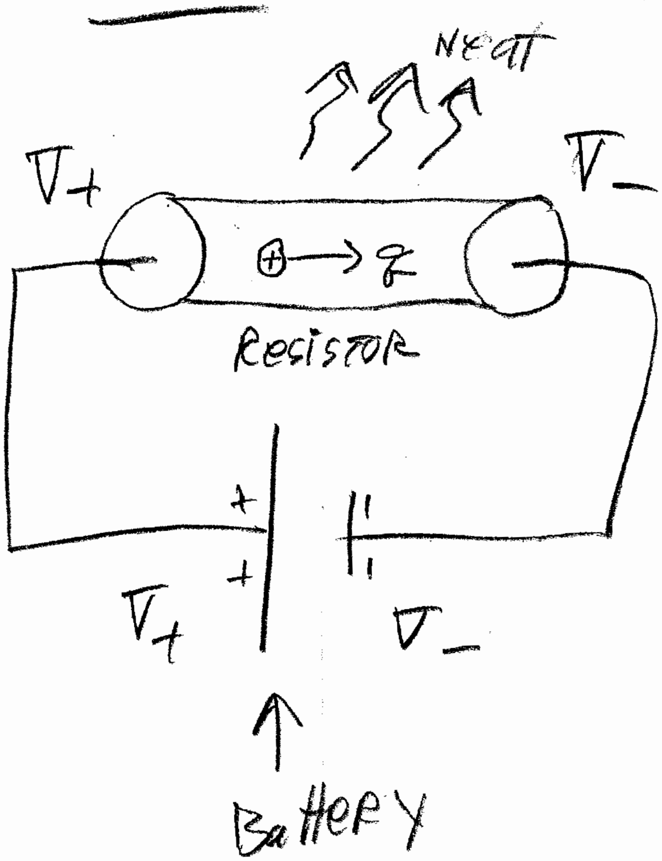
Power: sec. 25.5



Inside resistor: q loses potential energy to heat:

$$q \cdot (V_+ - V_-) = |\Delta U_{LOST}|$$

Inside Battery (see Fig 25.13): q gains potential energy due to chemical reaction: $q \cdot (V_+ - V_-) = \Delta U_{gain}$

conservation of Energy:

$$|\Delta U_{LOST}| = \Delta U_{gain}$$

$$q(V_+ - V_-) = q(V_+ - V_-)$$

rate of potential gained

$$= \frac{\Delta U_{gain}}{\Delta t} = \frac{q}{\Delta t} \cdot (V_+ - V_-)$$

$$= I \cdot (V_+ - V_-) \text{ since } I = \frac{q}{\Delta t}.$$

THUS: $$\frac{\Delta U_{gain}}{\Delta t} = \frac{|\Delta U_{LOST}|}{\Delta t} = I \cdot \Delta V$$

WHERE $\Delta V \equiv V_+ - V_-$.

Note: $I \cdot \Delta V = \left(\frac{\Delta V}{R}\right) \cdot \Delta V$

$$= \frac{\Delta V^2}{R}$$

ALSO $I \cdot \Delta V = I \cdot (I \cdot R)$

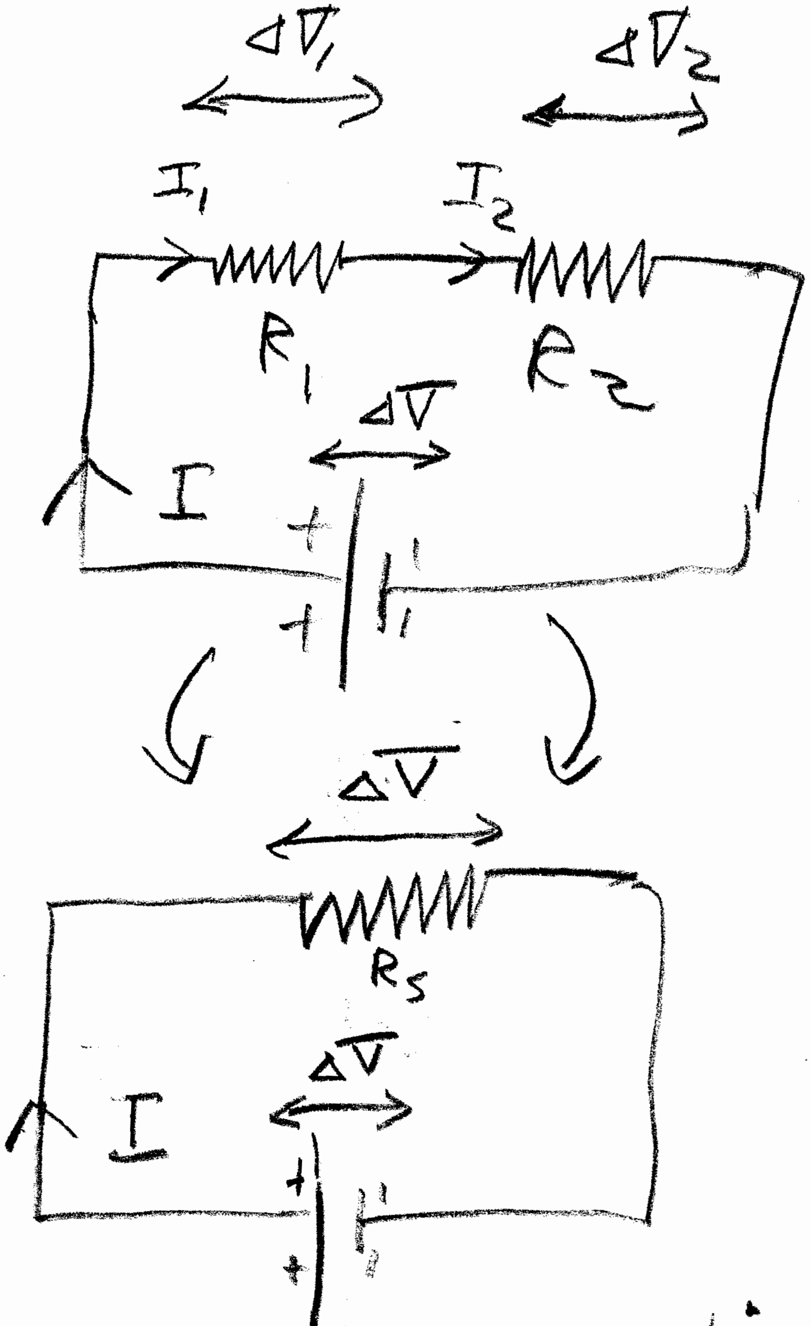
$$= I^2 \cdot R$$

THUS, rate of heat generated in resistor $= I^2 \cdot R = \frac{\Delta V^2}{R}$

where ΔV = Battery voltage and alternatively I = current.

Note: $I \cdot \Delta V$ = power delivered to circuit by Battery; unit is $\frac{\text{Joules}}{\text{sec}}$ = Watts (W).

sec 26.1 : Series

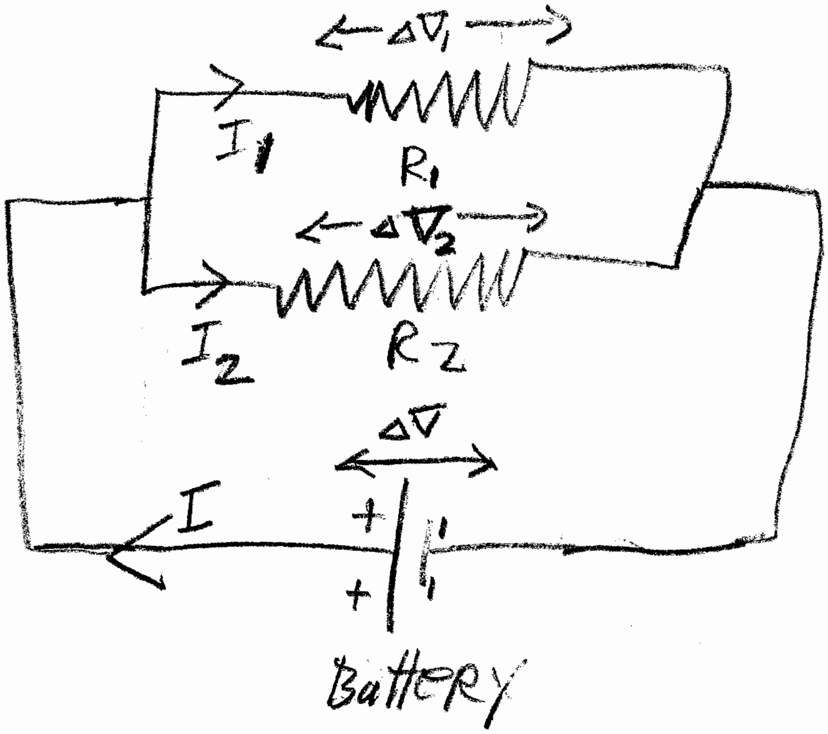


$I_1 = I_2 = I$ conservation of charge

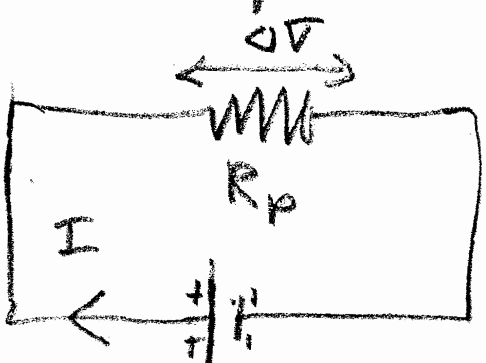
$\Delta V = \Delta V_1 + \Delta V_2$ conservation of Energy.

$I \cdot R_S = I \cdot R_1 + I \cdot R_2 \Rightarrow \boxed{R_S = R_1 + R_2}$

Sec 26.1 : parallel



$\Delta V_1 = \Delta V_2 = \Delta V$ from conservation of energy,



$I = I_1 + I_2$

$$\frac{\Delta V}{R_p} = \frac{\Delta V}{R_1} + \frac{\Delta V}{R_2}$$

Thus: $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ or $R_p = \frac{R_1 \cdot R_2}{R_1 + R_2}$