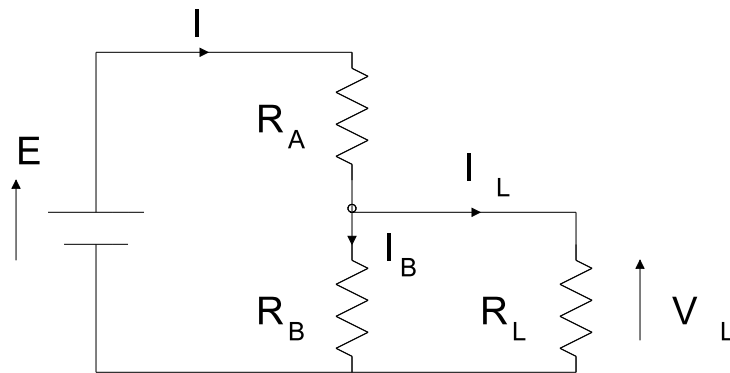


Programming Problem - Voltage Divider

Background



A device can be constructed to provide a source of electrical power within specified limits of voltage and current. Such a device is called a voltage divider, and is shown on the left.

Power is provided to the circuit from some primary source E . Only a portion of the source voltage is applied to the load resistor R_L .

The bleeder resistor R_B shunts some current I_B around the load. The load itself draws current I_L at voltage V_L . R_L and R_B are in parallel.

Problem Statement

Write a C++ program that calculates the load voltage and load current for

- (a) open circuit, and
- (b) a specified load resistance value.

Resistance values should be given as ohms.

The source voltage should be given in volts and the load voltage displayed as volts to two decimal places.

The load current should be displayed to the nearest milliampere (i.e., no decimal places).

Useful Formulae

On open circuit we have a series circuit consisting of two resistances R_A and R_B .

Hence the current will be

$$I = \frac{E}{R_A + R_B}$$

Thus the load voltage will be $V_L = I R_B$ with $I_L = 0$.

As long as we know the resistance values it is not necessary to calculate the current. The basic voltage divider equation for an open circuit is:

$$V_L = \frac{R_B}{R_A + R_B} E$$

If R_L has a finite value the circuit can still be solved if we remember that instead of R_B , the equivalent parallel resistance should be used. In that case, setting

$$R_e = \frac{R_B R_L}{R_B + R_L} \quad \text{then} \quad V_L = \frac{R_e}{R_A + R_e} E$$

Then load current will then be

$$I_L = \frac{V_L}{R_L}$$

Note: 1 A = 1000 mA

Generate at least one test case and work out the theoretical results, *before* you write the program.