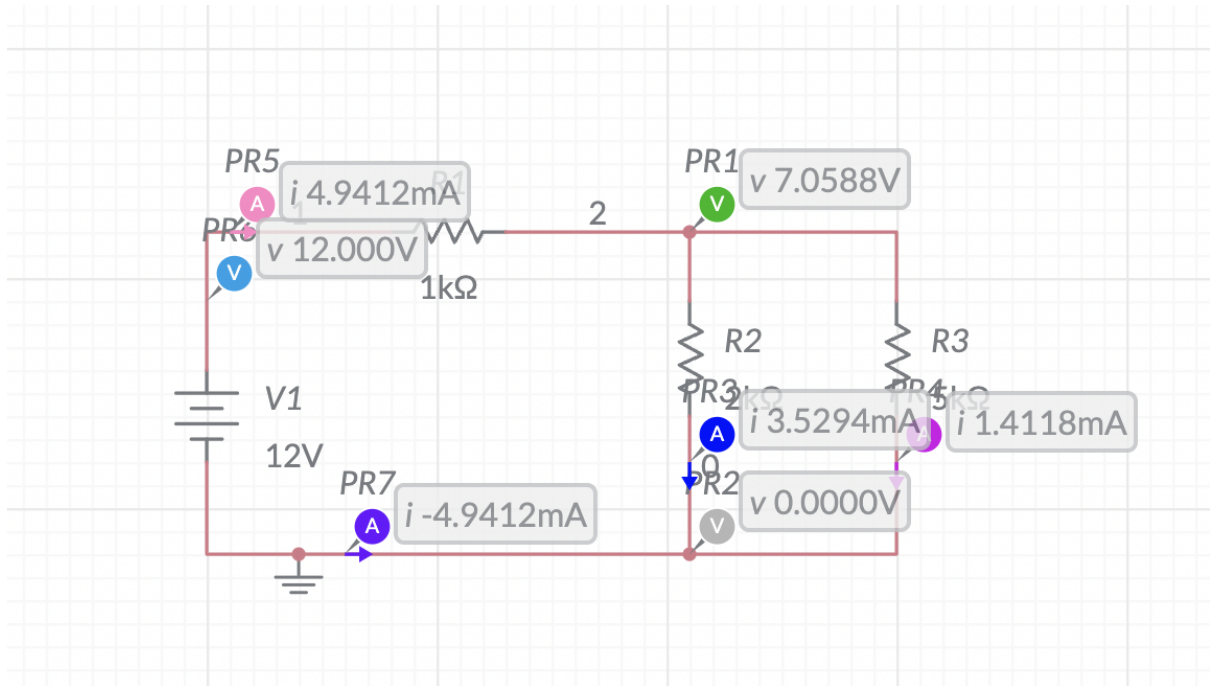


# CSU11031 Electronics Assignment 1

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## 1 Problem 1



### 1.1 (i) Verify the voltage and current

a) Voltage

To use the Voltage Divider rule, we need to calculate the total resistance  $R_4$  of parallel resistance  $R_2$  and  $R_3$ .  $R_4$  is given by

$$\frac{1}{R_4} = \frac{1}{R_2} + \frac{1}{R_3} \quad (1.1)$$

where  $R_2 = 2k\Omega$ ,  $R_3 = 5k\Omega$ , then the calculation is

$$\frac{1}{R_4} = \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{2000} + \frac{1}{5000} = \frac{7}{10000} = \frac{1}{1428.6} \quad (1.2)$$

$$R_4 = 1428.6\Omega$$

According to the Voltage Divider rule, the voltage in a serial circuit is given by

$$V_4 = V_{total} * \frac{R_4}{R_{total}} = \frac{R_4}{R_1 + R_4} \quad (1.3)$$

Given  $V_{total} = 12V$ ,  $R_1 = 1000\Omega$ ,  $R_4 = 1428.6\Omega$

$$V_4 = 12V * \frac{1428.6\Omega}{2428.6\Omega} = 7.0588V \quad (1.4)$$

b) Current

According to the current rule, the total current in the circuit is given by

$$i_{total} = \frac{V_{total}}{R_{total}} = \frac{12V}{2428.6\Omega} = 4.94mA \quad (1.5)$$

In the parallel circuit formed by R2, R3, the current is divided by

$$i_2 = \frac{V_4}{R_2} = \frac{7.0588V}{2000\Omega} = 3.5294mA \quad (1.6)$$

$$i_3 = \frac{V_4}{R_3} = \frac{7.0588V}{5000\Omega} = 1.4117mA \quad (1.7)$$

## 1.2 (ii) Verify by calculation Kirchoff's Current Law for the circuit

According to Kirchoff's Current Law, for  $i_2$  and  $i_3$

$$\sum I_{node} = 0 \quad (1.8)$$

$$3.5294mA + 1.4117mA + (-4.94mA) = 0 \quad (1.9)$$

## 1.3 (iii) Verify by calculation Kirchoff's Voltage Law for the circuit

According to Kirchoff's Voltage Law, for  $V_1$  and  $V_4$

$$\sum_{loop} V_{Branch} = 0 \quad (1.10)$$

$$V_1 = V_{total} * \frac{R_1}{R_{total}} = 12V * \frac{1000}{2428.6}\Omega = \quad (1.11)$$

## 1.4 (iv) Replace the battery with a 12V (peak) AC source

Run the simulation, observe grapher and explain your results.

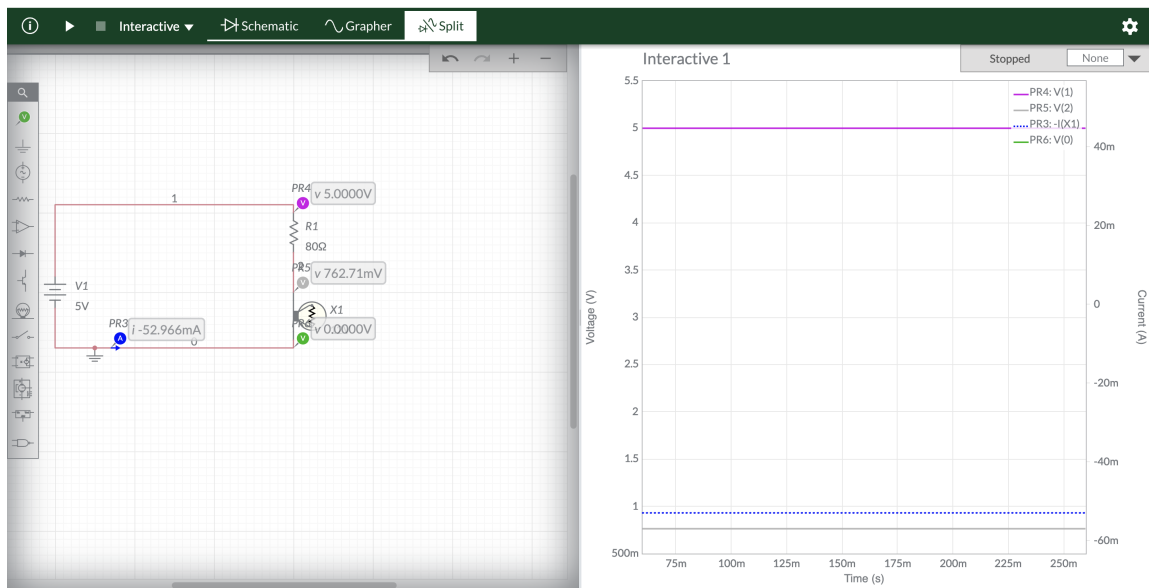


Figure 1: Circuit2.(i)

## 2 Problem 2

### 2.1 (i) Run the simulation

What do you observe?

The voltage of the circuit is divided by the voltage division law, giving the 12V bulb an approximately 0.7V voltage. Therefore the light bulb barely light up.

### 2.2 (ii) Replace R1 with a 1K resistor

What do you observe and why?

### 2.3 (iii) With R1 at 80 Ohms, place a 1K resistor in parallel with the lamp

What do you observe and why?

### 2.4 (iv) Replace the parallel 1K resistor with a 10 Ohm resistor keeping R1 at 80 Ohms

What do you observe and why?