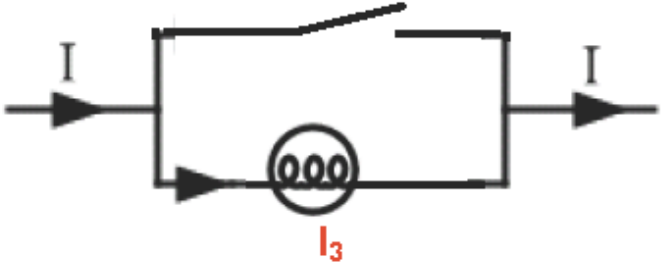
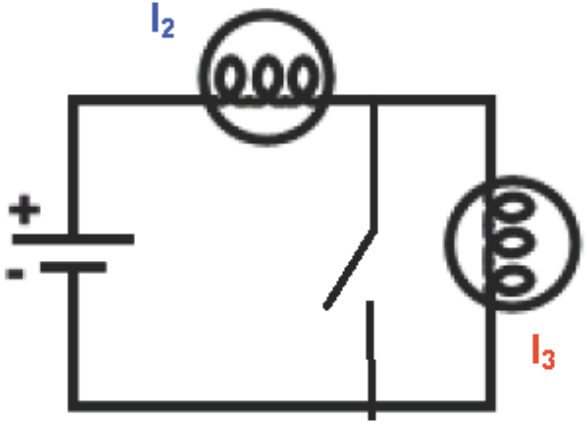
What happens when we close the switch?

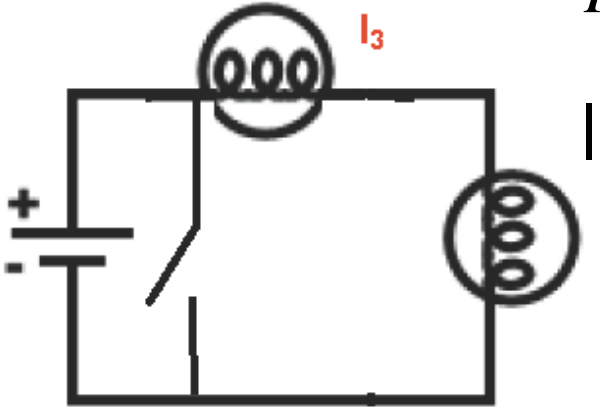
1. Nothing

2. The bulb gets brighter

3. The bulb gets dimmer

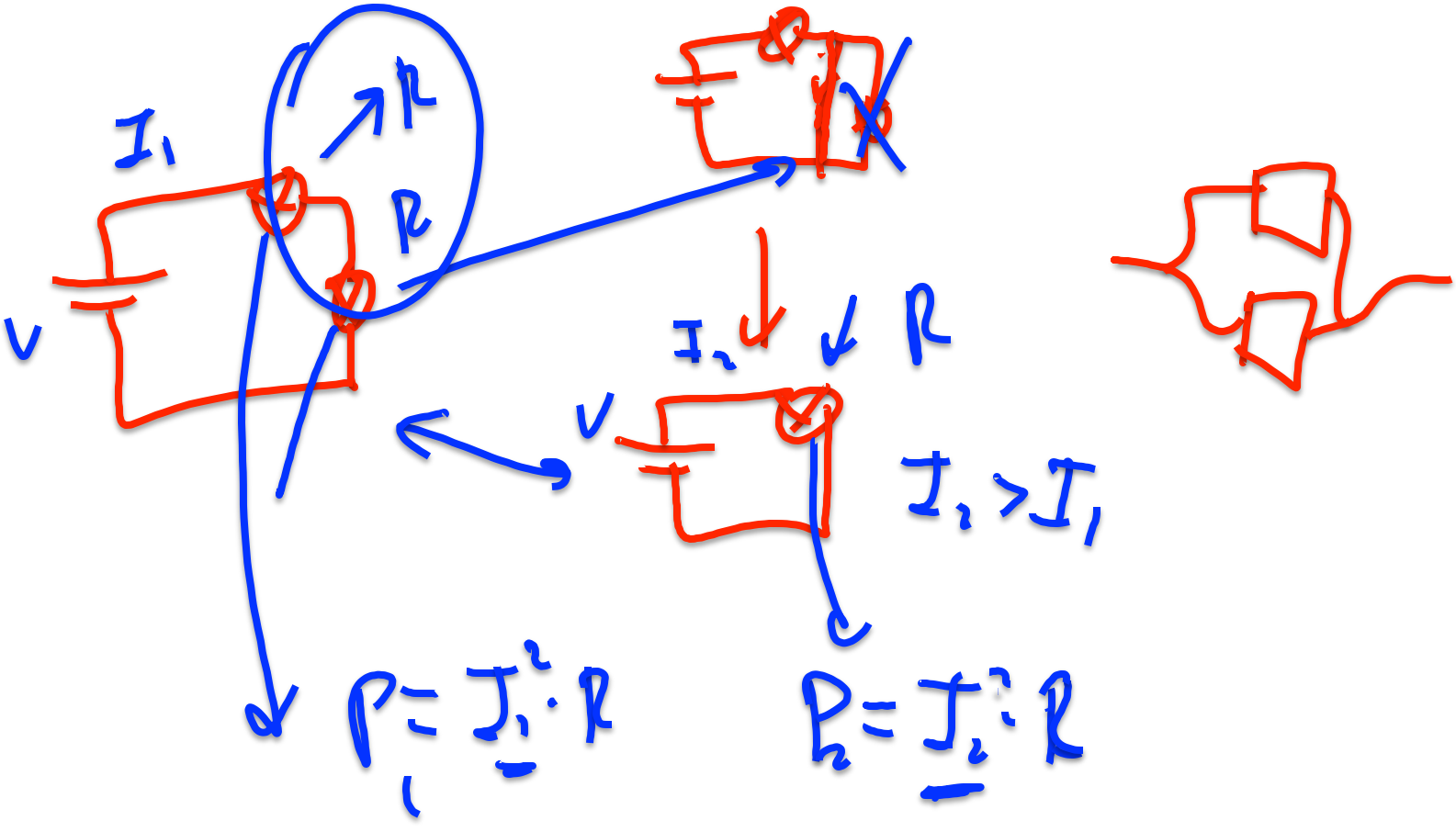




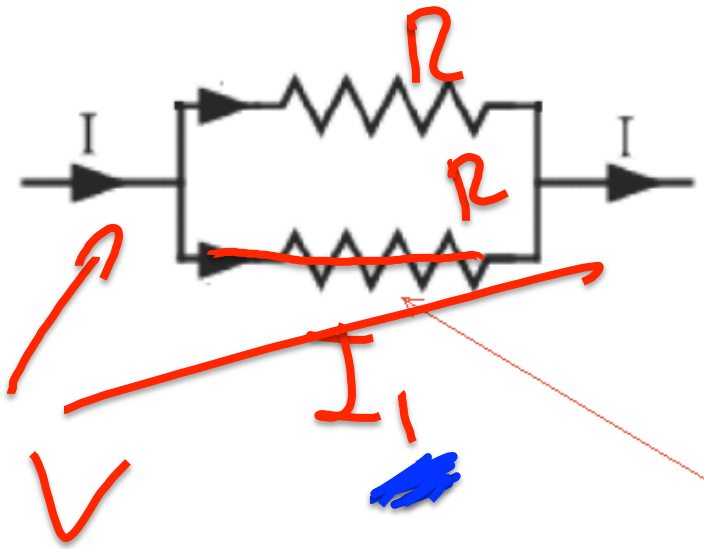


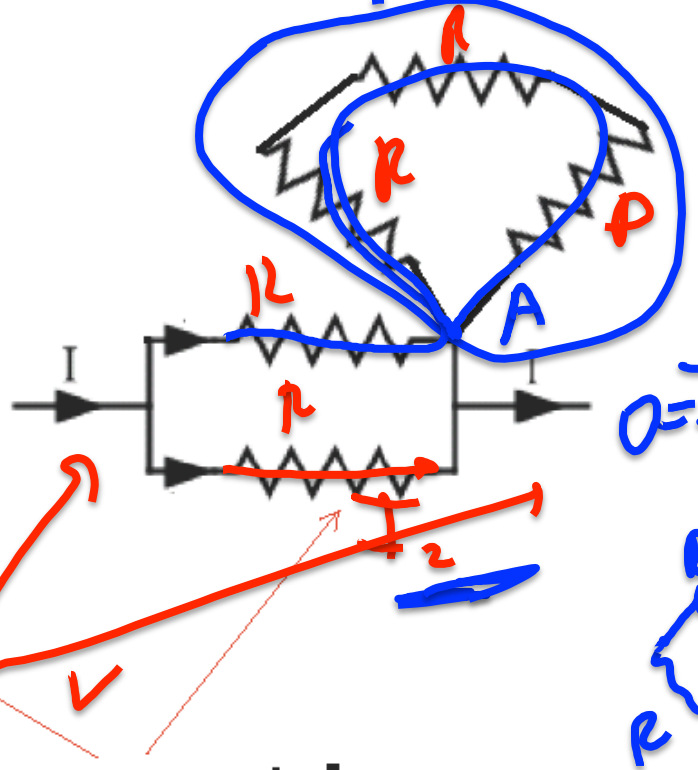
$$P = RI^2 = \frac{(\Delta V)^2}{R}$$

$$|\Delta V| = |I|R$$

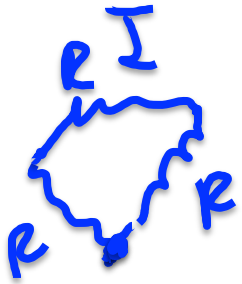

I1
R
R
V
I2
R
V
I2 > I1
P1 = I1² · R
P2 = I2² · R

$$|\Delta V| = |I|R$$



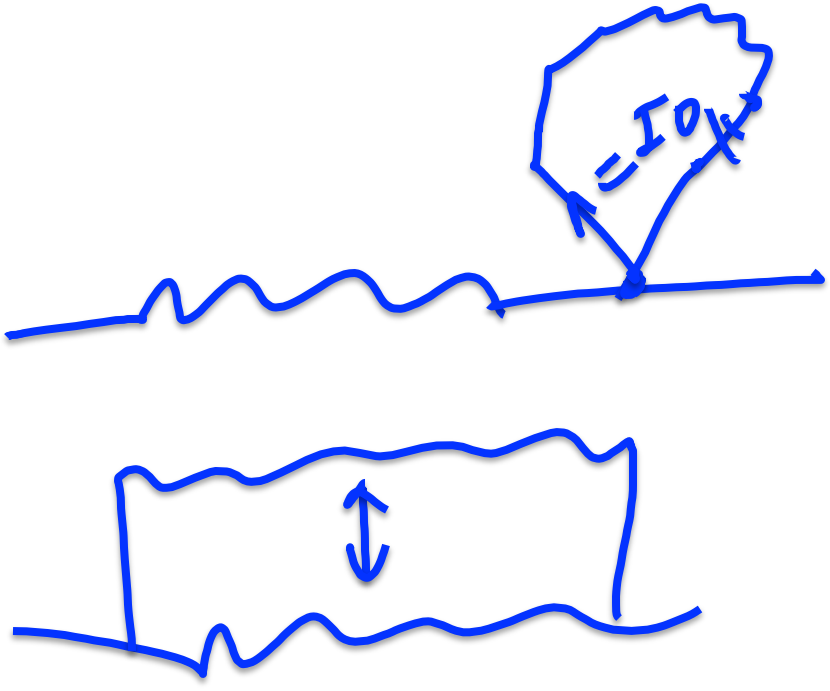


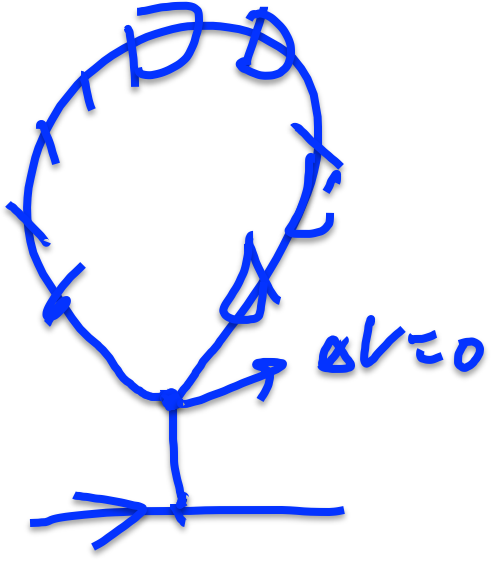
$$0 = I = \frac{V}{3R} = \frac{V_A - V_A}{3R}$$



Compare the currents!

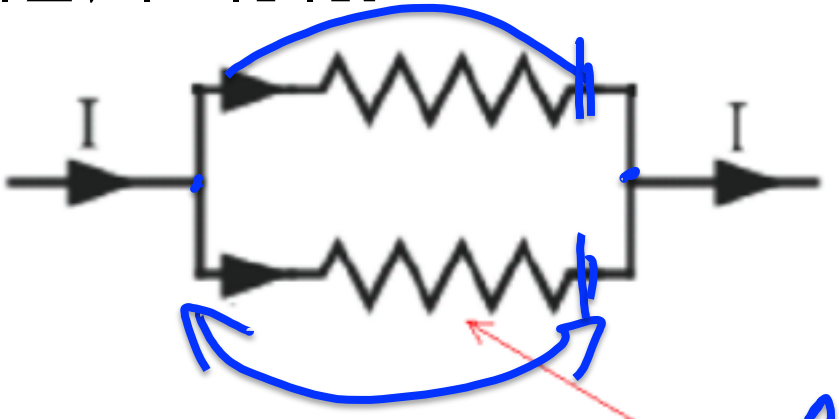
1. >
2. <
3. =

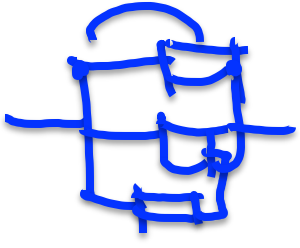

$=I_0$

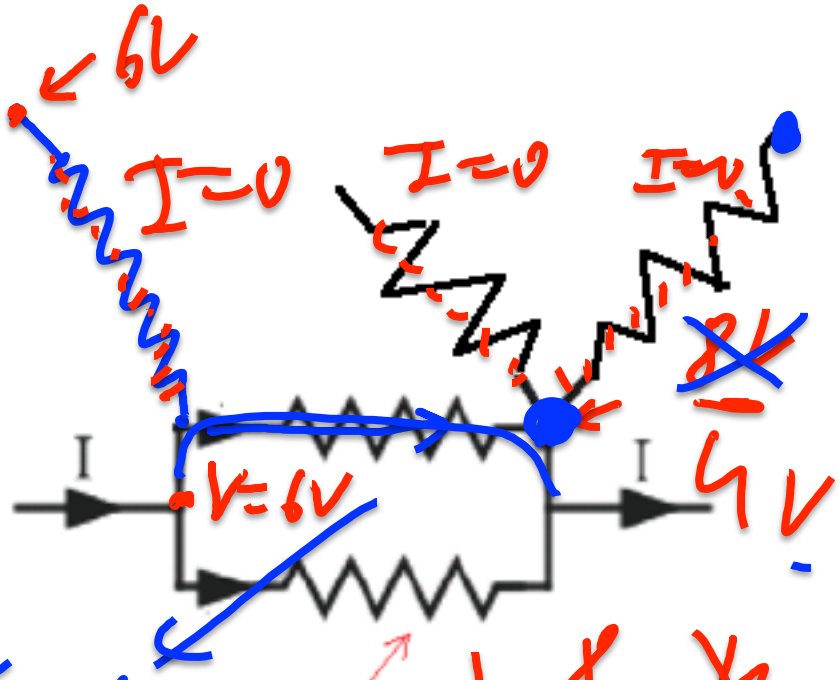

$\Delta V=0$

1. = 2. > 3. <

$$|\Delta V| = |I|R$$

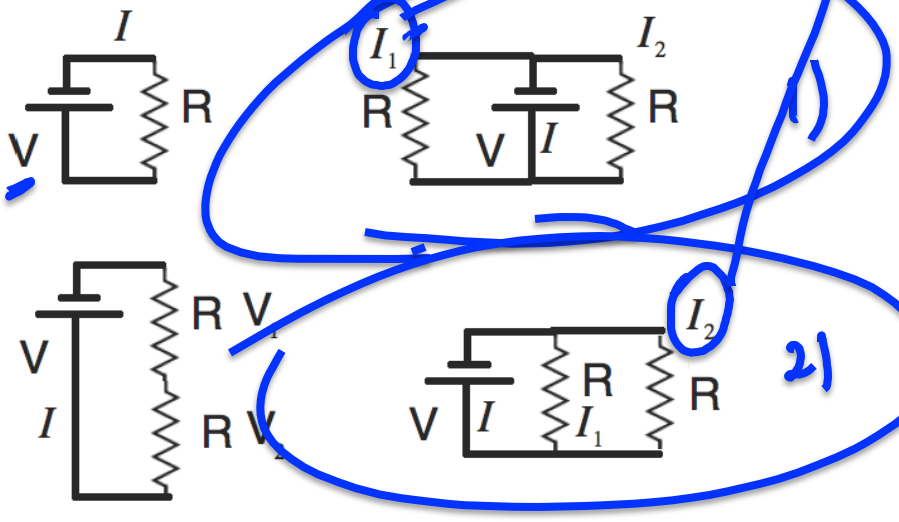






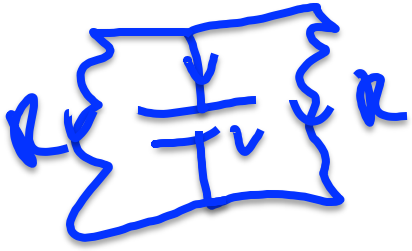
Compare the currents!

Practice Exercise

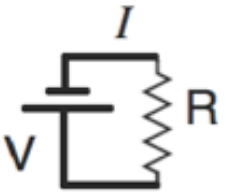


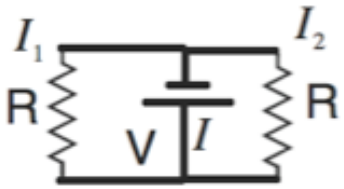
Compare currents, voltages in different circuits. V and R are the same for all circuits, but *I* might differ.

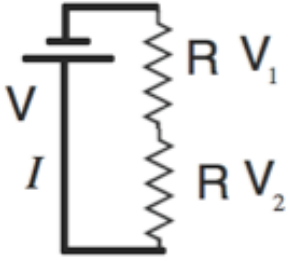
$$|\Delta V| = |I|R$$

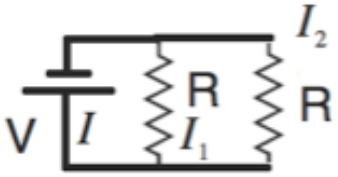

R
V
R

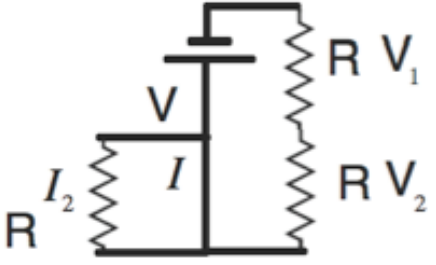

V
R
a

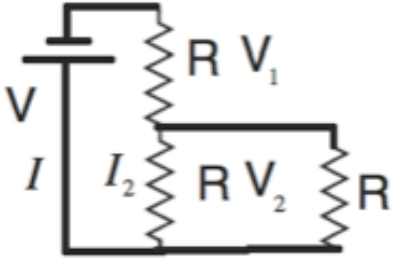












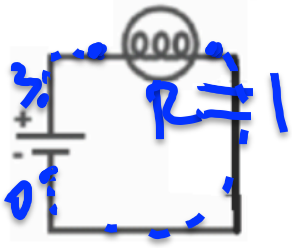
$$|\Delta V| = |I|R$$

In which circuit this bulb is brighter?

$$|\Delta V| = |I|R$$

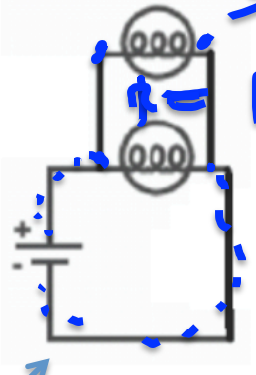
$P = \frac{\Delta V^2}{R} = \frac{3^2}{1} = 9$

$\Delta V_1 = 5 - 0 = 3$



1

$R = 1 \quad \Delta V_2 = 3 - 0 = 3$



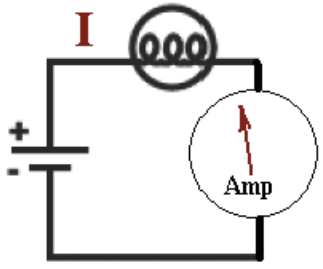
$P = \frac{3^2}{1} = 9$

2

3 same

$$|\Delta V| = |I|R$$

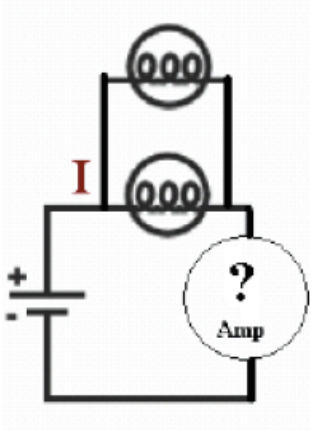
PRS



A circuit consists of an EMF and a resistor (a bulb, for example).

To measure the current an ammeter is included in the circuit.

Which current?

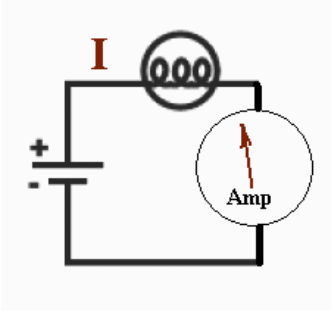


What happens to the current if another bulb is added to the circuit in parallel to the first one?

(or taken out)

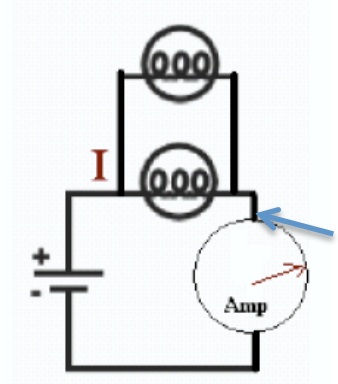
1. Nothing
2. The current decreases
3. The current increases
4. ammeter will brake and the current become zero

PRS



A circuit consists of an EMF and a resistor (a bulb, for example).

To measure the current an ammeter is included in the circuit.



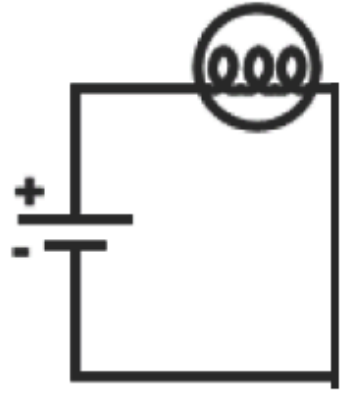
What happens to the current if another bulb is added to the circuit in parallel to the first one?

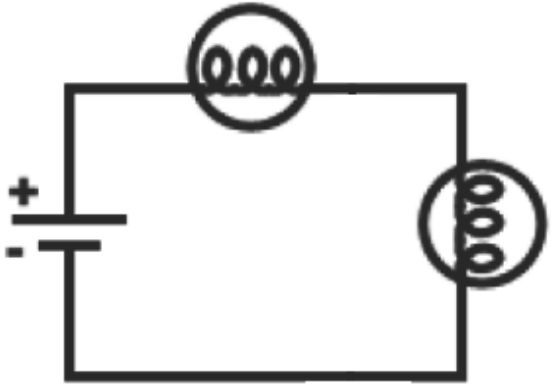
C. The current increases

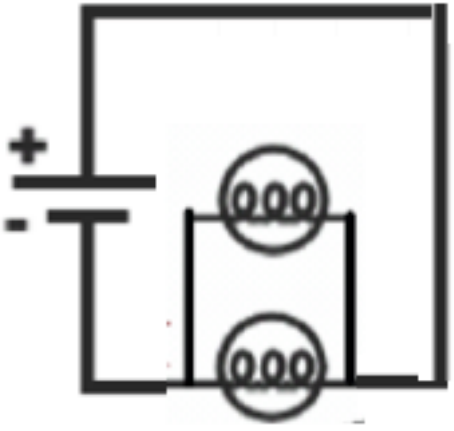
For two resistors in series: $\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}=\frac{R_2+R_1}{R_1\times R_2}$

or $R=\frac{R_1\times R_2}{R_1+R_2}$ If $R_1 = R_2$ => $R=\frac{R_1\times R_1}{R_1+R_1}=\frac{R_1\times R_1}{2R_1}=\frac{R_1}{2}$

The total resistance gets *smaller* (!), so the current $I = V/R$ increases!







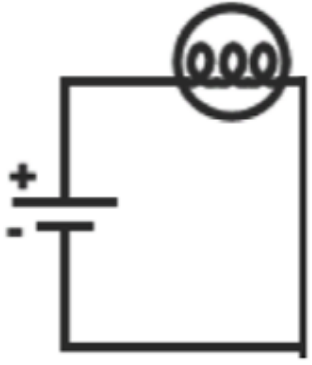
$$|\Delta V| = |I|R$$

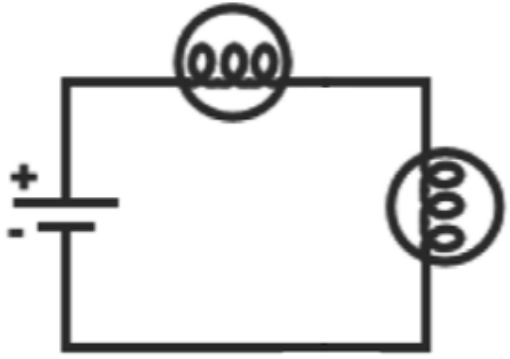
Is the current the same?

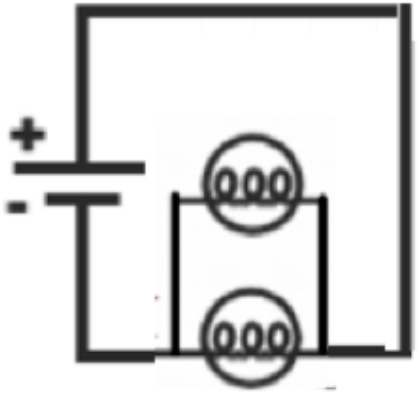
Does the current stay the same?

It depends on what "same" means!

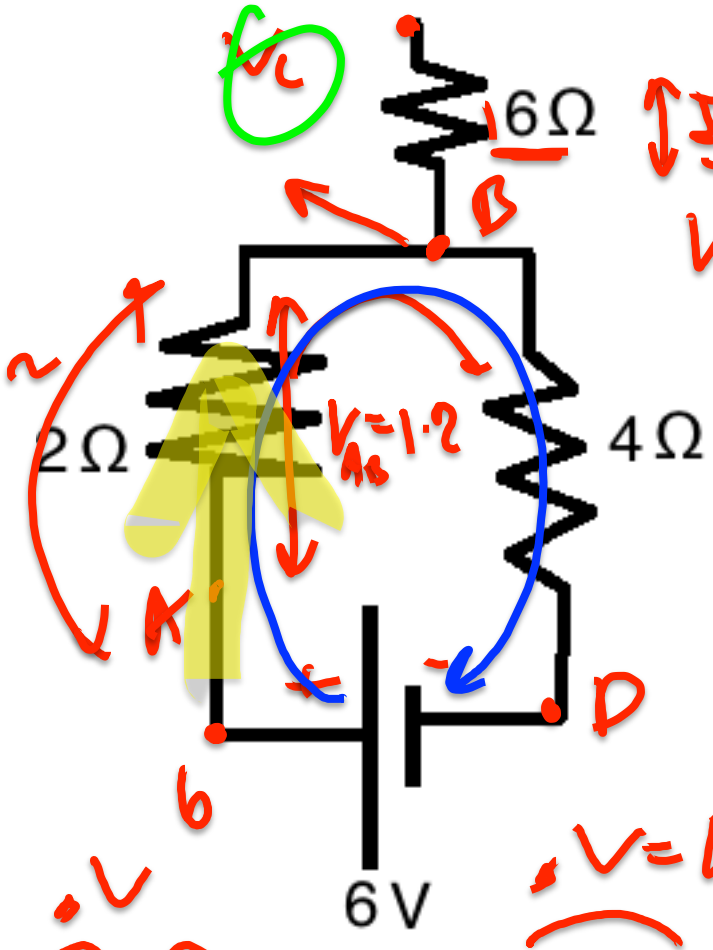
(Compare currents and voltages assuming all the batteries and bulbs are the same)



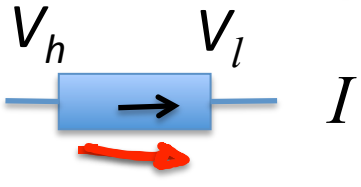




$$|\Delta V| = |I|R$$



$V_h - V_l = IR$



$V = V_h - V_l$

$V_c = V_D$

$I = 0$

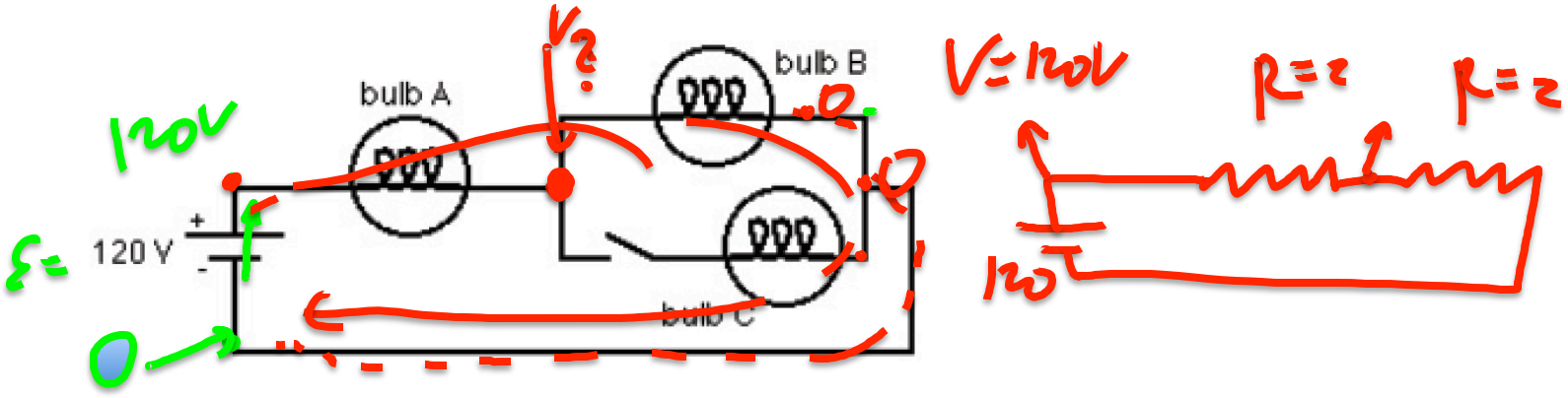
V_B

$R_{eq} = 6\Omega$

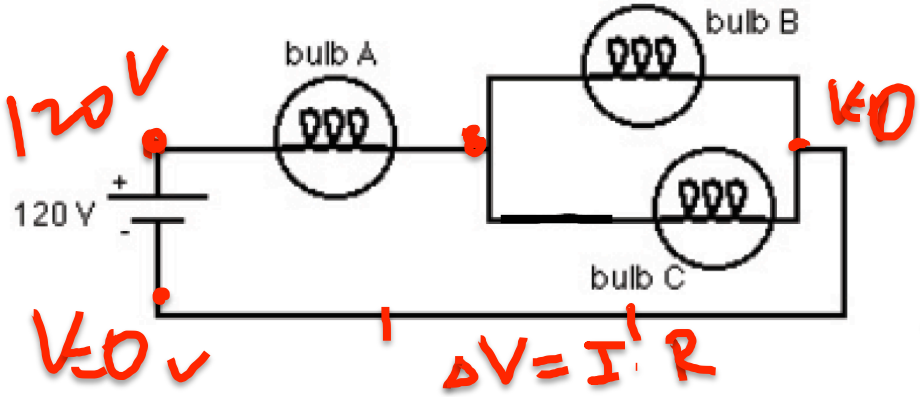
$V_c = V_h - I \cdot R$

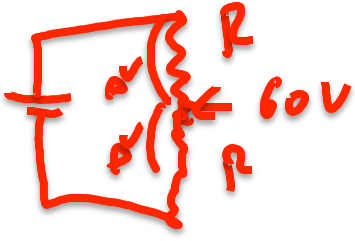
$4 = 6 - 1.2$

Find the potential $V_h - V_l = IR$  I

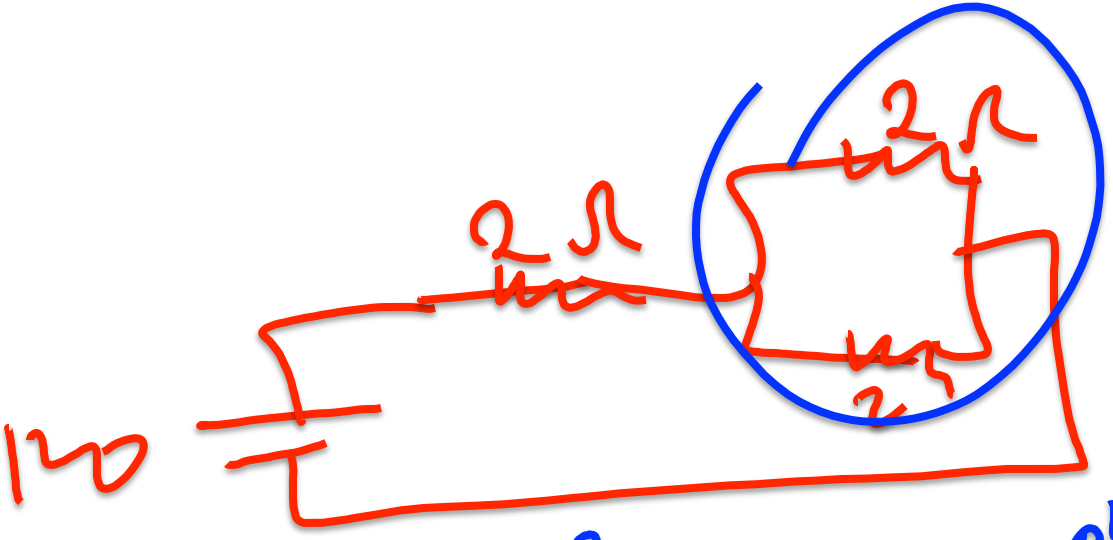


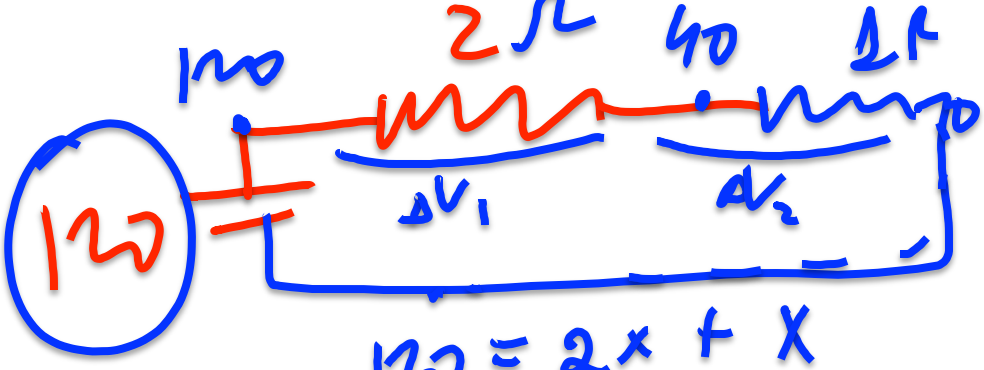
The bulbs are identical - find the potential near each bulb when the switch is open/closed.





$0 = I \cdot R$





$\Delta V_1 = I \cdot 2$

$\Delta V_2 = I \cdot 1$

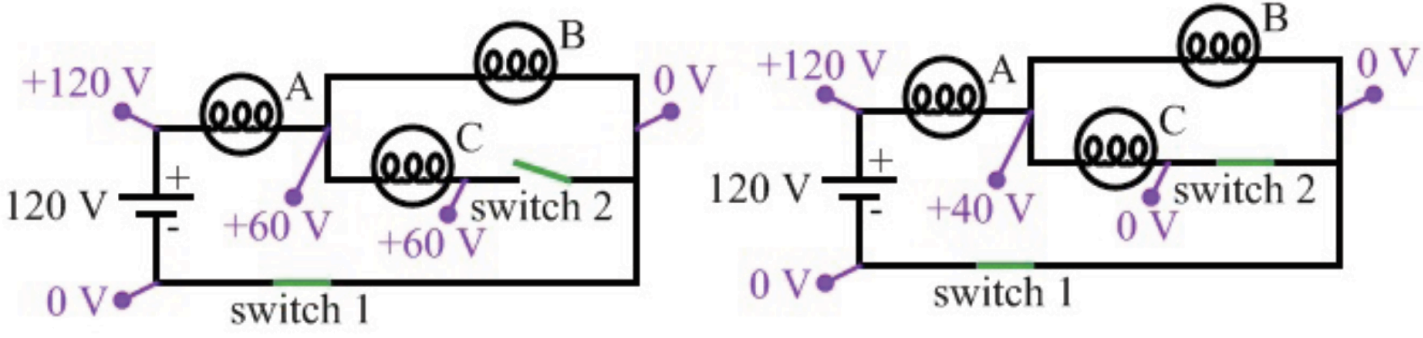
$\Delta V_1 = 2 \cdot \Delta V_2$

$120 = 2x + x$

$\frac{120}{3} = x = \Delta V_2 = 40$

Find the potential

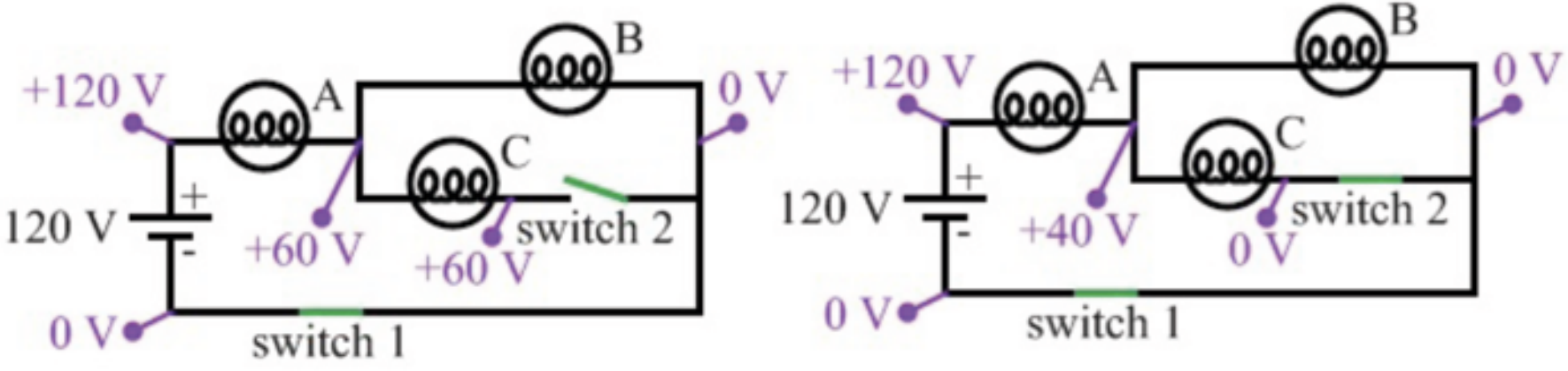
We label each point in the circuit with an electric potential. If we know the potential everywhere we can calculate any potential difference we need.



For the circuit on the left, we use setting 0 V as the potential at the negative terminal of the battery, we get 60 V across A, B, and the switch, and 0 V across C.

For the circuit on the right, after the switch is closed, we get 80 V across A and 40 V across B and C.

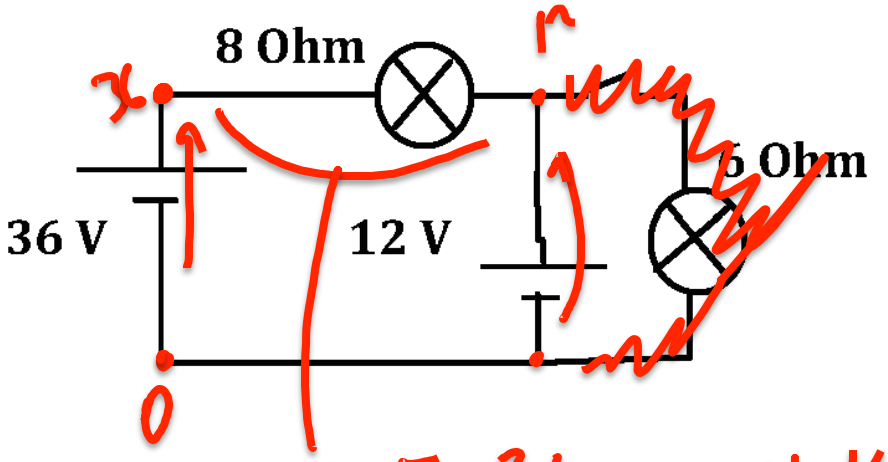
We label each point in the circuit with an electric potential. If we know the potential everywhere we can calculate any potential difference we need.



A) Compare all the bulbs in terms of brightness.

B) What is happening to the brightness of each bulb?

1. > 2. < 3. = 4. ??



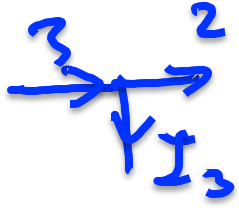
Find everything

$$V_h - V_l = IR$$

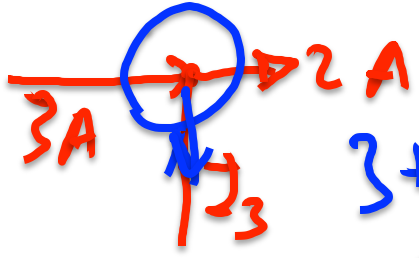
I

$\Delta V = 36 - 12 = 24\ V$

$\frac{24}{8} = 3\ A$

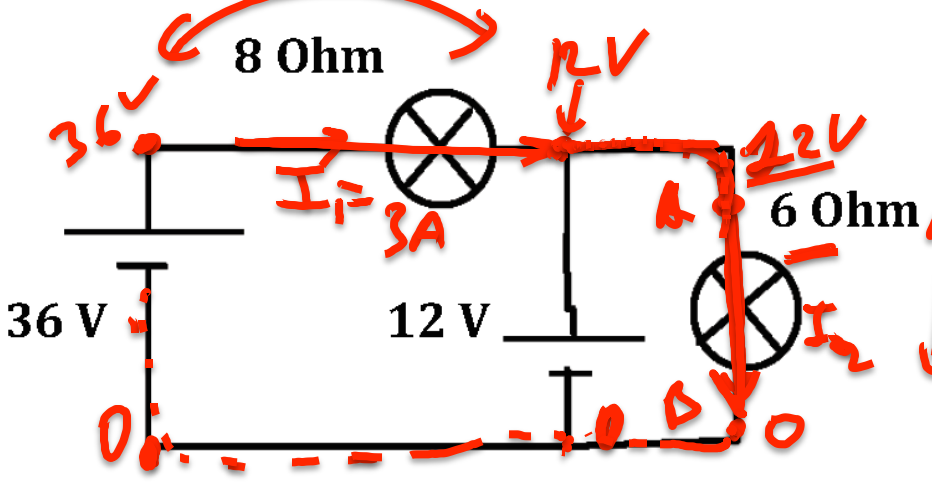


$3 = 2 + I_3$



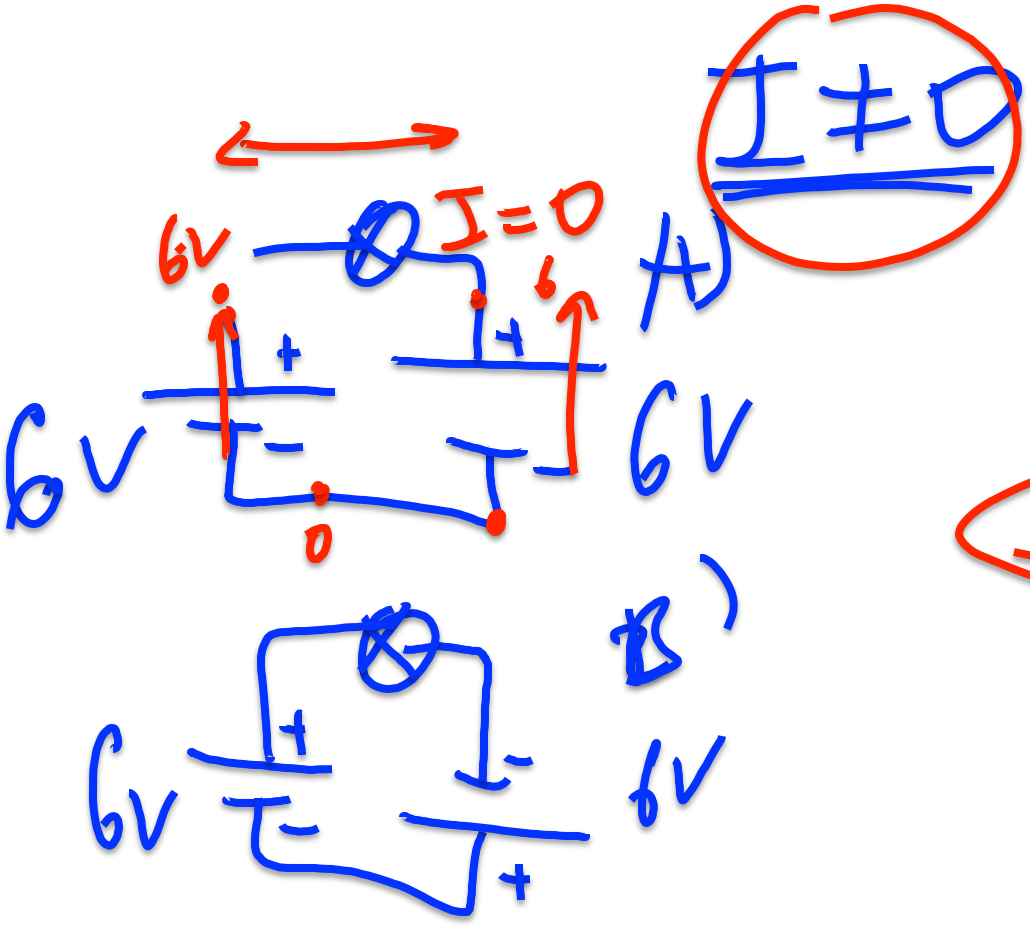
$3 + I_3 = 2$

$I_3 = -1\ A$

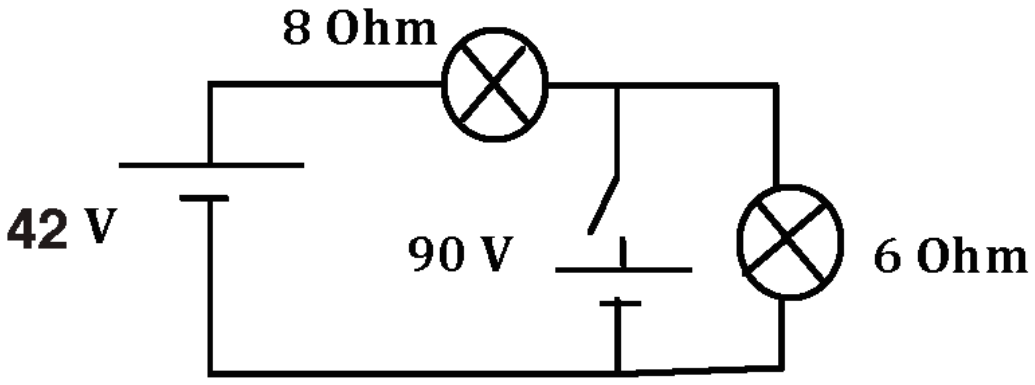


$\Delta V_2 = 12 - 0 = 12\ V$

$I_2 = \frac{\Delta V_2}{R} = \frac{12}{6} = 2\ A$

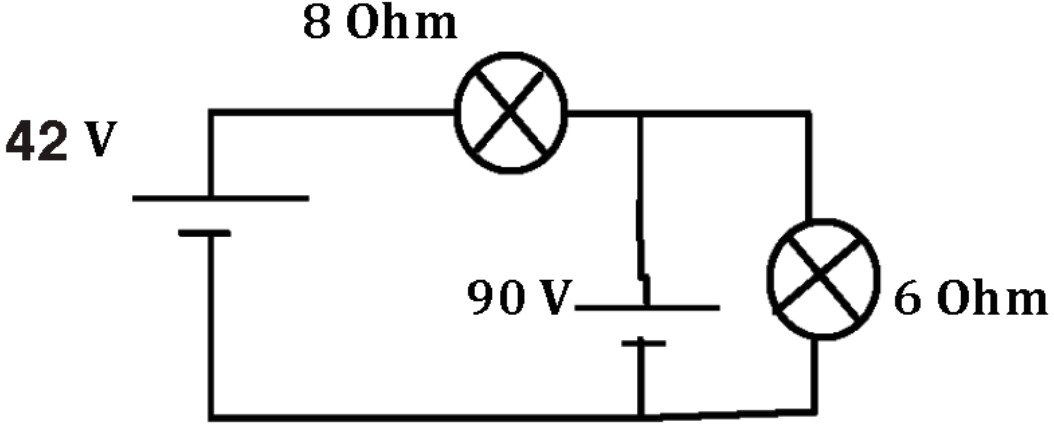


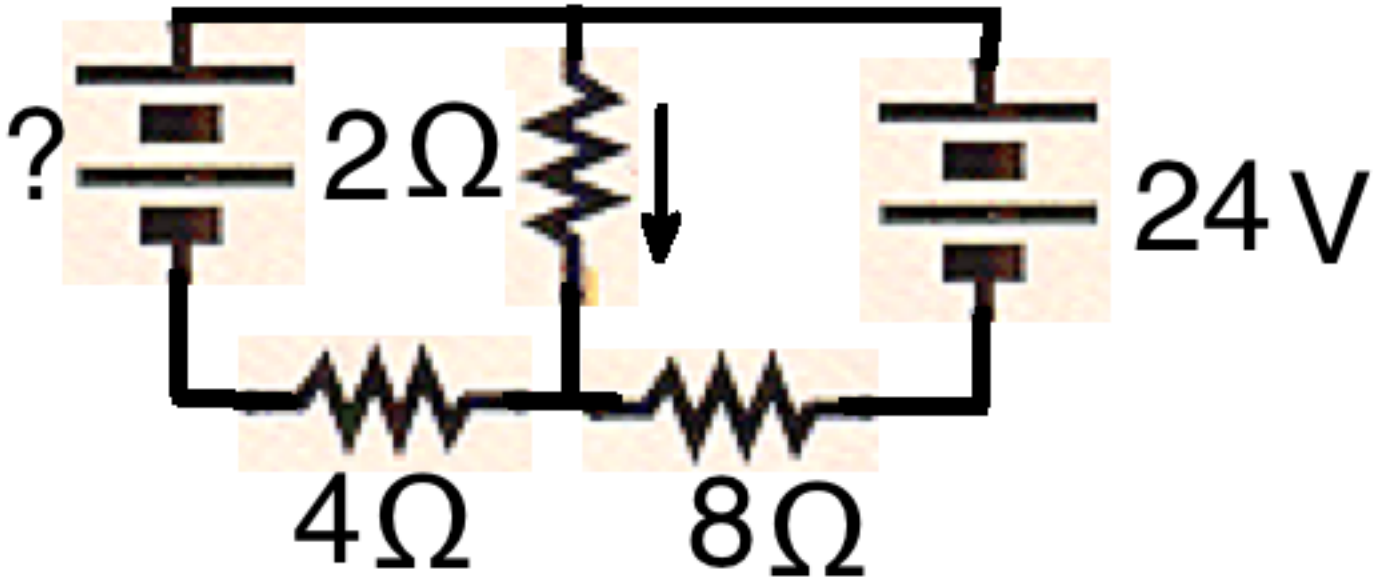
1. A only
2. B only
3. A, B
4. Neither



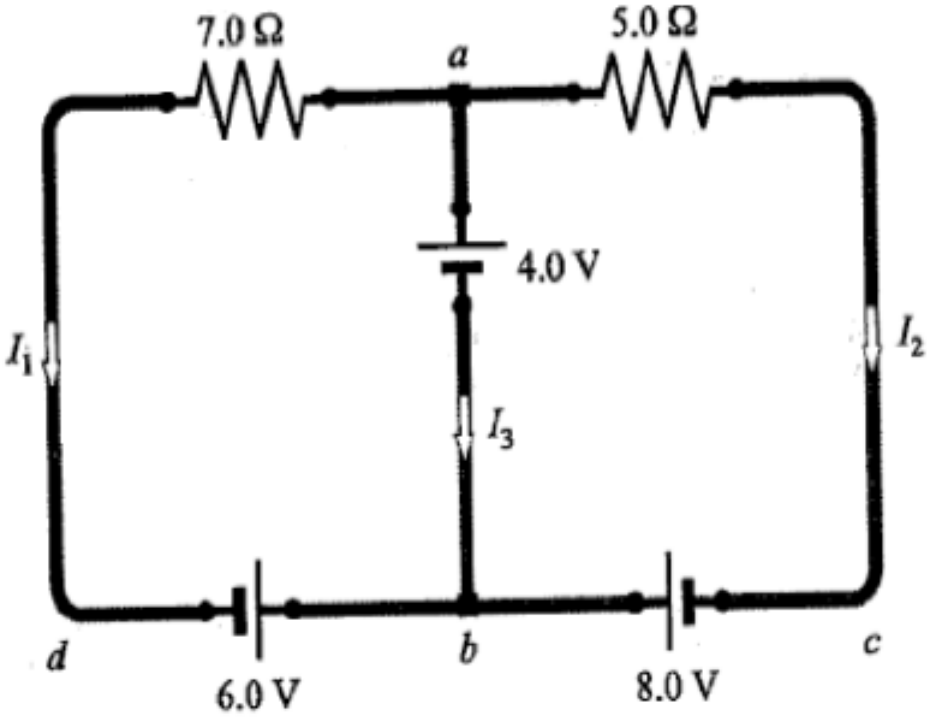
Find everything

$$V_h - V_l = IR$$





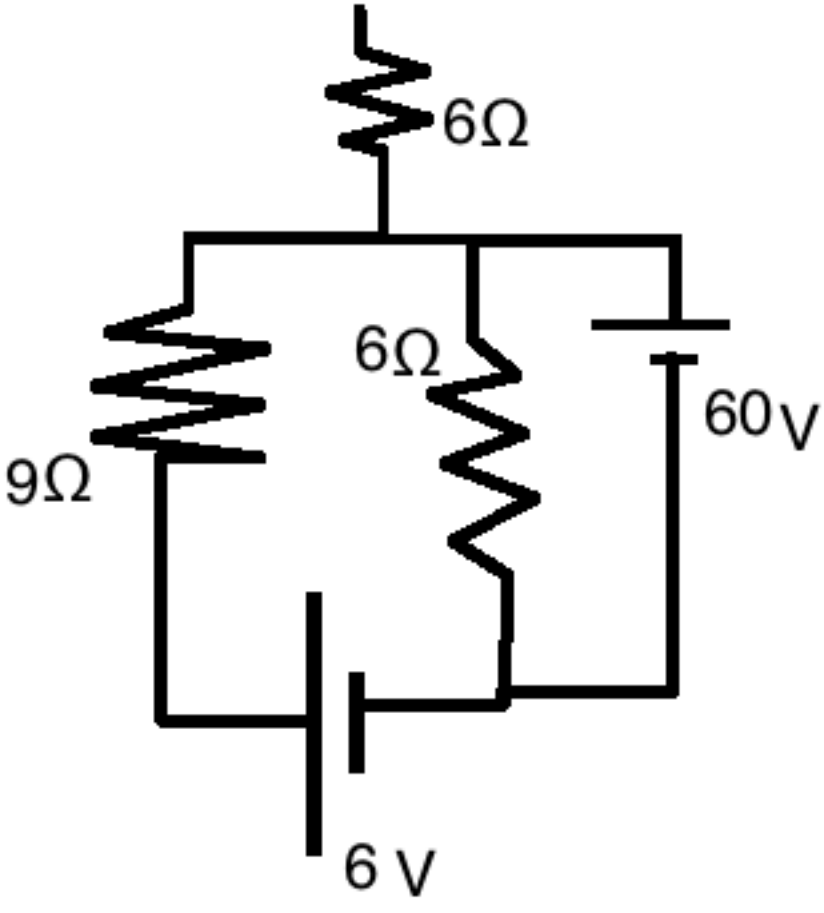
$V_h - V_l = IR$  I



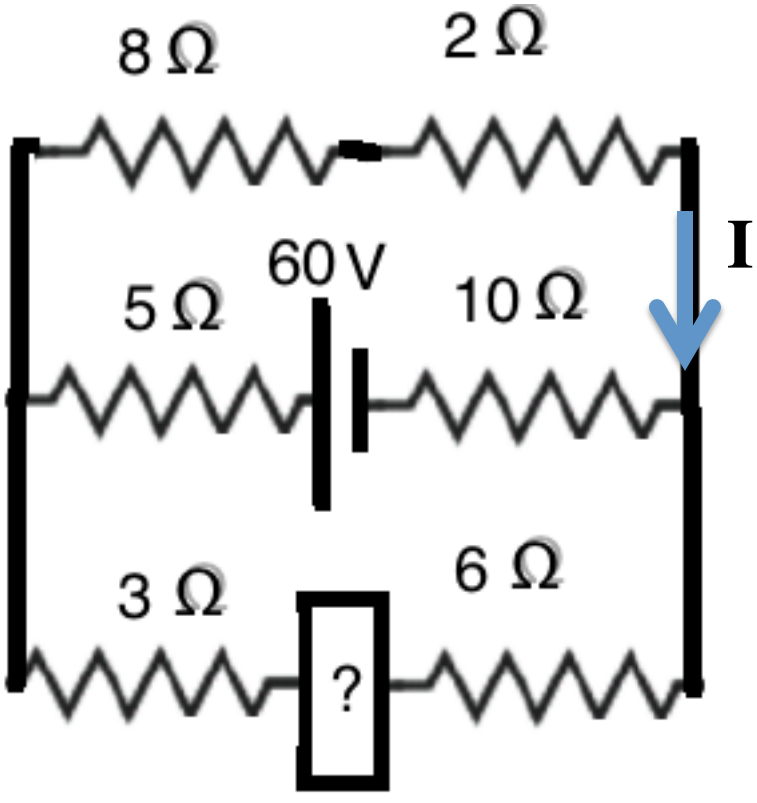
Find currents.

$$V_h - V_l = IR$$

I

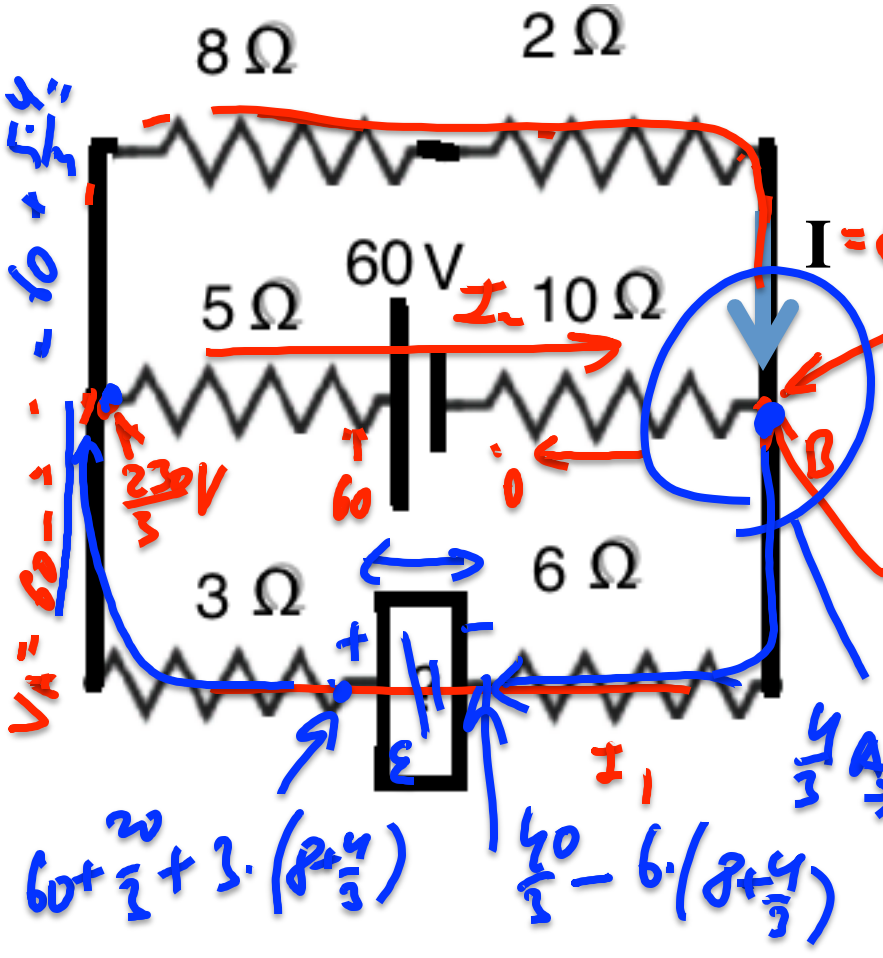


$V_h - V_l = IR$  I



I = … A) 3 A, B) 8 A

$V_h - V_l = IR$  I



I = … A) 3 A, B) 8 A

$V_B = V_A - 80 = 60 - 5 I_2 - 80$

$V_B = 0 + 10 \cdot I_2 = 10 \cdot \frac{4}{3} = \frac{40}{3} V$

$60 - 5 I_2 - 80 = 10 I_2$

$-20 = 15 I_2$

$I_2 = -\frac{4}{3} A$

$V_h - V_l = IR$ → I