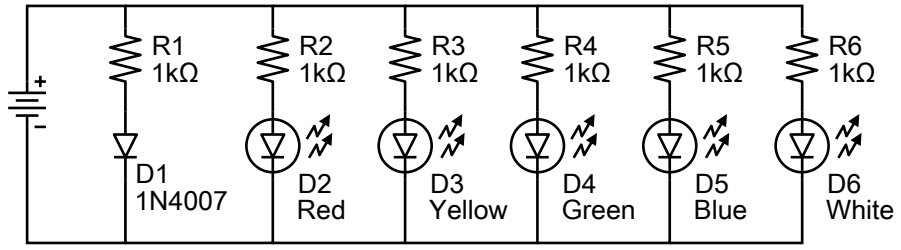
Activity: LED Voltage and Power versus Color



For this activity, we will examine the electrical characteristics of the circuit diagram given above. First study the circuit, then answer the pre-activity questions below.

1. Why do we use a resistor in series with each diode? What would happen if we removed it?

2. Do you expect more power to be dissipated by the light-emitting diodes (LED) or the diode that does not emit light? Why?

3. For light, how does wavelength and frequency relate to the color of light? How does wavelength of light relate to photon energy? Ignoring the white LED, which color of LED will produce the highest energy photons?

4. Since all resistors are 1kΩ, do you expect the current flowing through each branch to be the same? Why might the current differ between branches with different diodes?

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Measure the voltage across each resistor and diode given a power supply of 5 volts and record the values in the table, below.

To calculate the current through each branch, use ohm's law to calculate the current flow through the resistor. For example, if there is a voltage of 2.5V across a resistor of 1kΩ, the current flowing through the resistor is calculated with:

$$V = IR \; ; \quad I = \frac{V}{R} = \frac{2.5}{1000} = \mathbf{2.5\ mA}$$

To calculate the power consumed by the diode, use $P = VI$. Note that the current through the diode will be the same as the current through the resistor.

	Branch	1	2	3	4	5	6
5V	Diode Light Color	none	red	yellow	green	blue	white
	Resistor Voltage [V]						
	Diode Voltage [V]						
	Current [mA]						
	Diode Power [mW]						

Repeat the experiment using a 3.3V supply.

	Branch	1	2	3	4	5	6
3.3V	Diode Light Color	none	red	yellow	green	blue	white
	Resistor Voltage [V]						
	Diode Voltage [V]						
	Current [mA]						
	Diode Power [mW]						

5. How does diode color relate to its forward voltage? Relate this to wavelength and photon energy.

6. Which color of LED do you feel looks the brightest? It seems the power doesn't explain which LED appears the brightest. List three factors that might affect how bright an LED appears.

If we wish different colored LEDs to appear equally bright, we will need to adjust their resistor values.