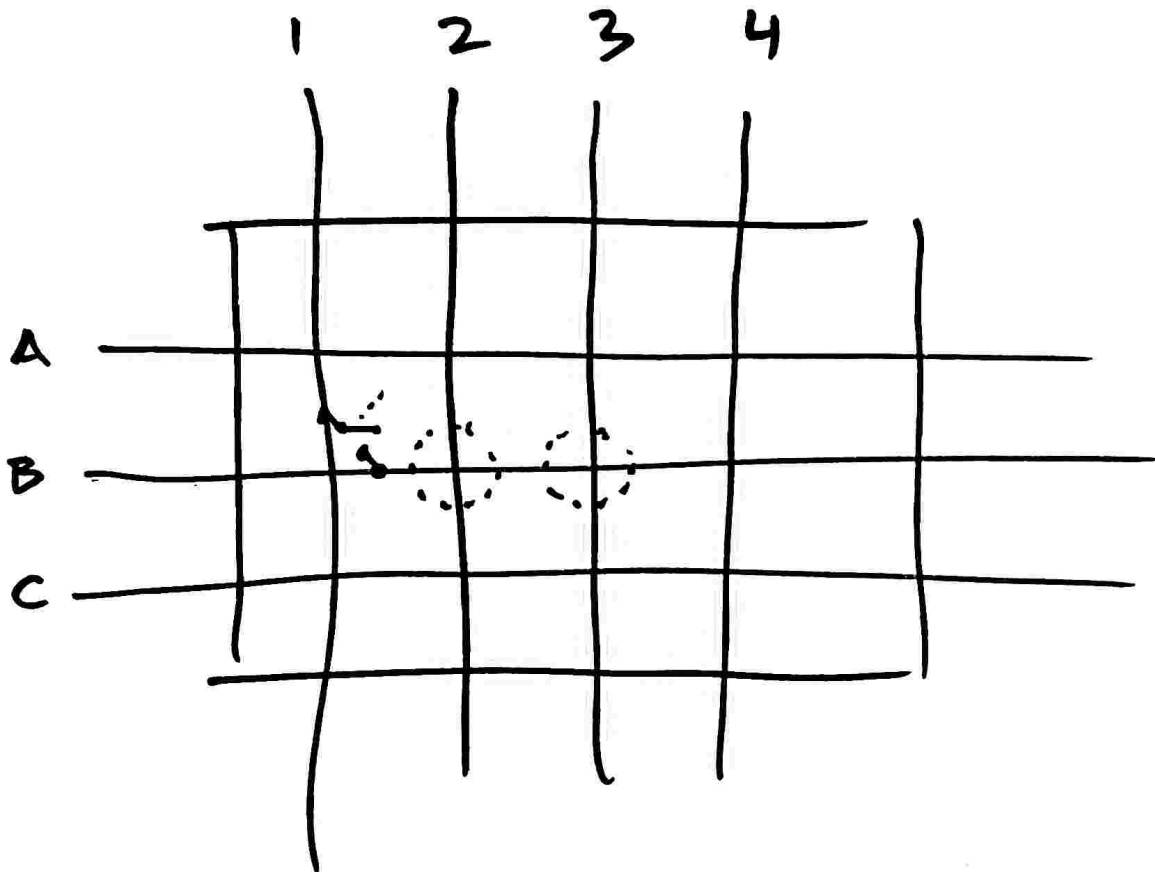


Module 2: Introduction to Circuits



INPUTS

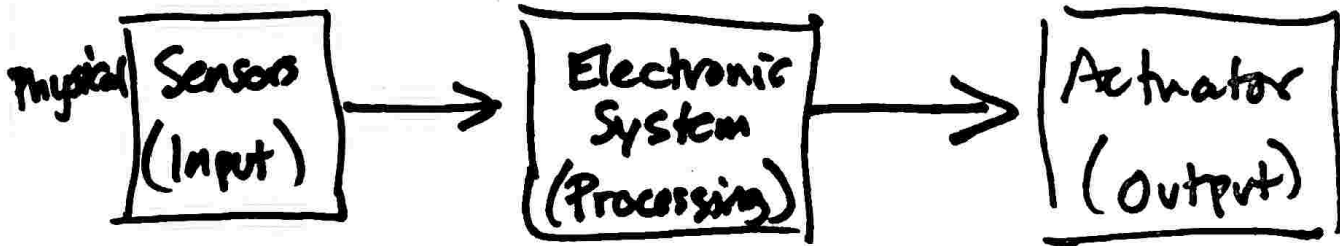
AUDIO
MOTION
LOCATION
LIGHT
ORIENTATION
⋮

PROCESSING

FILTERING
ALGORITHMS
⋮

OUTPUT

AUDIO
VIDEO/DISPLAY
VIBRATION
⋮



Electricity

→ electrons

→ Voltage V

$[V]$ volts



water pressure


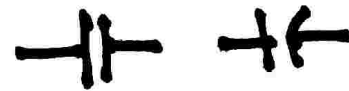





→ Current I

$[A]$ amperes



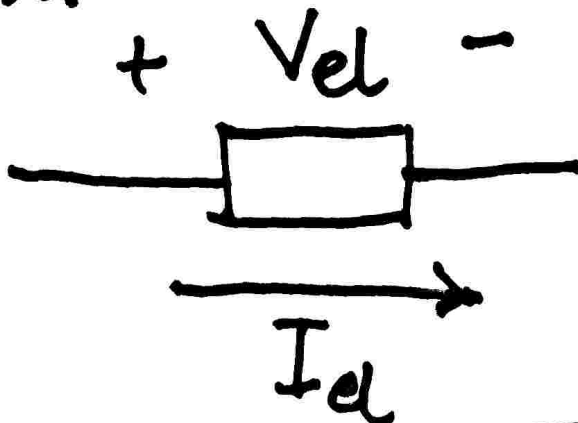
water flow

Circuit Elements

- Resistor 
- Capacitor 
- Wires 
- Inductors 
- Batteries 
- Switch 
- Ground 

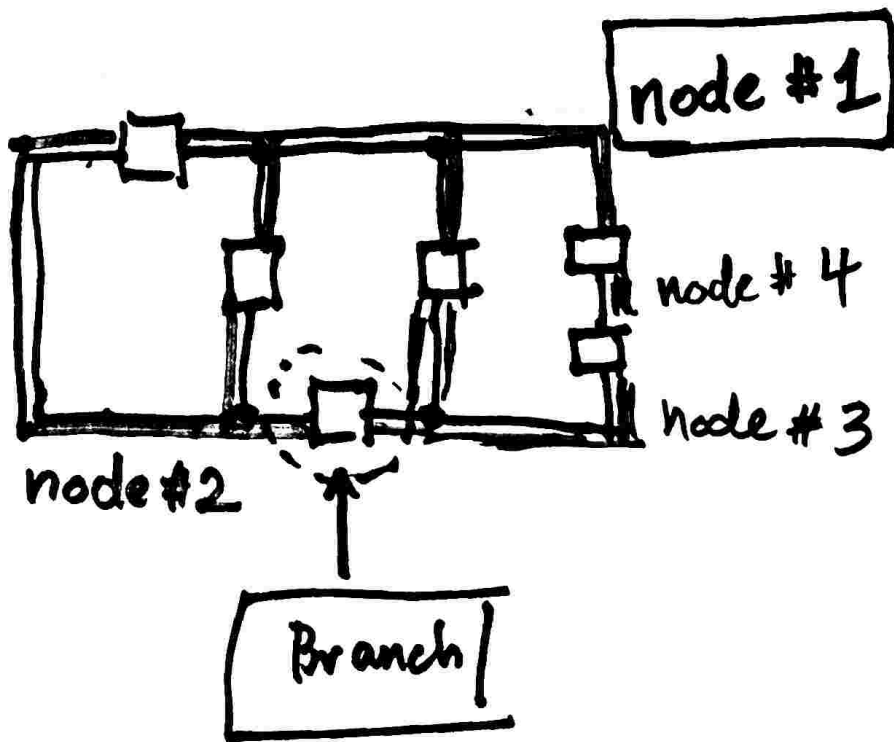
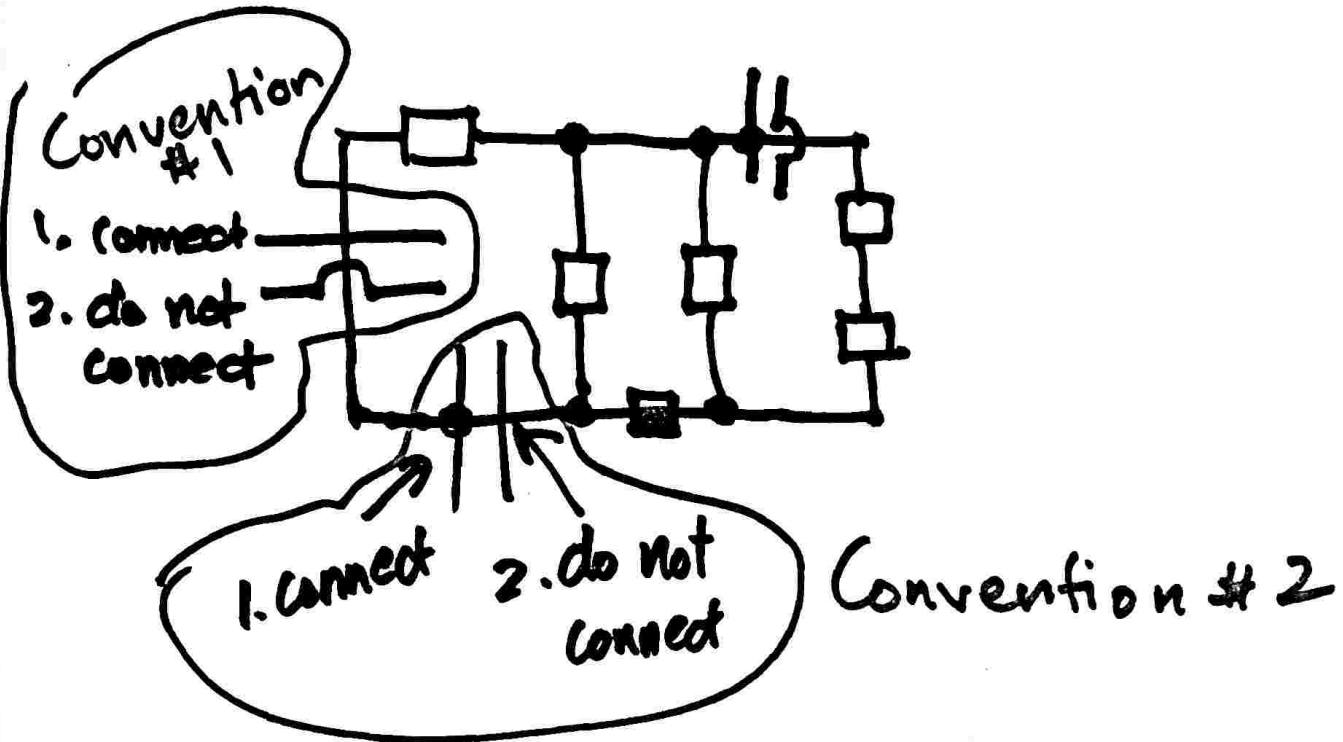
Generic Circuit Element

Symbol



"Passive Sign Convention"

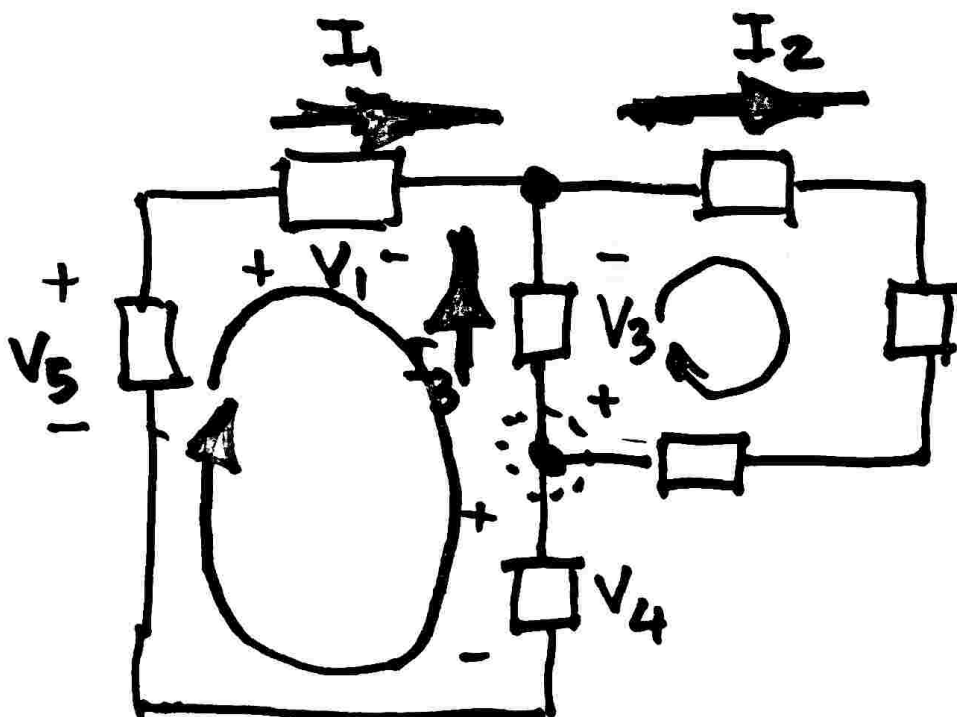
Circuit Elements → Circuits



Kirchhoff

KCL \rightarrow K's Current Law:

Sum of all currents entering a ~~node~~ node equals the sum of all currents leaving a node.



$$\text{KCL: } I_1 + I_3 = I_2$$

KVL \rightarrow K's Voltage Law:

Sum of the voltages around a loop equals zero.

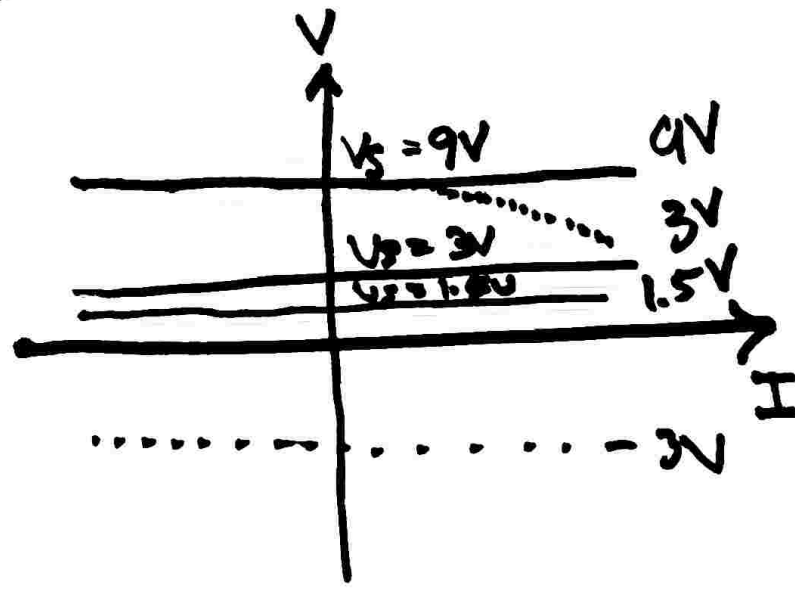
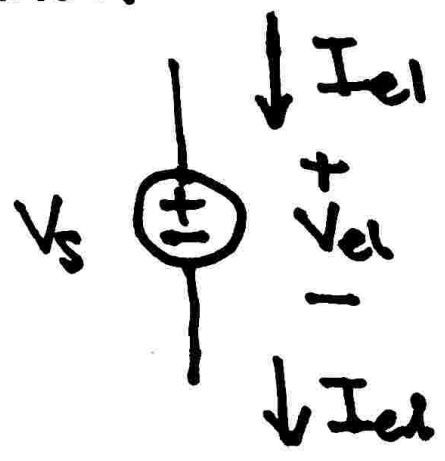
$$V_5 - V_1 + V_3 - V_4 = 0$$

$$V_5 - V_1 + V_3 - V_4 = 0$$

Partly there.... but how is
I and V related?

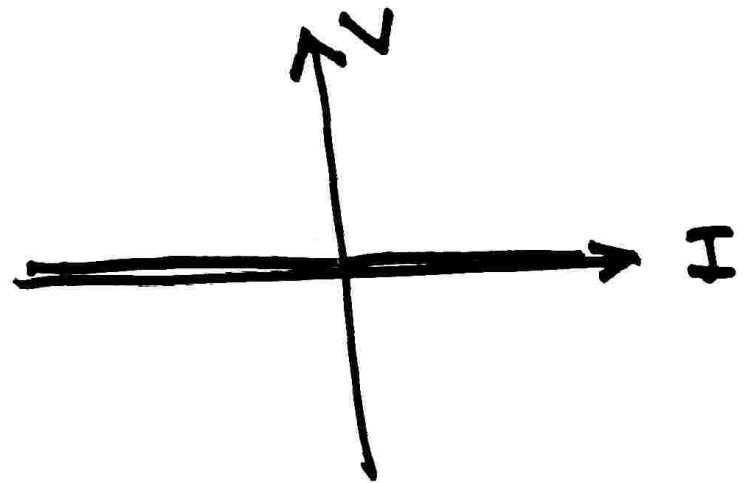
Basic Circuit Elements

- Voltage Source
- Symbol



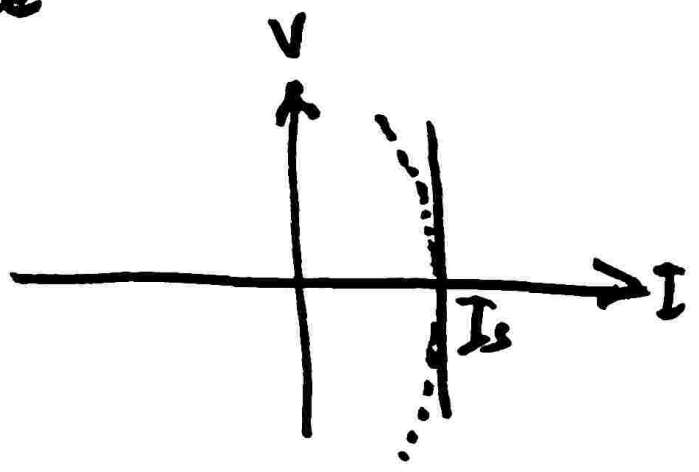
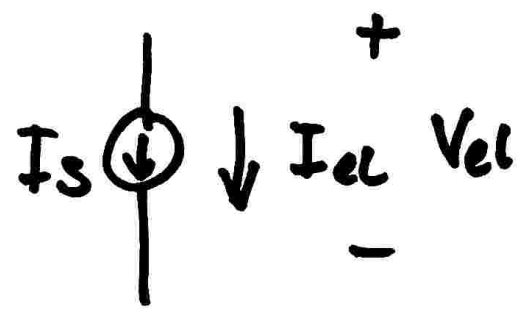
MODEL vs REALITY

• Wire

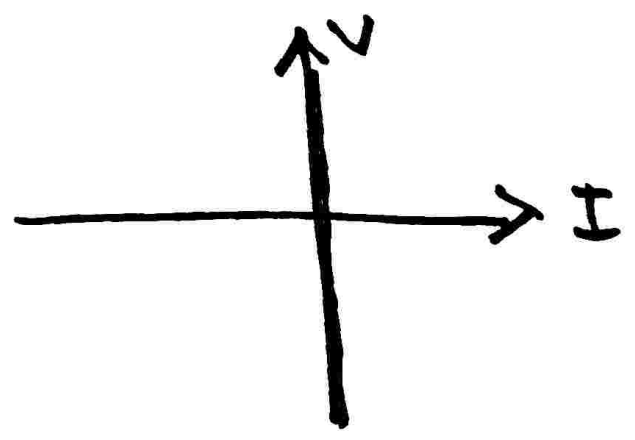
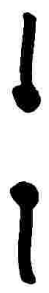


"short circuit"

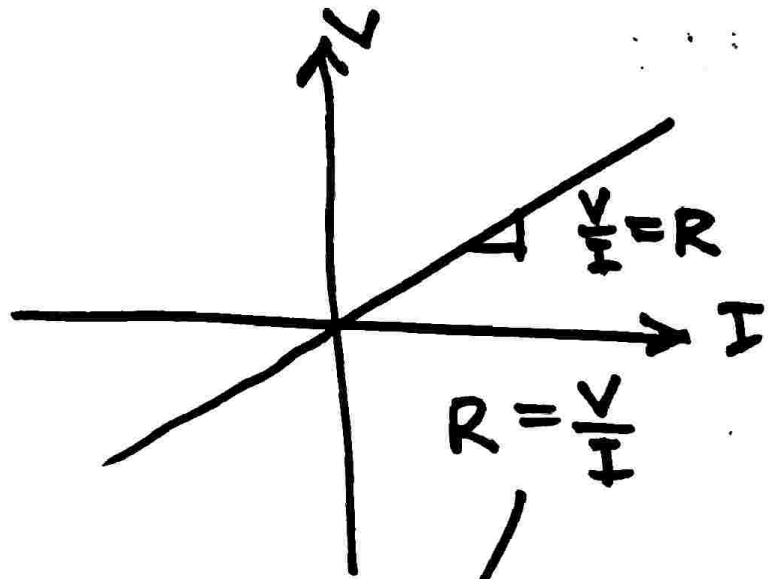
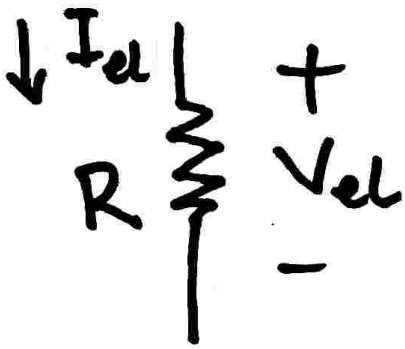
• Current Source



• Open circuit



- Resistor



Resistance $R = \frac{\text{Volts}}{\text{Amp}} = \text{Ohm}$ $V = IR$ "ohm's Law"

Ohm [Ω]

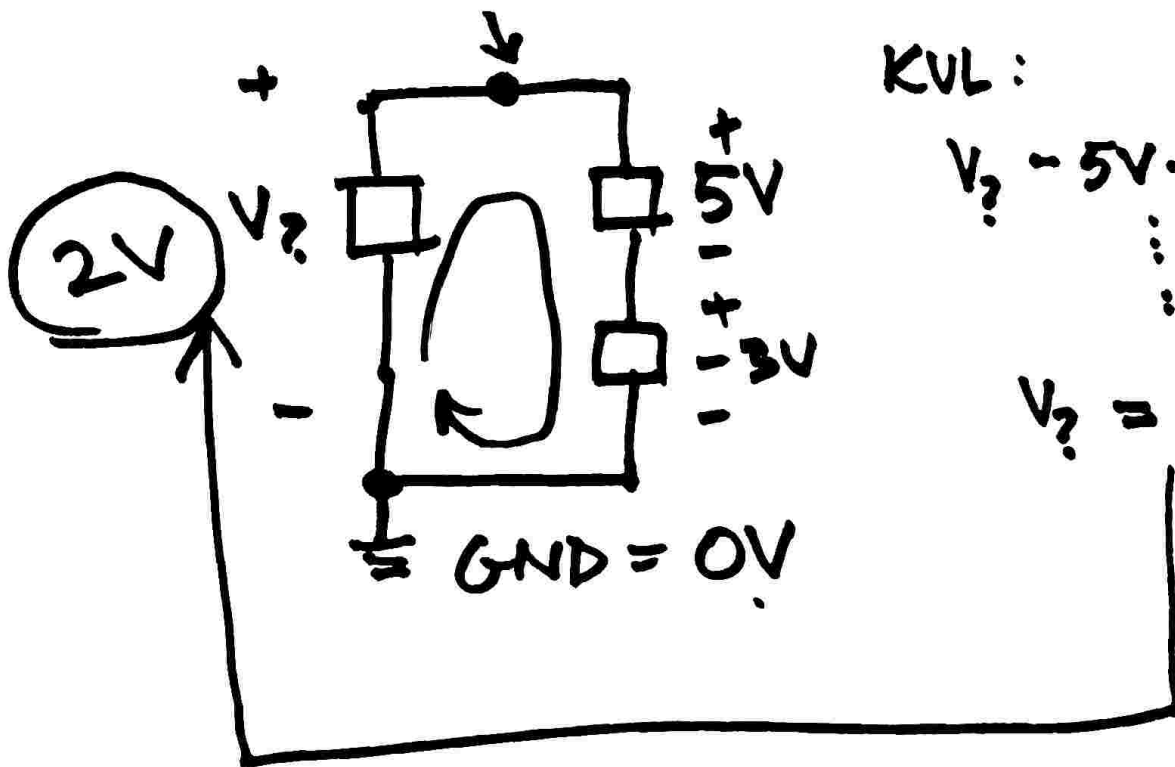
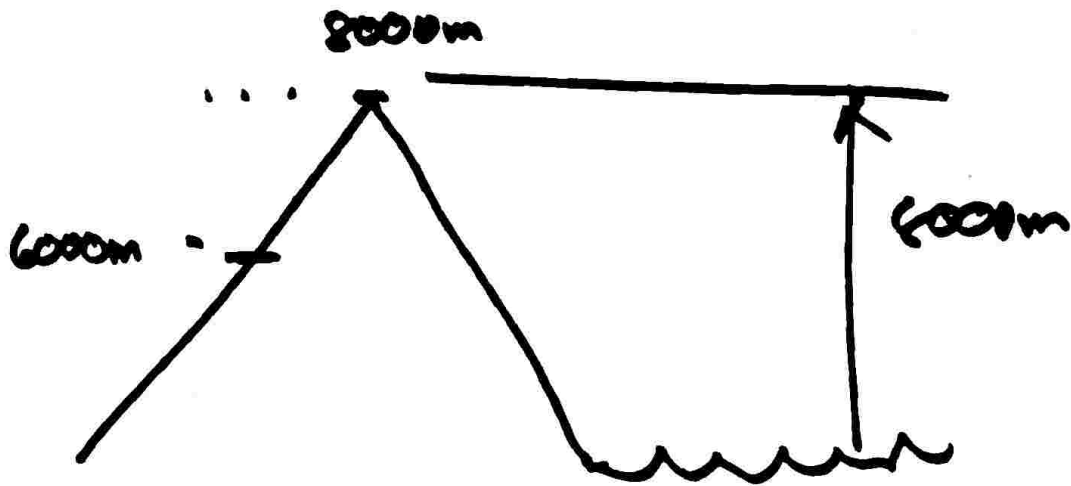
2 k Ω

2 "kilo-ohms"

1 V battery

$$I = \frac{V}{R} = \frac{1V}{2k\Omega} = 0.5 \text{ mA}$$

Node Voltage



KVL:

$$V_? - 5V - (-3V) = 0$$

⋮

$$V_? = 2V$$