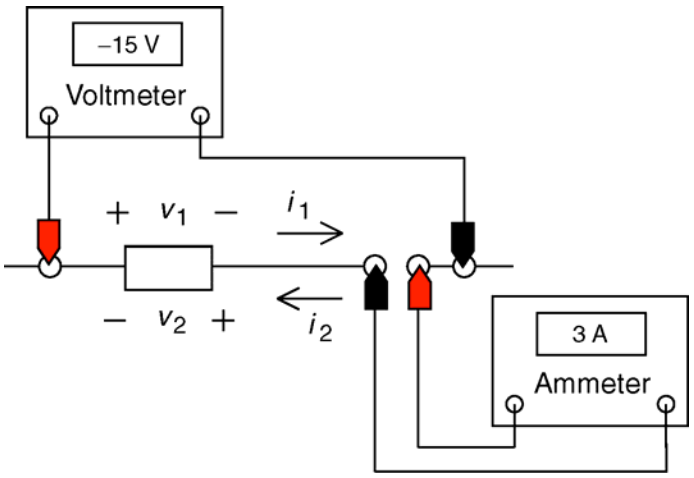
Passive Convention Exercises

Exercise 1:



The values of the element voltages and currents are

v_1 = _____ V, v_2 = _____ V, i_1 = _____ A and i_2 = _____ A.

The value of power received by the circuit element is _____ W.

Is it possible that the circuit element is a resistor? What would be the value of resistance?

Solution 1:

The values of the element voltages and currents are

$$v_1 = \_\_{-15}\_\_ \text{ V}, v_2 = \_\_\_15\_\_ \text{ V}, i_1 = \_\_\_\_{-3}\_\_ \text{ A and } i_2 = \_\_\_3\_\_\_\_ \text{ A}.$$

The value of power received by the circuit element is ___45___ W.

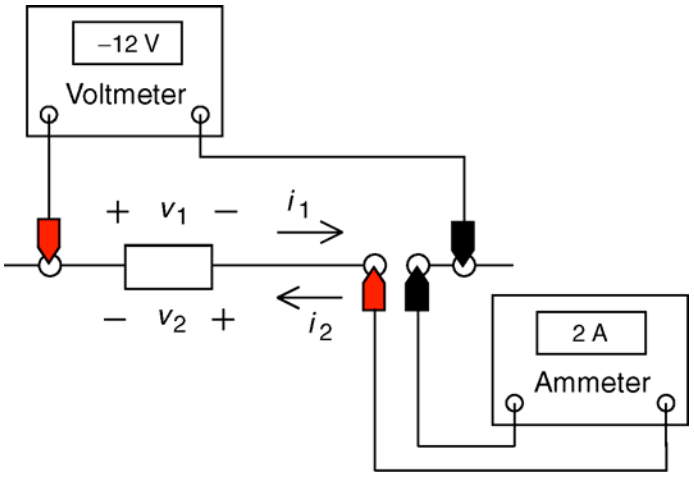
Is it possible that the circuit element is a resistor? What would be the value of resistance?

It's possible to build an electronic circuit that acts like a negative resistance, but we expect the resistance of a resistor to be positive, or at least non-negative. Here, noticing that v_1 and i_1 adhere to the passive convention, the resistance would be

$$R = \frac{v_1}{i_1} = \frac{-15}{-3} = 5\ \Omega$$

Consequently, the element can be a resistor.

Exercise 2:



The values of the element voltages and currents are

$$v_1 = \_\_\_\_\_ \text{ V}, v_2 = \_\_\_\_\_ \text{ V}, i_1 = \_\_\_\_\_ \text{ A and } i_2 = \_\_\_\_\_ \text{ A}.$$

The value of power received by the circuit element is _____ W.

Is it possible that the circuit element is a resistor? What would be the value of resistance?

Solution 2:

The values of the element voltages and currents are

v_1 = __–12__ V, v_2 = __12___ V, i_1 = ____2___ A and i_2 = ___–2___ A.

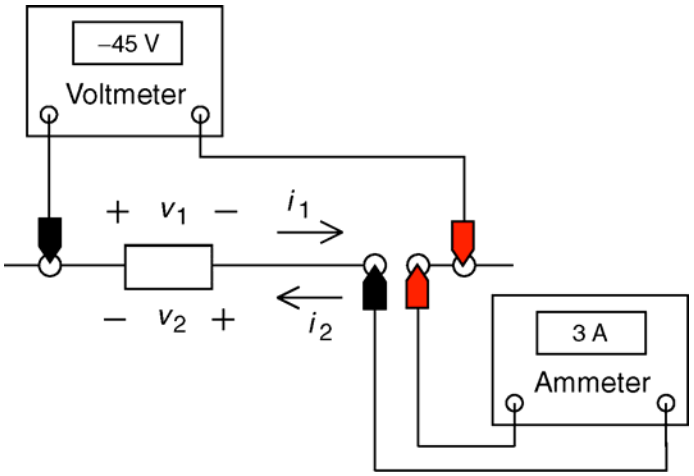
The value of power supplied by the circuit element is ___24___ W.

Noticing that v_1 and i_1 adhere to the passive convention, the resistance of the resistor would be

$$R = \frac{v_1}{i_1} = \frac{-12}{2} = -6\ \Omega$$

Consequently, the element cannot be a resistor.

Exercise 3:



The values of the element voltages and currents are

v_1 = _____ V, v_2 = _____ V, i_1 = _____ A and i_2 = _____ A.

The value of power received by the circuit element is _____ W.

The value of power supplied by the circuit element is _____ W.

Solution 3:

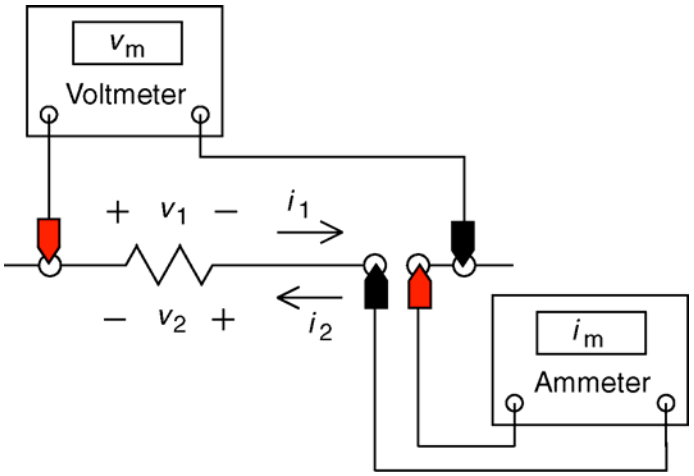
The values of the element voltages and currents are

$$v_1 = \_\_\_45\_\_ \text{ V}, v_2 = \_\_-45\_\_ \text{ V}, i_1 = \_\_\_\_-3\_\_ \text{ A and } i_2 = \_\_\_\_3\_\_\_ \text{ A}.$$

The value of power received by the circuit element is __−135___ W.

The value of power supplied by the circuit element is ___135__ W.

Exercise 4:



Suppose $v_m = 12$ V and $i_m = -2$ A. The value of power dissipated by the resistor is _____ W.

Suppose the resistance of the resistor is 15 Ω and $i_m = -2$ A. The value of voltage measured by the voltmeter is v_m = _____ V.

Suppose $v_m = 60$ V and $i_m = 5$ A. The value of resistance of the resistor is _____ Ω.

Solution 4:

Suppose v_m = 12 V and i_m = –2 A. The value of power dissipated by the resistor is __24__ W.

Suppose the resistance of the resistor is 15 Ω and i_m = –2 A. The value of voltage measured by the voltmeter is v_m = __30__ V.

Suppose v_m = 60 V and i_m = 5 A. The value of resistance of the resistor is __–12_ Ω. (It's probably not a good idea to suppose that v_m = 60 V and i_m = 5 A.)