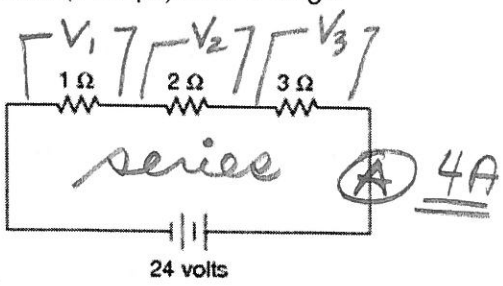
Series Circuits Worksheets

1. In this circuit, three resistors receive the same amount of current (4 amps) from a single source.

$V_1 = I_1 R_1$
$= (4A)(1\Omega)$
$= 4V$

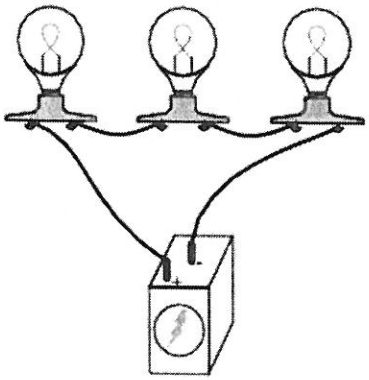
$V_2 = I_2 R_2$
$= (4A)(2\Omega)$
$= 8V$

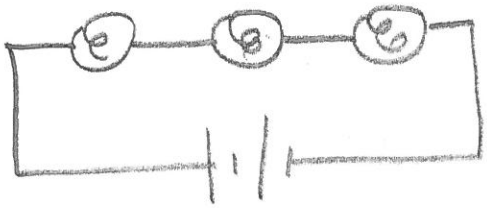


Calculate the amount of voltage "dropped" by each resistor.

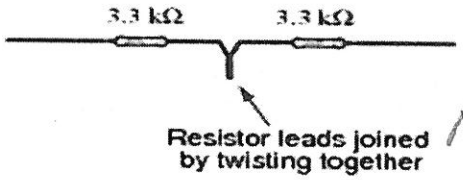
$V_3 = I_3 R_3$
$= (4A)(3\Omega)$
$= 12V$

2. Re-draw this circuit in the form of a schematic diagram:





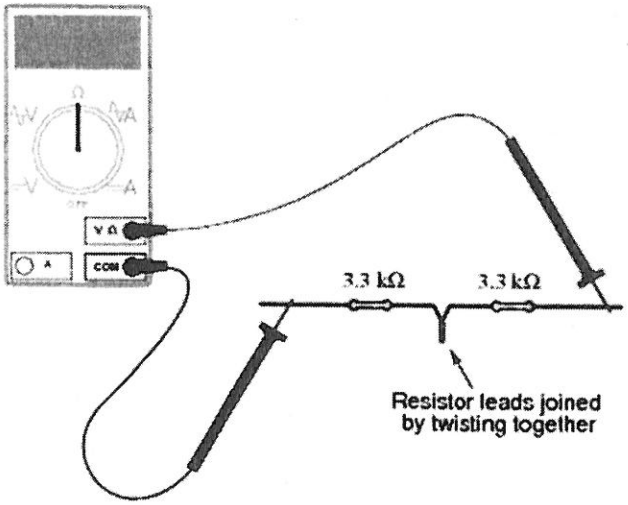
3. Suppose I connect two resistors in series with one another, like this:



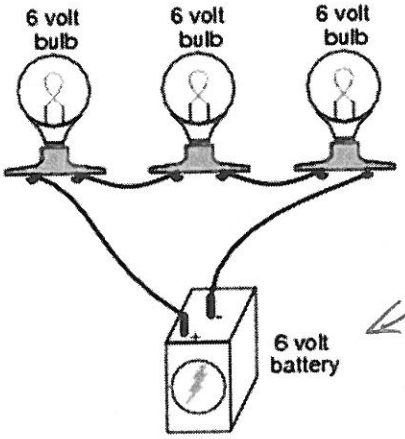
series

How much electrical resistance would you expect an ohmmeter to indicate if it were connected across the combination of these two series-connected resistors?

$R_T = R_1 + R_2$
$= 3.3k\Omega + 3.3k\Omega$
$R_T = 6.6 k\Omega$



4. What would happen if three 6-volt light bulbs were connected as shown to a 6-volt battery? How would their brightness compare to just having a single 6-volt light bulb connected to a 6-volt battery?



• connected this way they would dee be dim

6V

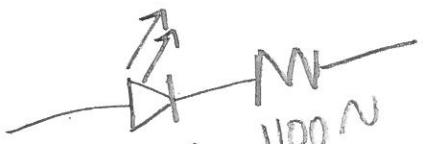
4 1 1

6V

= connected this way they'd be bright

5. Light-emitting diodes, or *LED*s, are rugged and highly efficient sources of light. They are far more rugged and efficient than incandescent lamps, and they also have the ability to switch on and off much faster because there is no filament inside needing to heat or cool:

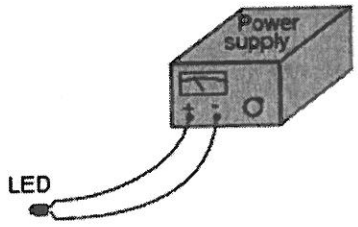
Close-up view of a light-emitting diode



in series
$\therefore R_T = 1200\ \Omega$

$20\text{mA} \times \frac{1\text{A}}{1000\text{mA}} = 0.02\text{ A}$

LEDs are low voltage devices, typically rated in the range of 1.5 to 2 volts DC maximum. Single diodes generally draw low currents as well, about 20 milliamps each. The problem is, how do you operate an LED from a typical electronic power source, which may output 24 volts DC or more?



The LED will become damaged if overpowered!

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

$\frac{2V}{0.02A} = 100\ \Omega$

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

$\frac{24V}{0.02A}$ = R needed to keep I at 0.02A

$1200\ \Omega = R$

6. Calculate the necessary series "dropping" resistor value to operate a 1.8 volt, 20 mA LED from a 34 volt DC power source.

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

$\frac{1.8V}{0.02A} - R = 90\ \Omega$

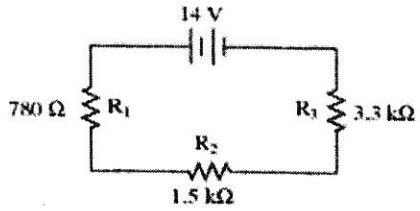
$\frac{V=IR}{I\ \ I}$

$\frac{34V}{0.02A} = R = 1700\ \Omega$

$\therefore 1700\ \Omega - 90\ \Omega =$

$1610\ \Omega = R$ needed.

7. Complete the table of values for this circuit:



	R_1	R_2	R_3	Total
V	1.95V	3.75V	8.25V	14V
I	0.0025	0.0025	0.0025	0.0025A
R	780 Ω	1.5 kΩ	3.3 kΩ	5580Ω
P				

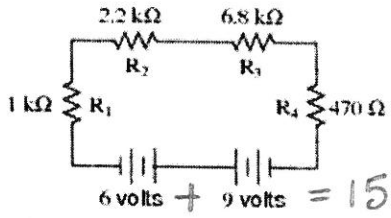
① $R_T = R_1 + R_2 + R_3$

780Ω
1500Ω
3300Ω
5580Ω = R_T

③ $V = IR$

② $\frac{V_T}{R_T} = \frac{IR}{R} = I_T = \frac{14V}{5580\Omega} = 0.0025A = I_T$

8. Complete the table of values for this circuit:



	R_1	R_2	R_3	R_4	Total
V	1.4V	3.08V	9.52V	0.658V	15V
I	0.0014A	0.0014	0.0014	0.0014	0.0014 A
R	1 kΩ	2.2 kΩ	6.8 kΩ	470 Ω	10470Ω
P					

① $R_T = R_1 + R_2 + R_3 + R_4$
$= 1000\Omega + 2200\Omega + 6800\Omega + 470\Omega$

$R_T = 10470\Omega$

② $V_T = V_1 + V_2 = 15V$

③ $\frac{V_T}{R_T} = \frac{I_T R_T}{R_T} = \frac{15V}{10470\Omega} = 0.0014A$

④ $V = IR$