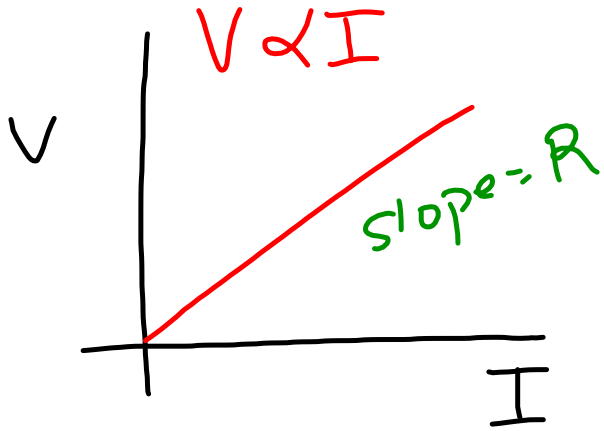
Ohm's Law

Lab first

A resistor is a linear circuit element. The relationship between current and voltage for a resistor is a linear or directly proportional relationship. A graph of voltage and current gives a linear graph.

3 uses...

control current
to create heat
to create light



V = IR

52.(c) A student measured the potential difference across, and the current through, two circuit elements, X and Y, and obtained the following data.

Element X

Potential difference (V)	Current (A)
1	1
10	3
35	5

Element Y

Potential difference (V)	Current (A)
5	1
15	3
25	5

(i) Draw a clearly labelled voltage vs. current graph for each element.

(ii) Which element obeys Ohm's law? Explain.

_____

_____

_____

_____

(iii) Calculate the resistance of the element in (ii).

Ohm's Law

V = IR

Current

$$I = \frac{Q}{t}$$

Voltage

$$V = \frac{EPE}{Q} \qquad V = \frac{W}{Q}$$

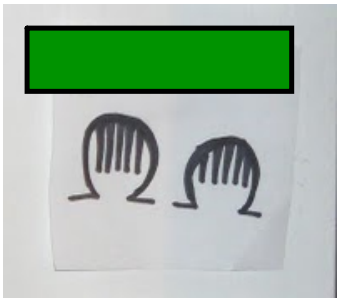
Before we go any further, you need to practise...

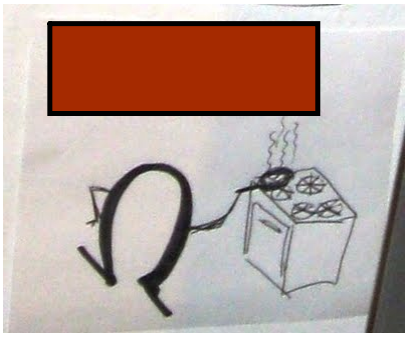
Page 620 # 9, 10

Page 621 # 11, 13, 14, 23, 24, 25

Page 622 #35 a & b

Ohm's Law Worksheet

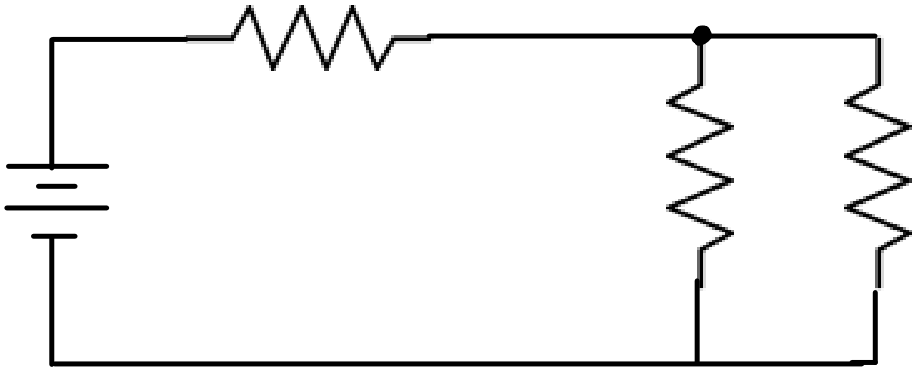




Summary to Date...we are making progress...!!!

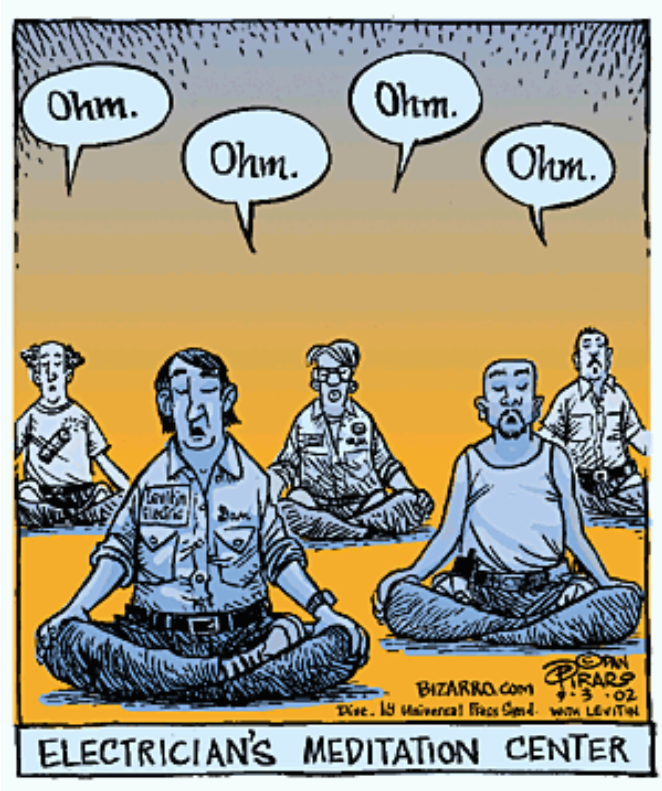
	Series Circuits	Parallel Circuits
Voltage		
Current		

Kirchoff's Laws



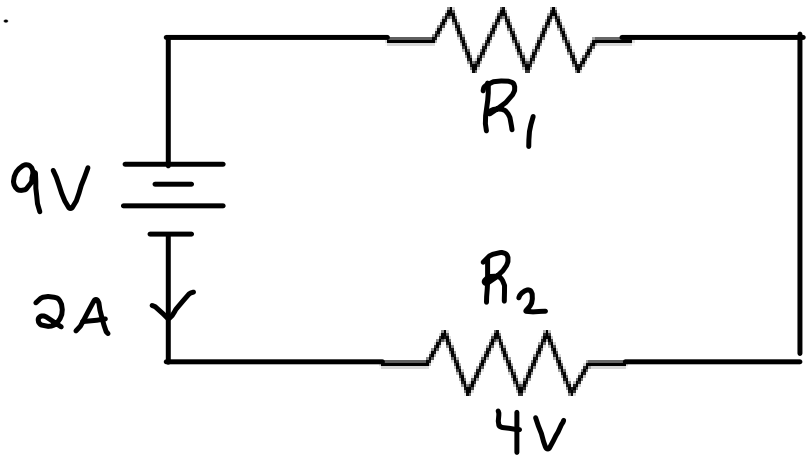
Kirchoff's Current Law

Kirchoff's Voltage Law



...Sample Circuits # 1-4

1.



V = IR

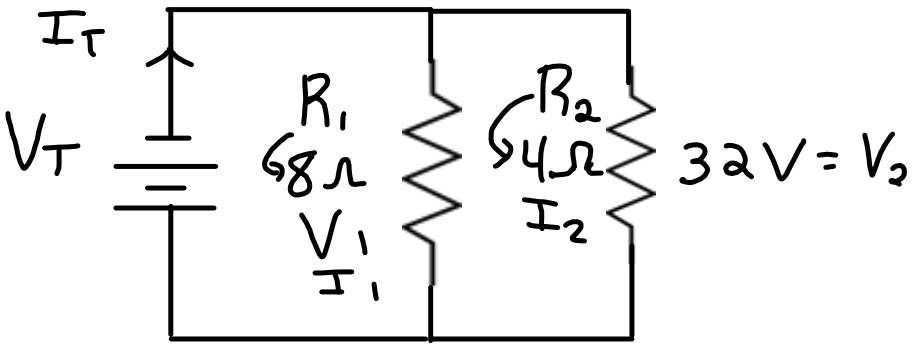
I const. in series

V const. in parallel

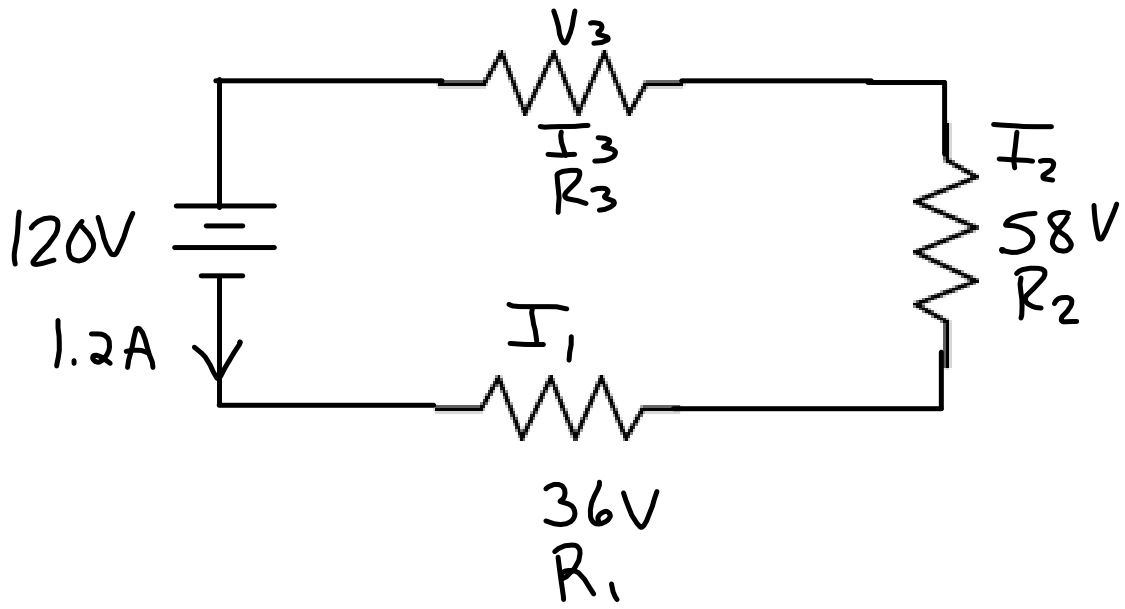
KCL

KVL

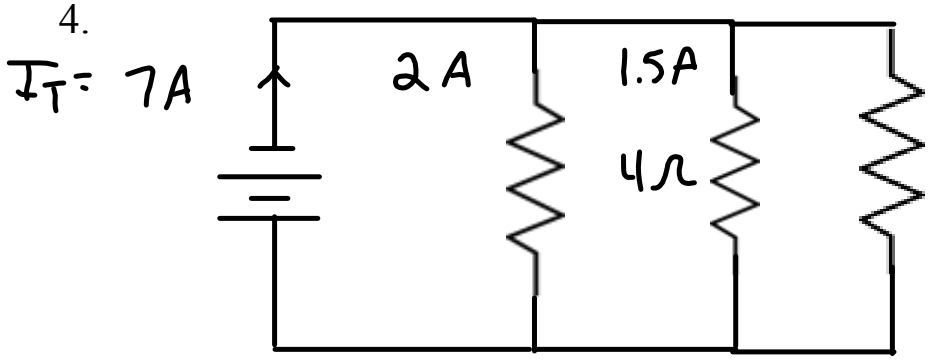
2.



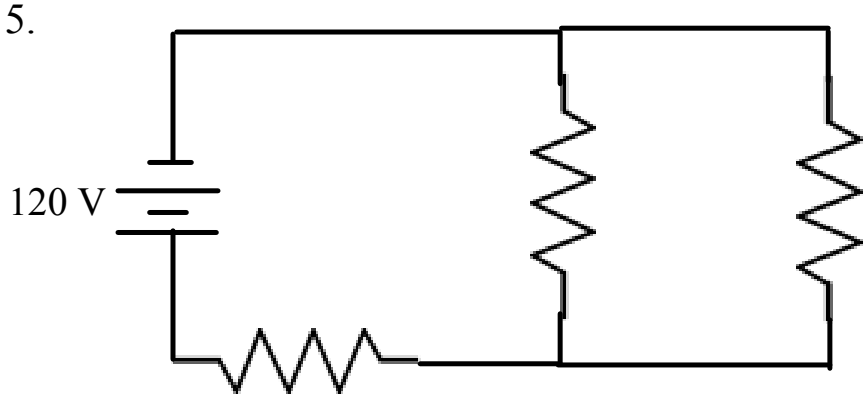
3.



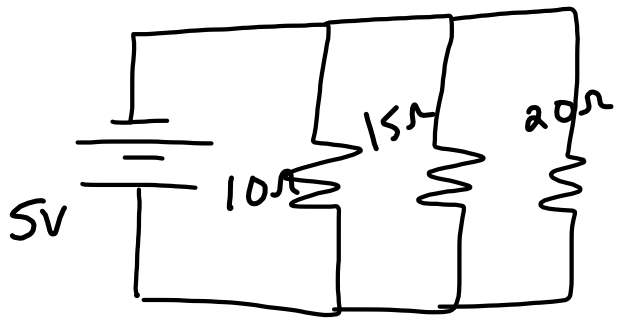
4.

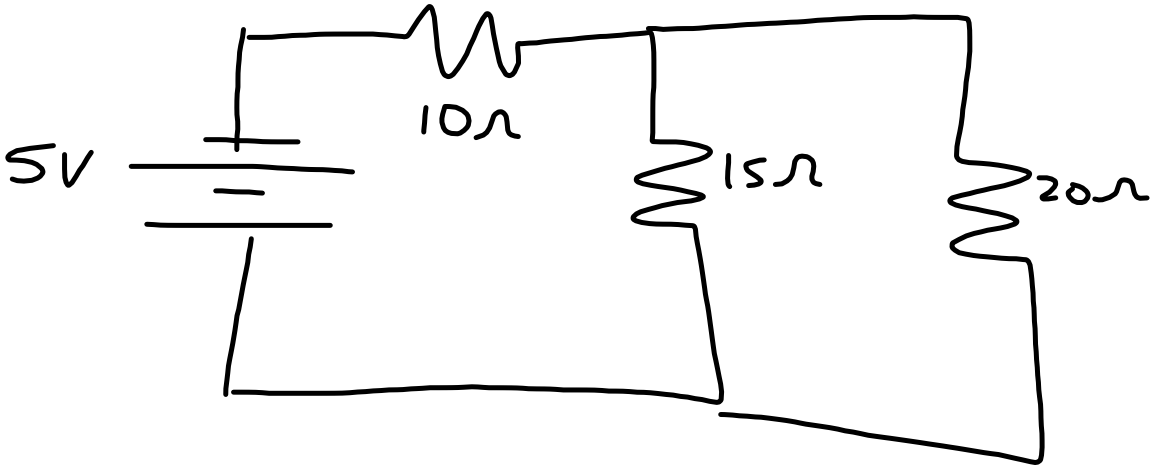


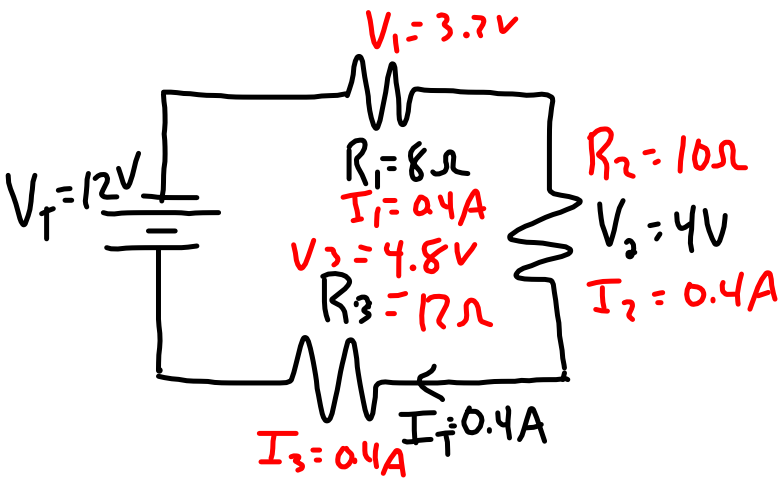
5.



$V_T = 5\ V$
$R_1 = 10\Omega$
$R_2 = 15\Omega$
$R_3 = 20\Omega$







In series → I constant
In || → V constant

$V = IR$
KVL
KCL
R_{eq}

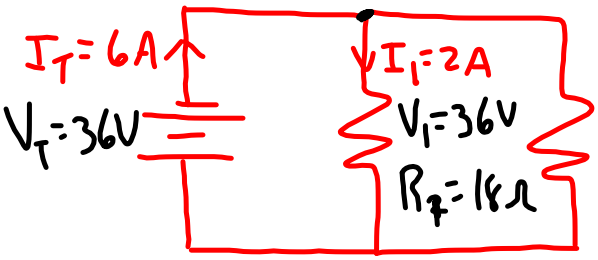
$I_1 = I_2 = I_3 = 0.4A$ (I const. in series)

$V_1 = I_1 R_1$
$V_1 = (0.4)(8)$
$V_1 = 3.2V$

$R_2 = \frac{V_2}{I_2}$
$R_2 = \frac{4}{0.4}$
$R_2 = 10\Omega$

$V_{rises} = V_{drops}$ (KVL)
$12 = 3.2 + 4 + V_3$
$4.8V = V_3$

$R_3 = \frac{V_3}{I_3}$
$= \frac{4.8}{0.4} \rightarrow 12\Omega$



$V_2 = 36V$

$R_2 = 9\Omega$

$I_2 = 4A$

(KCL) $I_{in} = I_{out}$

$6 = 2 + I_2$

$4A = I_2$

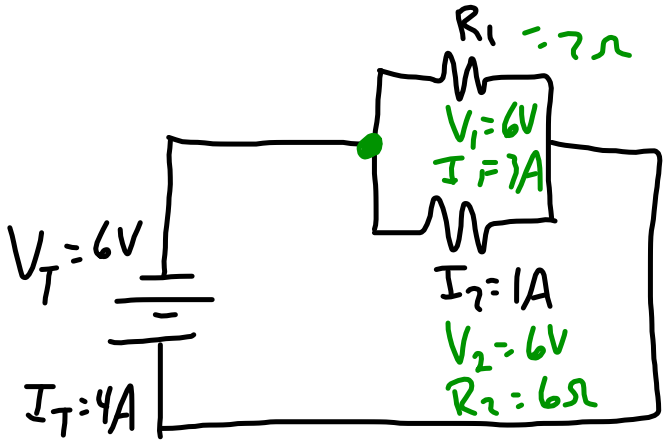
$V_2 = I_2 R_2$

$V_2 = 4(9)$

$V_2 = 36V$

$V_1 = V_T = 36V$ (V const in parallel)

$R_1 = \frac{V_1}{I_1} \Rightarrow \frac{36}{2} = 18\ \Omega$



$V_1 = V_2 = 6V$ (V const. in parallel)

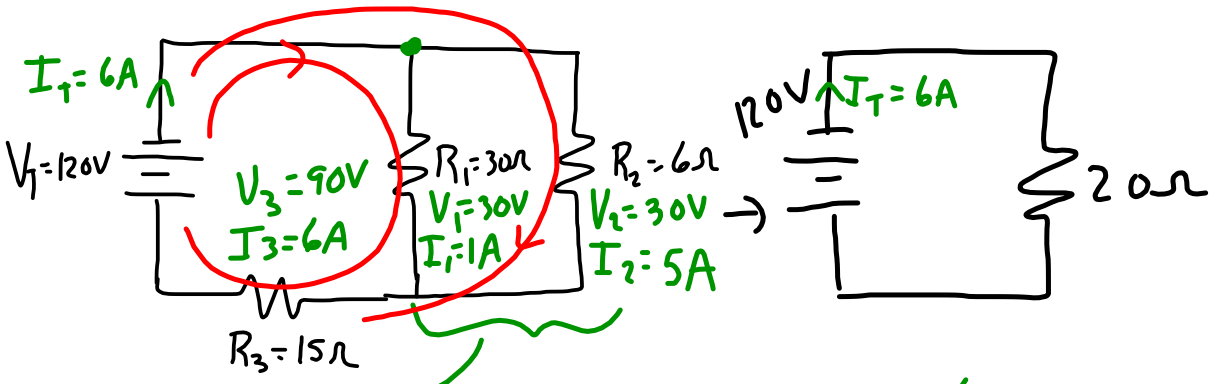
$R_2 = \frac{V_2}{I_2} \rightarrow \frac{6}{1} = 6\Omega$

$R_1 = \frac{V_1}{I_1}$ $\frac{6}{3} = 2\Omega$

$I_{in} = I_{out}$ (KCL)

$4 = I_1 + 1$

$I_1 = 3A$



$\frac{1}{R_{eq}} = \frac{1}{30} + \frac{1}{6}$

$\frac{1}{R_{eq}} = \frac{1+5}{30}$

$R_{eq} = 5\Omega$

$R_T = 15 + 5$

$R_T = 20\Omega$

$I_T = \frac{V_T}{R_T}$

$I_T = \frac{120}{20} = 6A$

- $I_3 = 6A$ (I const. in series)

$V_3 = I_3 R_3$

$V_3 = 6(15)$

$V_3 = 90V$

(KVL) $V_{rises} = V_{drops}$

$120 = V_1 + 90$

$V_1 = 30V$

$V_2 = 30V$ (V const. in parallel)

$I_1 = \frac{V_1}{R_1}$ (KCL)

$I_{in} = I_{out}$

$I_1 = \frac{30}{30}$

$6 = 1 + I_2$

$I_1 = 1A$

$I_2 = 5A$