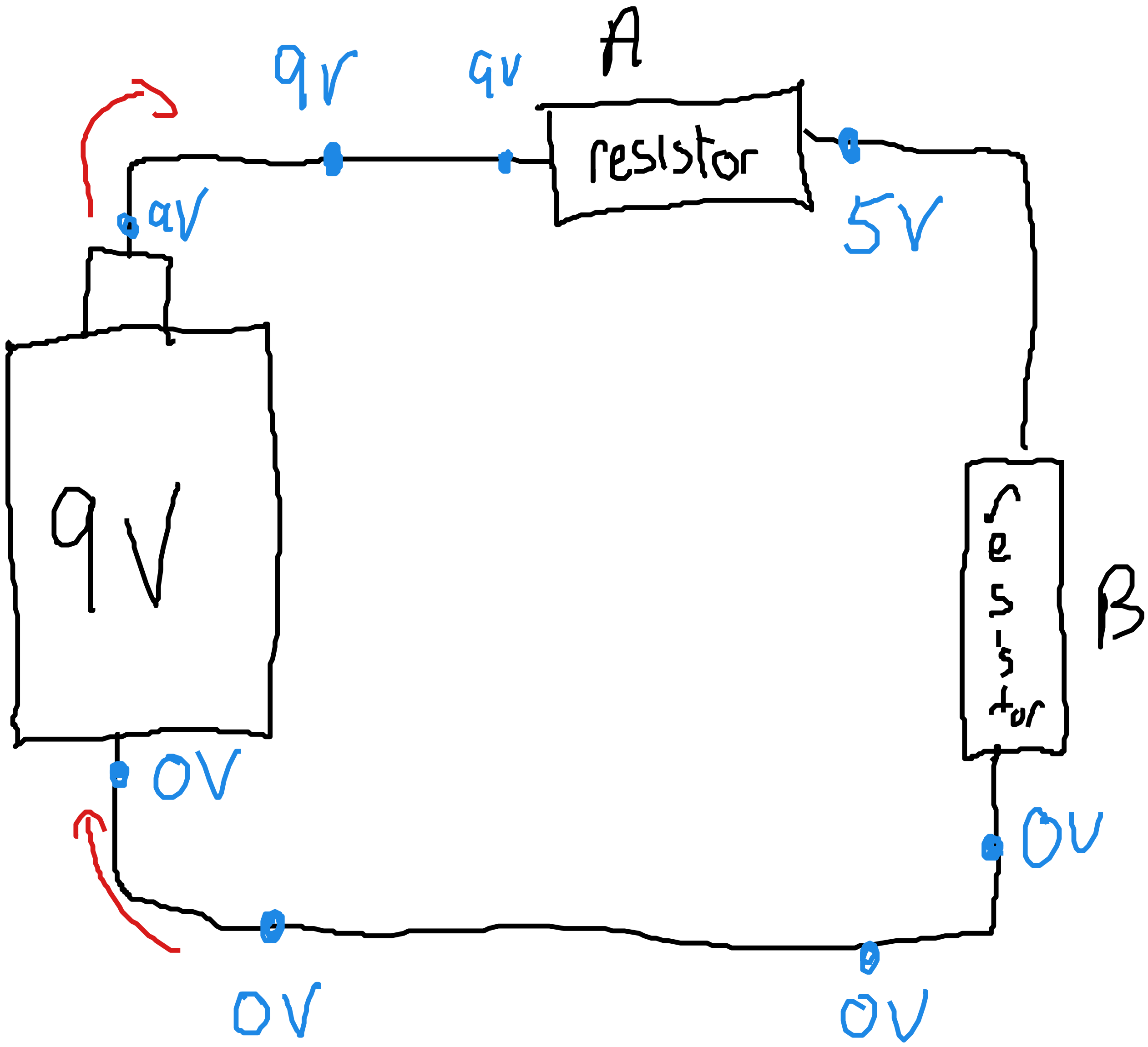


The potential V is the same everywhere on an ideal wire.

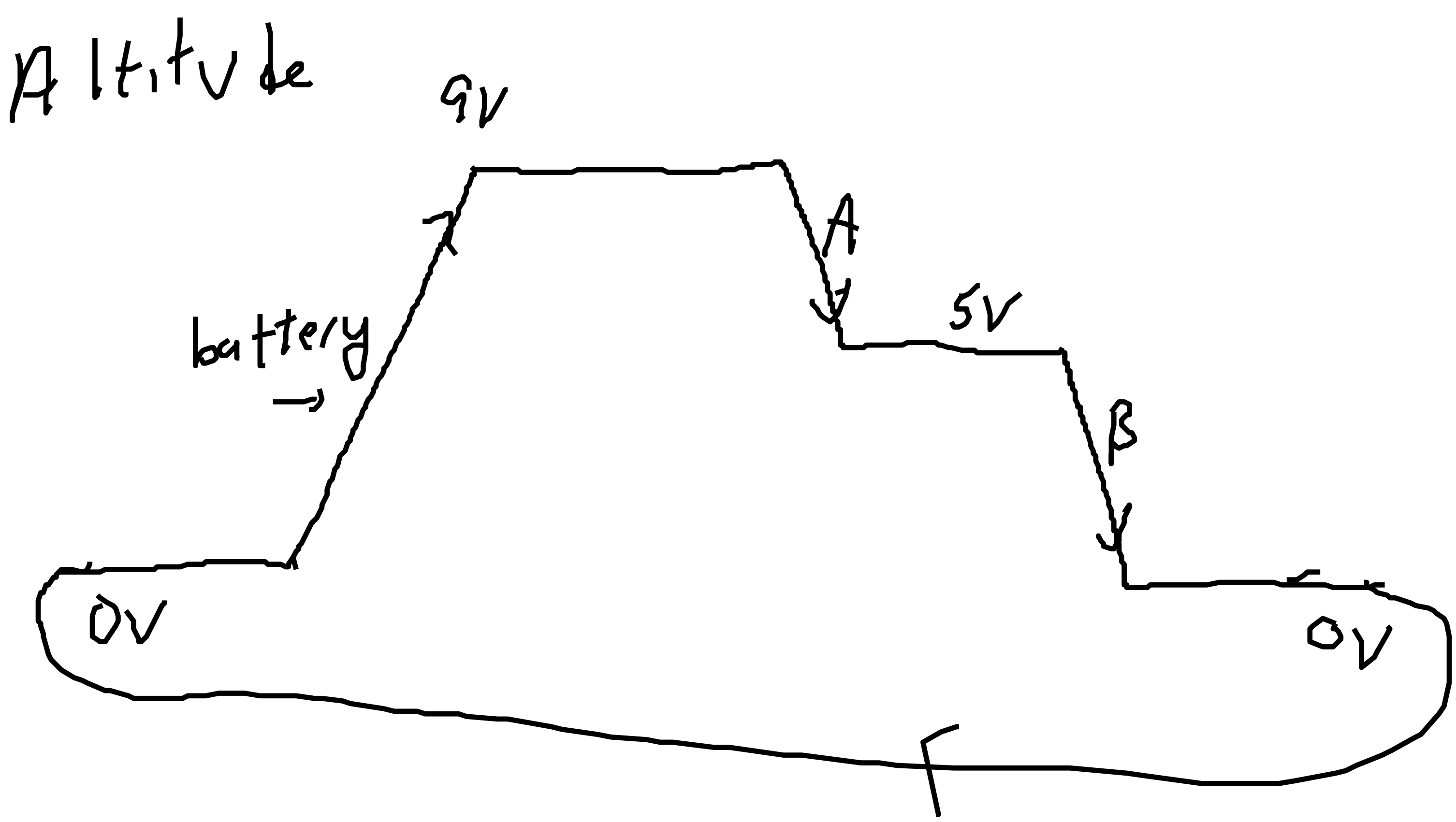
The potential difference ΔV between two points p & q is $\Delta V = V_p - V_q$

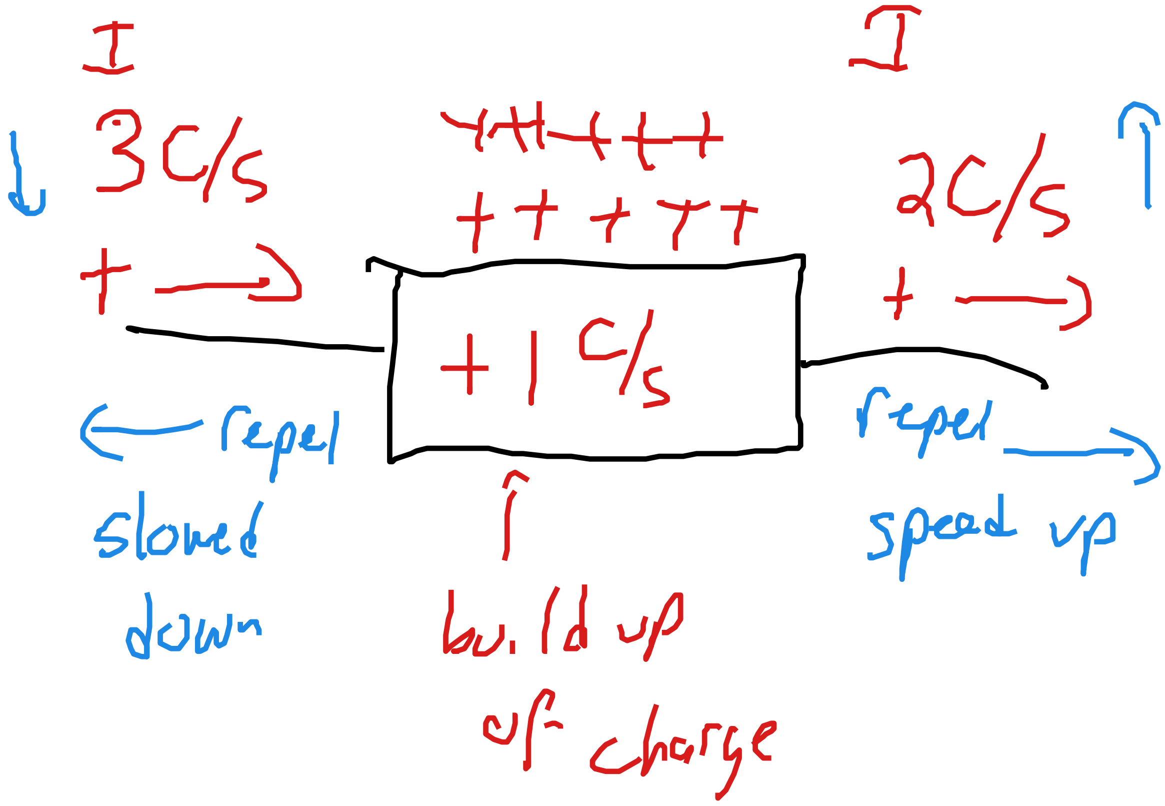
aka "voltage"

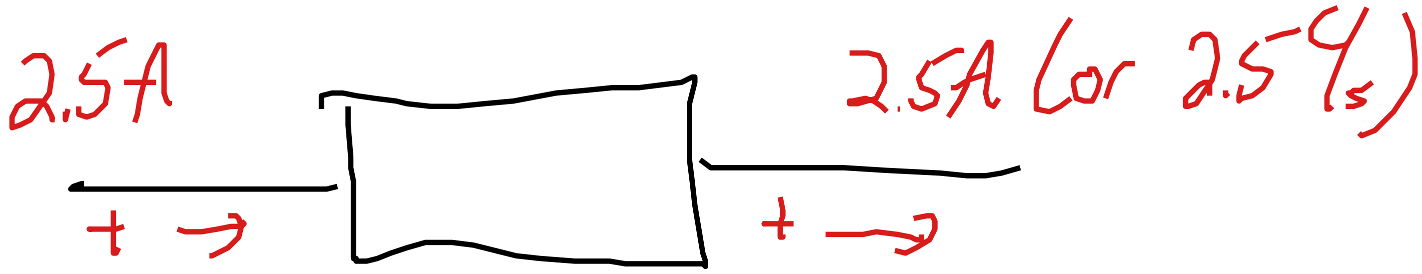
Potential Drop across A is

$$\Delta V_A = 9V - 5V = \boxed{4V}$$

$$\Delta V_B = 5V - 0V = \boxed{5V}$$

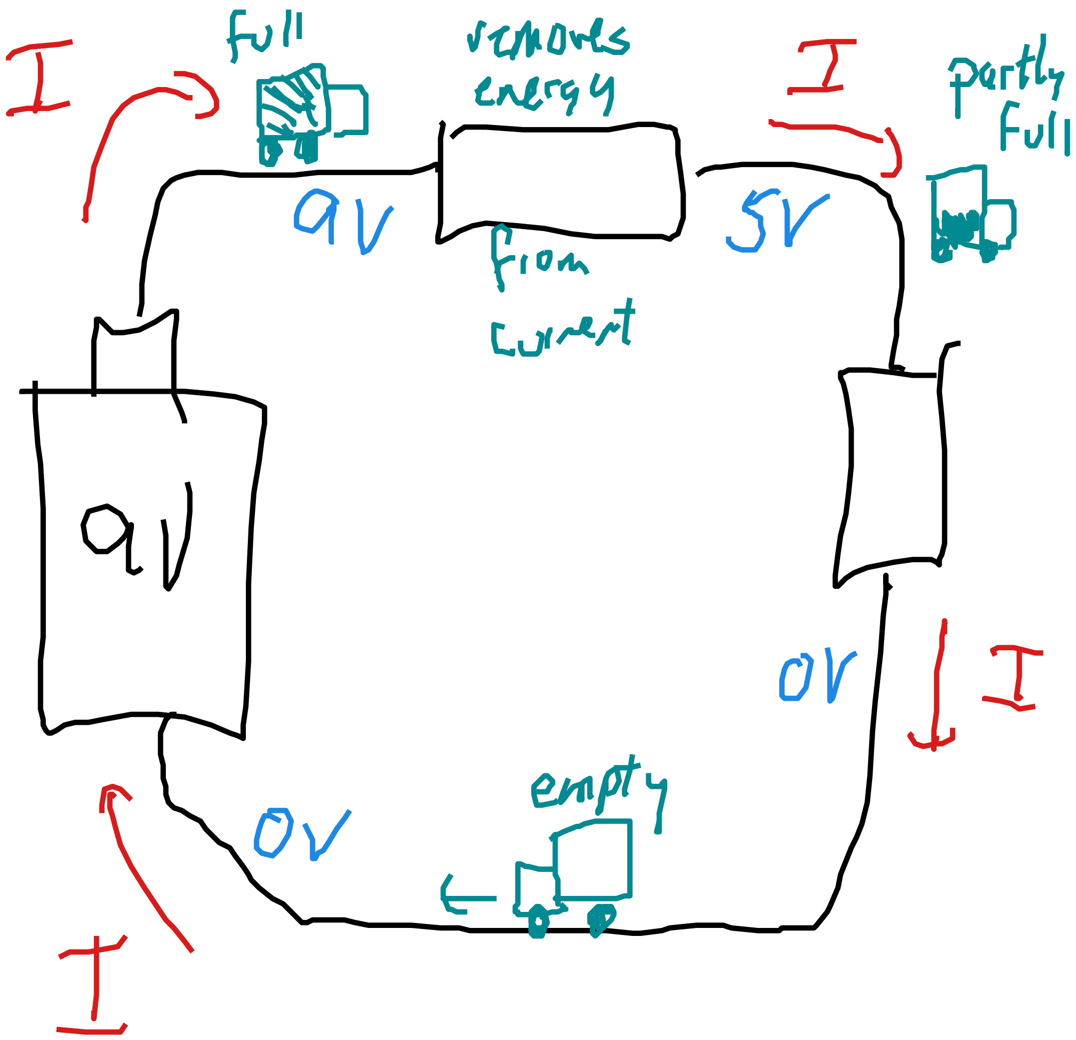






Steady current exhibits **conservation of current**

Current in = current out for any device



$I = I_1 + I_2$

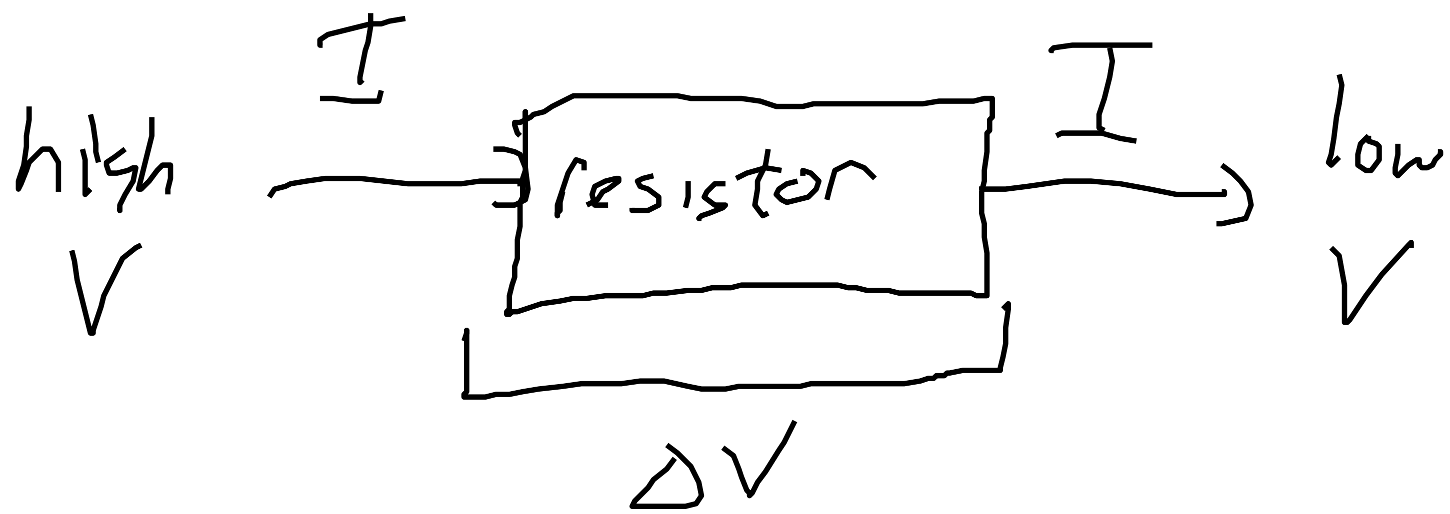
Where does potential come in?

Current = train cars

Potential Energy = cargo

Resistors have <u>resistance</u>

R



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

- bigger drop ΔV, more current I
- less resistance, more current I

$$R = \frac{\Delta V}{I}$$ definition of resistance

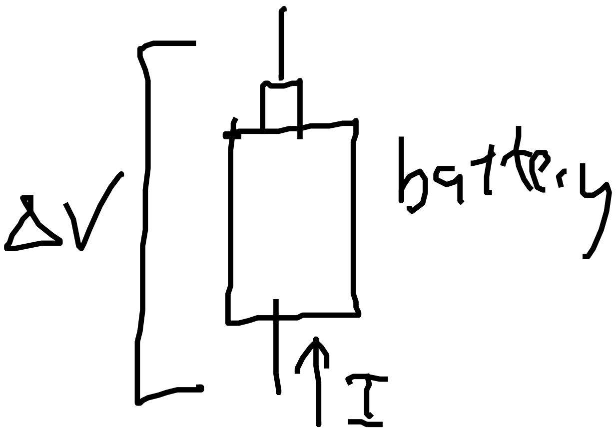
Units: $\frac{\text{Volts}}{\text{Amperes}} = 1 \text{ Ohm } (\Omega)$

thousand: $k\Omega$ (10^{+3}) & million: $M\Omega$ (10^{+6}) are common

$$\boxed{\Delta V = IR}$$ Ohm's Law

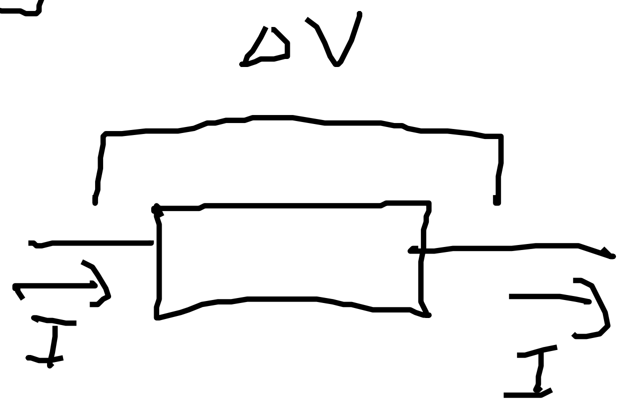
For most simple device's (e.g. resistors) R is constant.

$$P = I\Delta V$$



Power supplied by battery is $P = +I\Delta V$

(curent goes uphill)



power released by resistor is $P = -I\Delta V$

(curent goes downhill)

$$P = I\Delta V$$

$$\Delta V = IR$$

$$P = I(IR) \qquad P = \left(\frac{\Delta V}{R}\right)\Delta V$$

$$P = I^2 R \qquad P = \frac{(\Delta V)^2}{R}$$

Two incandescent light bulbs

$P_A = 40W$ $\qquad$ $P_B = 60W$

Which light bulb has the higher resistance?

Is P proportional to R or $1/R$?

If I is constant, then
$P = I^2 R$ suggests $P \sim R$

If ΔV is constant, then
$P = \frac{(\Delta V)^2}{R}$ suggests $P \sim \frac{1}{R}$

Light Bulbs:

In household circuit,
ΔV at wall sockets is 120V.

40W

$P = I\Delta V$

$40W = I(120V)$

$I = \frac{40}{120} = 0.33A$

$\Delta V = IR$

$120 = (0.33)R$

$R = \frac{120}{0.33} = 360\,\Omega$

$P = I^2R = 40 = (0.33)^2(360)$

$P = \frac{\Delta V^2}{R} \Rightarrow 40 = \frac{(120)^2}{360}$

60W

$P = I\Delta V$

$60W = I(120V)$

$I = \frac{60}{120} = 0.5A$

$\Delta V = IR$

$120 = (0.5)R$

$R = 240\,\Omega$

$P = 60 = (0.5)^2(240)$

$60 = \frac{(120)^2}{240}$