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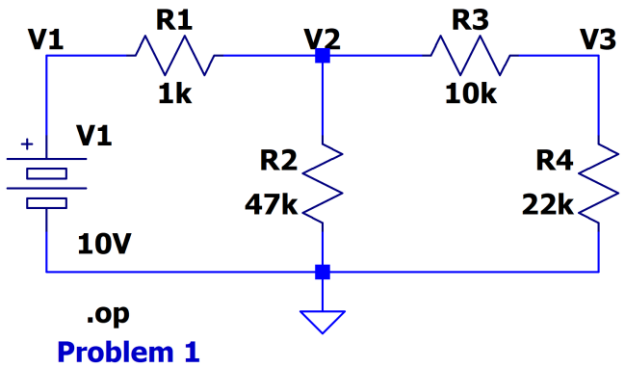
Laboratory-2 DC Power Supplies, Resistors and Digital Multi-Meters

SPICE Simulation

Problem 1

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--- Operating Point ---

V(v1):          10              voltage
V(v2):          9.50095         voltage
V(v3):          6.5319          voltage
I(R4):          -0.000296905    device_current
I(R2):          -0.000202148    device_current
I(R3):          -0.000296905    device_current
I(R1):          -0.000499052    device_current
I(V1):          -0.000499052    device_current
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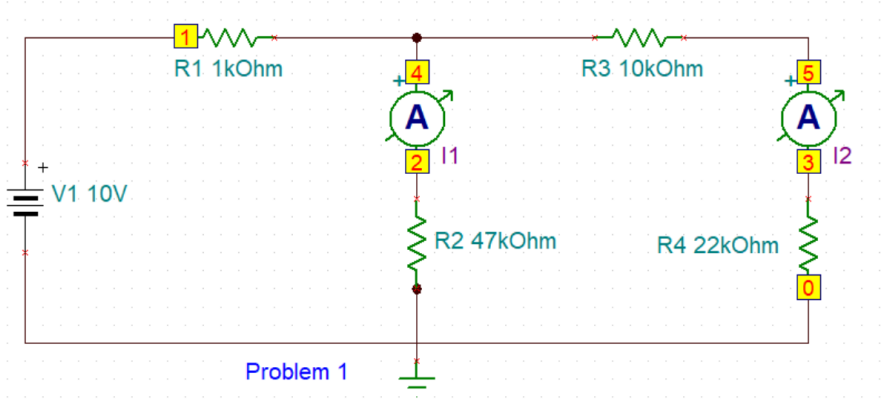
Fig 1. Circuit Diagram & Operating Points (LTSpice)



I_R1[1,4]	499.05uA
I_R2[2,0]	202.15uA
I_R3[5,4]	-296.9uA
I_R4[0,3]	-296.9uA
I1	202.15uA
I2	296.9uA
V_I1[4,2]	0V
V_I2[5,3]	0V
V_R1[1,4]	499.05mV
V_R2[2,0]	9.5V
V_R3[5,4]	-2.97V
V_R4[0,3]	-6.53V
V_V1[1,0]	10V
VP_1	10V
VP_2	9.5V
VP_3	6.53V
VP_4	9.5V
VP_5	6.53V

Fig 2. Circuit Diagram and Operating Point (TINA TI)

Table 1

	Simulated Values
V_{R1}	499.05mV
V_{R2}	9.5V
V_{R3}	-2.97V
V_{R4}	-6.53V
I_1	202.15uA
I_2	296.9uA
Power Delivered	≈ 5mW
Power Absorbed	$1.92\text{mW} + 0.881\text{mW} + 1.94\text{mW} \approx 4.741\text{mW}$

Problem 2

1. What are the color codes for 1k, 10k and 20k resistors?

a) 1k Brown Black Red

b) 10k Brown Black Orange

c) 20k Red Black Orange

2. What are the values of resistors with the following color codes (with units)?

a) Red Red Yellow 22kOhms

b) Brown Black Brown 100 Ohms

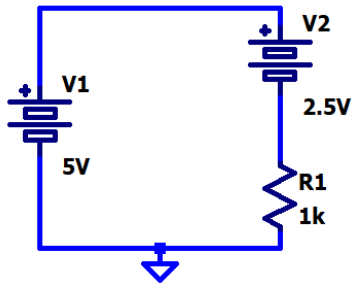
c) Green Blue Violet 560MOhms

Maximum Possible Currents

3. What maximum current can a 1kOhm, 0.25W resistor can handle? 15.81 mA
4. What maximum current can a 47kOhm, 0.25W resistor can handle? 2.30 mA
5. What maximum current can a 10kOhm, 0.25W resistor can handle? 5 mA
6. What maximum current can a 22kOhm, 0.25W resistor can handle? 3.37 mA

Problem 3

Sweep the voltage source V1 from 0V to 5V with 0.5V increment and plot the curve of V1 versus I when voltage source V2 equals to 2.5V and 5V.



Problem 3 - Voltage-Current Characteristics

.dc V1 0 5 0.5

Fig 3. Circuit Diagram

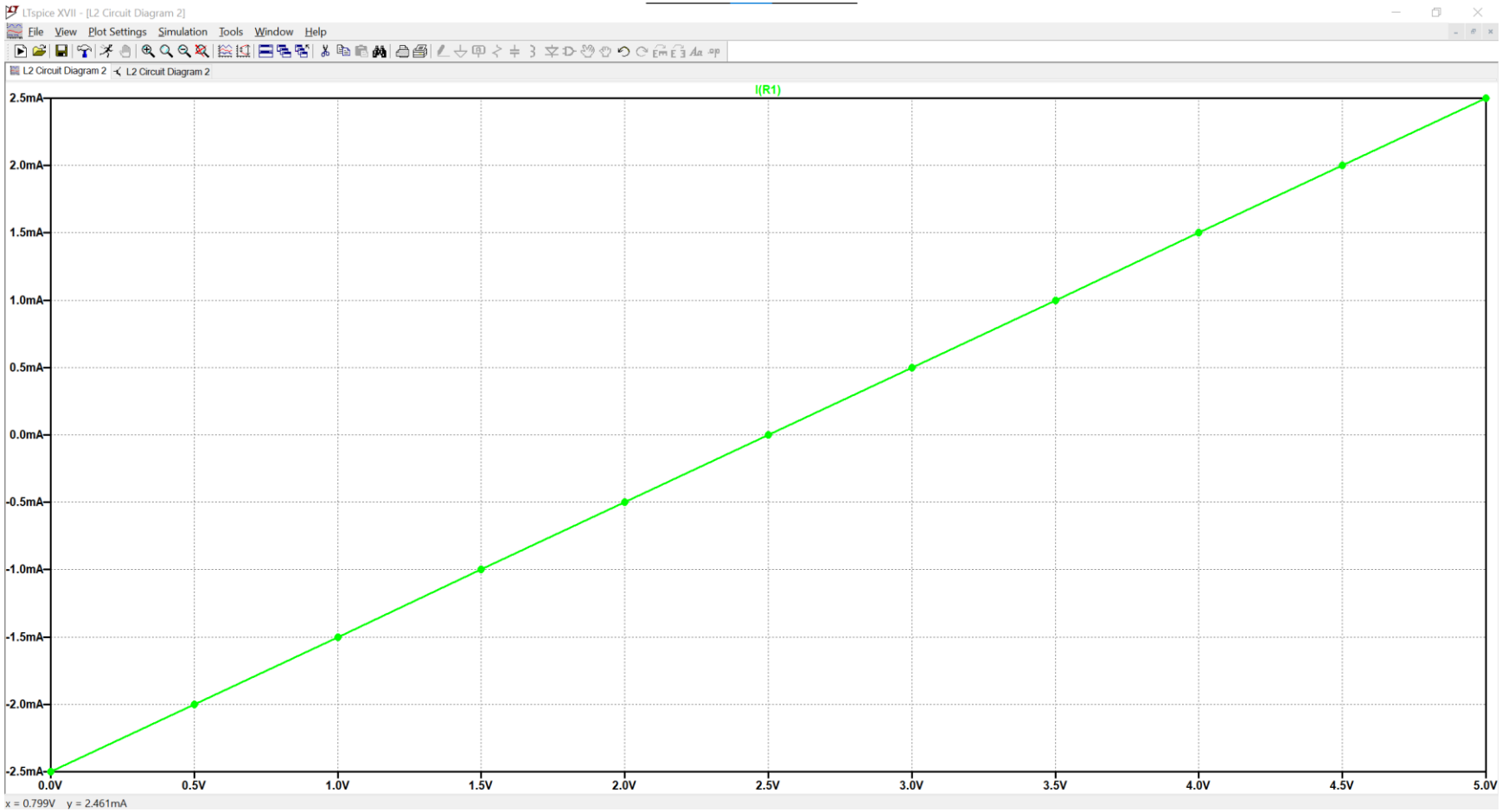


Fig 4a. Voltage Current Characteristics (Device Voltage 2.5V)

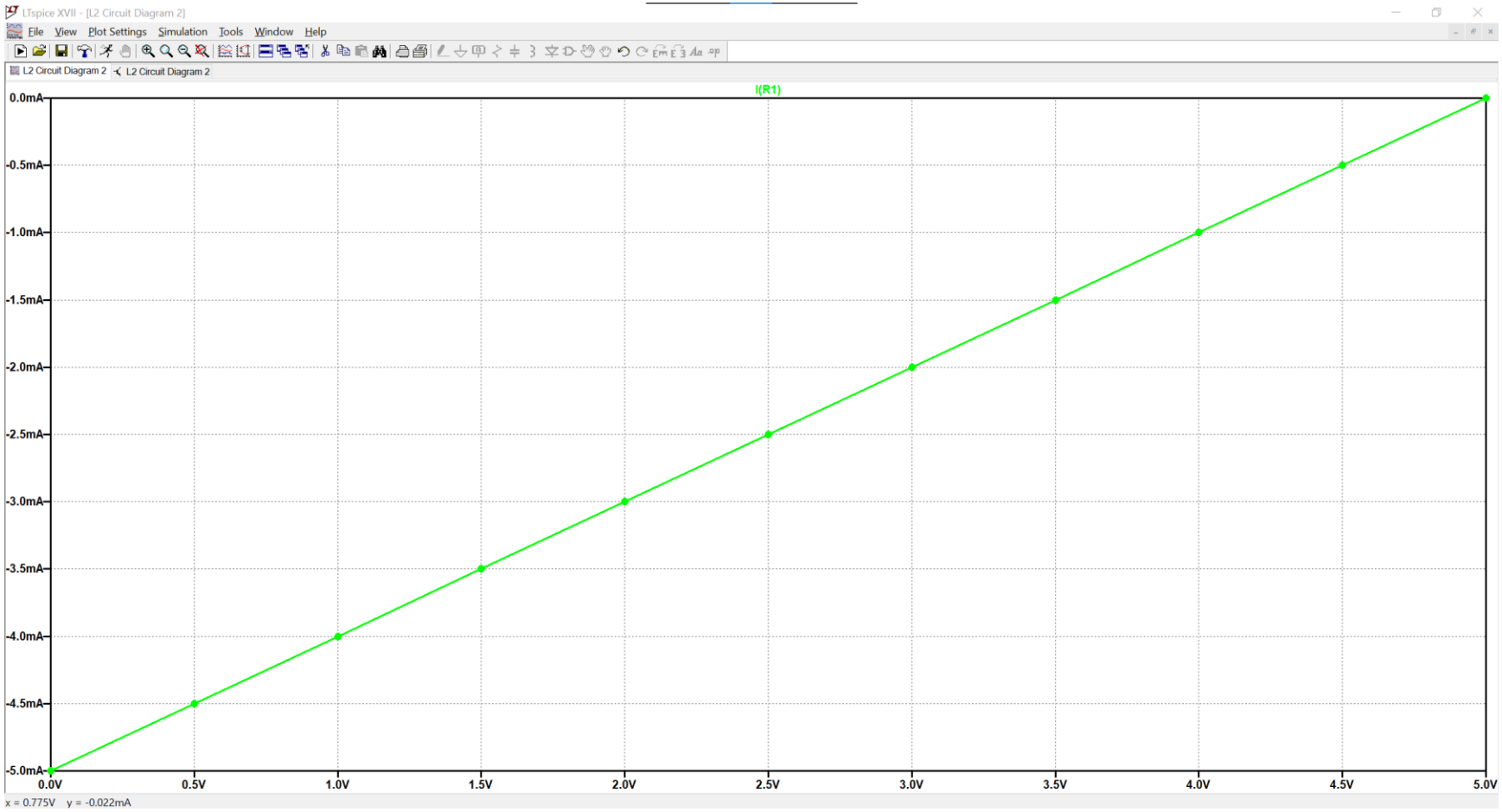


Fig 4b. Voltage Current Characteristics (Device Voltage 5V)

1. If the power rating for R1 is 0.25 W, what is the range to sweep when source voltage V2 equals to 2.5V and 5V?

$$V = \frac{P}{I} = \frac{0.25}{15.81 * 10^{-3}} = 15.81V$$

The maximum current through a 1kOhm resistor with a power rating of 0.25W is 15.81mA. So, when the V2 of device equals 2.5 and 5 volts, the input DC power supply can be swept upto 15V without any damage to the resistor.