Name _____ Period _____ Date _____

44

SERIES-PARALLEL CIRCUITS

USE LOGGER PRO - EXP 26A SERIES-PARALLEL CIRCUITS

Circuits such as that of Figure 44-1 are called series-parallel circuits. Arrangements of this type are frequently used when it is necessary to reduce the amount of current in a parallel circuit. The presence of R_1 in the circuit of Figure 44-1 increases the effective resistance of the circuit and, therefore, reduces the current available to the parallel portion of the circuit.

To find the effective resistance of the circuit, the effective resistance of the parallel portion must be found first. This is done by using the equation $\frac{1}{R_{2,3}} = \frac{1}{R_2} + \frac{1}{R_3}$. The circuit is then considered to be simply a series circuit with the first resistor (R_1) in series with the effective resistance of the parallel portion of the circuit.

Equipment

power supply or dry cells
~~three 10-ohm resistors~~
voltmeter (0-10 or 0-15 volt)
ammeters (0-1.5 and 0-15 A)
connecting wires
knife switch

10 Ω, 50 Ω, 68 Ω

$R_1 = 10\ \Omega$

$R_2 = 50\ \Omega$

$R_3 = 68\ \Omega$

* VOLTMETER AND AMMETER WILL NEED TO BE MOVED TO THE LOCATIONS SHOWN. YOU DON'T NEED 3 PROBES.

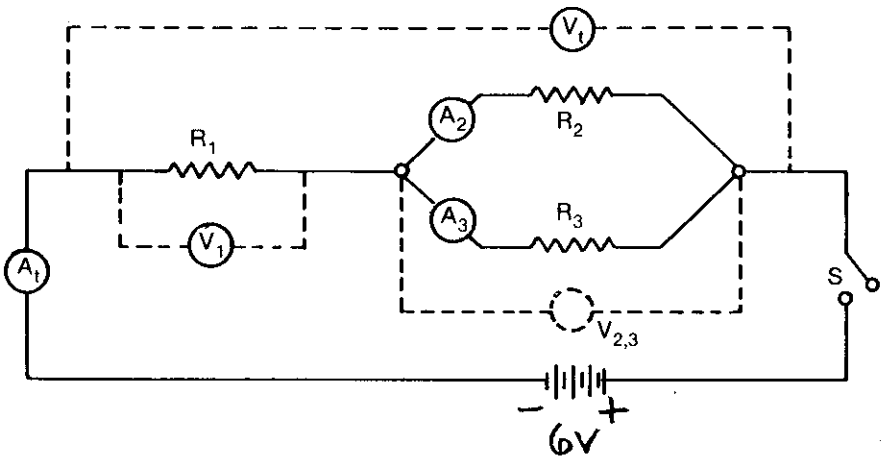

Figure 44-1. Ohm's law holds for complex circuits as well as for simple ones. Complex circuits may be reduced to simpler circuits.

Objective

During this investigation you will
investigate some characteristics of a series-parallel circuit.

Procedure

1. Fill in the spaces provided in Figure 44-2(a) in the Data and Observations section with the known values of the resistors you are using. Calculate the effective resistance of the parallel portion of the circuit, and then fill in the spaces provided in Figure 44-2(b). Figure 44-2(b) is called the equivalent circuit.
2. Set up the circuit as in Figure 44-1. Determine the ammeter and voltmeter readings for each of the positions of the meters as indicated. Reposition meters as necessary to obtain all the readings. Record your observations in Table 44-1.

Data and Observations

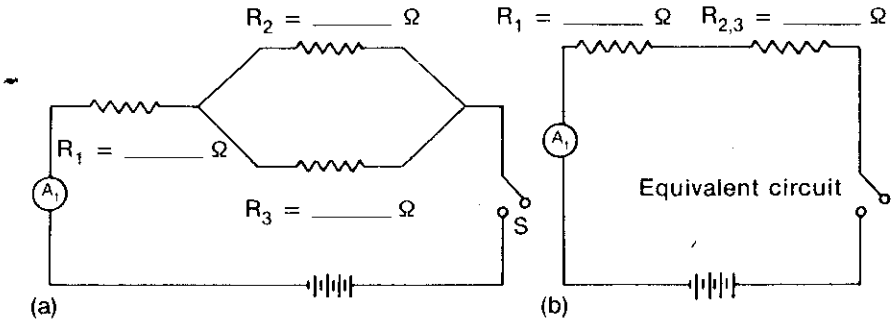

Figure 44-2. In part (a), fill in the value of each known resistor. Calculate the resistance of the parallel part of the circuit. Enter this as $R_{2,3}$ in part (b). Calculate the total resistance of the equivalent circuit, which is a series circuit.

1. Calculated effective resistance of equivalent circuit

   $(R_1 + R_{2,3}) =$ _____

   Printed value of R_1 _____

Table 44-1

Ammeter reading (A)			Voltmeter reading (V)		
I_t	I_2	I_3	V_t	V_1	$V_{2,3}$

2. Measured effective resistance, R_{eff}, of the circuit

   $(V_t/I_t) =$ _____

3. Measured value of R_1 = _____

4. Measured total current through parallel branch of

   circuit = _____

5. Measured effective resistance of parallel circuit _____

Interpretation

1. Describe the procedure you would use to analyze a series-parallel circuit in terms of Ohm's law.

   _____

   _____

2. How could you describe the amount of current flowing through the parallel part of the circuit in Figure 44-1?

   _____

   _____