

# Circuits

Electrons flowing in a continual closed loop.

## Parts of a circuit

### 1- Power supply

Gives the **push** the electrons need to travel in the circuit.



Types: 1- photovoltaic cell: generates current when exposed to light. ex: solar calculator or watch.

2- Batteries and generators.

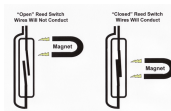
### 2- Wires

Allows the **conduction** of electrons and connects all the parts of the circuit.

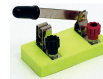
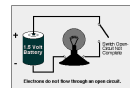


### 3- Control or switch

**Controls** the ability of electrons to travel in a circuit.

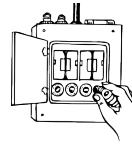


open switch = no current  
closed switch = current



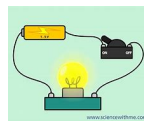
### 4- Fuses or breakers

**Protection** of the circuit by completely stopping electron flow when too much current is needed at once.



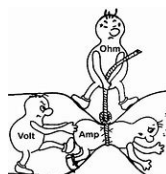
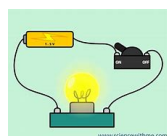
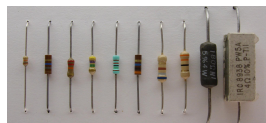
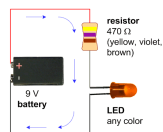
### 5- Transformers

Device used to **transfer** electrical energy from one circuit to another or to another form of energy. Ex: light, sound or motor













### 6- Resistors

**Stop or slow down** the flow of electrons in a circuit. Light bulbs are transformers and resistors.



## Symbols

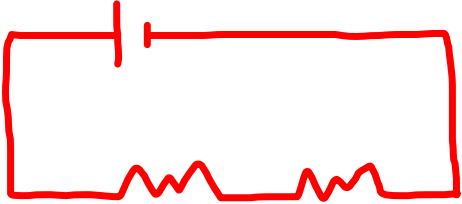
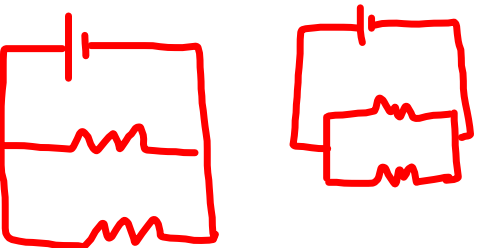
Resistor	Light bulb	Wire	Open switch	Closed switch
				
Power supply	Fuse	Voltmeter	Ammeter	Motor
				

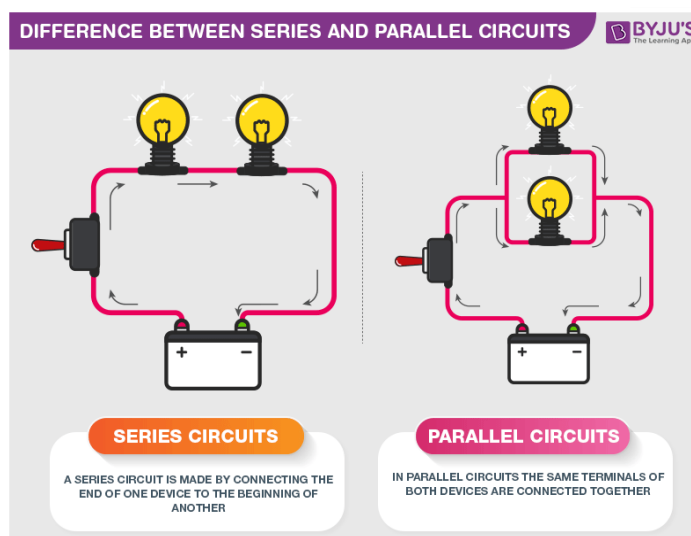
**voltmeter:** measures the voltage of the circuit.

**ammeter:** measures the current intensity of the circuit.

[https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab\\_en.html](https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html)

## Types of circuits

Series	Parallel
	
<ul style="list-style-type: none"> <li>- electrons only have 1 pathway to follow</li> <li>- either all resistors are working or none are working</li> </ul>	<ul style="list-style-type: none"> <li>- electrons have multiple pathways</li> <li>- you can have some resistors working while others are not</li> </ul>

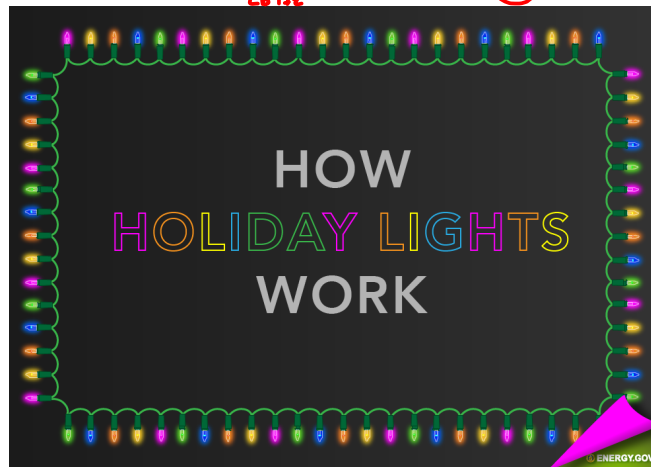
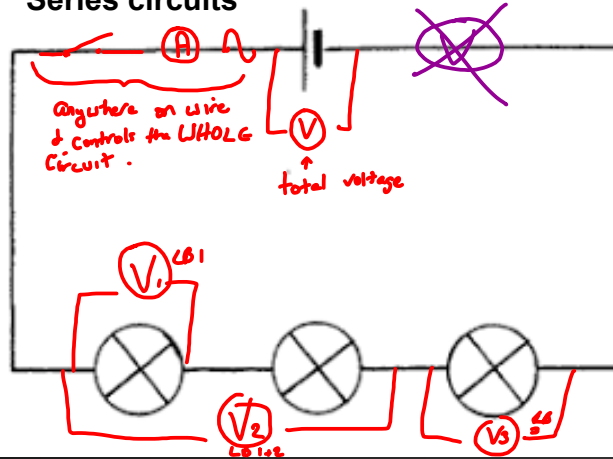


### Symbols on a circuit

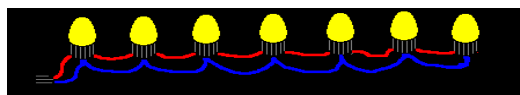
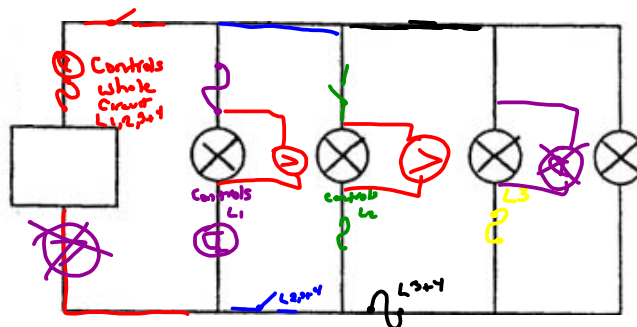
**Ammeter, switches and fuses:** All are placed the same way on a circuit, **directly on a wire**. Depending where they are placed they can control a **part, parts or the whole circuit**. The way they are placed is called in 'series'.

**Voltmeters:** Are placed in 'parallel' which means **above or below** the resistor or power supply.

### Series circuits



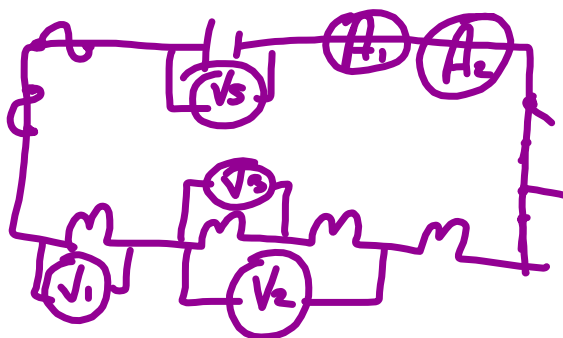
### Parallel circuit



## Putting it all together

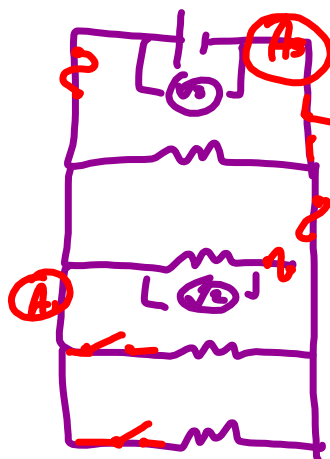
### Example 1:

- Circuit with one pathway
- 4 light bulbs
- Voltmeter to measure total voltage, ( $V_s$ )
- Voltmeter to measure  $L_1$ , ( $V_1$ )
- Voltmeter to measure  $L_2$  and  $L_3$ , ( $V_2$ )
- Voltmeter to measure  $L_4$ , ( $V_3$ )
- Ammeter to measure total current, ( $A_1$ )
- Ammeter to measure current of  $L_1$ , ( $A_2$ )
- Fuse controlling the whole circuit
- Fuse controlling  $L_3$
- Switch controlling  $L_1$
- Switch controlling all lights



### Example 2:

- Circuit with 4 pathways with resistors
- Voltmeter to measure total voltage, ( $V_s$ )
- Voltmeter to measure  $R_2$ , ( $V_2$ )
- Ammeter to measure total current, ( $A_s$ )
- Ammeter to measure  $R_3$  and  $R_4$ , ( $A_1$ )
- Fuse controlling the whole circuit
- Fuse controlling  $R_2$
- Fuse controlling  $R_2$ ,  $R_3$  and  $R_4$
- Switch controlling  $R_3$
- Switch controlling  $R_4$
- Switch for whole circuit

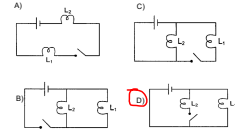


Past exam questions

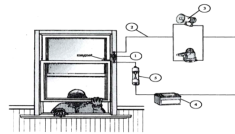
1. A mystery circuit consists of two light bulbs ( $L_1$  and  $L_2$ ), a switch, and a power supply. The following table shows what happens to both light bulbs when the switch is opened or closed.

Test	Observations
Open the switch	$L_1$ stays on and $L_2$ goes out
Close the switch	$L_1$ stays on and $L_2$ comes on

Which diagram correctly represents this mystery circuit?



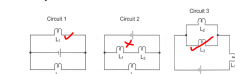
2. The electrical circuit of a magnetic alarm system is illustrated in the diagram below



Which of the following shows the correct match between the five numbered components in this circuit diagram and their corresponding electrical functions?

	1	2	3	4	5
A	control	conduction	transformation	Power supply	protection
B	control	conduction	Power supply	transformation	protection
C	power supply	protection	transformation	control	conduction
D	power supply	conduction	protection	transformation	control

3. If you unscrew lightbulb  $L_2$  in each of the three electrical circuits shown below, where will light bulb  $L_1$  remain lit?

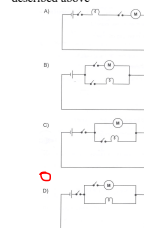


- A) In circuits 1 and 2      C) In circuits 2 and 3
- B) In circuit 3 only      D) In circuits 1 and 3

4. When a grocery store check-out clerk is ready to serve customers:

- he must press a switch to turn on a light indicating that the cash is open
- he can start the conveyer belt motor, if necessary, by using another switch
- he can start the conveyer belt motor only if the light is on to indicate that his cash is open

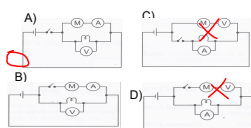
Which electrical circuit represents the situation described above



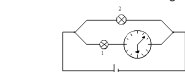
5. Listed below are the characteristics of an electrical circuit consisting of a power source, a light bulb, a switch and a motor (represented by the symbol M in the diagrams below).

- The circuit has a device for measuring the potential difference across the light bulb.
- The circuit has another device for measuring the current intensity in the motor.
- Only the motor is controlled by a switch.

Which of the following diagrams correctly represents this electrical circuit?

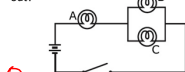


6. The following circuit diagram shows an electric circuit with a power source, two lights and a clock. What will be observed if light 1 breaks?



- A) The clock will stop and light 2 will go off.
- B) The clock and light 2 will both remain on as before.
- C) The clock will continue to work and light 2 go off.
- D) The clock will stop and light 2 will remain on as before.

7. What would happen if the switch were closed and then Bulb A in this electrical circuit burned out?



- A) All three bulbs would go dark
- B) All three bulbs would remain normally lit up
- C) Bulb A would be dark and Bulbs B and C would be more dimly lit
- D) Bulbs B and C would remain normally lit but A would be dark