$V = IR$

Daily Quiz

1. What voltage is applied to a 5.0 Ω resistor if the current is 1.5 A?
2. A voltage of 80 V is applied across a 20 Ω resistor. What is the current through the resistor?
3. The current running through a starter motor in a car is 240 A. If this motor is connected to a 12 V battery, what is the resistance of the motor?

V = IR

Daily Quiz - Answers

1. What voltage is applied to a 5.0 Ω resistor if the current is 1.5 A?

$V = I \times R$

$I = 1.5\ A$

$R = 5.0\ \Omega$

$V = ?$

$1.5 \times 5.0 =$

$7.5\ V$

V = IR

Daily Quiz - Answers

2. A voltage of 80 V is applied across a 20 Ω resistor. What is the current through the resistor?

V

R

$V = I \times R$

$I = \frac{V}{R} = \frac{80V}{20\Omega} = 4A$

V = IR

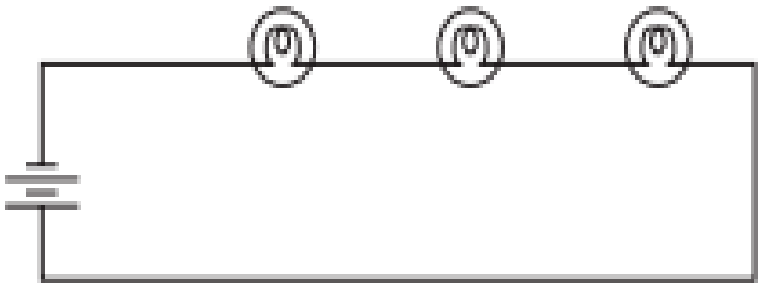
Daily Quiz - Answers

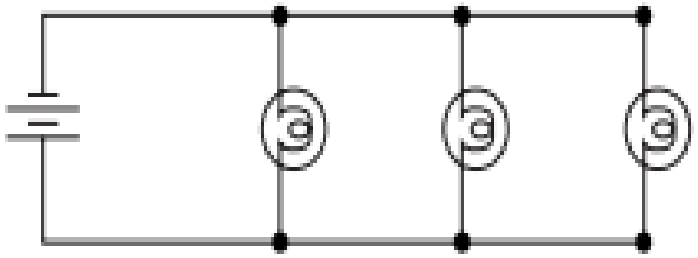
3. The current running through a starter motor in a car is 240 A. If this motor is connected to a 12 V battery, what is the resistance of the motor?

$$\frac{12}{240} = \frac{240 \times R}{240}$$

$$0.05 = R$$

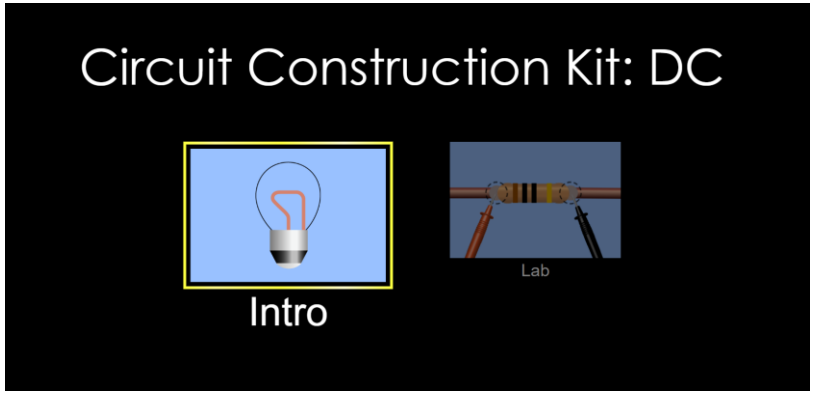
Ω





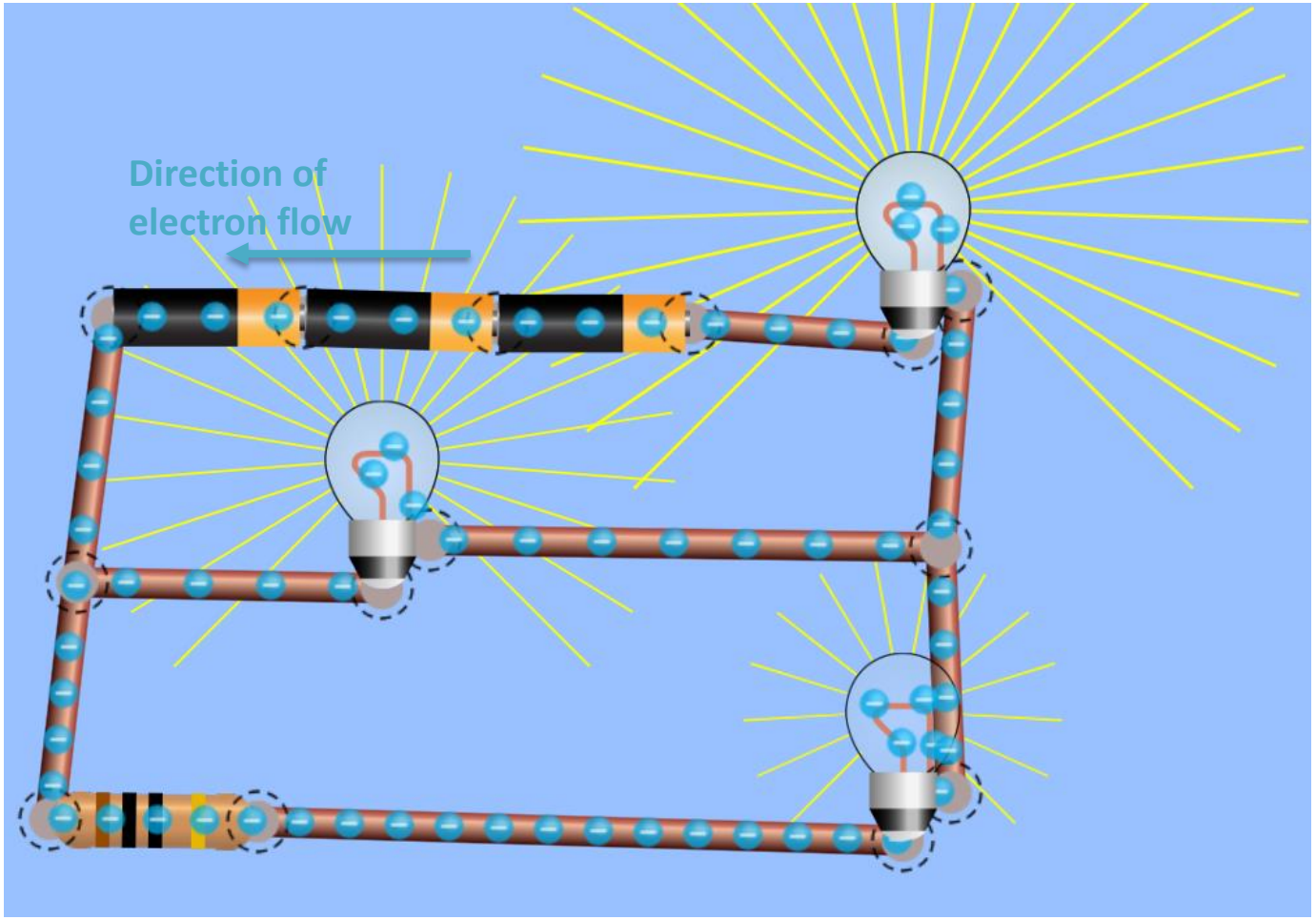
2.3 ANALYZING AND DRAWING ELECTRICAL CIRCUITS

Virtual Circuit Challenge!!



- Can you light a bulb?
- Can you increase or decrease the bulb's brightness?
- Can you make 2 bulbs in the same circuit have different brightness?
- Can you make a circuit where one bulb is switched off while another is on?
- Can you set your circuit on fire?

Why is the brightness different for each bulb?



Main Parts of a Circuit - Review

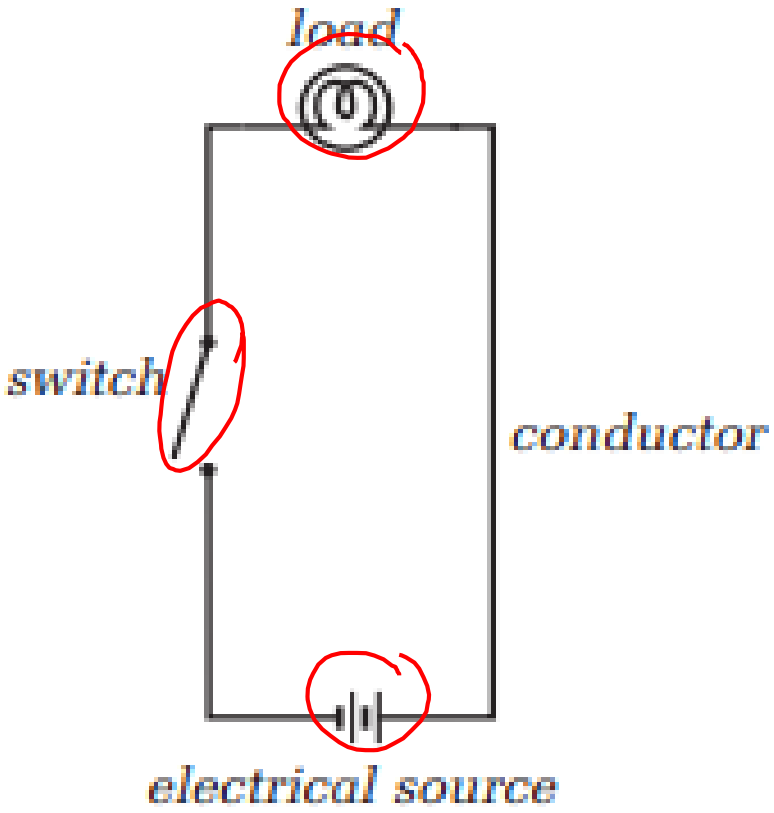


Figure 2.22 The four basic parts of an electrical circuit

Symbols for Circuit Diagrams

Symbol	Represents	Description
	conductor ★	conducts electricity through circuit
	cell ★	stores electricity (large bar is positive)
	battery ★	combination of cells
	lamp ★	converts electricity to light
	resistor ★	controls the amount of current in the circuit
	switch ★	opens and closes circuit—allows current to flow
	ammeter ★	measures amount of current in circuit
	voltmeter ★	measures voltage across a device in a circuit
	rheostat	variable resistor
	motor	converts electricity to mechanical energy
	fuse	melts if current in circuit is too high

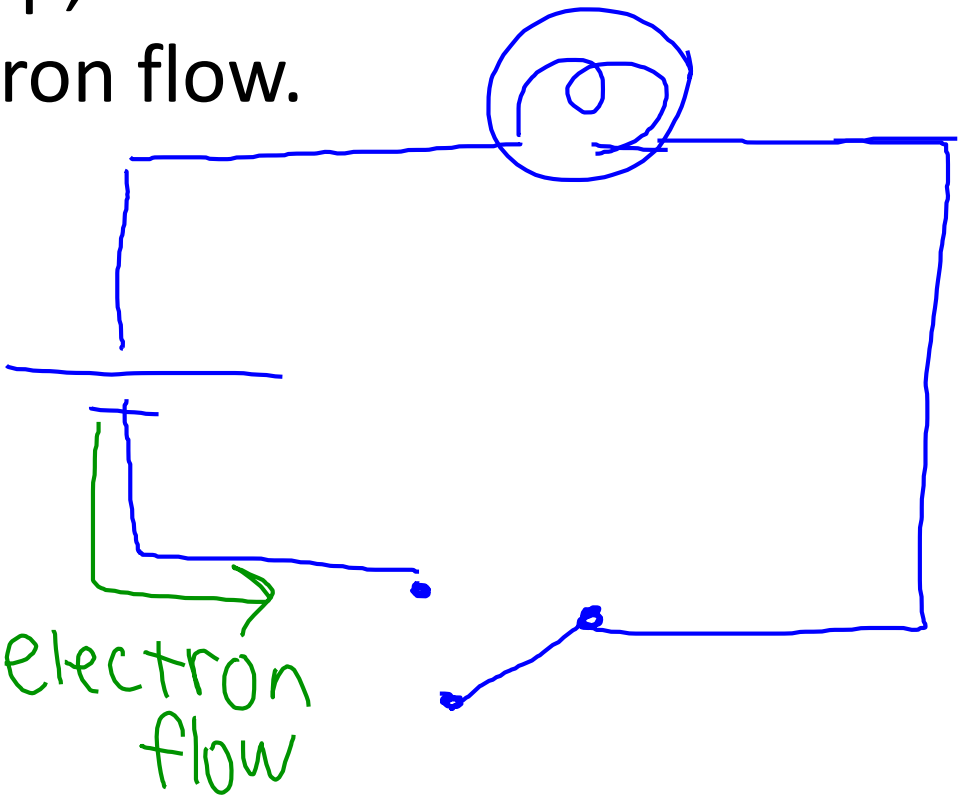
You should memorize the starred ones!

Rules for Drawing Circuit Diagrams

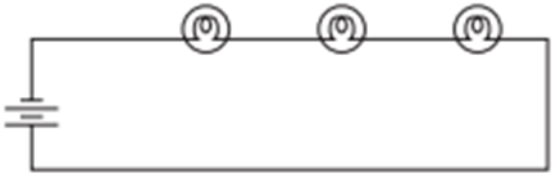
- use standard symbols (shown above) to show parts and connections
- electrons move from negative to positive
- All lines must be straight
- All corners must be 90° angles

Example 1

Draw a closed circuit diagram with one ~~battery,~~ cell one lamp, and one switch. Indicate the direction of electron flow.



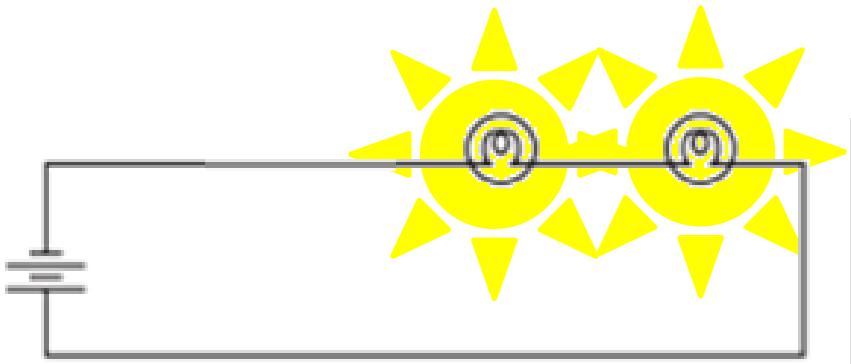
Two Kinds of Circuits



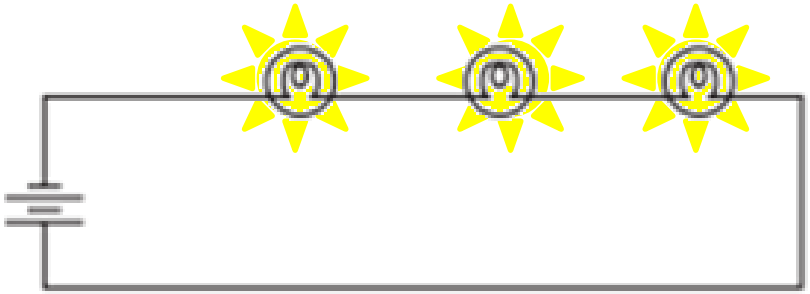
1. Series Circuit

- only one pathway for the current
- all electrons travel through each component in the circuit
- adding loads increases resistance and decreases current.
- Current stops flowing if the circuit is broken at any point

Series Circuits

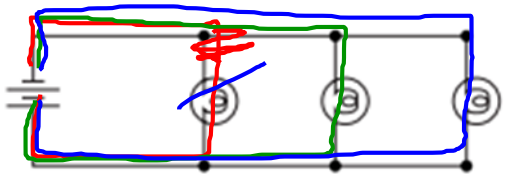


If one bulb burns out, the other bulb will <u>burn out</u>



Adding bulbs will decrease the <u>brightness</u> of each bulb.

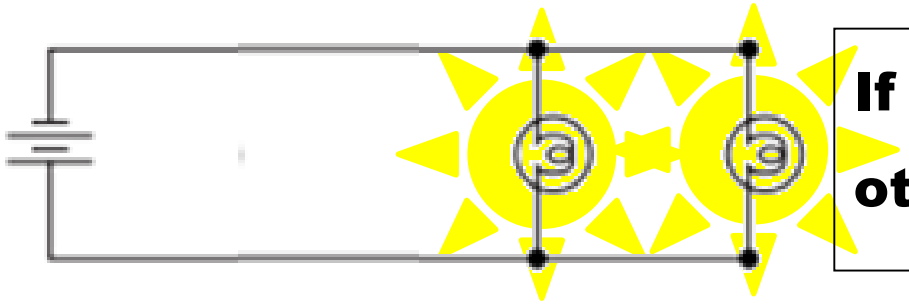
Two Kinds of Circuits



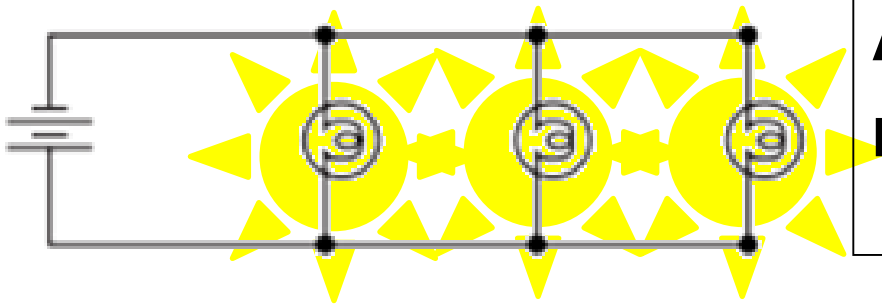
2. Parallel Circuit

- more than one pathway for the current
- a break in one pathway does not affect other pathways in the circuit
- total current is split, with some electrons travelling through each branch, or part of the circuit.
- Adding resistance in one pathway does not affect resistance in other pathways.
- Most electrical devices in a house are connected in parallel

2. Parallel Circuits

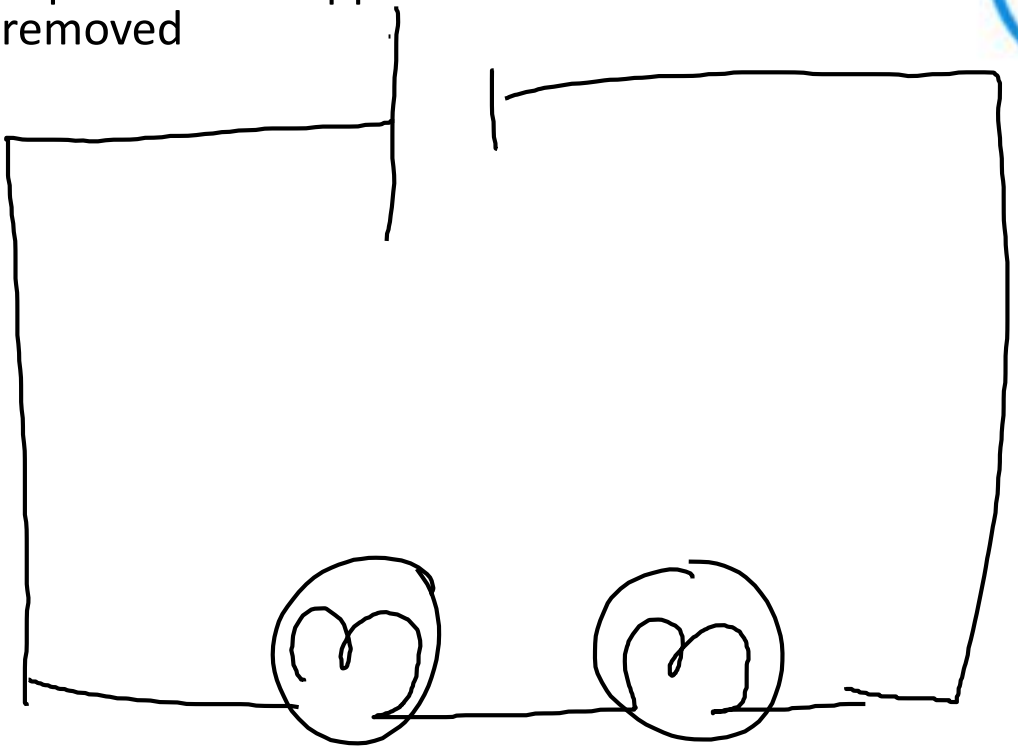


If one bulb burns out, the other bulb <u>is unaffected</u>



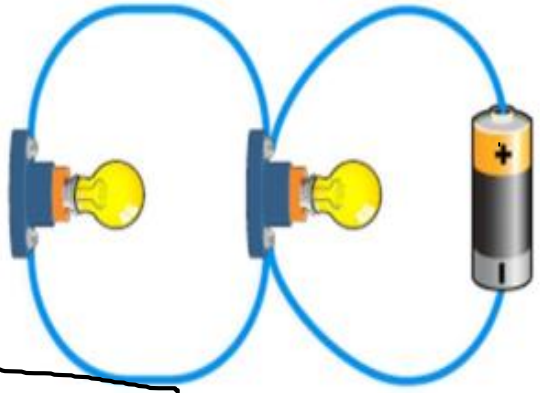
Adding bulbs will <u>not affect</u> the brightness of each bulb.

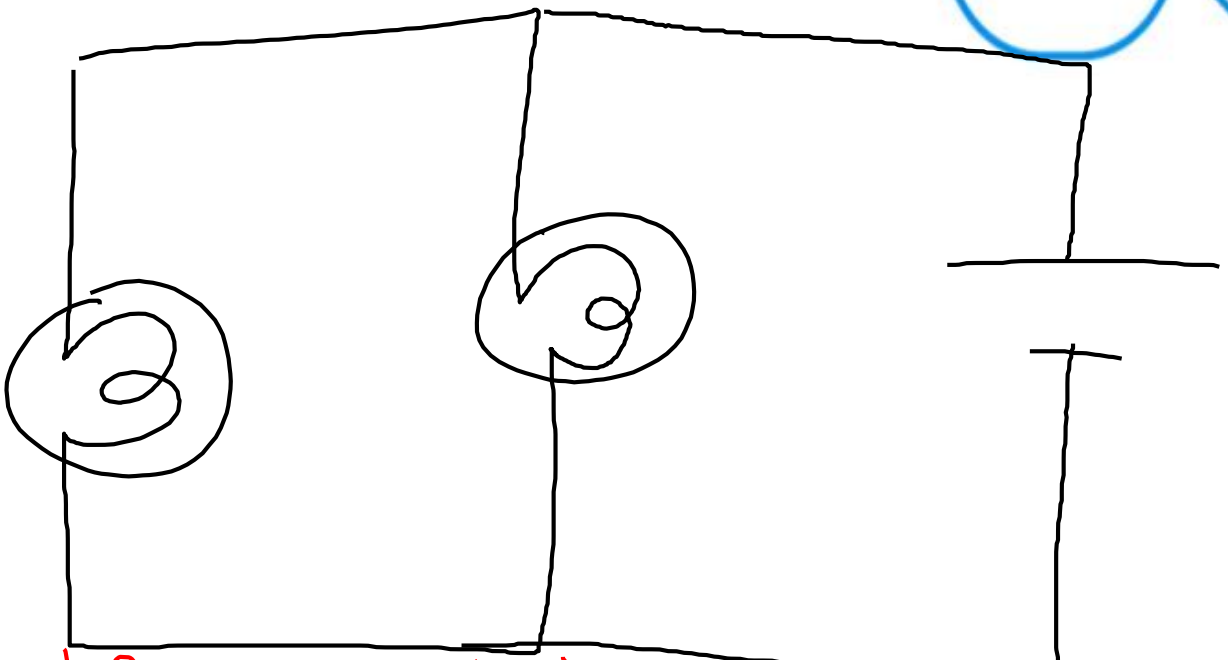
- Draw
- Indicate direction of electron flow
- Label series or parallel
- Explain what happens if one bulb is removed



Series
If one bulb is removed, the other goes out as well

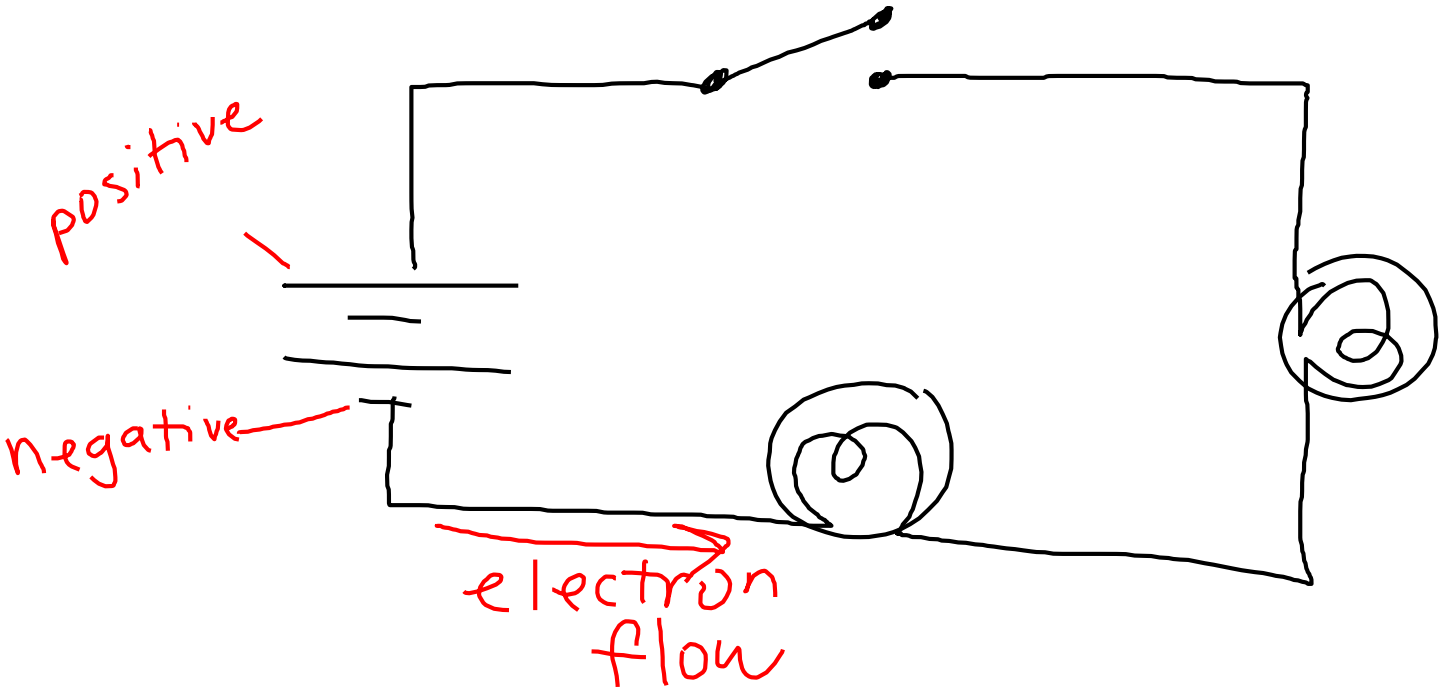
- Draw
- Indicate direction of electron flow
- Label series or parallel
- Explain what happens if one bulb is removed



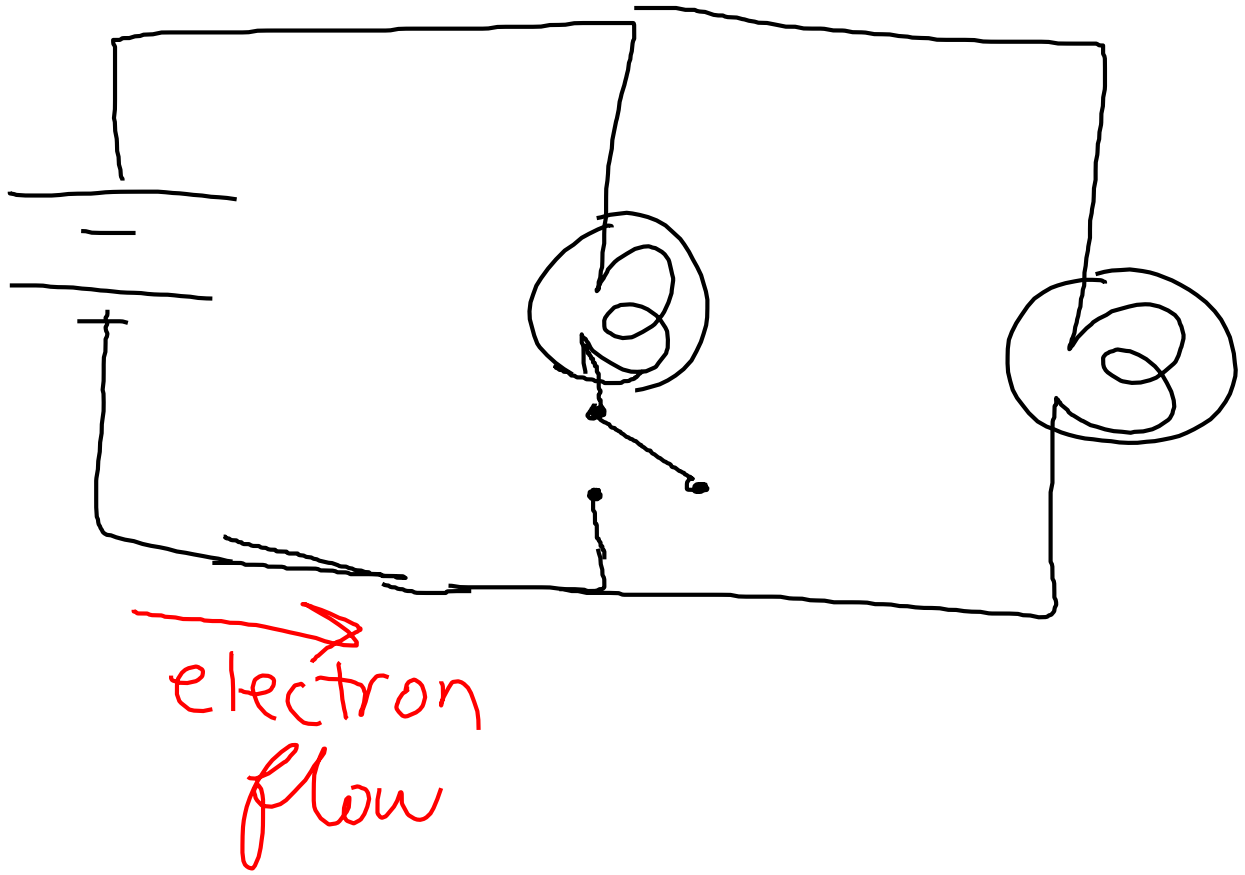


If one bulb is removed, the other stays on.

c.) Draw a complete circuit that includes 2 cells and 2 lamps. The lamps are connected in series. A switch controls the entire circuit. Indicate the direction of electron flow.



d.) Draw a complete circuit that includes 2 cells and 2 lamps. The lamps are connected in parallel. A switch controls the one of the lamps but does not affect the other. Indicate the direction of electron flow.



e.) A circuit was made with 3 cells, with a total voltage of 6.0 V. There were 2 lamps connected in parallel. An ammeter was connected right after the battery and read 5.8 A.

negative end

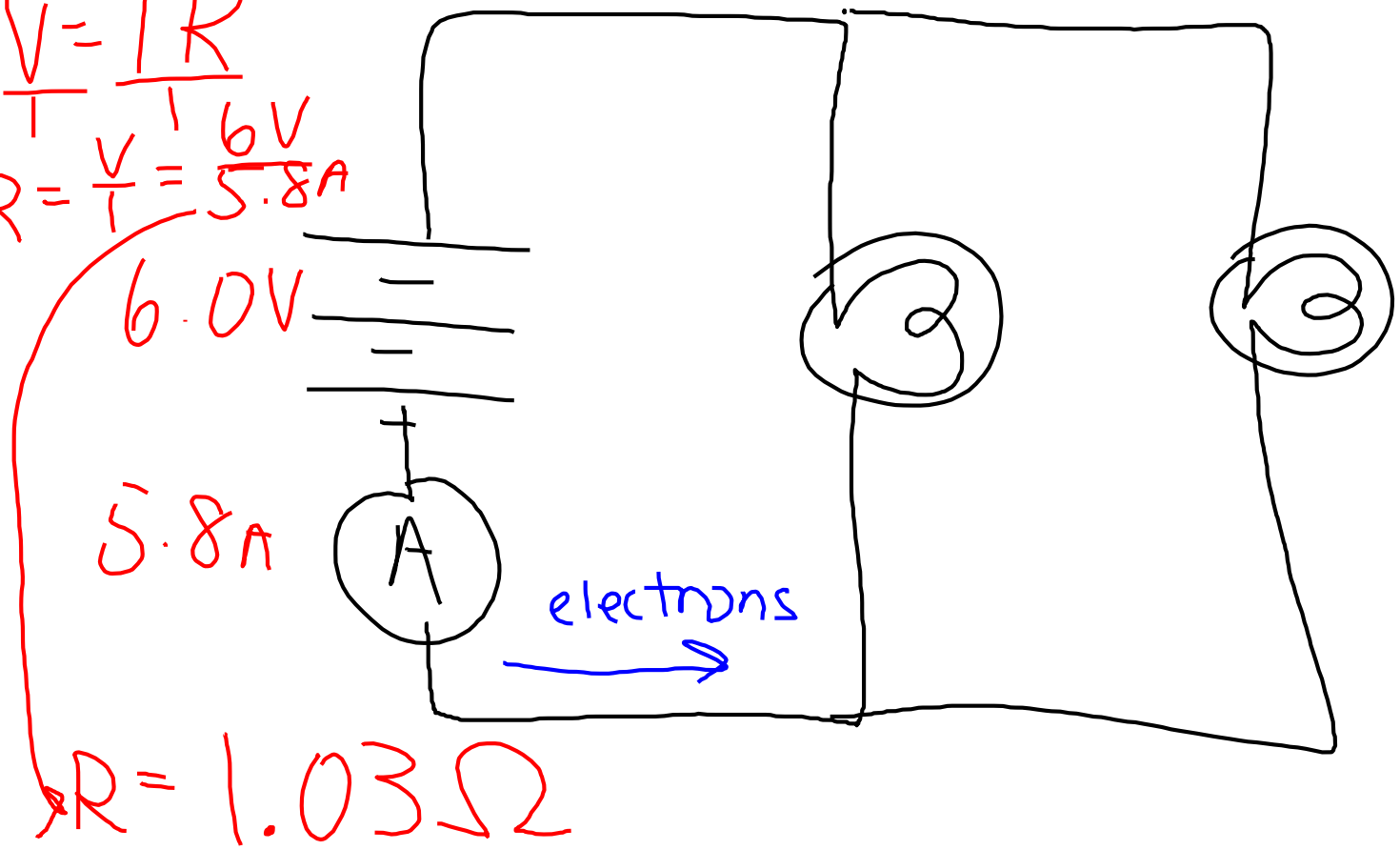
- Draw the circuit, indicate the direction of electron flow, and calculate the resistance of the circuit at the point of the ammeter.

$V = IR$

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

6V

$R = \frac{6V}{5.8A}$

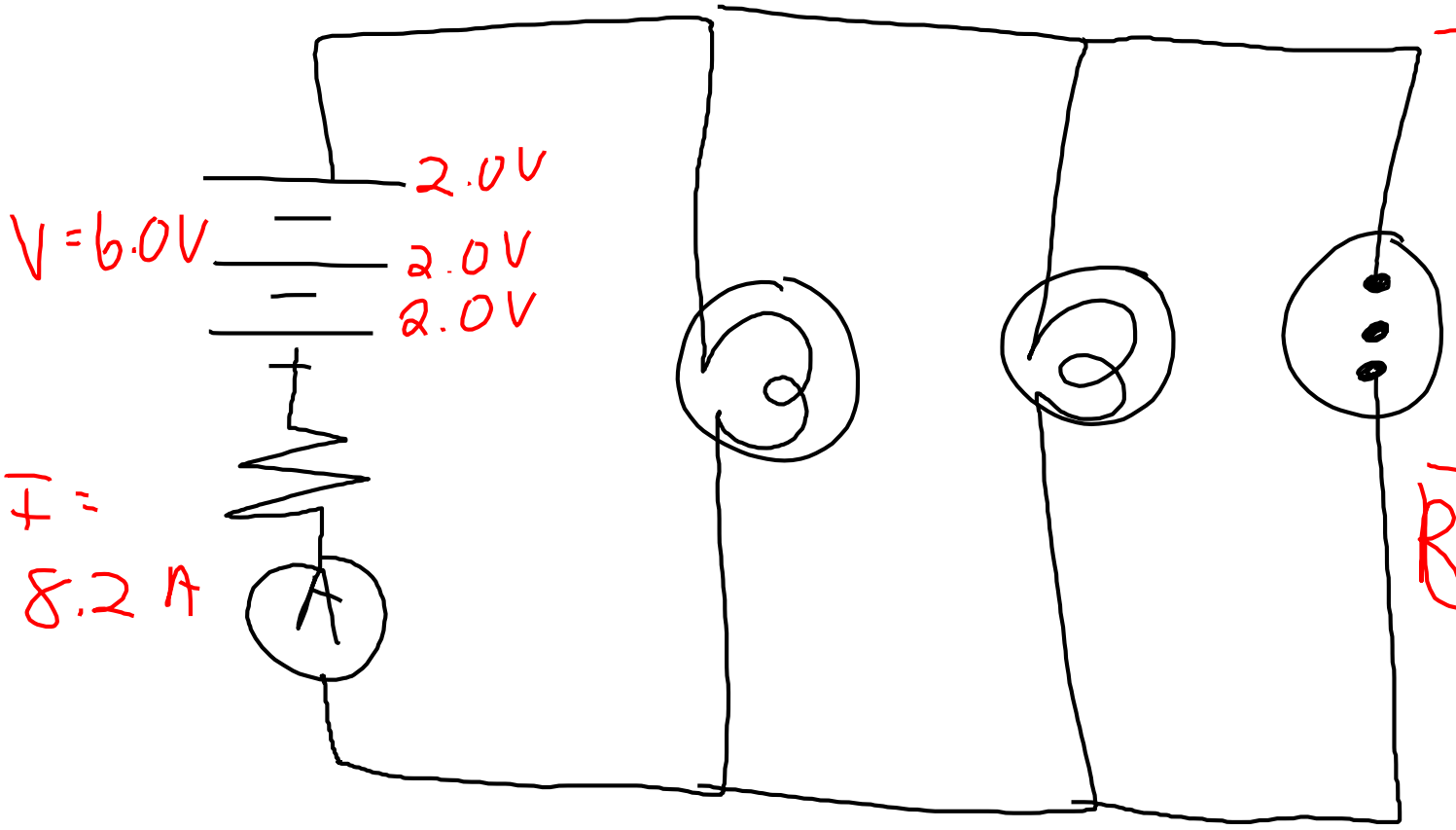


$R = 1.03\Omega$

each

f.) A circuit was made with 3 cells, with 2.0 V. There were 2 lamps and a motor connected in parallel. A resistor was connected right after the battery, and an ammeter was connected right after the resistor. The ammeter read 8.2 A.

- Draw the circuit, indicate the direction of electron flow, and calculate the resistance of the circuit at the point of the ammeter.



$V = IR$

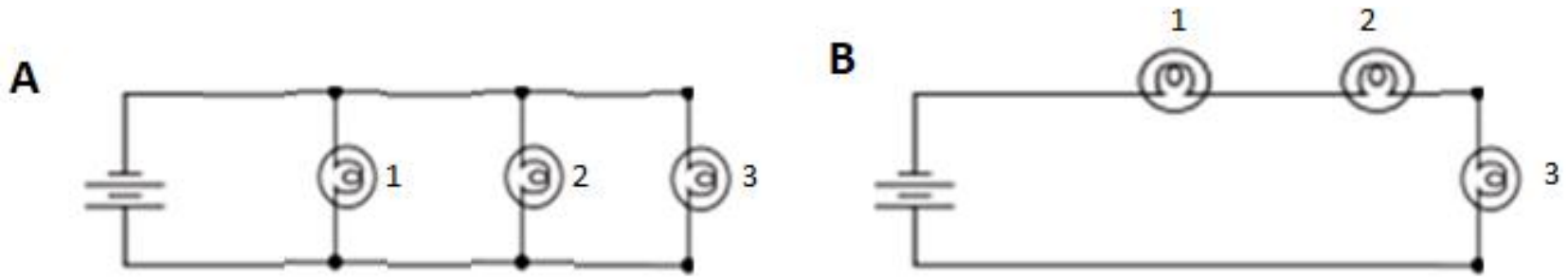
$\frac{V}{I} = \frac{IR}{I}$

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

$= \frac{6.0V}{8.2A}$

$R = 0.73\Omega$

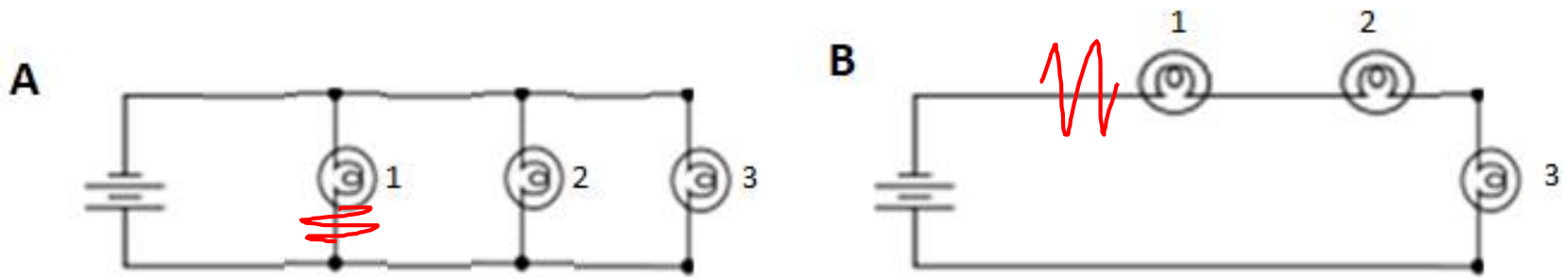
Brightness of Lamps



1. Each circuit shown above contains 3 lamps. In which circuit will the lamps be brighter?

"A" because it is a parallel circuit, so the flow of electrons is split

Brightness of Lamps



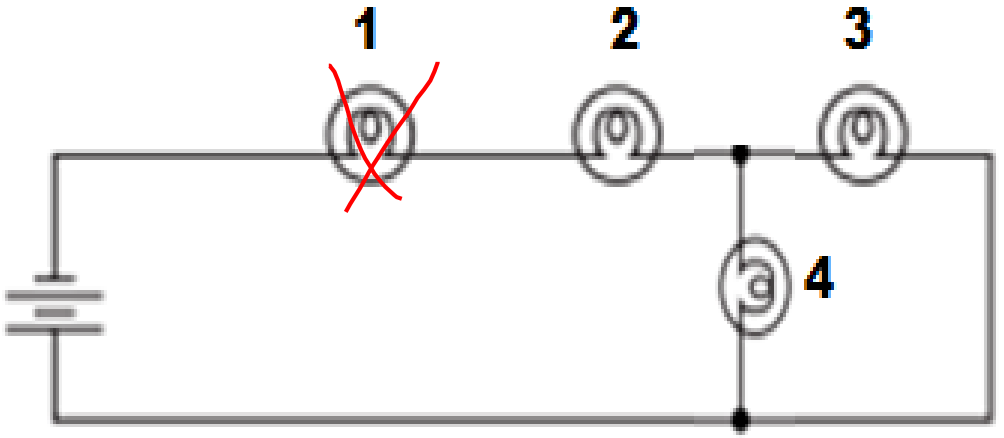
2. Draw a resistor just before Bulb 1 on each circuit. How is the brightness of the bulbs affected in:

-circuit A? Bulb A is dimmer than bulbs 2+3

-circuit B? All bulbs are dimmer than they were without the resistor.

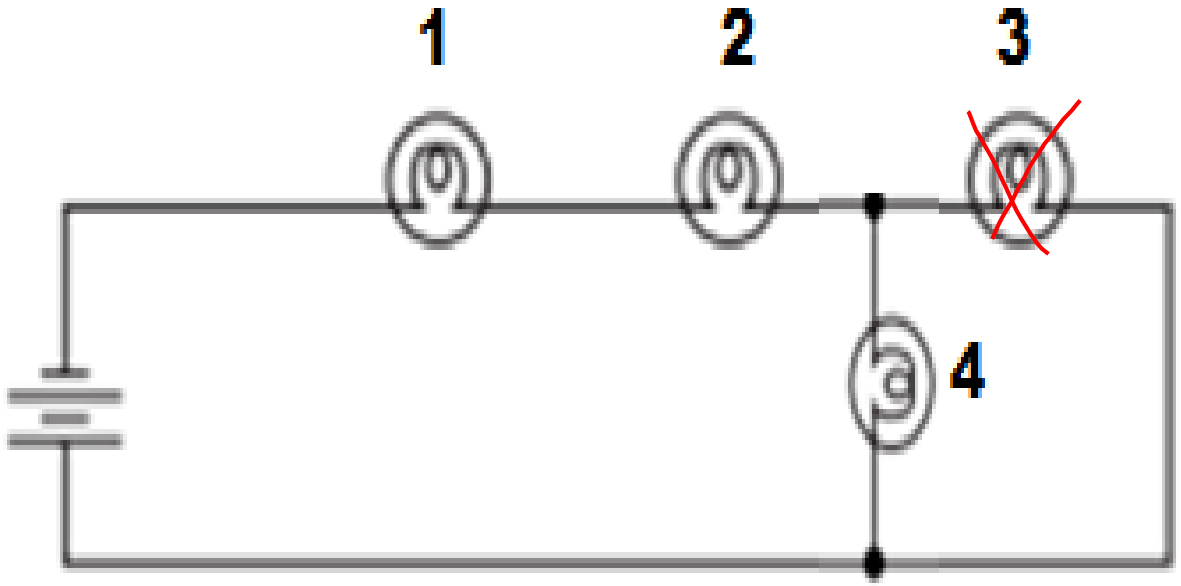
Combination Circuits

- Some loads are connected in series and others in parallel



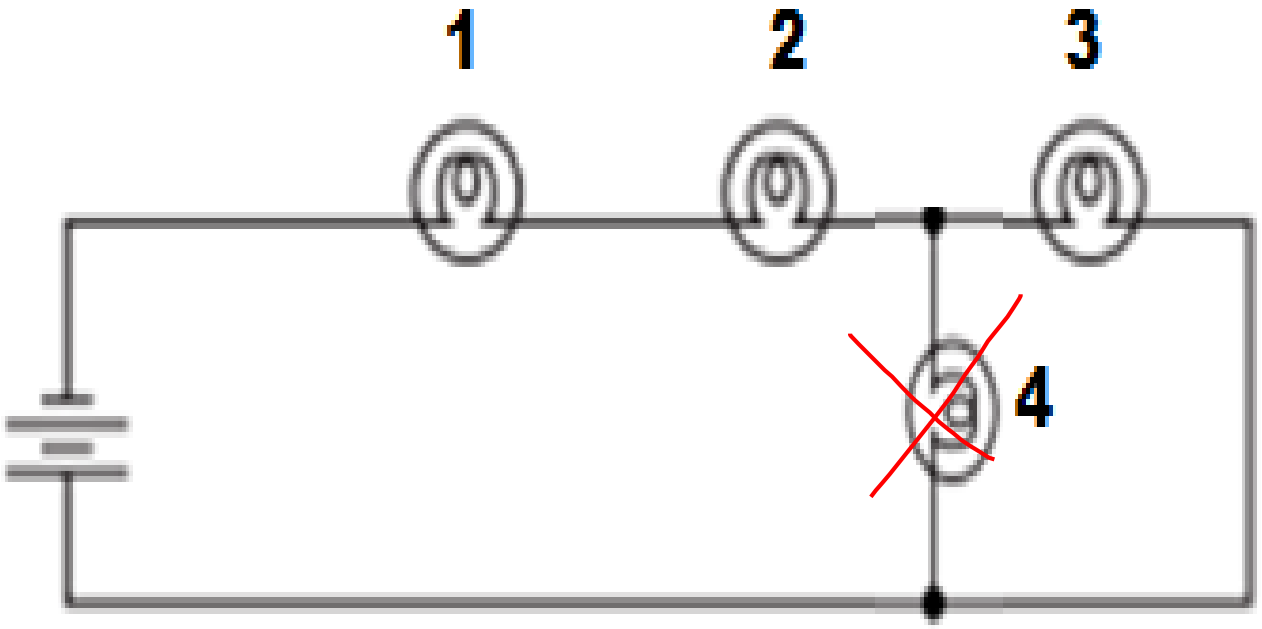
  - If bulb 1 burns out: All burn out

Combination Circuits



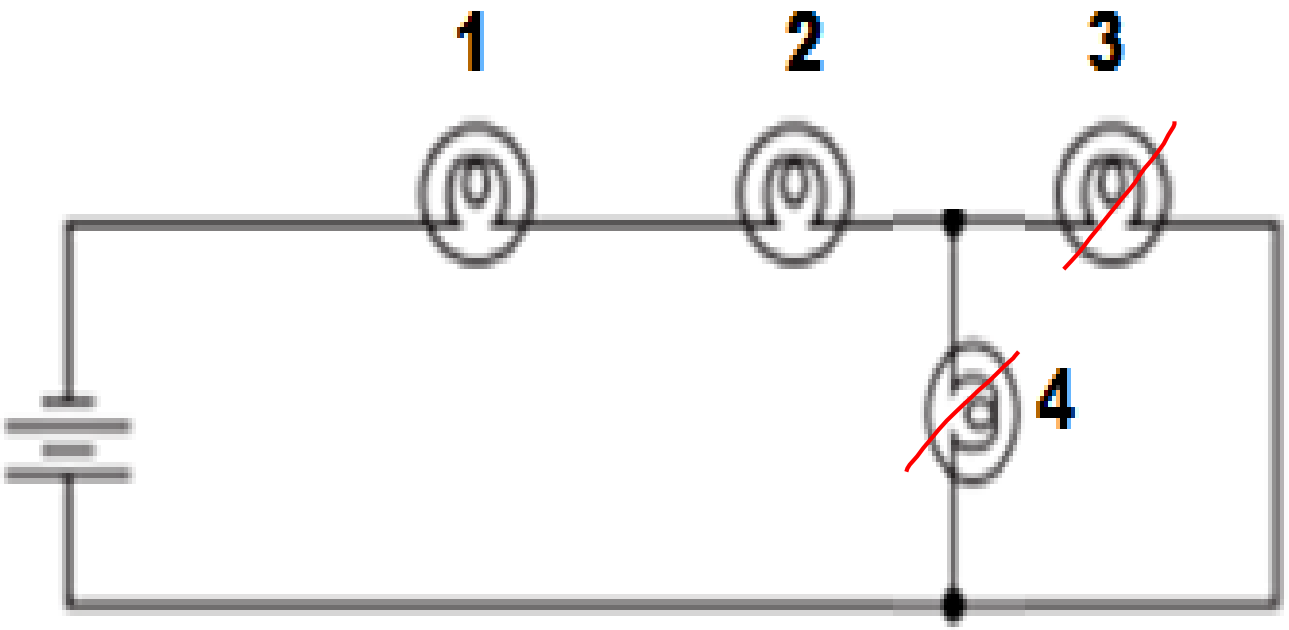
- If bulb 3 burns out: Bulbs 1, 2, 4 Stay lit

Combination Circuits



- If bulb 4 burns out: 1, 2, 3 stay lit

Combination Circuits

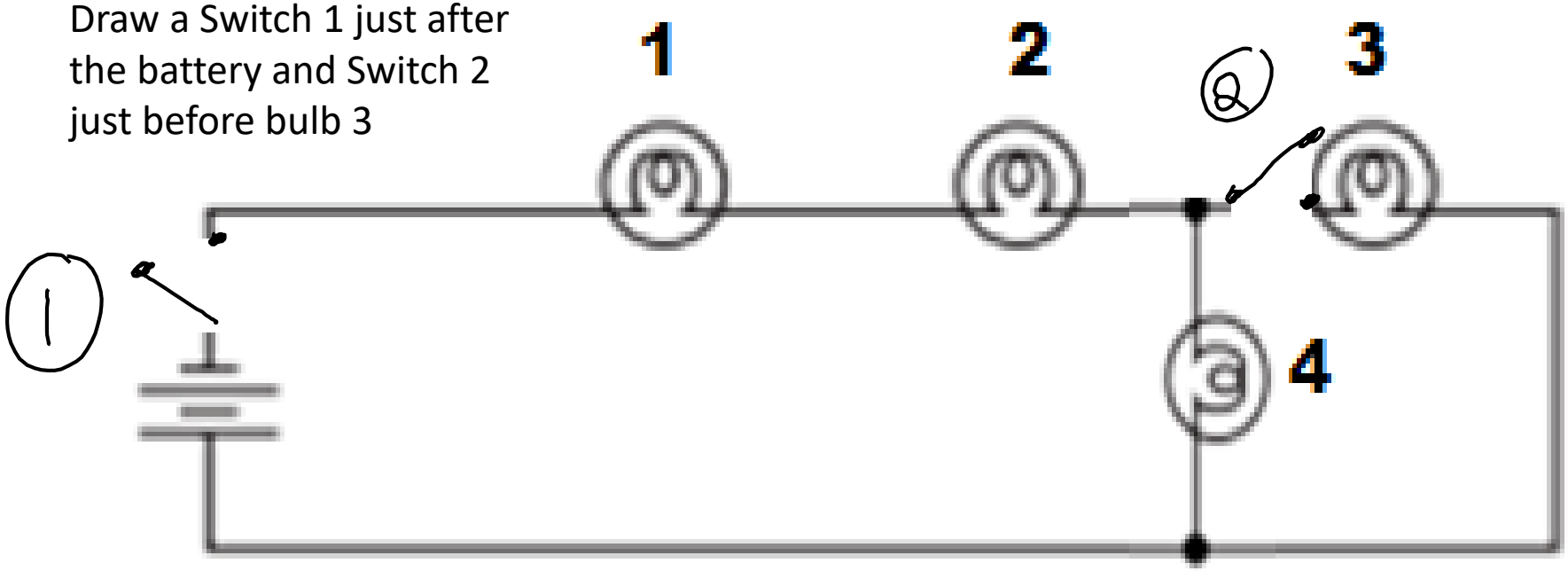


- If bulbs 3 & 4 burn out:

1 and 2 burn out also

Combination Circuits

Draw a Switch 1 just after the battery and Switch 2 just before bulb 3

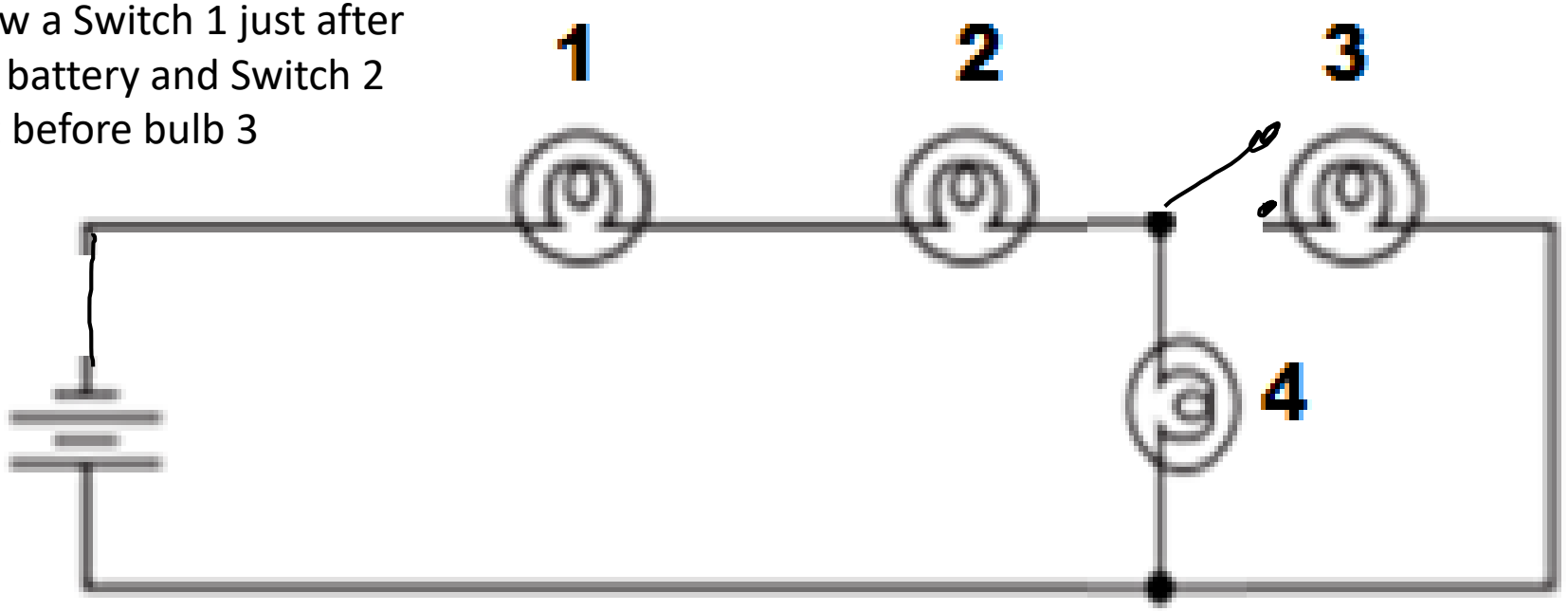


How will the lamps be affected if switch 1 is open and Switch 2 is closed?

No complete circuit, so no bulbs lit

Combination Circuits

Draw a Switch 1 just after the battery and Switch 2 just before bulb 3



How will the lamps be affected if switch 1 is closed and Switch 2 is open?

1, 2, & 4 will be lit but lamp 3 will not

✓ Check Your Understanding

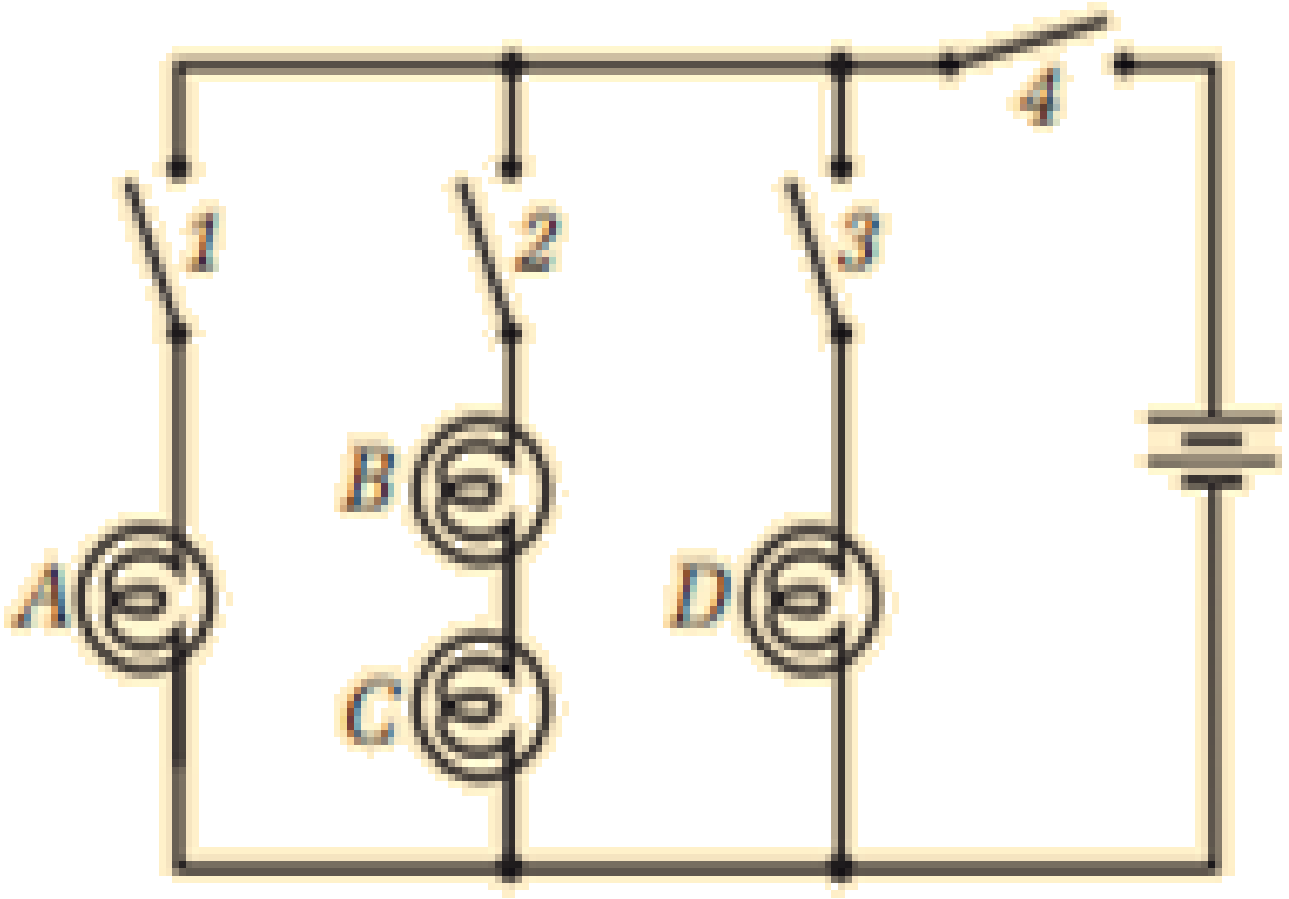
Make sure you label your lamps

- Draw a circuit made with a 3-cell battery and 3 lamps. Lamp 1 is connected in parallel with lamp 3. Lamp 2 is connected in series with lamps 1 and 3. A switch controls the entire circuit.

- Draw a circuit that contains two motors and a lamp, connected in parallel. Include two switches: one to operate the lamp and one to control the whole circuit.

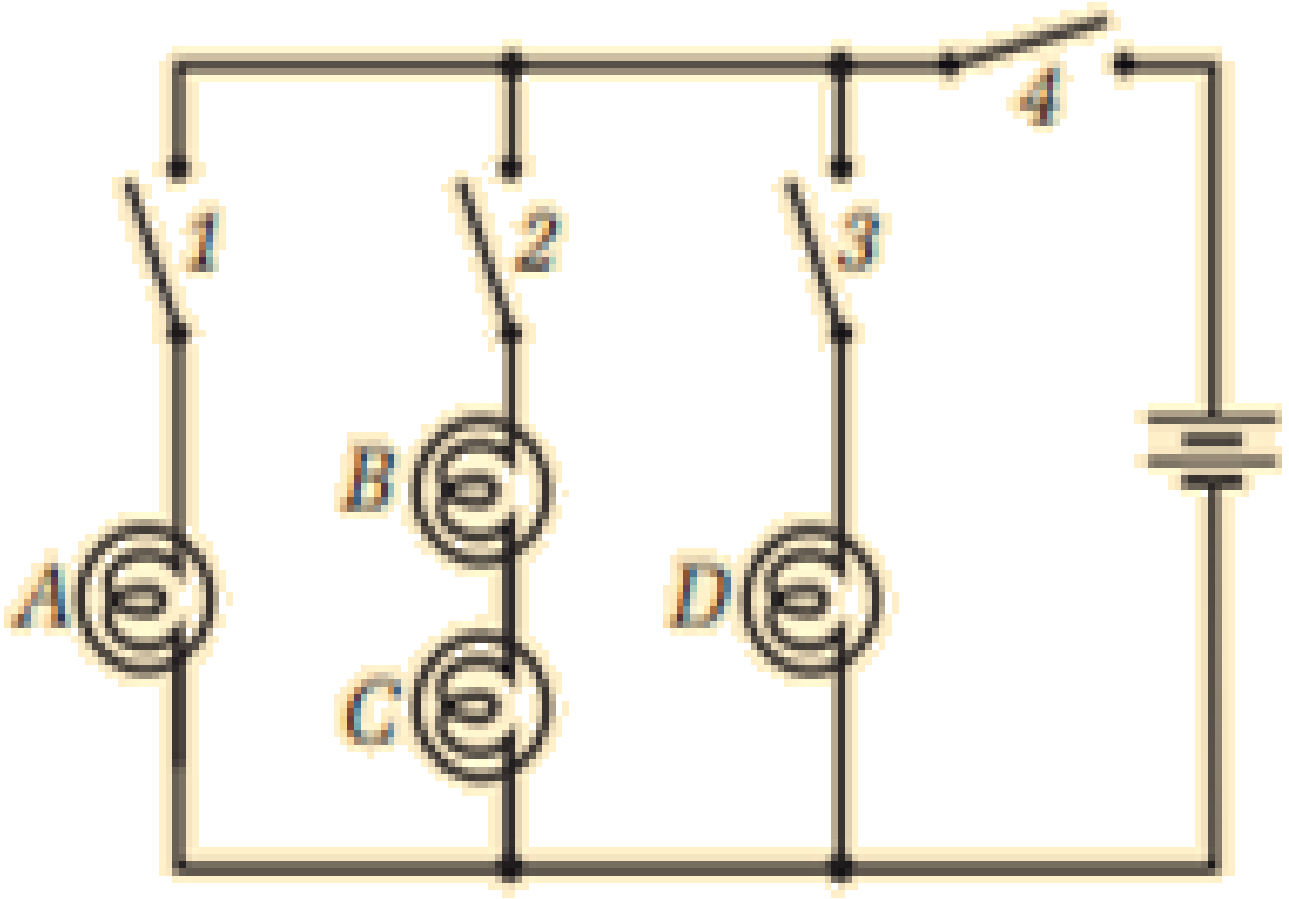
The circuit below has four bulbs (A-D) and four switches (1-4).

a.) Which switch(es) should be closed to light bulbs A and D only? _____



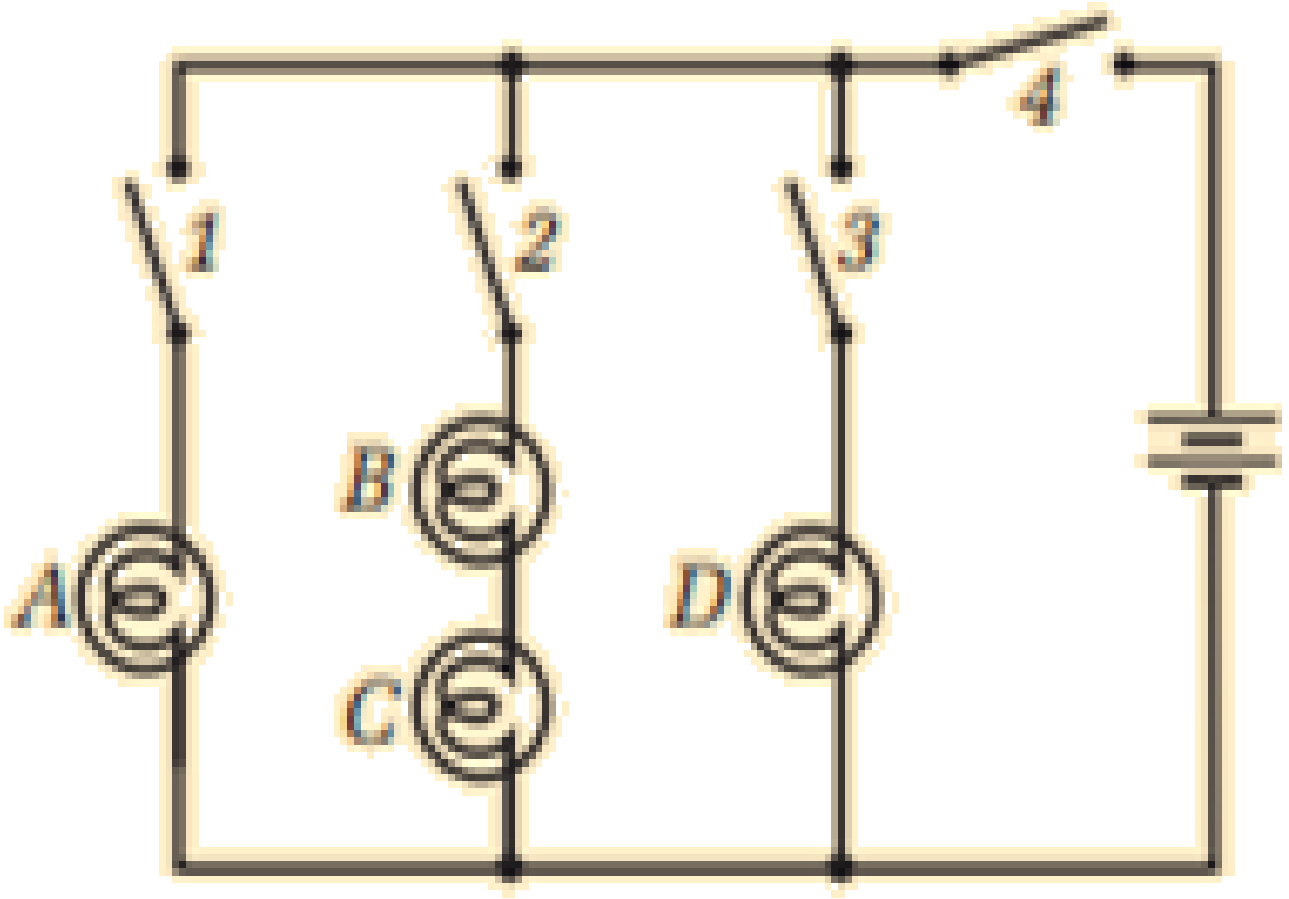
The circuit below has four bulbs (A-D) and four switches (1-4).

b.) Which switch(es) should be closed to light bulb A only? _____



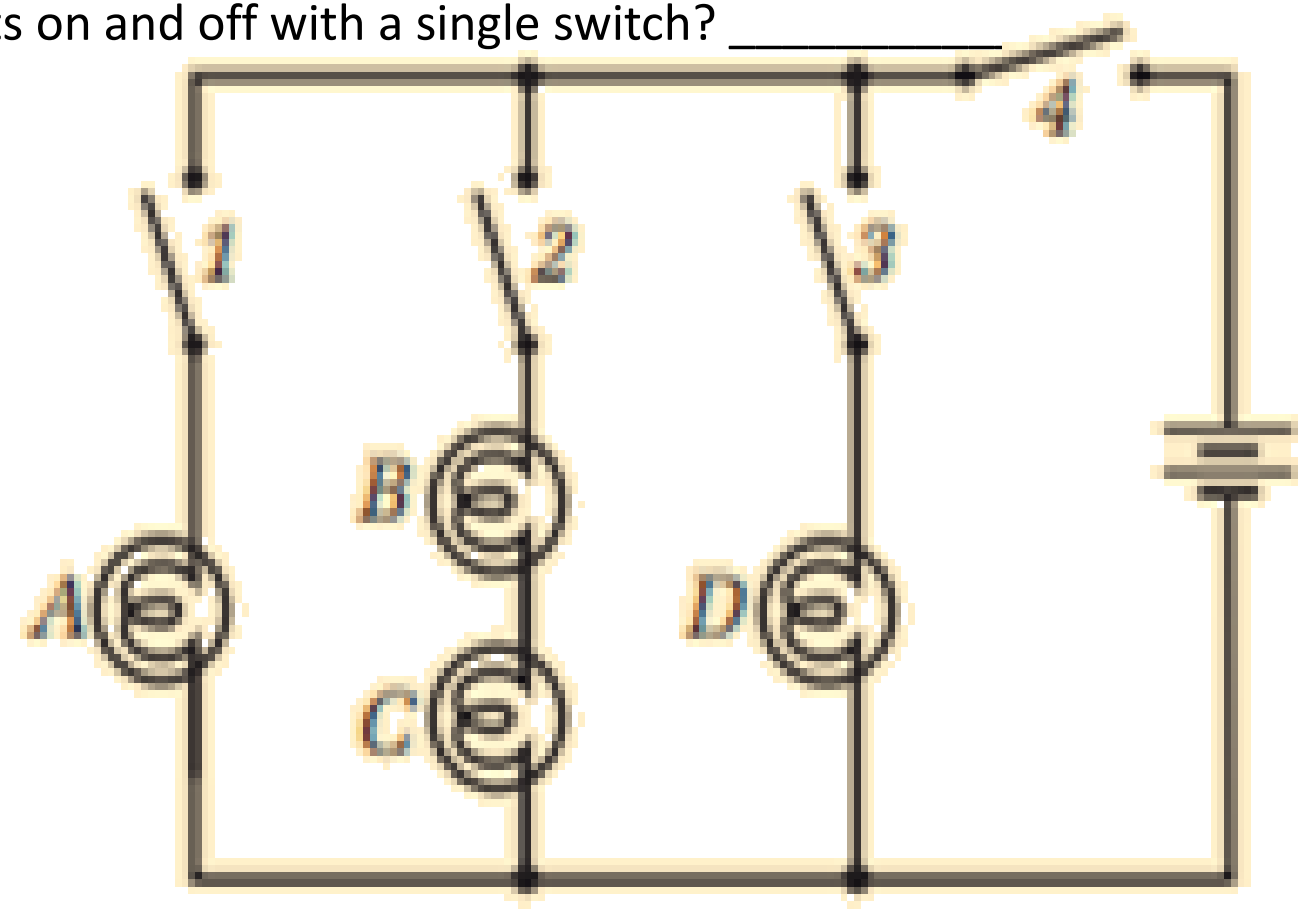
The circuit below has four bulbs (A-D) and four switches (1-4).

c.) Which switch(es) should be closed to light bulbs B and C only? _____



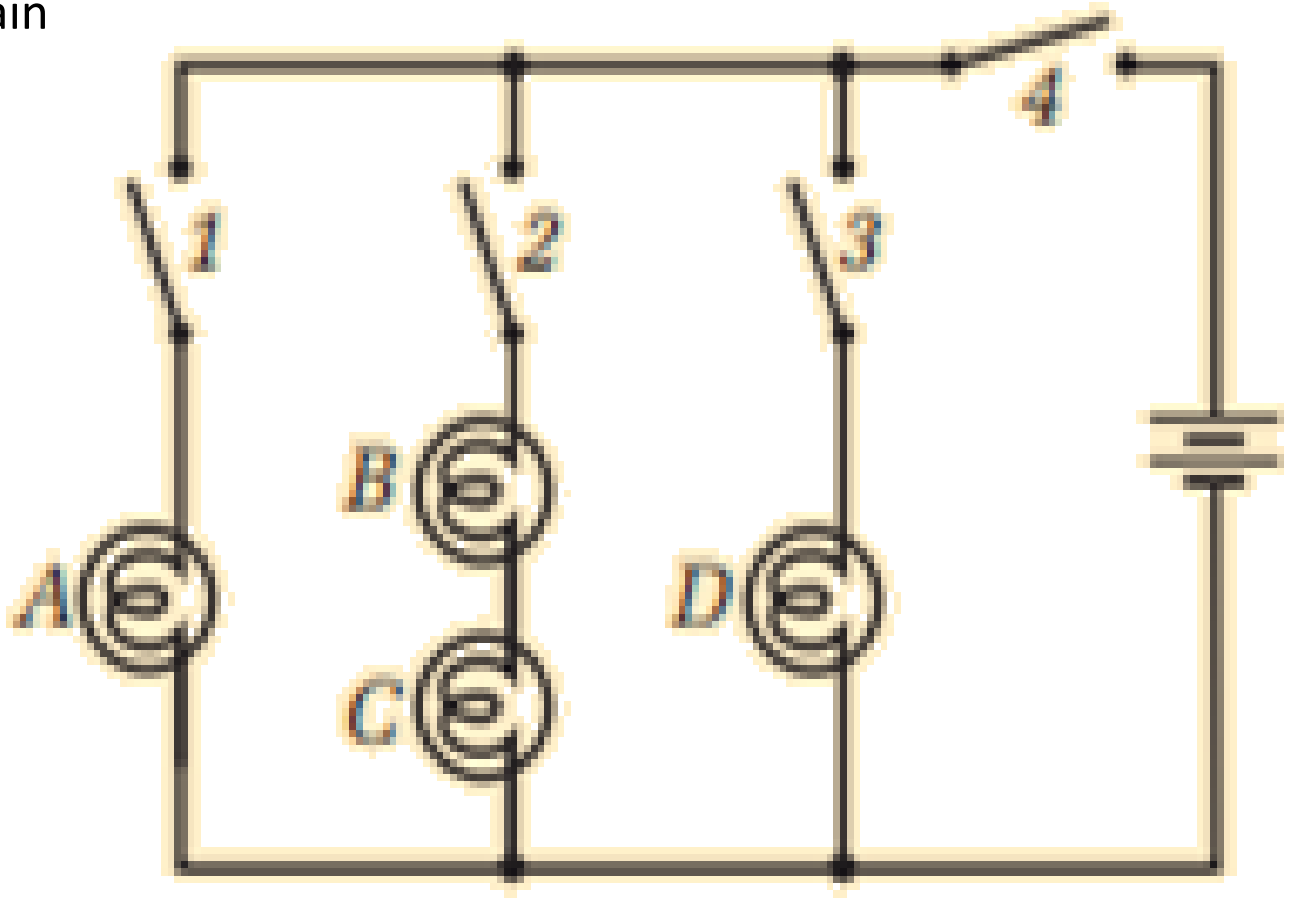
The circuit below has four bulbs (A-D) and four switches (1-4).

d.) How would you organize the switches so that you could turn all the lights on and off with a single switch? _____



The circuit below has four bulbs (A-D) and four switches (1-4).

e.) Is it possible to operate bulbs B and C independently of each other? Explain



4. A circuit was made with 3 cells, each with a voltage of 2.0 V. There were 2 lamps connected in parallel. An ammeter was connected right after the battery and read 5.8 A. There was also a resistor connected in series with both lamps.

- Draw the circuit and indicate the direction of electron flow
- Calculate the resistance of the circuit at the point of the ammeter