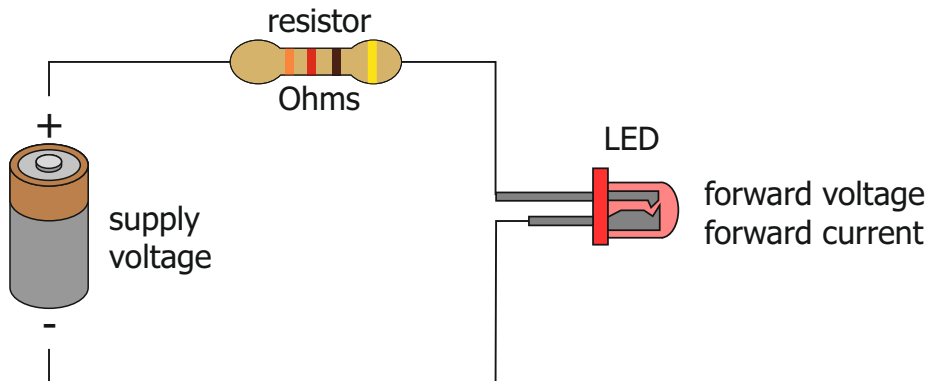
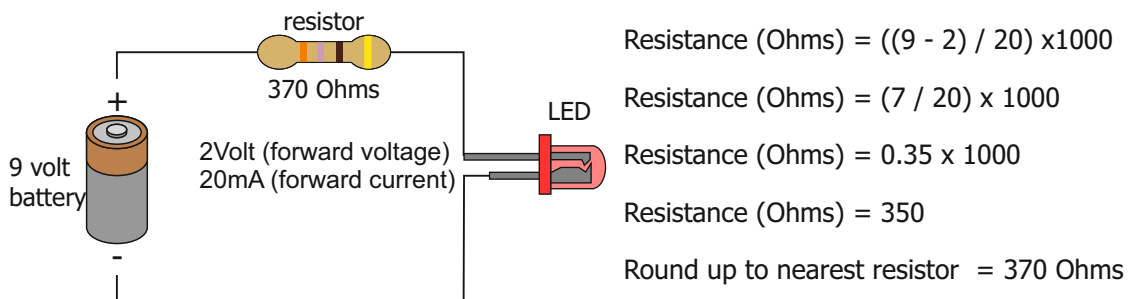


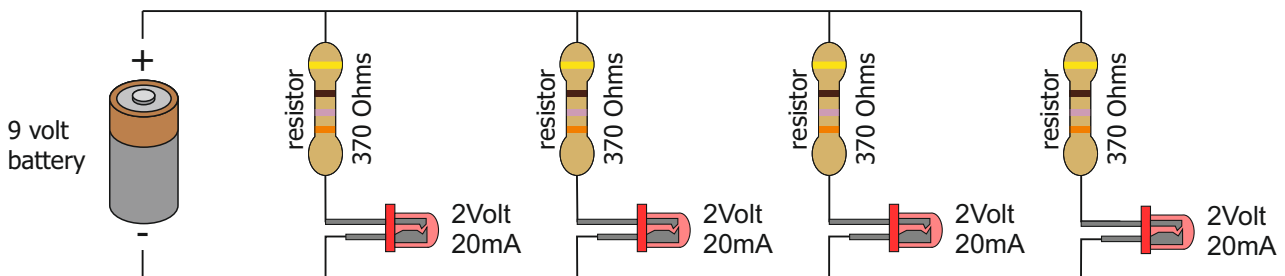
When using LED's you should always use at least one resistor to avoid the LED's burning out. To work out what resistor is needed in your circuit use the following equation  
 Resistance (Ohms) = (Supply voltage - LED voltage) / LED current mA x1000



As an example in the circuit below the resistor needed is worked out as below



This resistor will then work for a number of LED's wired in a parallel circuit using one resistor for each LED.



For series circuits the resistor for the circuit below is calculated in the following way.

$$\text{Resistor (Ohms)} = \{ [ \text{Supply Voltage} - (\text{sum of LED voltage}) ] / \text{LED current (mA)} \} \times 1000$$

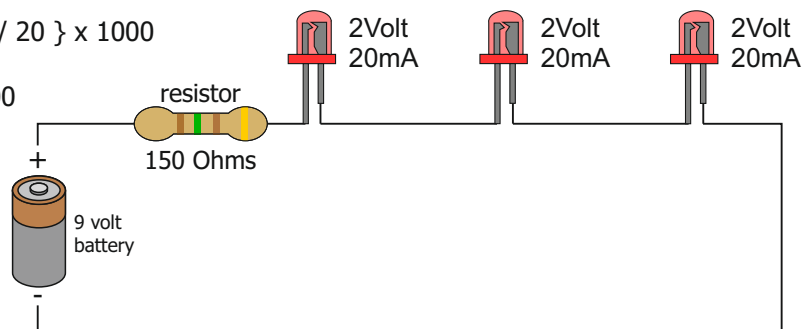
$$\text{Resistor (Ohms)} = \{ [ 9 - ( 2 + 2 + 2 ) ] / 20 \} \times 1000$$

$$\text{Resistor (Ohms)} = \{ [ 9 - 6 ] / 20 \} \times 1000$$

$$\text{Resistor (Ohms)} = \{ 3 / 20 \} \times 1000$$

$$\text{Resistor (Ohms)} = 0.15 \times 1000$$

$$\text{Resistor (Ohms)} = 150$$



note: The sum of the LED's forward voltage can not exceed the voltage available so in the example above the maximum number of LED's is 4.