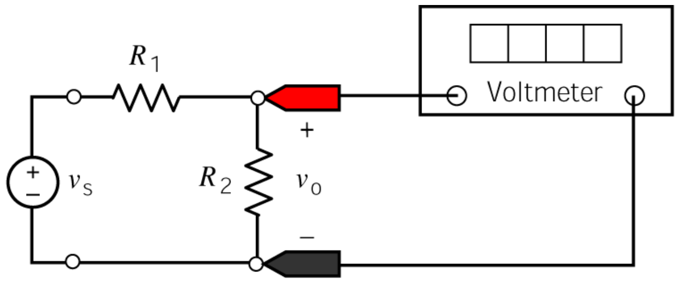

The input to this circuit is the source voltage, v_s. The output is the voltage measured by the meter, v_o. A voltage divider connects the source to the meter. Given these observations:

A. The input $v_s = 10$ V causes the output to be $v_o = 2$ V.
B. When $v_s = 50$ V the source supplies 5 W.

Answer the following questions:

a. What in the value of the output when $v_s = 25$ V?

From the given observations, the gain of the voltage divider is $g = \frac{v_o}{v_s} = \frac{2}{10} = 0.2$ V/V. Consequently, an input of $v_s = 25$ V causes the output to be $v_o = g\,v_s = 0.2 \times 25 = 5$ V.

b. What input is required to cause the output to be $v_o = 15$ V?

$$v_o = g\,v_s \quad \Rightarrow \quad 15 = 0.2\,v_s = v_s = \frac{15}{0.2} = 75 \text{ V}$$

c. How much power will the source supply when $v_s = 20$ V?

The power supplied by the source is $p = \frac{{v_s}^2}{R_1 + R_2} = \frac{{v_s}^2}{R_{in}}$ where $R_{in} = R_1 + R_2$. We may not know the resistance values, but we know that they haven't changed. From the given observations, $R_{in} = \frac{{v_s}^2}{p} = \frac{50^2}{5} = \frac{2500}{5} = 500\ \Omega$. Consequently, an input of $v_s = 25$ V requires the source to supply $p = \frac{{v_s}^2}{R_{in}} = \frac{25^2}{500} = \frac{625}{500} = 1.25$ W.

d. How much power will the source supply when the output is $v_o = 20\text{ V}$?

$$v_o = g\,v_s \quad \Rightarrow \quad 20 = 0.2\,v_s = v_s = \frac{20}{0.2} = 100\text{ V}$$

$$p = \frac{{v_s}^2}{R_{in}} = \frac{100^2}{500} = \frac{10000}{500} = 20\text{ W}$$

e. How large can the input be if we require that the source supplies at most 1 W?

$$1 \ge \frac{{v_s}^2}{500} \quad \Rightarrow \quad {v_s}^2 \le 500 \quad \Rightarrow \quad v_s \le \sqrt{500} = 22.36\text{ V}$$

f. What are the values of the resistances?

$$0.2 = g = \frac{R_2}{R_1 + R_2} \quad \text{and} \quad 500 = R_{in} = R_1 + R_2 \quad \Rightarrow \quad \begin{cases} R_1 = (1-g)\,R_{in} = 400\ \Omega \\ R_2 = g\,R_{in} = 100\ \Omega \end{cases}$$