1):

$P = I^2R$

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0.25W 0.25W

I_1 I_2 $\because I_1 = I$ ① So the 1000Ω resistor will burn out first.

PHYS0525 Analog and Digital Electronics – Spring 2025

Assignment 1

Due Monday, January 27, 2024

$I^2R = 0.25$ $I^2 = \frac{1}{4} \times \frac{1}{1000}$

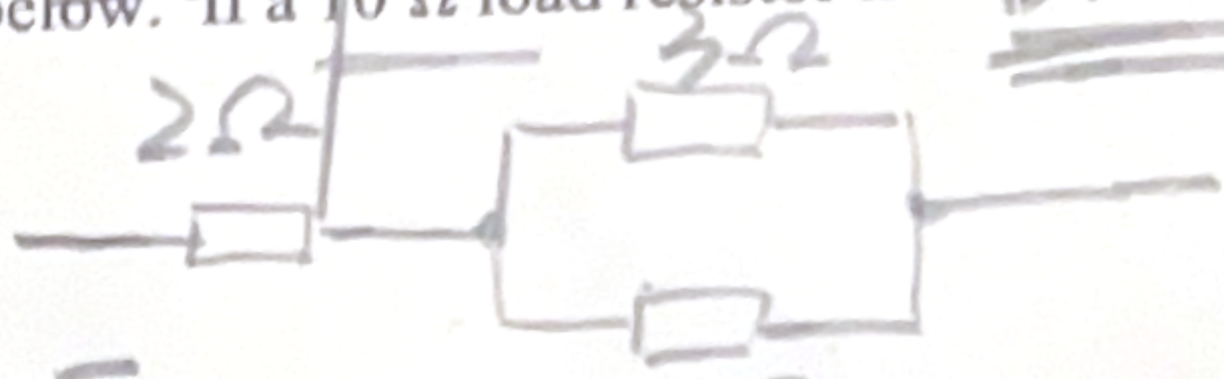
$I = 0.016A$ $\therefore V = 1500\Omega \times 0.016A = 24V$.

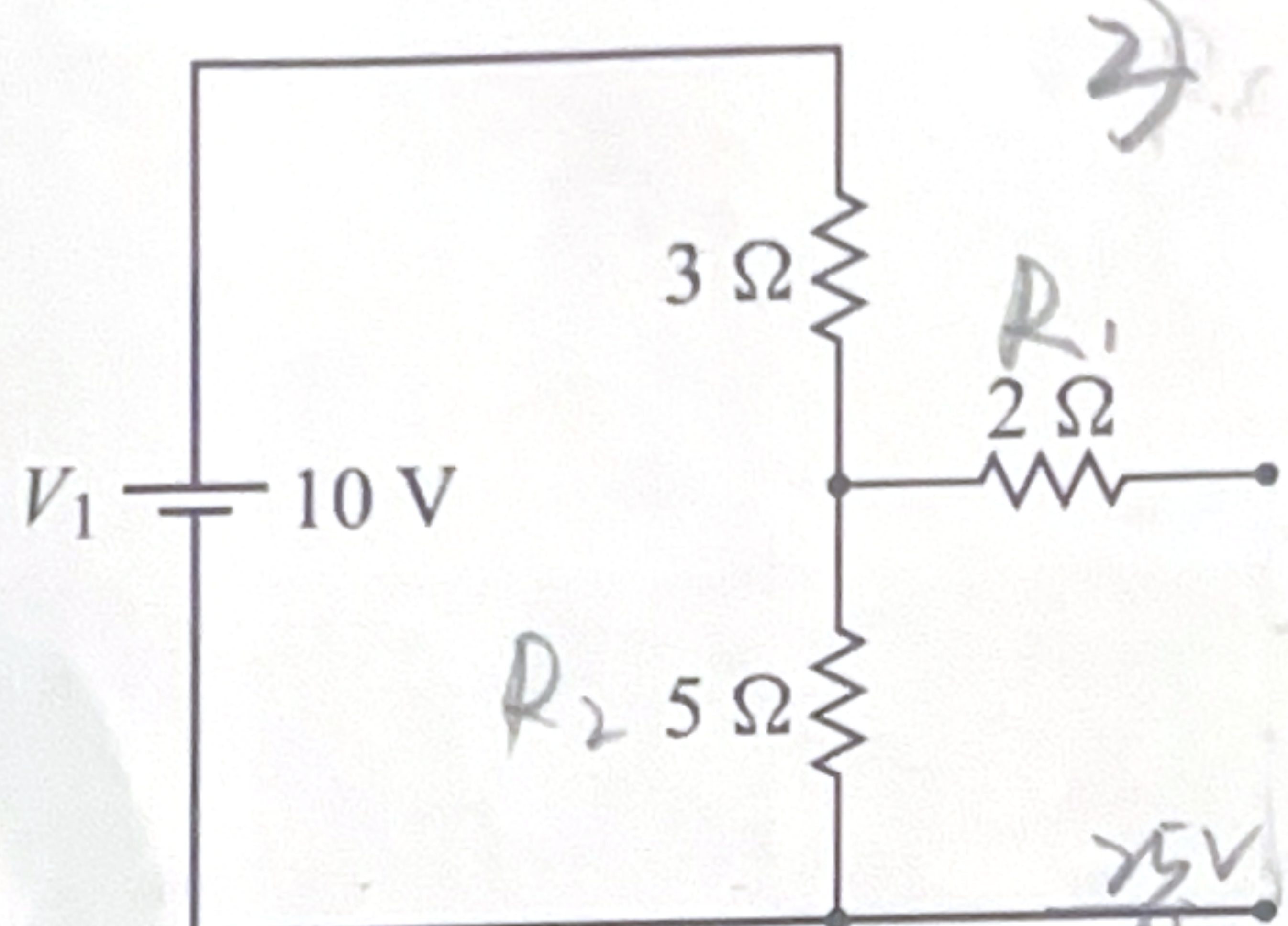
$\frac{1}{5} \frac{1}{3} + \frac{1}{5} = \frac{8}{15}$

1) A 500 Ω and a 1000 Ω resistor are connected in series, and both are rated to 0.25 W. The resistors are connected across a variable DC voltage supply. If you start at a low voltage and then turn up the voltage, which of the resistors will burn out first? At what voltage does this resistor burn out (assuming it does so right when it reaches it maximum rated power)?

② At 24V, this resistor burn out

2) Find the Thevenin equivalent circuit for the circuit shown below. If a 10 Ω load resistor is placed across the output, what is voltage across the output?



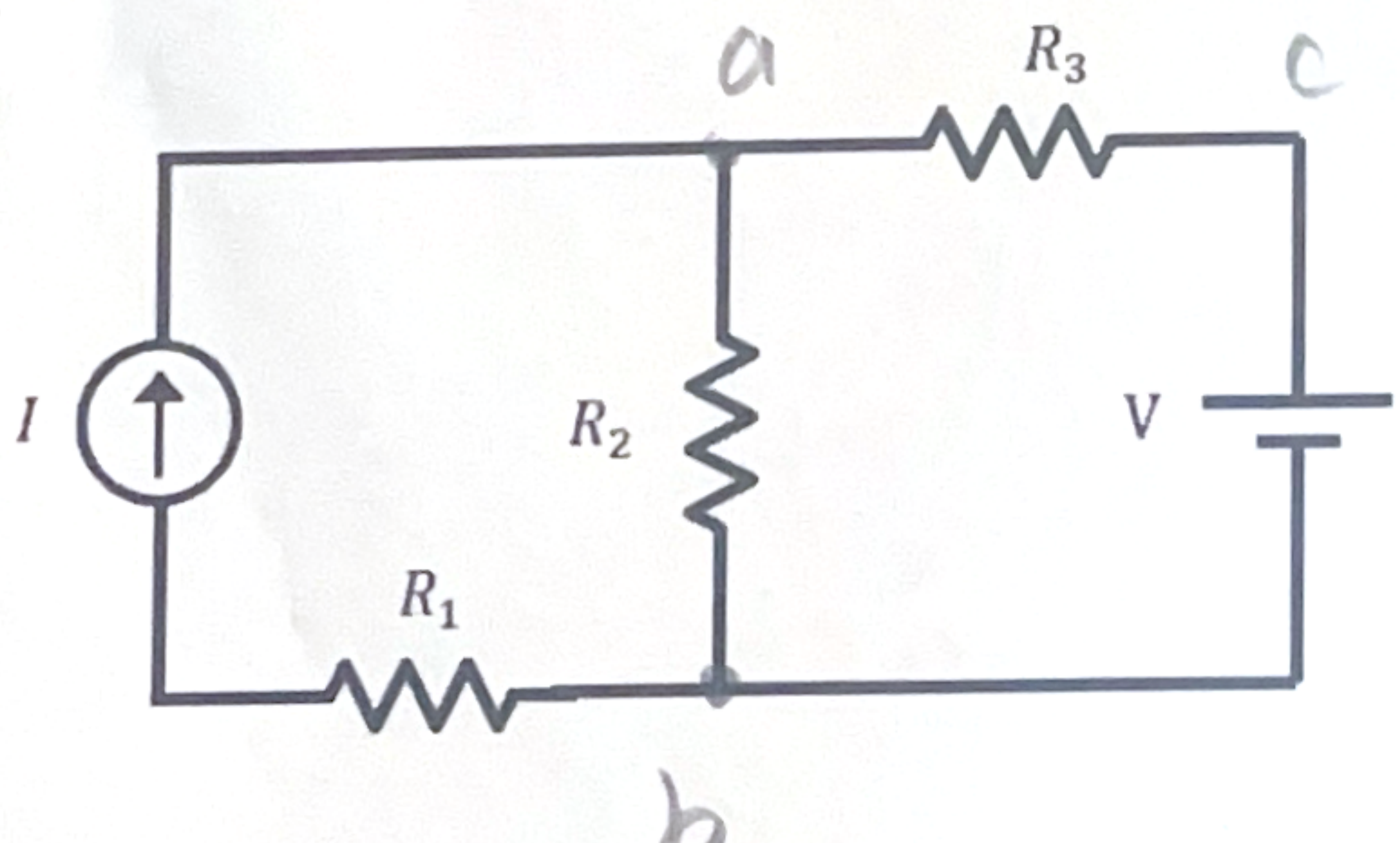


2) $R_{eq} = 2 + \frac{15}{8} = \frac{31}{8}\Omega$

$V_{th} = \frac{5}{8} \times 10 = \frac{25}{4}V$

$V = \frac{10}{\frac{31}{8} + 10} \times \frac{25}{4} = 4.50V$

3) A voltage source of voltage V, a current source with current I, and three resistors with resistances R_1, R_2, and R_3 are arranged into a circuit as shown below. What is the voltage across R_2? What is the current supplied by the voltage source?



3) $V_{ab} = IR_1 = V_{R_2}$

$V_{ac} = V - V_{ab}$

$= V - IR_1$

$\therefore I_3 = \frac{V_{ac}}{R_3} = \frac{V - IR_1}{R_3}$

the voltage across R_2 is IR_1

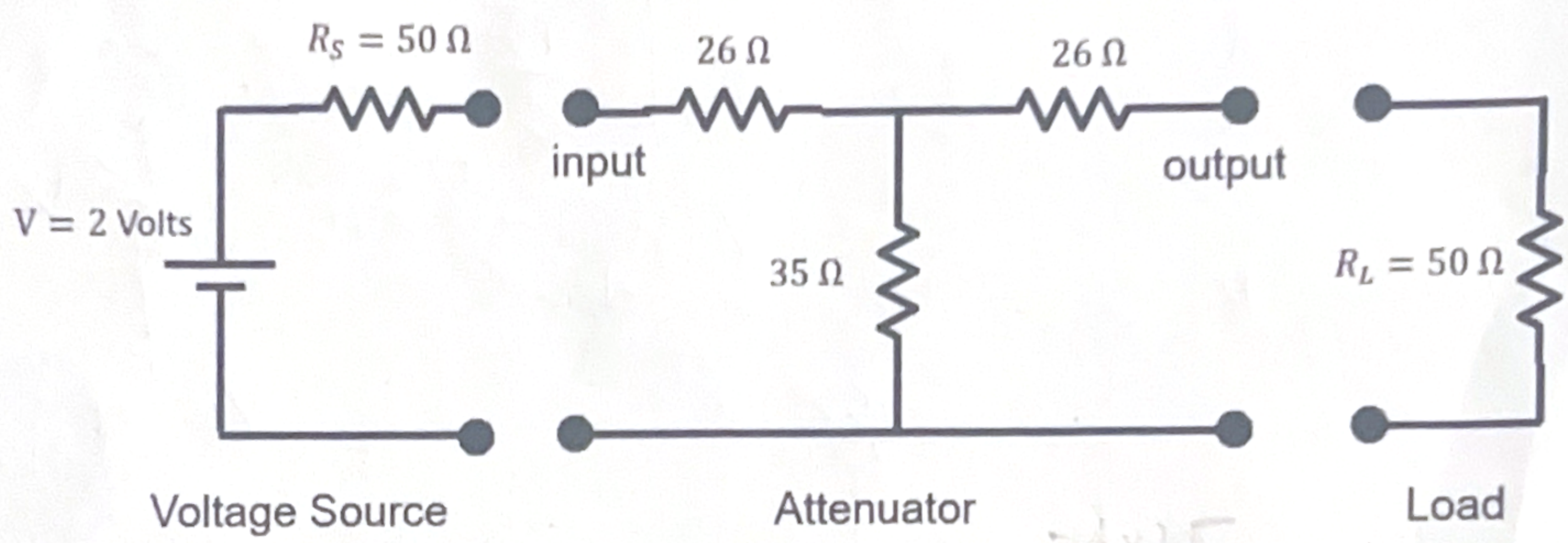
the current supplied by the voltage source is $\frac{V - IR_1}{R_3}$

4) A resistive attenuator circuit is drawn below. This circuit consists of 3 resistors with the values of the resistances given in the diagram.

a) Calculate the input resistance of the circuit if no load is attached to the output of the circuit. Also calculate the input resistance of the circuit if the load ($R_L = 50\ \Omega$) is attached to the output of the circuit. (Assume the voltage source is not yet attached to the circuit.)

b) Calculate the power supplied to the load resistor if the voltage source with output resistance $R_s = 50\ \Omega$ is connected to the input of the attenuator circuit and the load is attached to the output of the circuit.

c) Calculate the power supplied to the load resistor if it is connected directly to the output terminals of the voltage source. Then compute the ratio of the power you calculated in part (b) to the power you just calculated. This is called the attenuation factor.



a): $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$ $\therefore R_{total} = 26 + 35 = 61\ \Omega$

$R_{total} = 26 + \frac{35 \times 76}{35 + 76} = 49.96\ \Omega$

b): $R_{eq} = 26 + \frac{35 \times 76}{35 + 76} \approx 50\ \Omega$

$V_{th} = \frac{35}{76 + 35} \times 2 = 0.63V$

$\therefore P_{(b)} = \frac{(0.315)^2}{50} = 0.00198W$

c): $P_{(c)} = \frac{1^2}{50} = 0.02\ W$

$\frac{P_{(b)}}{P_{(c)}} = \frac{0.00198}{0.02} = 0.099$

$= 9.9\%$