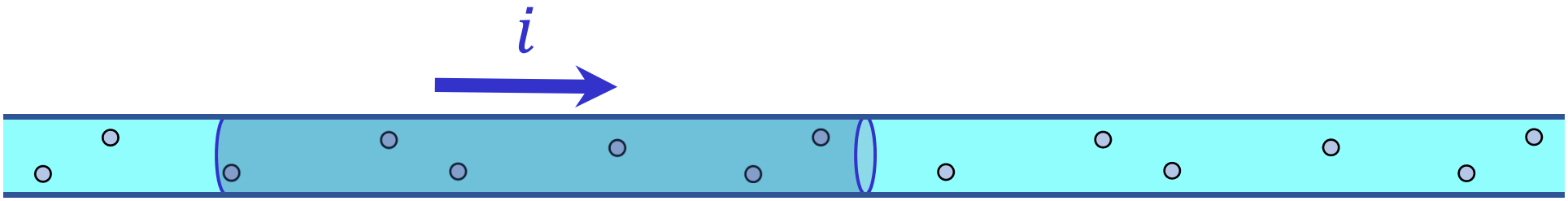
Basic Introduction to Electronics

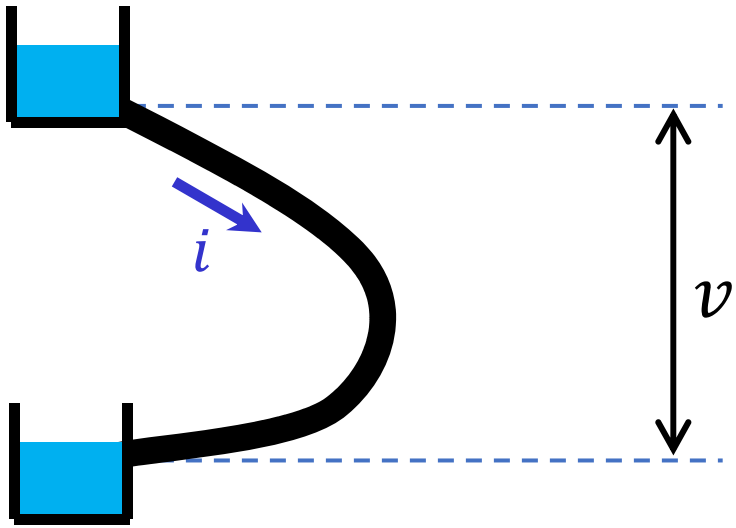


Electrical current

Symbol: i

Unit: Ampere (A)

For example: 1 mA = 0.001 Amperes

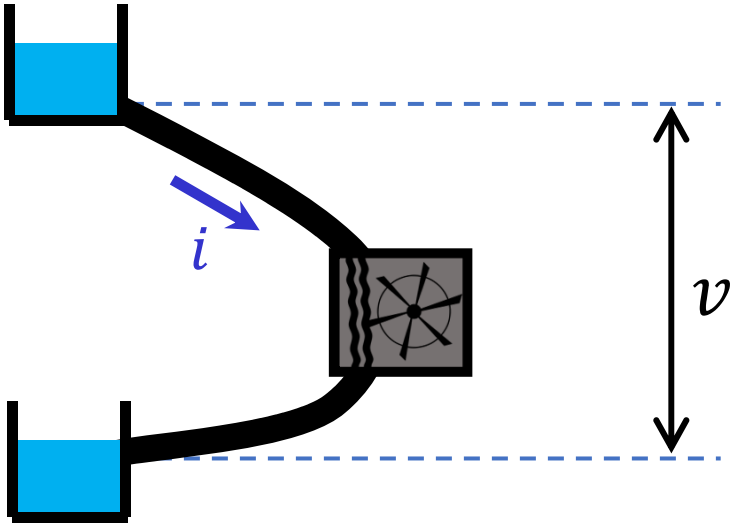


Voltage

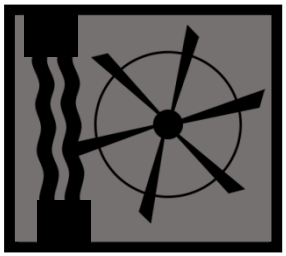
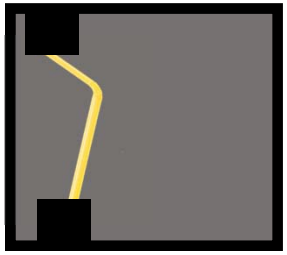
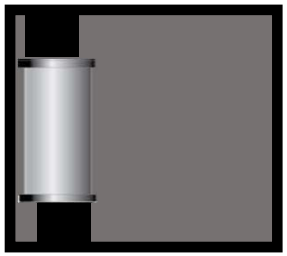
Symbol: v

Unit: Volt (V)

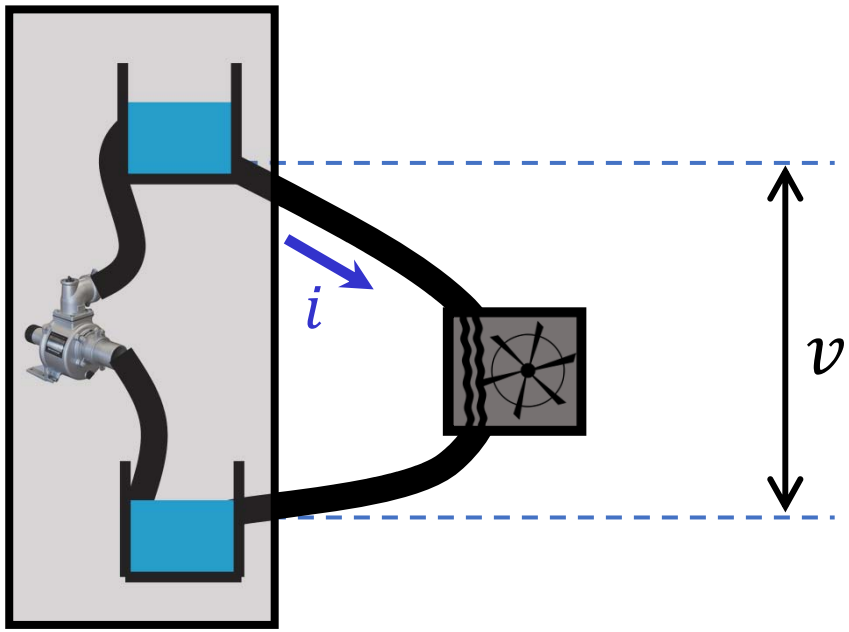
For example: 5 V

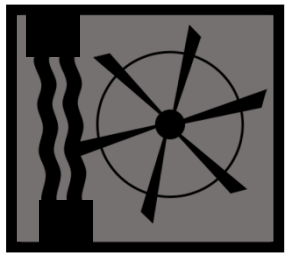


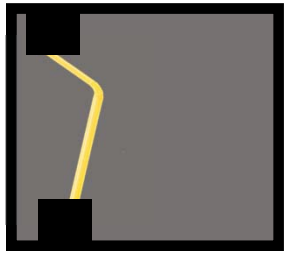
Circuit elements

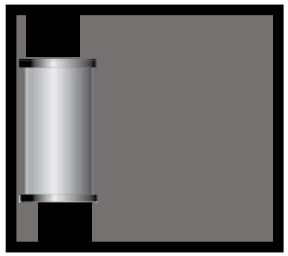




Same v Different i

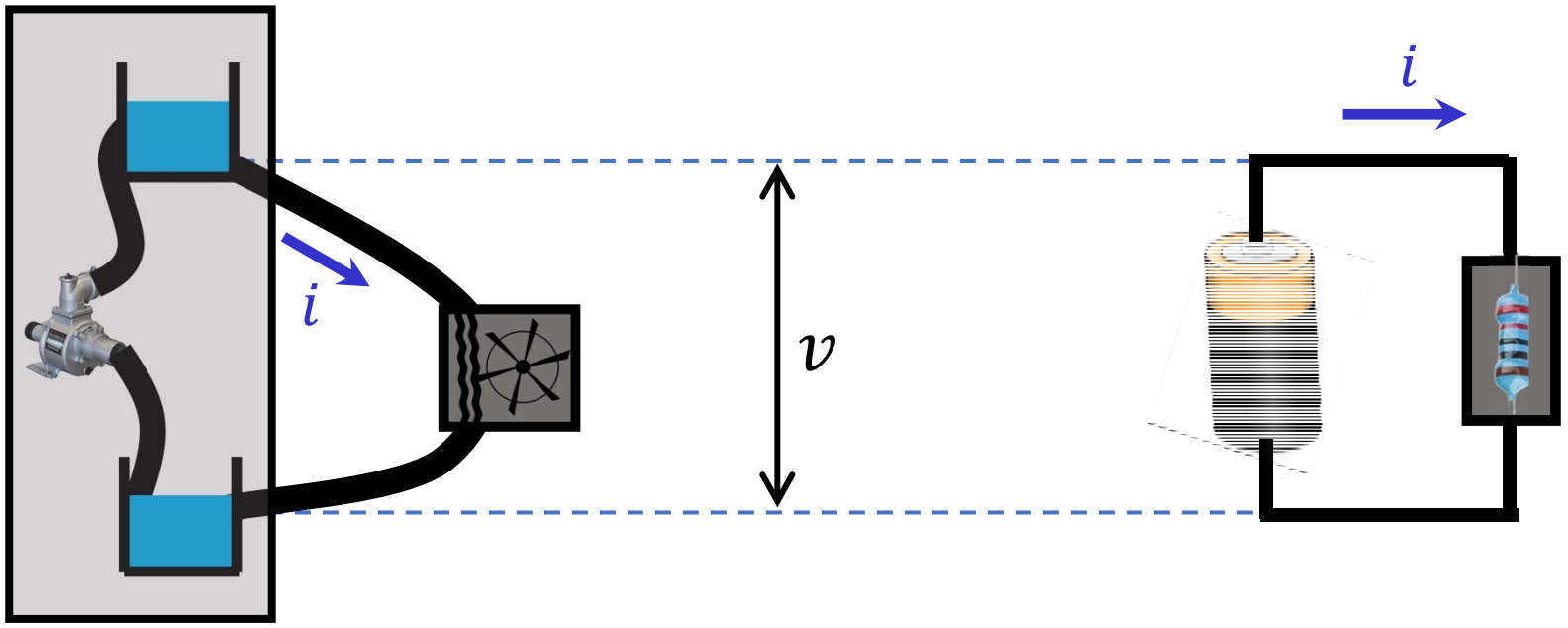






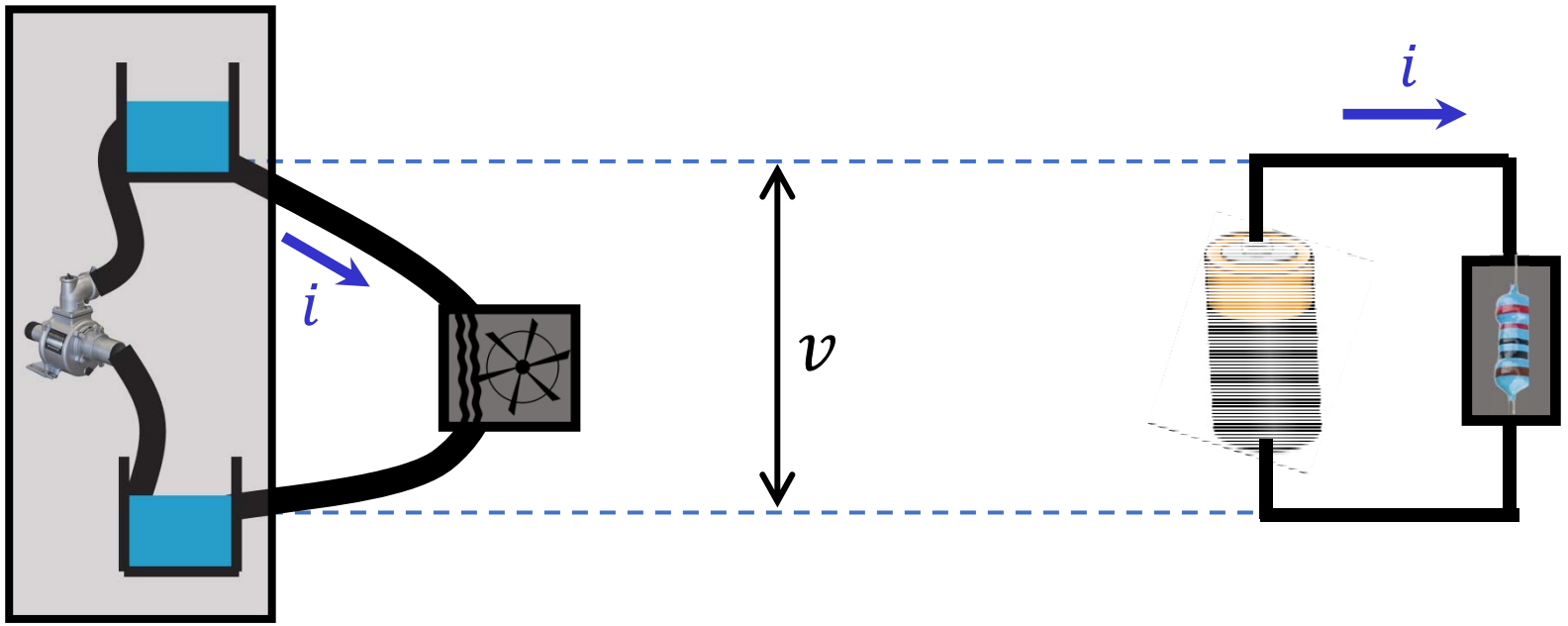


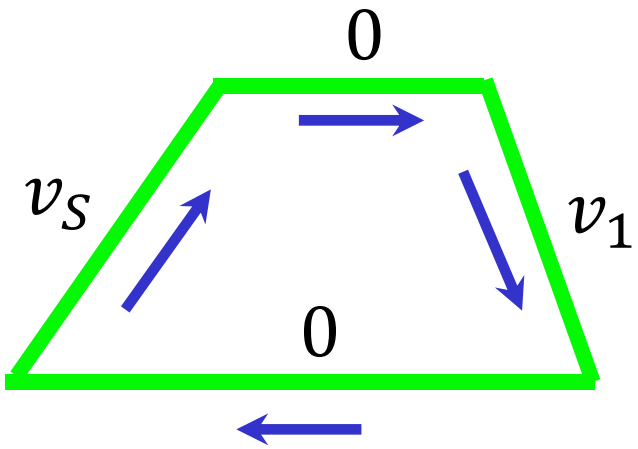
Same v Different i

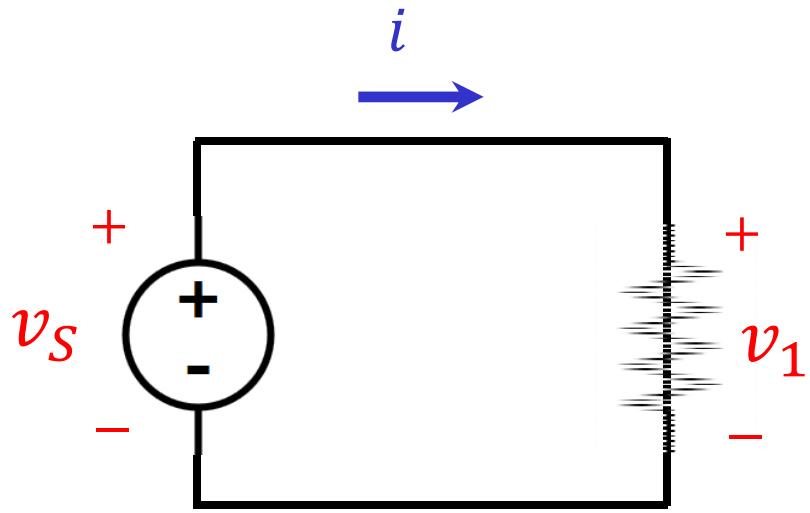


Circuit elements

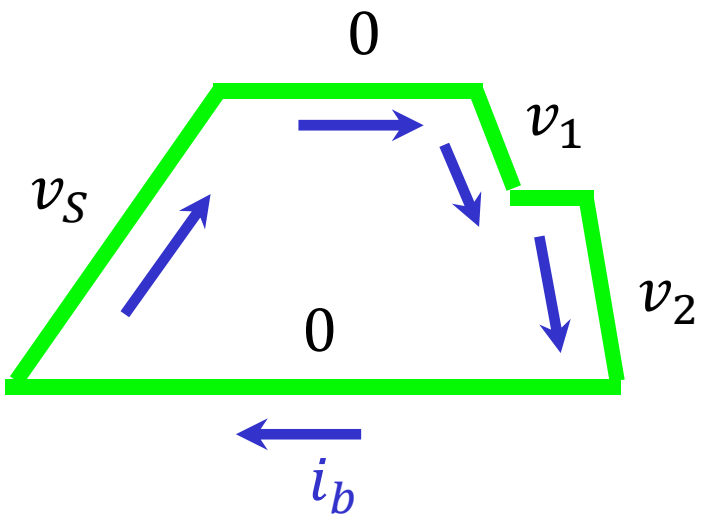
Same v Different i

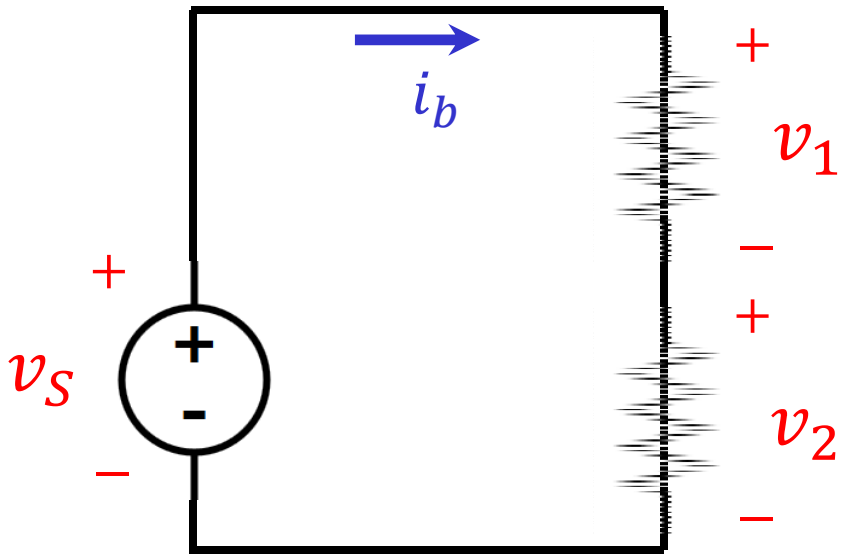

i
i
v

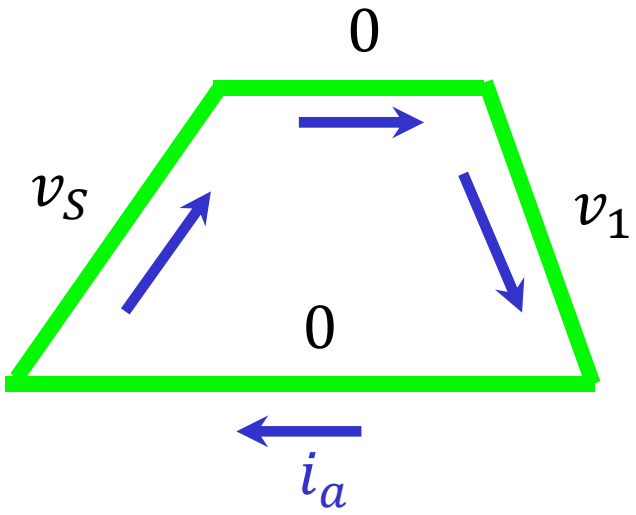

0
v_S
v_1
0

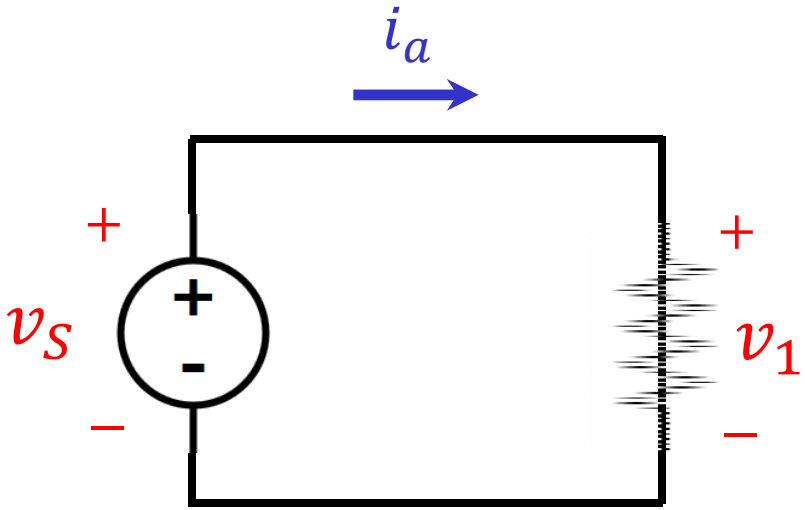

i
+
v_S
-
−
+
v_1
−

$v_S = v_1 + v_2$

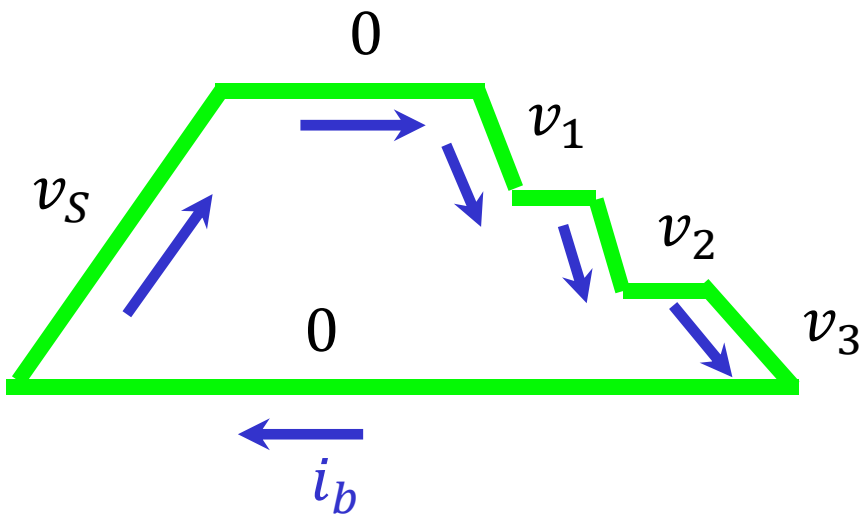








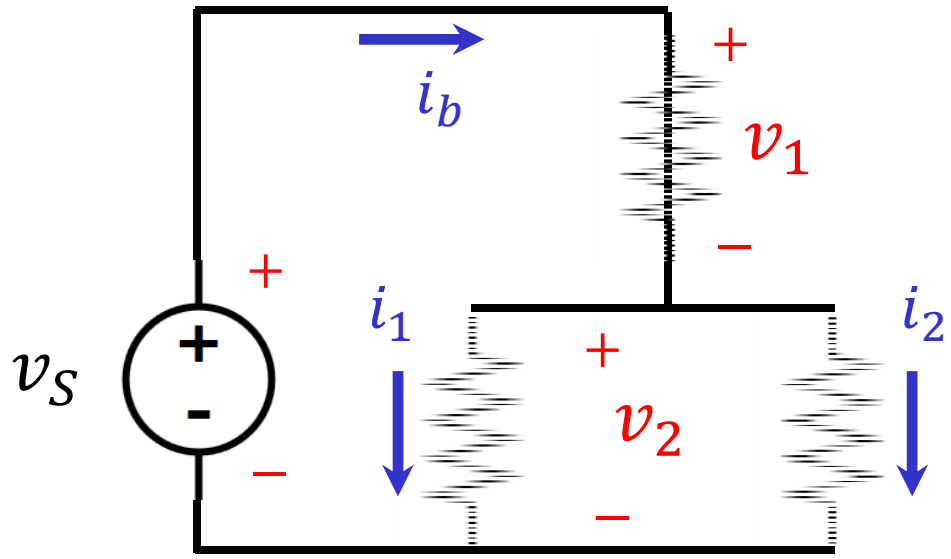
$v_S = v_1$



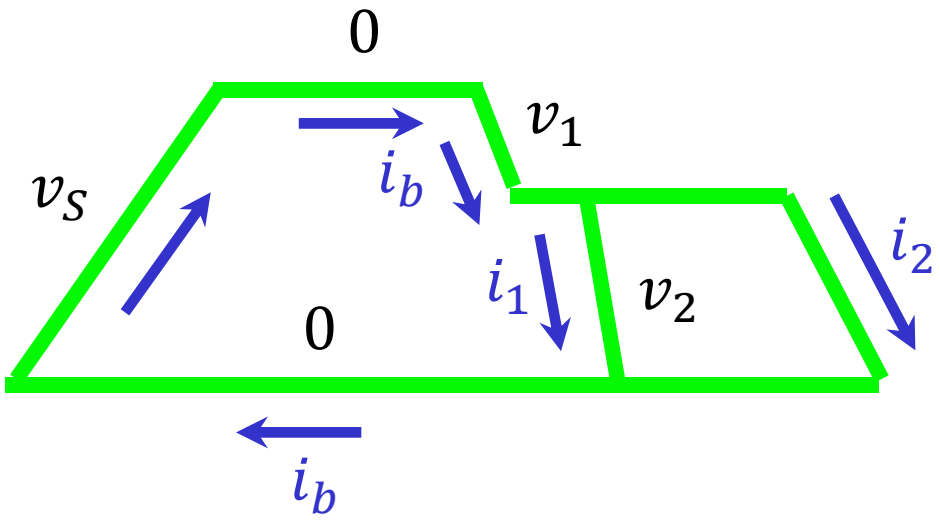
$$\sum_{up} v = \sum_{down} v$$

KVL

Kirchhoff's Voltage Law

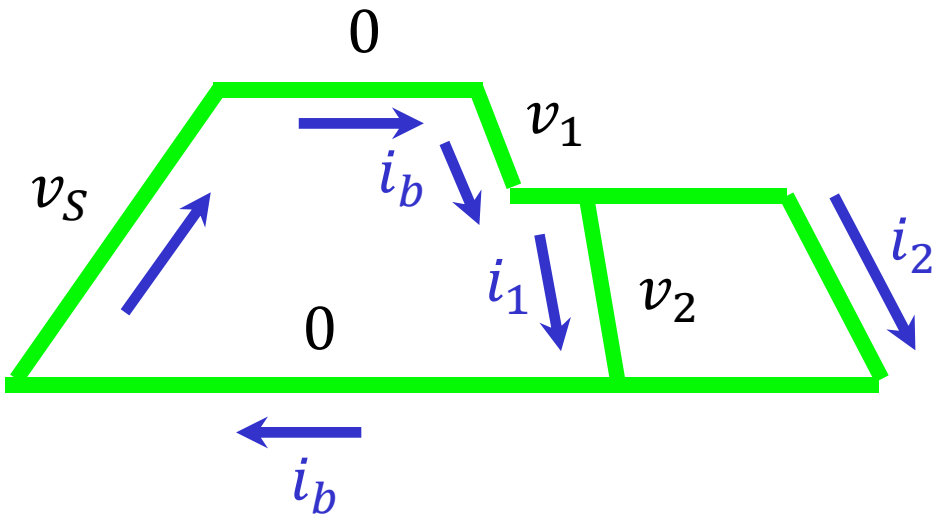


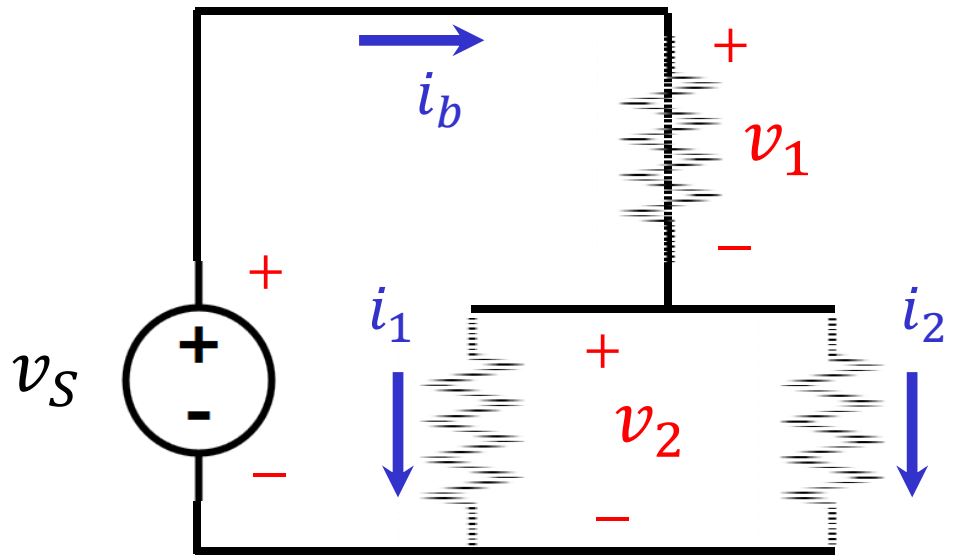
$$i_b = i_1 + i_2$$



$$\sum_{in} i = \sum_{out} i$$

KCL
Kirchhoff's Current Law

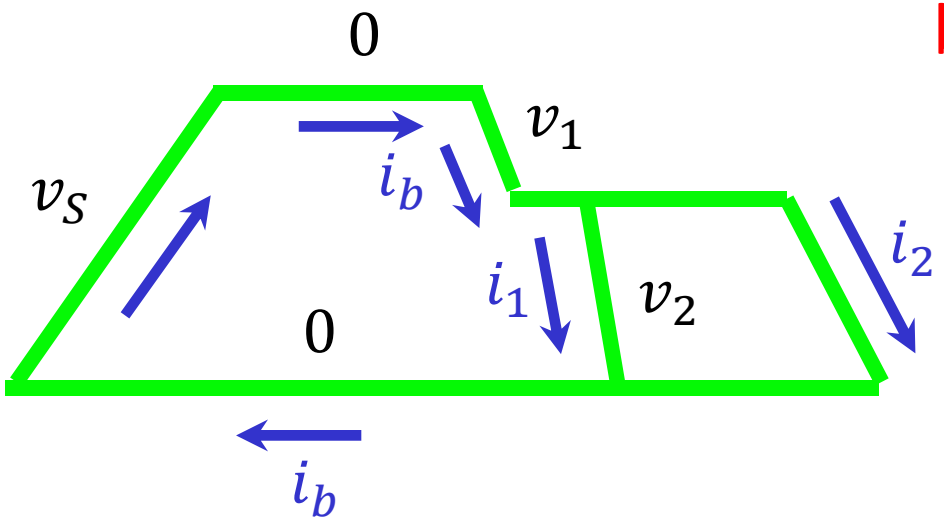


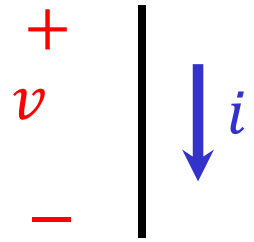


$$v_S = v_1 + v_2$$

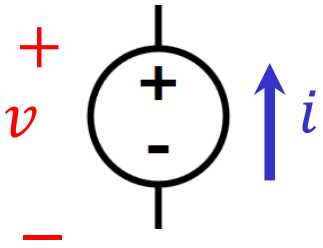
$$i_b = i_1 + i_2$$

Relationship between *i* an *v* ?

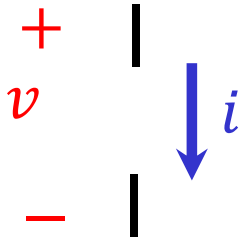




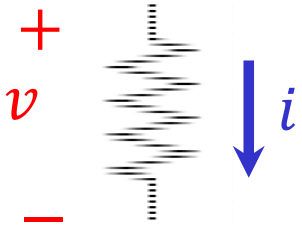
$v = 0$ $R = 0$



$v = V_S$



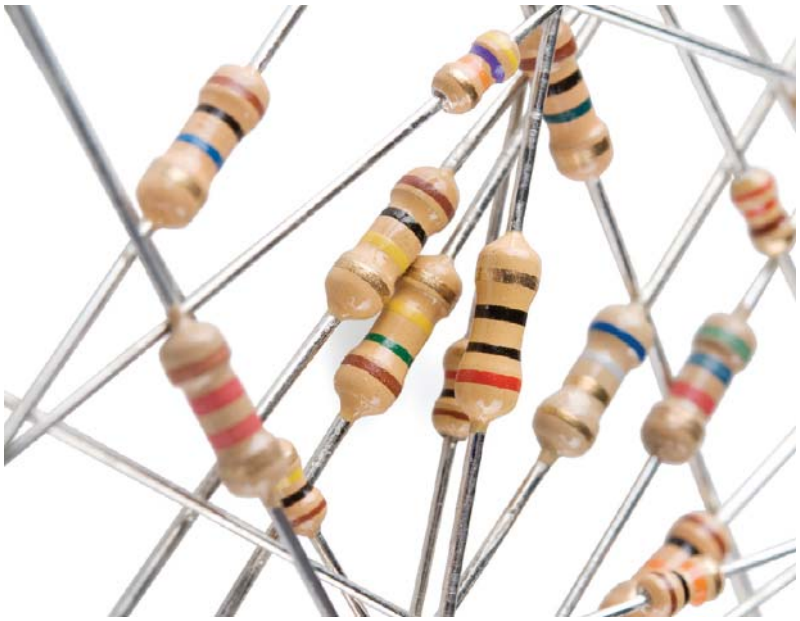
$i = 0$ $R = \infty$



$v = i \cdot R$ $i = \frac{v}{R}$

Ohm's Law

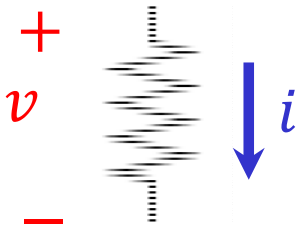
Resistor



Symbol: R

Unit: ohm (Ω)

For example: 1 kΩ

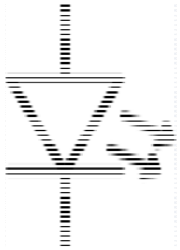


$$v = i \cdot R$$

$$i = \frac{v}{R}$$

Ohm's Law

Other components $v = f(i)$



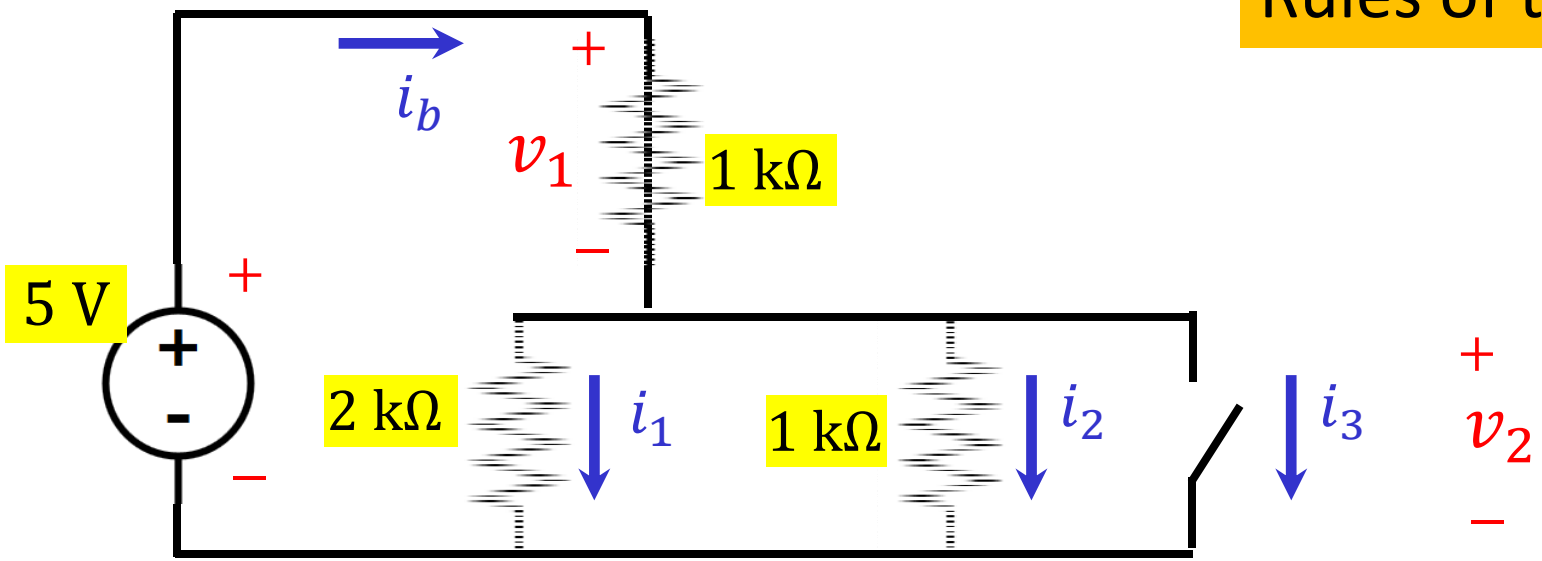
LED

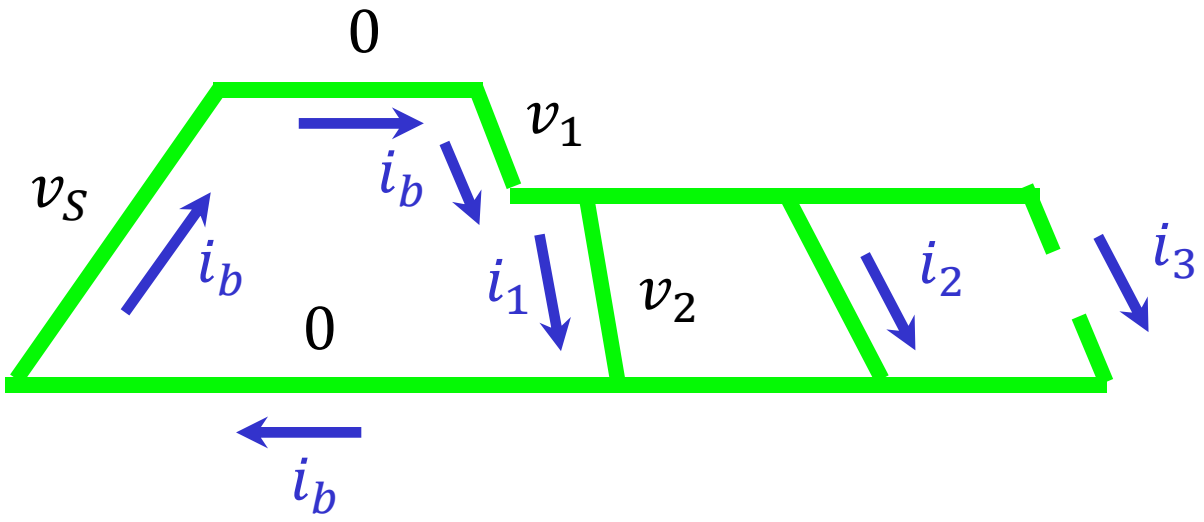
$v = V_{FIXED}$ if it is on ($i > 0$)

Photocell

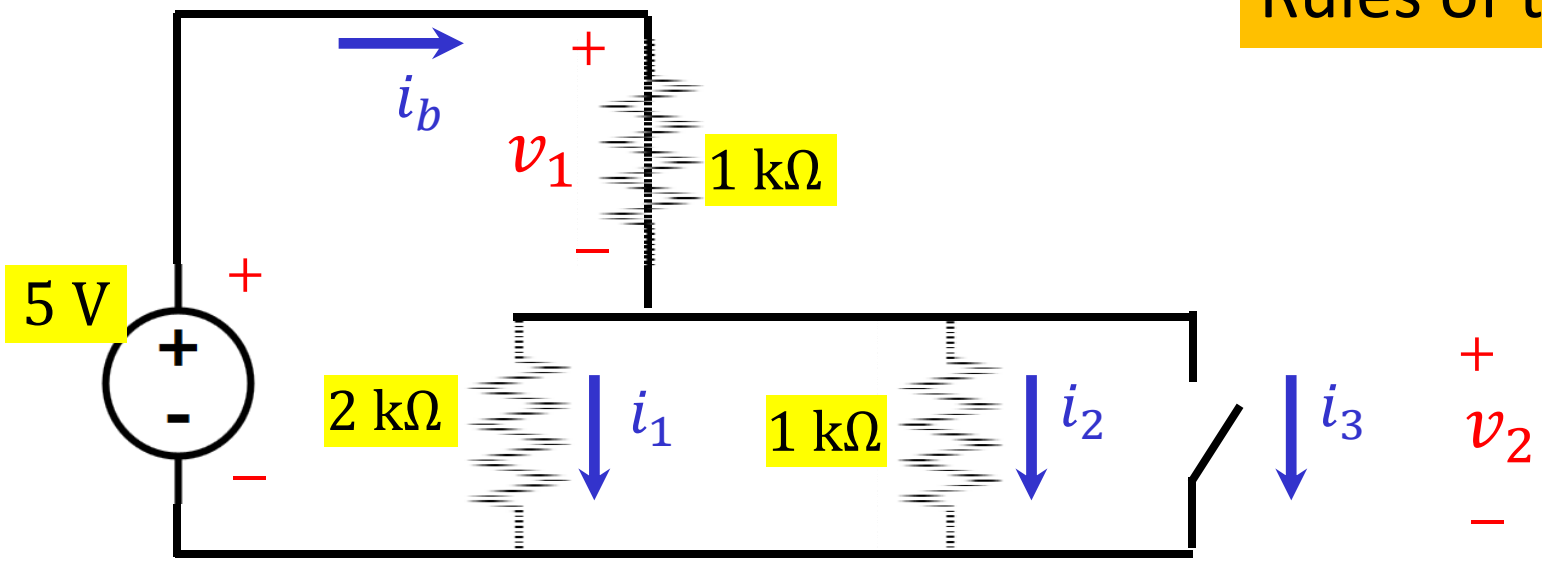
$v = i \cdot R$ $R(light)$

Rules of the game





Rules of the game



KCL

$$\sum_{in} i = \sum_{out} i$$

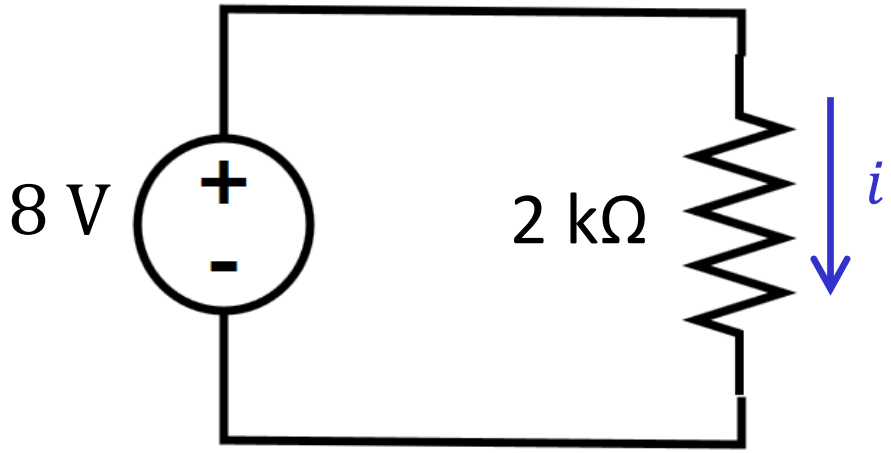
KVL

$$\sum_{up} v = \sum_{down} v$$

Ohm's Law

$$v = i \cdot R$$

If the resistance R is 2 kΩ, the current i is:



[A] 0 mA

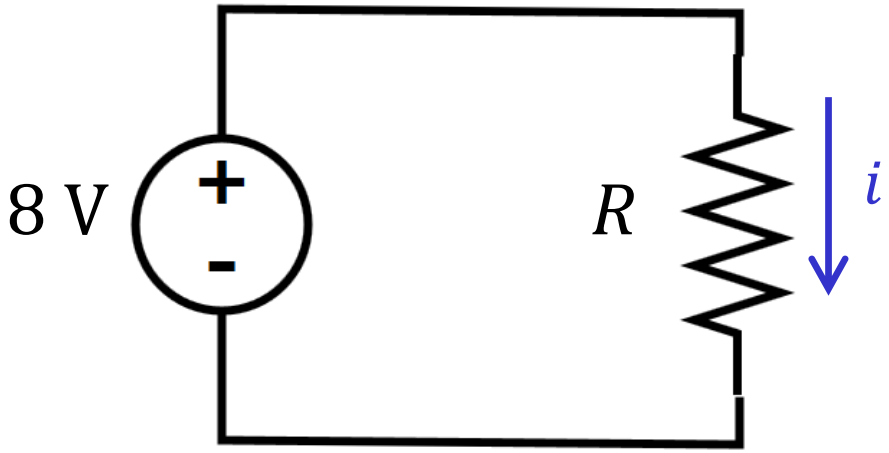
[B] 2 mA

[C] 4 mA

[D] 16 mA

[E] I don't know

What happens when the resistance *R* is lowered?



[A] The current i increases

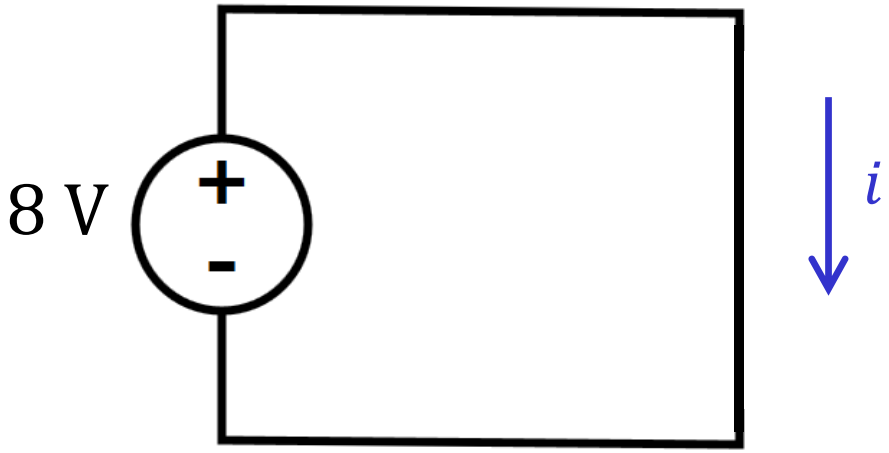
[B] The current i decreases

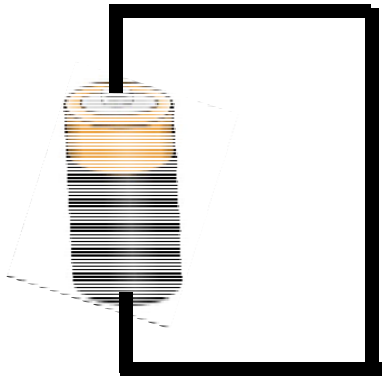
[C] The current i stays the same

[D] The current i cannot be calculated

[E] I don't know

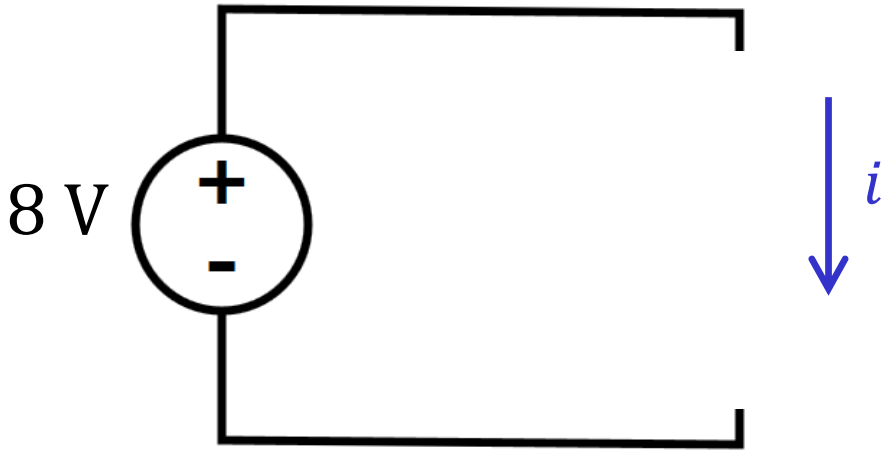
What happens when the resistance *R* is lowered?





Very bad!

What is the current i ?



[A] 0 mA

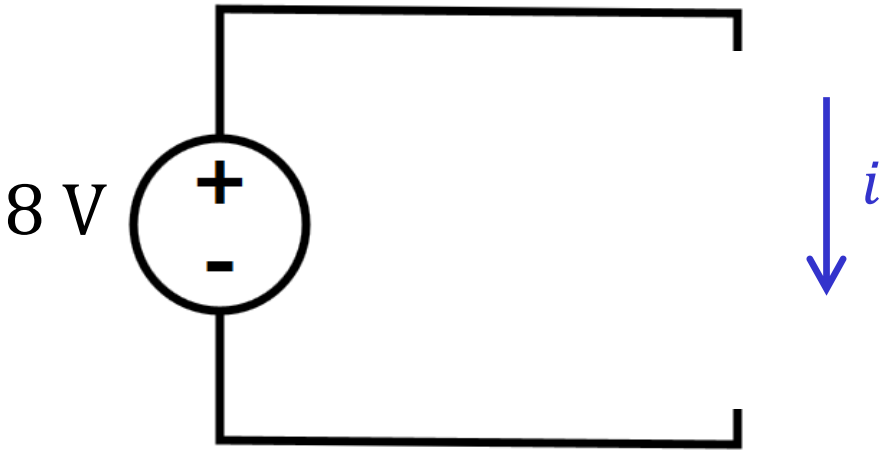
[B] 8 mA

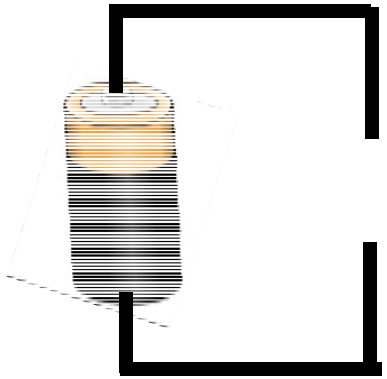
[C] 8 A

[D] $\propto$

[E] I don't know

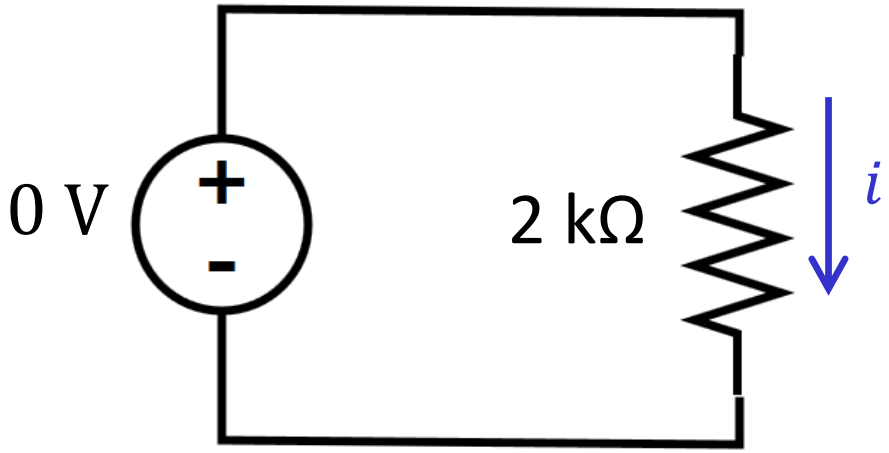
What is the current i ?





No current

If the resistance *R* is 2 kΩ, the current i is:



[A] 0 mA

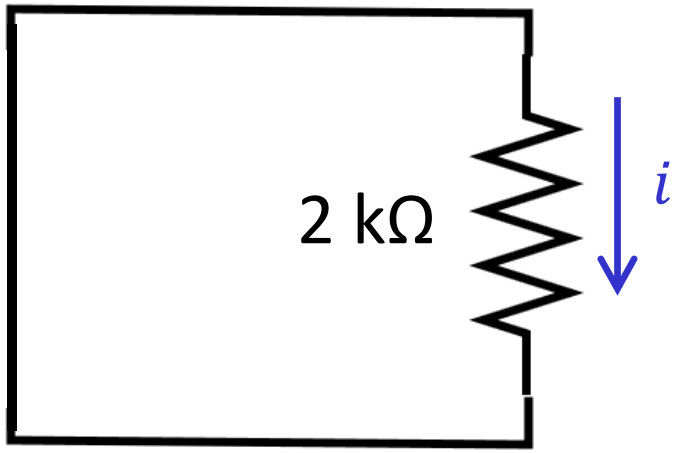
[B] 2 mA

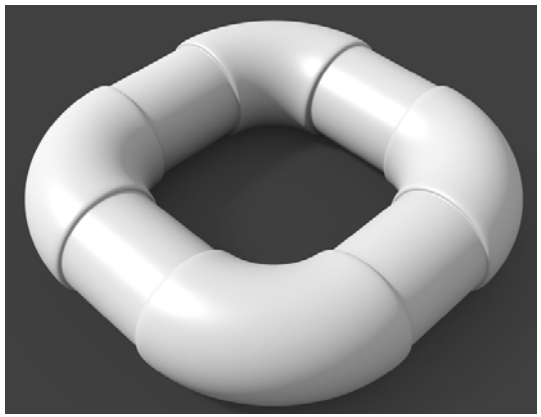
[C] 4 mA

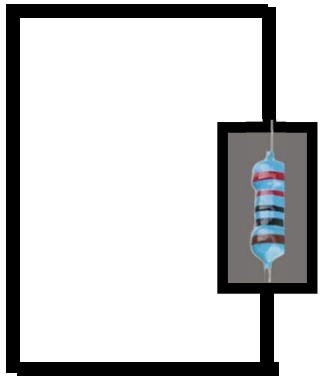
[D] 16 mA

[E] I don't know

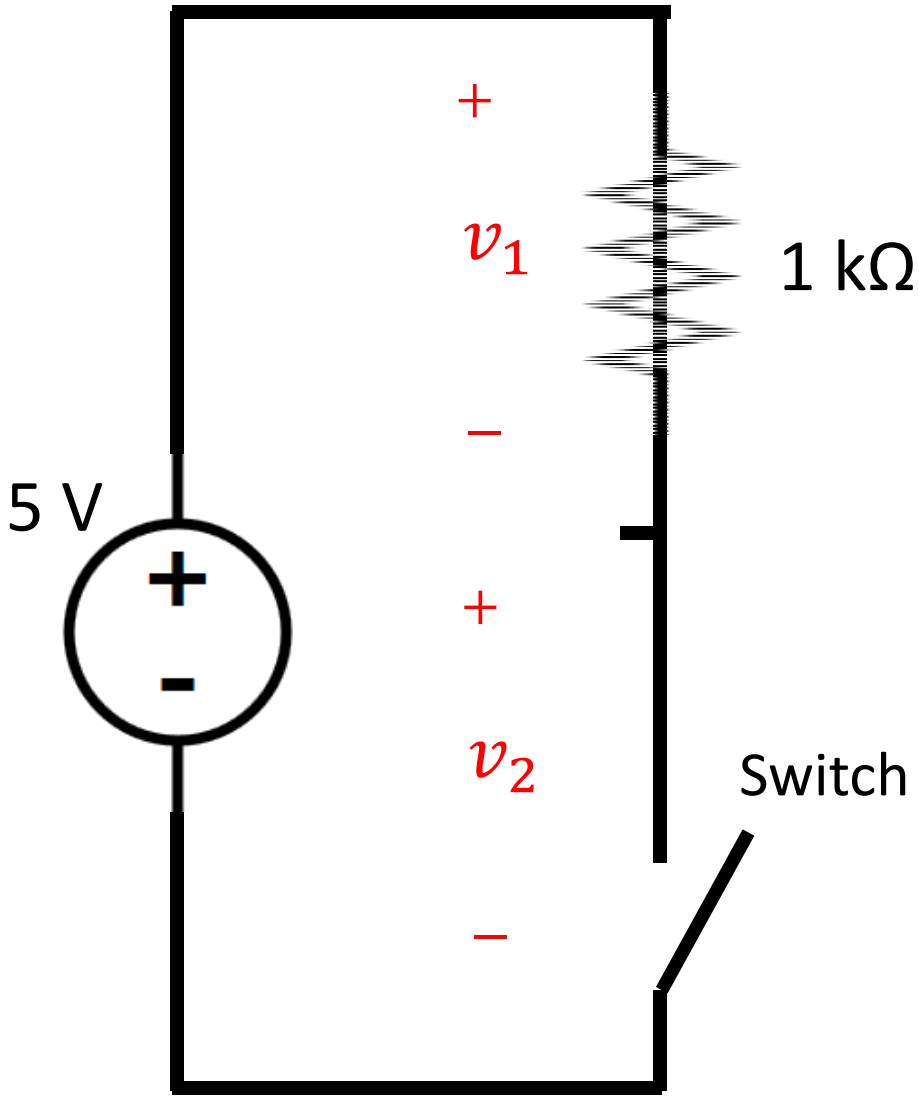
If the resistance R is 2 kΩ, the current i is:







No current



When the switch is <u>open</u>, the voltage v_2 is:

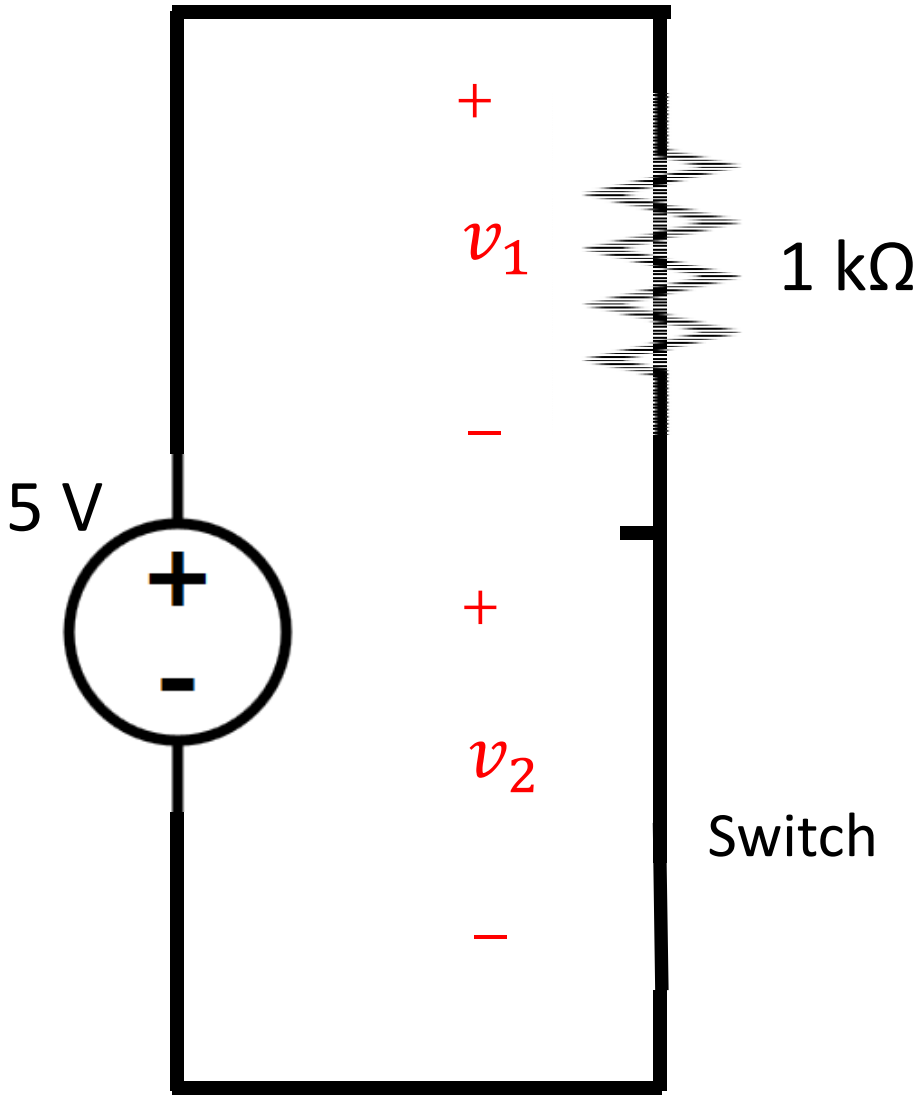
[A] 0 V

[B] 1 mV

[C] 1 V

[D] 4 V

[E] 5 V



When the switch is <u>open</u>, the voltage v_2 is:

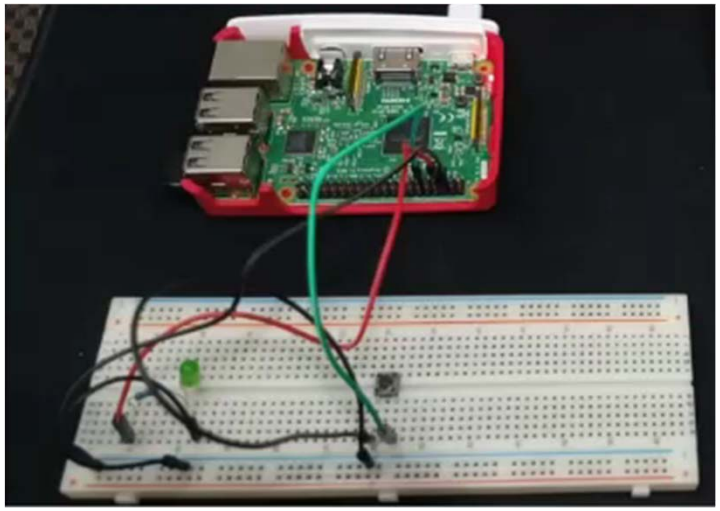
[A] 0 V

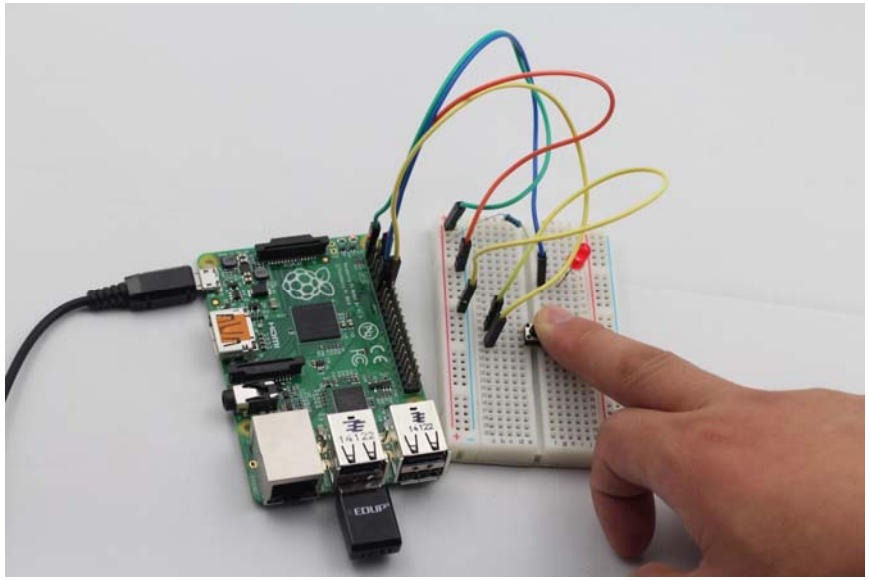
[B] 1 mV

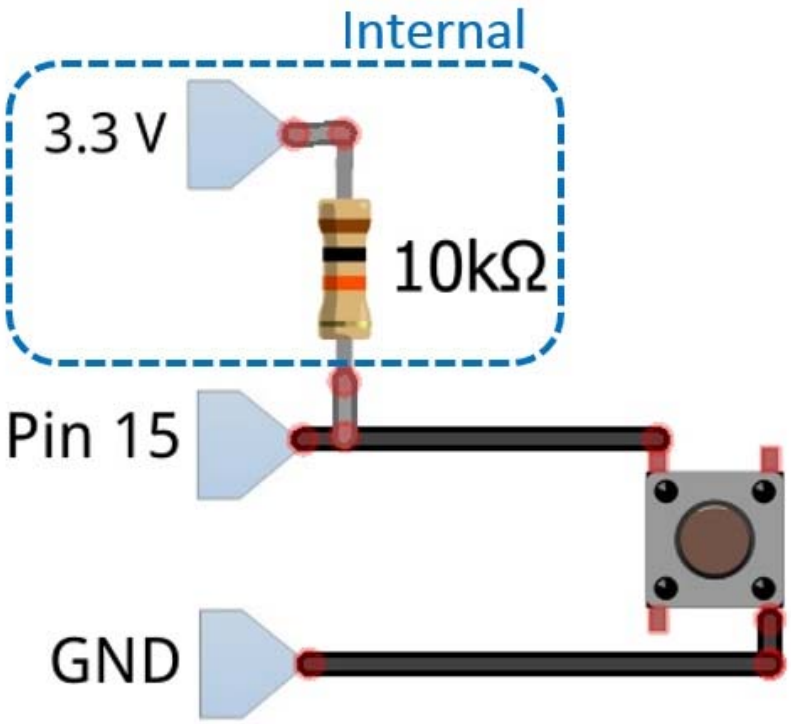
[C] 1 V

[D] 4 V

[E] 5 V






Internal
3.3 V
10kΩ
Pin 15
GND