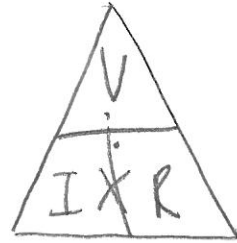


key

Electricity, Energy and Magnetism



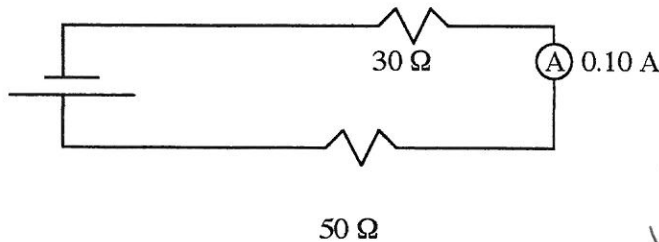
Exercises

Series = $R_1 + R_2 + R_3 \dots$

Parallel $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

- Three 20Ω resistors are connected in series across a 120 V generator. What current flows through the circuit?
 $R_T = 20 + 20 + 20 = 60 \Omega = R$
 $V = 120$
 $\frac{V}{R} = I \Rightarrow \frac{120}{60} = 2 \text{ amps}$
- Ten Xmas lights gave equal resistances. When connected to a 120 V outlet, a current of 0.50 A flows through each bulb. What is the resistance of one bulb?
 $\frac{V}{I} = R \Rightarrow \frac{120}{0.5} = 240 \Omega$
- A lamp with a resistance of 10Ω is connected across a 12 V battery. What resistance must be connected to the lamp to create a current of 0.50 A ?
 $\frac{V}{I} = R \Rightarrow \frac{12}{0.5} = 24 \Omega$
- A 20Ω resistor and a 30Ω resistor are connected in series and placed across potential difference of 100 V . Find the voltage drop across each resistor.
- Find the voltage across each resistor, as well as the total voltage.

a.



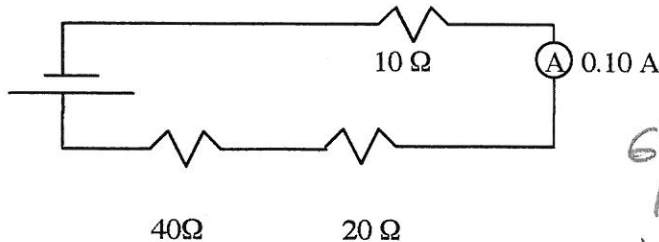
$$V = IR$$

$$5V = 50 \times 0.10$$

$$3V = 30 \times 0.10$$

$$V_T = 3V + 5V = 8V$$

b.



$$V = IR$$

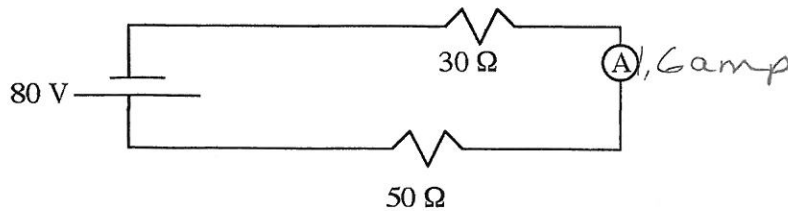
$$6V = (40 + 20) \times 0.10$$

$$1V = 10 \times 0.10$$

$$V_T = 1V + 6V = 7V$$

- Find the current as well as the voltage across each resistor.

a.



$$\frac{80}{50} = I$$

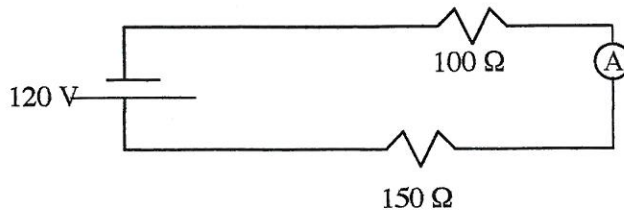
$$1.6 \text{ amp} = I$$

$$V = 30 \times 1.6$$

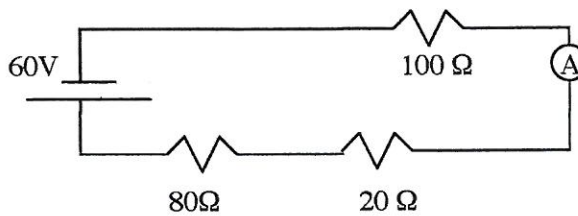
$$V = 48V$$

Ohm's Law and Circuits

b.



c.



7.

a. Draw a circuit consistent with the following information:

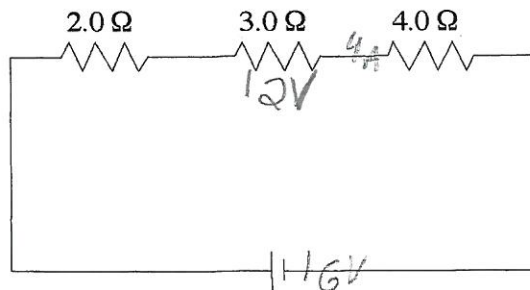
- $V_1 = 5.0 \text{ V}$ and R_1 is an unknown resistor
- There is a 2.0 A current measured by the ammeter next to the power source
- $R_2 = 2.0 \Omega$.

b. Calculate R_1

c. Find the voltage of the power source.

8.

Three known resistances are connected in series to the terminals of a power source. The potential difference at the terminals of the 3.0Ω resistance is 12 V .



a. What is the potential difference of the power source?

b. What is the voltage drop across the 4.0Ω resistor?

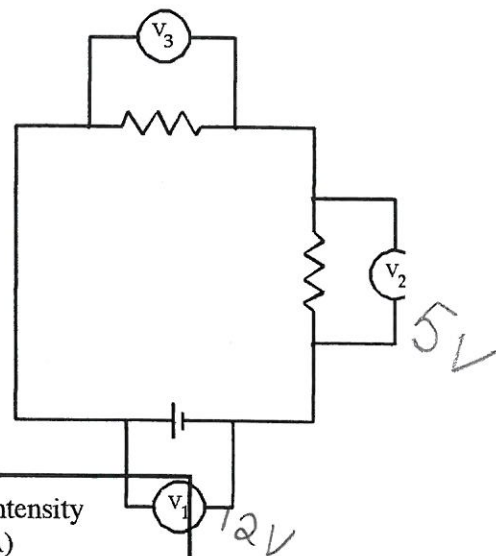
c. What is the voltage drop across the 2.0Ω resistor?

~~16V~~ $4 \times 4 = 16 \text{ V}$
 $16 - 12 = 4 \text{ V}$

Electricity, Energy and Magnetism

9. Use the diagram to your right, where $V_1 = 12\text{ V}$; $V_2 = 5.0\text{ V}$.

- a. What is the reading on voltmeter V_3 ?
- b. If the current flowing out of the battery was 125 mA , what would be the value of R_2 ?

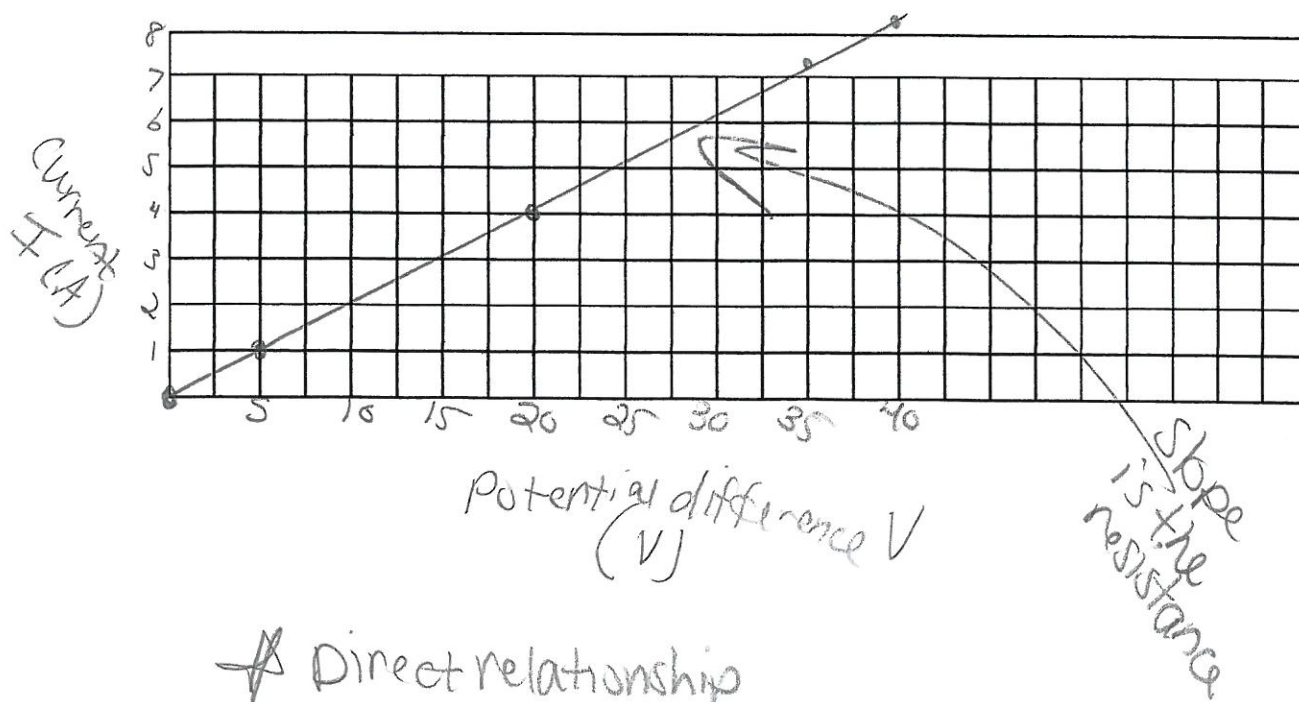


10. *Flashback*

In an electric circuit, the potential difference across the terminals of a resistor was set at different levels and the resulting current intensity was measured. The measurements are recorded in the table below.

Potential Difference $V\text{ (V)}$	Current Intensity $I\text{ (A)}$
0	0
5	1.0
20	4.1
35	7.1
40	8.1

Draw a graph using the above data and then use the graph to determine the resistance of this resistor.



Ohm's Law and Circuits

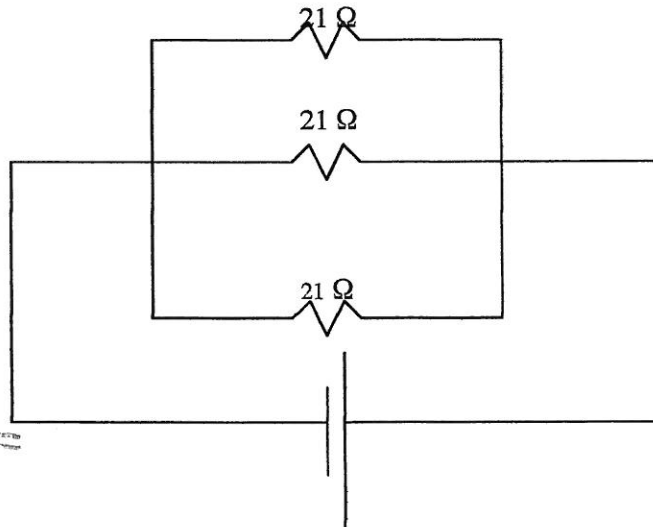
Example 3

In a parallel circuit, what effect does adding more resistors have on total current?

Exercises

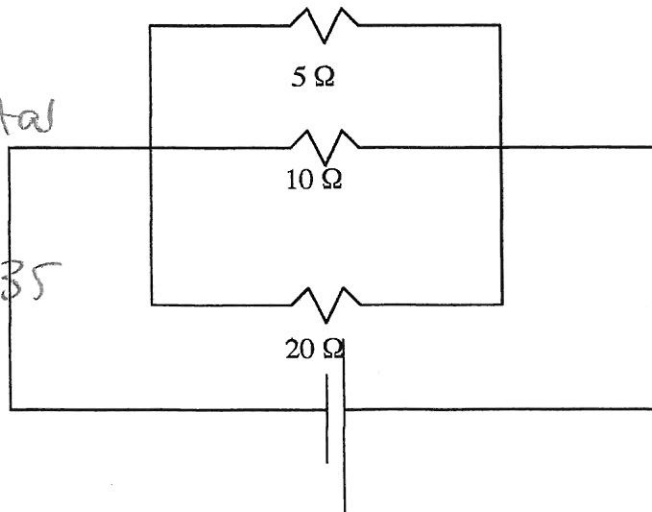
1. Find the total resistance in each case.

a.



$$\frac{1}{21} + \frac{1}{21} + \frac{1}{21} = \frac{1}{R_T}$$
$$R_T = 7\ \Omega$$

b.



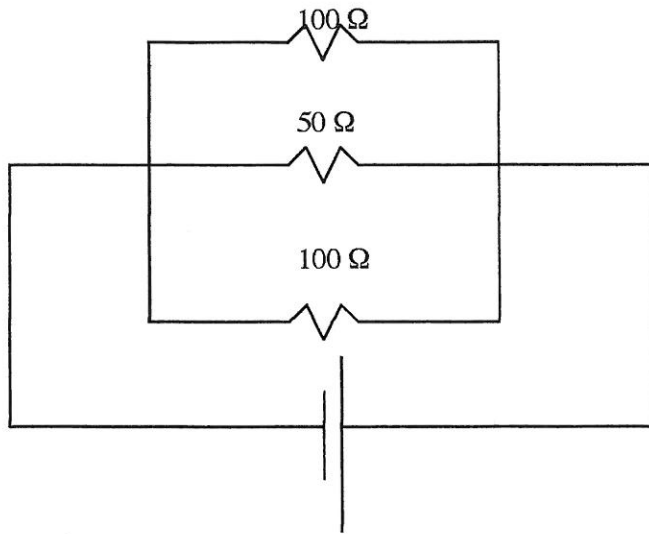
take inverse
of your
answer to find total
resistance

$$\frac{1}{5} + \frac{1}{10} + \frac{1}{20} = \frac{1}{R_T} = 0.35$$

$$R_T = 2.86\ \Omega$$

Electricity, Energy and Magnetism

c.



$$\frac{1}{100} + \frac{1}{50} + \frac{1}{100} = \frac{1}{R_T} = \frac{1}{25}$$

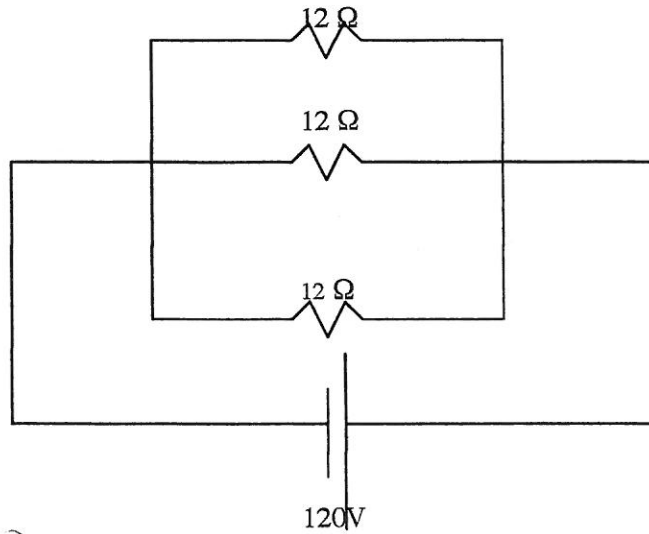
$$R_T = 25 \Omega$$

(answer: 25 Ω.)

2.

Find the current passing through each resistor.

a.

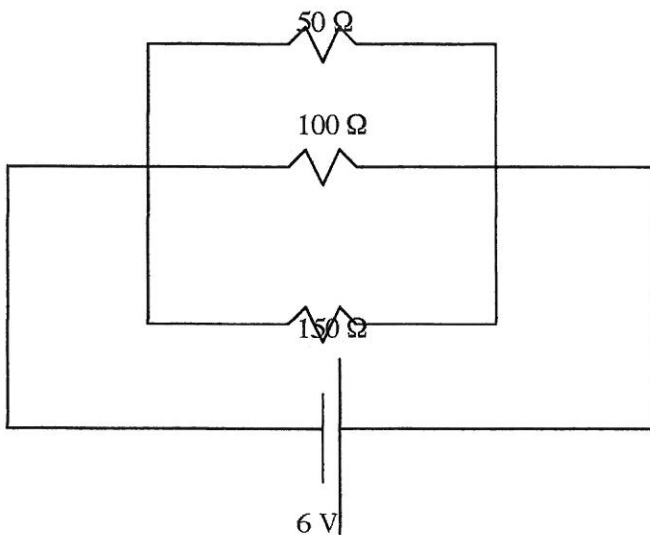


$$\frac{V}{R} = I \quad \frac{120}{12} = 10A$$

120

Ohm's Law and Circuits

b.

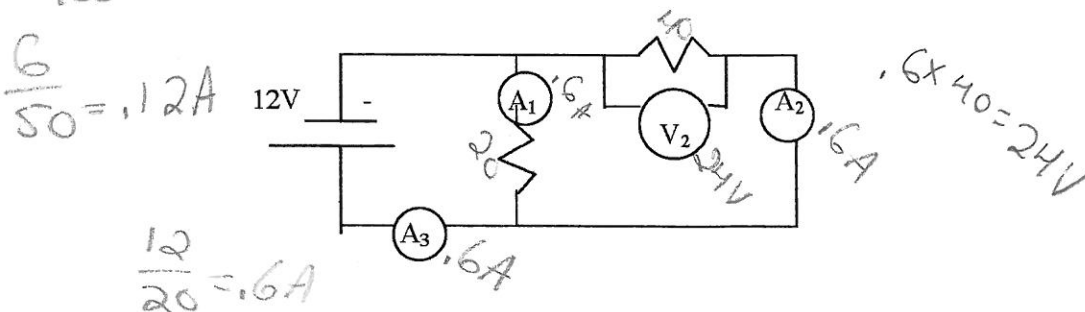


$$\frac{V}{R} = I$$

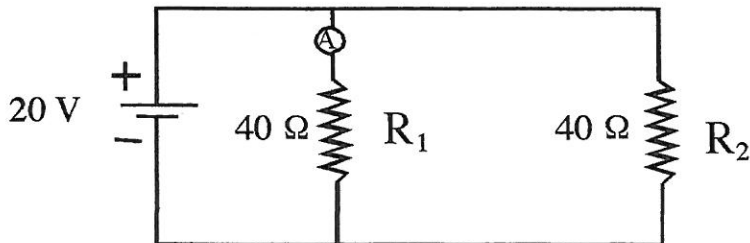
$$\frac{6}{150} = .04A$$

$$\frac{6}{100} = .06A$$

Find the missing reading for each meter. $R_1 = 20 \Omega$ and $R_2 = 40 \Omega$.



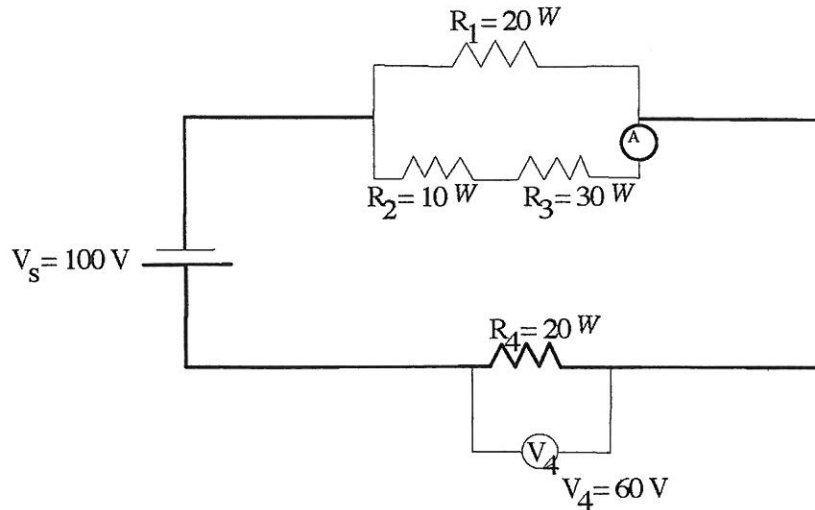
4. The electric circuit shown below consists of an ammeter A, a power supply, and resistors R_1 and R_2 connected in parallel.



What is the current intensity (I) flowing through the ammeter?

Ohm's Law and Circuits

11. The following electrical circuit consists of a power source, four resistors (R_1 , R_2 , R_3 and R_4) and a voltmeter V_4 ($V_s = V_{\text{total}}$).



What is the current intensity (I_3) through R_3 ?

12. How can one 25Ω and two 100Ω resistors be connected so that their total resistance is 75Ω ?
13. How can four 1.0Ω resistors and one 2.0Ω resistor be connected to give a combined resistance of 1.5Ω ?
14. Four identical resistors are connected as shown. If the total voltage is 12V , find the voltage across each resistor.

