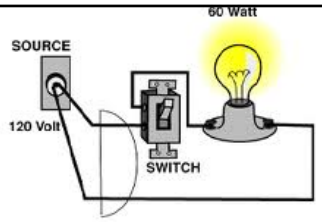
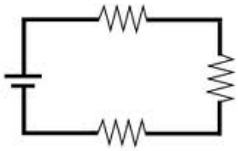
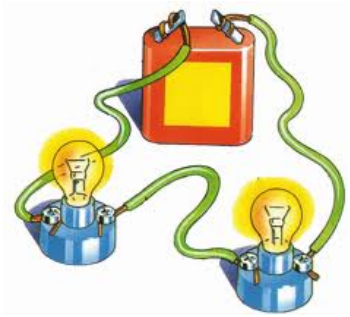
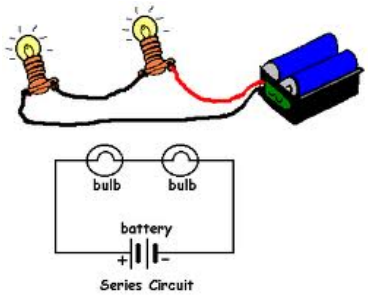




Unit 12

Solving The Series Circuit





Jan 29-10:29 AM

May 20-2:56 PM

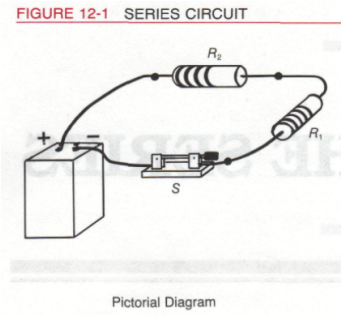
Series Circuit Connection

- Recall series are connected end-to-end

- Only one pathway can be traced from one side of the voltage source to the other.

  - one path for electrons to travel

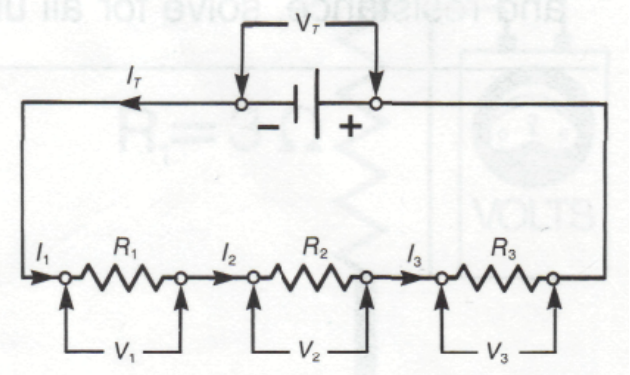
  - If path gets broken anywhere then current flow stops (doesn't work anymore)



Mar 14-10:53 AM

When we have more than one load resistor we use subscripts to identify the difference in the circuit quantities.

Current	I_1 , I_2 , I_3 , ...	Individual current across each resistor
Voltage	V_1 , V_2 , V_3 , ...	Individual voltage drop across each resistor
Resistance	R_1 , R_2 , R_3 , ...	Individual resistors

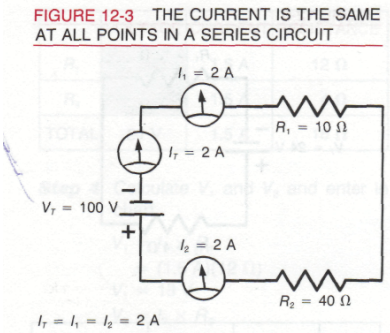


I_T V_T R_T

total (for all circuit)

Mar 14-11:21 AM

Series Circuit: Current



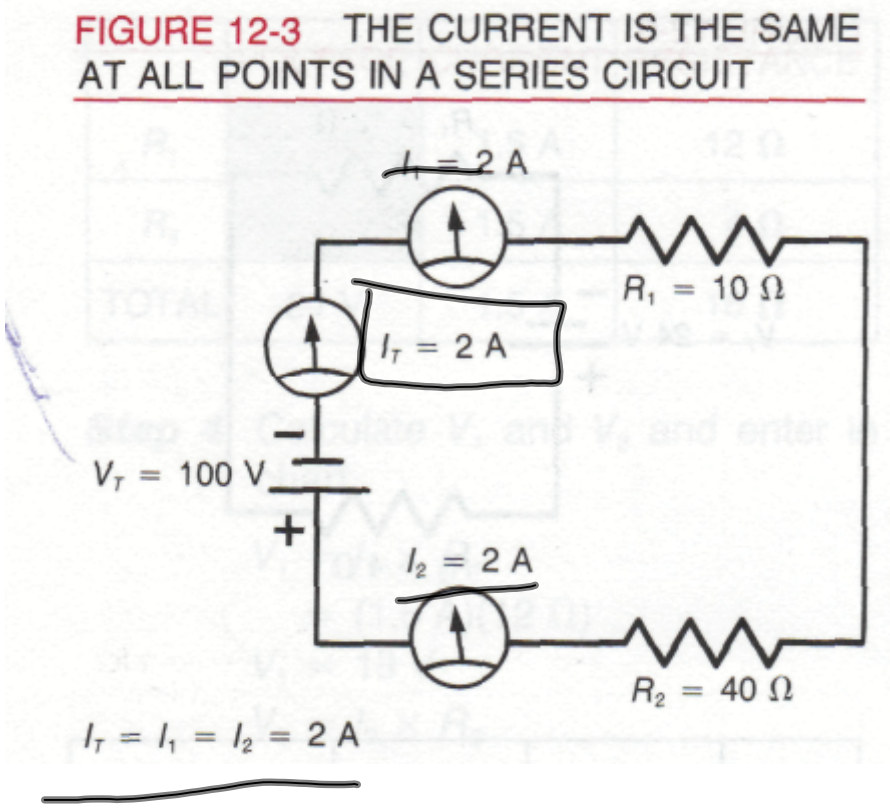
Current is the **SAME** throughout a SERIES

$$I_T = I_1 = I_2 = \ldots.$$

- Because there is only one path. There is no loss or gain of current.

* e- flow out from negative side of voltage source and MUST flow through each component and return to the positive side of the voltage source

Mar 15-11:11 AM



May 21-2:18 PM

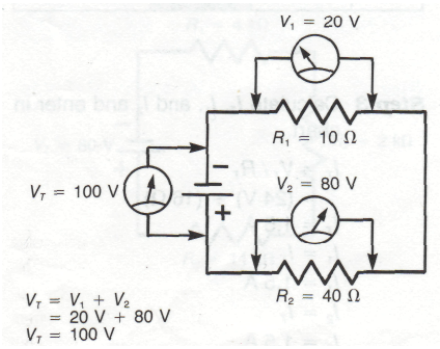
Series Circuit: Voltage

- Voltage in a series circuit is divided among each of the loads

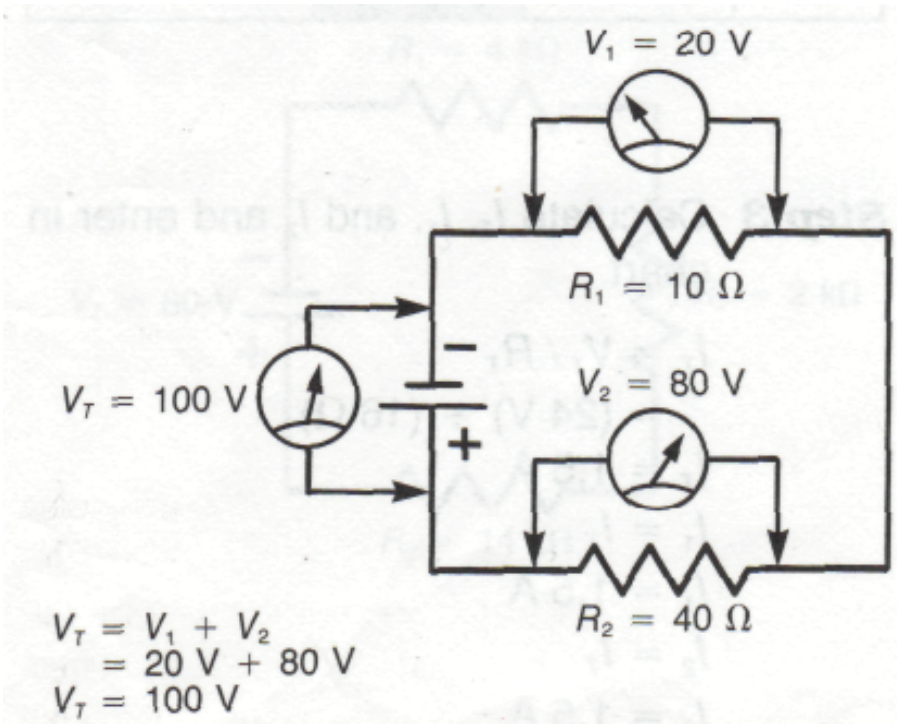
- Amount depends on the resistance value on the load (Directly proportional)

- **Total Voltage Drop**: is the sum of individual voltage drops

$$V_T = V_1 + V_2 + V_3.....$$



Mar 15-11:25 AM



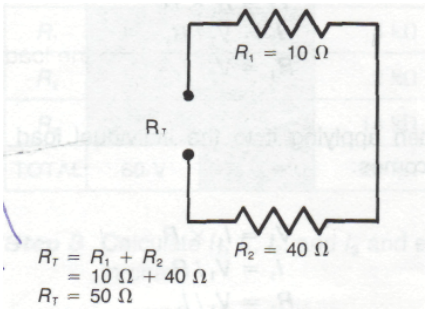
May 21-2:28 PM

Series Circuit: Resistance

- **Total Resistance**: is the sum of individual load resistors

- Because there is only one path for e- to flow they MUST travel through each load resistor.

$$R_T = R_1 + R_2 + R_3.....$$



Mar 15-11:26 AM

Solving Series Circuits

- Calculating unknown values when give at least 2 other values

Will need to use:

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

And

$$I_T = I_1 = I_2 = ...$$

$$R_T = R_1 + R_2 + R_3.....$$

$$V_T = V_1 + V_2 + V_3.....$$

Mar 15-11:39 AM

Solving Series Circuits as a WHOLE

$V_T = I_T \times R_T$

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

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

Mar 17-5:32 PM

Solving Series Circuits as an INDIVIDUAL

$V_1 = I_1 \times R_1$

$R_1 = \frac{V_1}{I_1}$

$I_1 = \frac{V_1}{R_1}$

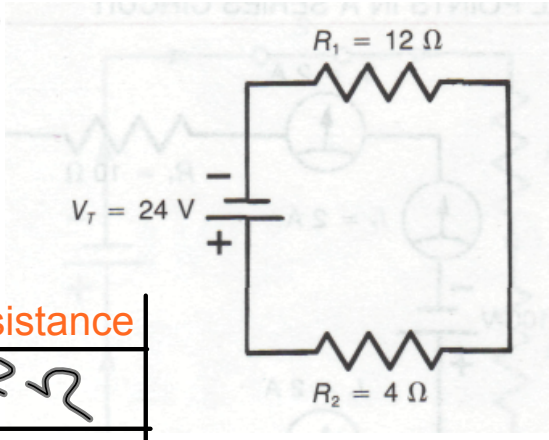
and so on...

Charts help

Mar 17-5:32 PM

Example 1)

Find all the unknown values of V, I and R for each circuit below. (SHOW ALL WORK)



Step 1) Make a chart

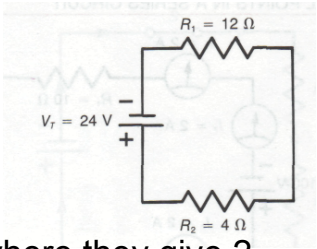
Resistors

	Voltage	Current	Resistance
R_1			12 Ω
R_2			4 Ω
Total	24 V		

Mar 17-5:43 PM

Example 1) continued

Find all the unknown values of V, I and R for each circuit below. (SHOW ALL WORK)



Step 2) Fill in the information given and start where they give 2 pieces of info in the same column or row.

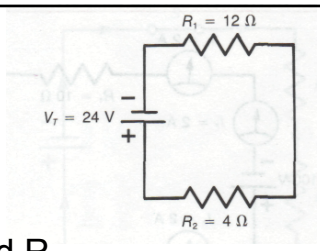
	Voltage	Current	Resistance
R_1			12 Ω
R_2			4 Ω
Total	24 V		16 Ω

} Given both R_1 & R_2 so can calculate R_T

$R_T = R_1 + R_2$

Mar 17-5:43 PM

Example 1) continued



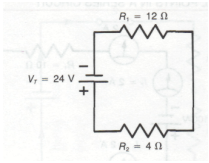
Step 3) Solve for ___ when given R_1 and R_2.

$$R_T = R_1 + R_2$$
$$= 12\Omega + 4\Omega$$
$$= 16\ \Omega$$

	Voltage	Current	Resistance
R_1			12 Ω
R_2			4 Ω
Total	24 V		___ Ω

Mar 17-5:43 PM

Example 1) continued



$$I_T = I_1 = I_2 = ...$$

Step 4) Calculate I_T. (also I_1 and I_2 since all are equal)

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

$$I_T = \frac{24\ V}{16\ \Omega}$$

$$I_T = 1.5\ A$$

	Voltage	Current	Resistance
R_1			12 Ω
R_2			4 Ω
Total	24 V	1.5 A	16 Ω

Mar 17-5:43 PM

$I_T = I_1 = I_2 = ...$

	Voltage	Current	Resistance
R_1	18V	1.5 A	12 Ω
R_2	6V	1.5 A	4 Ω
Total	24 V	1.5 A	16 Ω

OP
Ohm

Now can calculate Voltage1 and Voltage 2

$V_1 = I_1 \times R_1$

$= 1.5 \times 12$

$= 18\ V$

$V_2 = I_2 \times R_2$

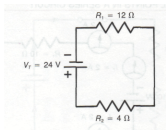
$V_2 = 1.5 \times 4$

$V_2 = 6\ V$

Mar 17-5:55 PM

Example 1) continued

	Voltage	Current	Resistance
R_1		1.5 A	12 Ω
R_2		1.5 A	4 Ω
Total	24 V	1.5 A	16 Ω



Step 5) Calculate V_1 and V_2.

$V_1 = I_1 X R_1$

= (1.5 A) X (12 Ω)

= 18 V

$V_2 = I_2 X R_2$

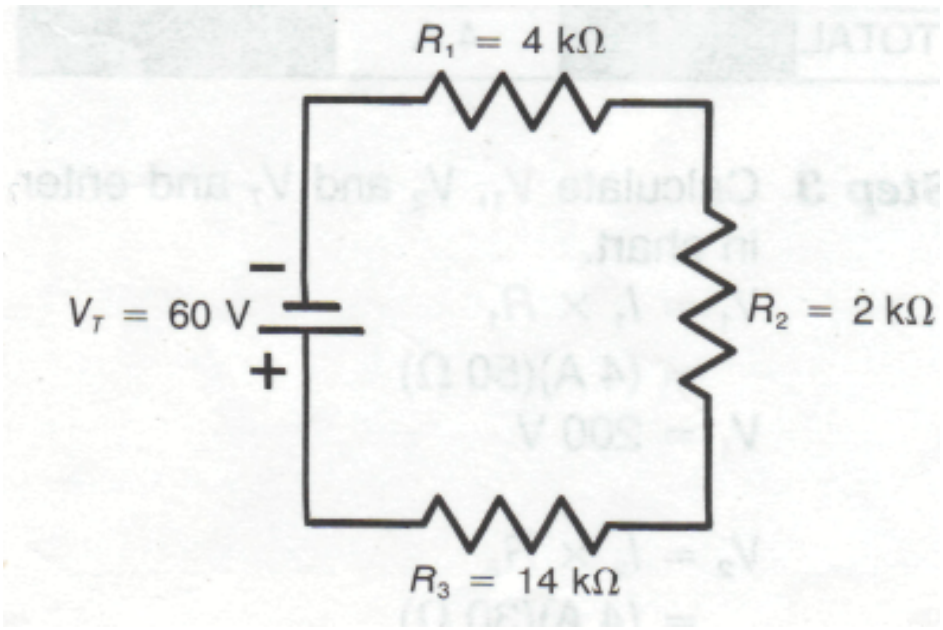
= (1.5 A) X (4 Ω)

= 6 V

	Voltage	Current	Resistance
R_1	V	A	12 Ω
R_2	V	A	4 Ω
Total	24 V	A	Ω

DONE

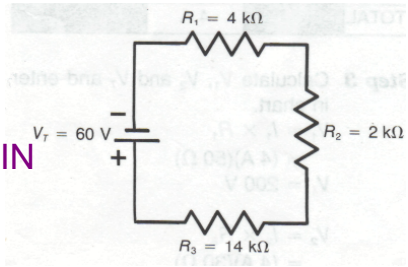
Mar 17-5:43 PM



May 22-2:04 PM

Example 2) [Watch Units]

Find all the unknown values of V, I and R for each circuit below. (SHOW ALL WORK)



CHANGE ALL UNITS TO BEGIN

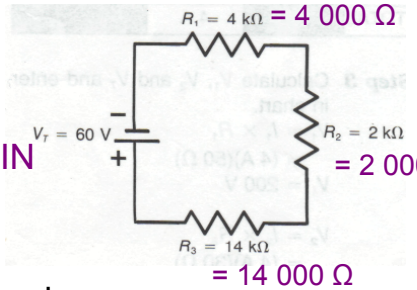
Step 1) Make a chart

	Voltage	Current	Resistance
R_1			
R_2			
R_3			
Total			

Mar 17-6:12 PM

Example 2) [Watch Units]

Find all the unknown values of V, I and R for each circuit below. (SHOW ALL WORK)



CHANGE ALL UNITS TO BEGIN

Step 2) Make a chart and fill in given numbers

	Voltage	Current	Resistance
R_1			4 000 Ω
R_2			2 000 Ω
R_3			14 000 Ω
Total	60 V		

Mar 17-6:12 PM

Example 2) [Watch Units]

Find all the unknown values of V, I and R for each circuit below. (SHOW ALL WORK)

	Voltage	Current	Resistance
R_1			4 000 Ω
R_2			2 000 Ω
R_3			14 000 Ω
Total	60 V		

Step 3) Calculate R_T

$$R_T = R_1 + R_2 + R_3.....$$

$$R_T = 4\,000\ \Omega + 2\,000\ \Omega + 14\,000\ \Omega$$

$$R_T = 20\,000\ \Omega$$

	Voltage	Current	Resistance
R_1			4 000 Ω
R_2			2 000 Ω
R_3			14 000 Ω
Total	60 V		20 000 Ω

Mar 17-6:12 PM

Example 2) [Watch Units]

	Voltage	Current	Resistance
R_1			4 000 Ω
R_2			2 000 Ω
R_3			14 000 Ω
Total	60 V		20 000 Ω

Step 4) Calculate I_T

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

$$I_T = \frac{60\ V}{20\ 000\Omega}$$

$$I_T = 0.003\ A$$

$$I_T = I_1 = I_2 = ...$$

	Voltage	Current	Resistance
R_1			4 000 Ω
R_2			2 000 Ω
R_3			14 000 Ω
Total	60 V	0.003A	20 000 Ω

Mar 17-6:12 PM

$$I_T = I_1 = I_2 = ...$$

	Voltage	Current	Resistance
R_1		0.003 A	4 000 Ω
R_2		0.003 A	2 000 Ω
R_3		0.003 A	14 000 Ω
Total	60 V	0.003 A	20 000 Ω

Now calculate V_1, V_2 and V_3.

Mar 17-6:24 PM

	Voltage	Current	Resistance
R_1		0.003 A	4 000 Ω
R_2		0.003 A	2 000 Ω
R_3		0.003 A	14 000 Ω
Total	60 V	0.003 A	20 000 Ω

Step 5) Calculate V_1, V_2 and V_3.

$V_1 = I_1 \times R_1$

= (0.003A) X (4000Ω)

= 12 V

$V_2 = I_2 \times R_2$

= (0.003A) X (2000 Ω)

= 6 V

$V_3 = I_3 \times R_3$

= (0.003A) X (14000Ω)

= 42 V

Final Answer

	Voltage	Current	Resistance
R_1	12 V	0.003 A	4 000 Ω
R_2	6 V	0.003 A	2 000 Ω
R_3	42 V	0.003 A	14 000 Ω
Total	60 V	0.003 A	20 000 Ω

Mar 17-6:35 PM

OR with more representative units

Final Answer

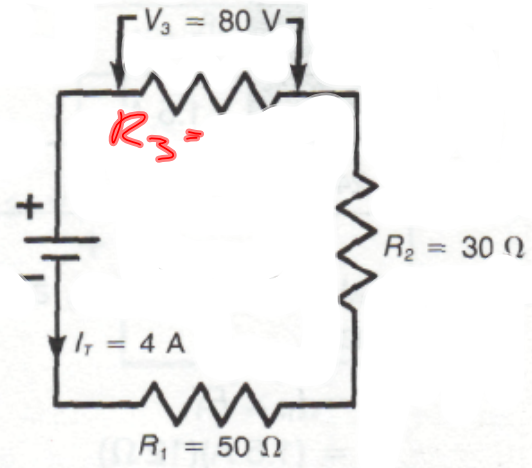
	Voltage	Current	Resistance
R_1	12 V	3 mA	4 kΩ
R_2	6 V	3 mA	2 kΩ
R_3	42 V	3 mA	14 kΩ
Total	60 V	3 mA	20 kΩ

Mar 17-9:16 PM

You Try

Example 3)

Find all the unknown values of V, I and R for each circuit below. (SHOW ALL WORK)



Mar 17-9:18 PM

Solution:

Step 1 Make a chart and record all known values.

	VOLTAGE	CURRENT	RESISTANCE
R_1			50 Ω
R_2			30 Ω
R_3	80 V		
TOTAL		4 A	

Step 2 Calculate I_1, I_2 and I_3 and enter in chart.

$I_T = I_1 = I_2 = I_3 = 4$ A

	VOLTAGE	CURRENT	RESISTANCE
R_1		4 A	50 Ω
R_2		4 A	30 Ω
R_3	80 V	4 A	20Ω
TOTAL		4 A	100Ω

$R_T = R_1 + R_2 + R_3$

$= 100\Omega$

R_3

$V_3 = 80$ V

$I_3 = 4$ A

$R_3 = \frac{V_3}{I_3}$

$= \frac{80V}{4A} = 20\Omega$

Mar 17-9:22 PM

Step 3 Calculate V_1, V_2 and V_T and enter in chart.

$V_1 = I_1 \times R_1$

$= (4\ A)(50\ \Omega)$

$V_1 = 200\ V$

$V_2 = I_2 \times R_2$

$= (4\ A)(30\ \Omega)$

$V_2 = 120\ V$

$V_T = V_1 + V_2 + V_3$

$= (200\ V) + (120\ V) + (80\ V)$

$V_T = 400\ V$

	VOLTAGE	CURRENT	RESISTANCE
R_1	200 V	4 A	50 Ω
R_2	120 V	4 A	30 Ω
R_3	80 V	4 A	20 Ω
TOTAL	400 V	4 A	100 Ω

Mar 17-9:24 PM

Step 4 Calculate R_3 and R_T and enter in chart.

$R_3 = V_3 / I_3$

$= (80\ V) \div (4\ A)$

$R_3 = 20\ \Omega$

$R_T = V_T / I_T$

$= (400\ V) \div (4\ A)$

$R_T = 100\ \Omega$

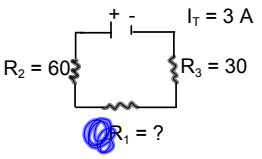
	CURRENT	VOLTAGE	RESISTANCE
R_1	200 V	4 A	50 Ω
R_2	120 V	4 A	30 Ω
R_3	80 V	4 A	20 Ω
TOTAL	400 V	4 A	100 Ω

Mar 17-9:25 PM

May 22-2:37 PM

Fill in the chart and find the missing values

600 V = V_T



	Voltage	Current	Resistance
R_1	330V	3A	110Ω
R_2	180V	3A	60Ω
R_3	90V	3A	30Ω
Total	600V	3A	200Ω

$I_T = I_1 = I_2 = I_3$

$R_T = \frac{V_T}{I_T} = \frac{600V}{3A} = 200V$

$R_1 = R_T - R_2 - R_3$
$= 200 - 60 - 30$
$= 110\Omega$

$V_1 = R_1 \times I_1$
$= 110 \times 3$
$= 330V$

$V_2 = I_2 \times R_2$
$= 3 \times 60$
$= 180V$

$V_3 = R_3 \times I_3$
$= 30 \times 3$
$= 90V$

May 22-1:19 PM

May 22-2:46 PM

Page 121 - 122

For each diagram: Calaculate the missing V, I, and R values in a chart form. **Show all work**. (You don't have to do (a), (b),... just do the calculations

1, 2, 3, 4, 5(watch the units) ---> drawings

Page 123 - 124 (Self Evaluation Test)

Show all WORK

~~# 4 to #7~~ 1 - 7

HAND IN ALL WORK

Mar 17-9:25 PM

	Voltage	Current	Resistance
R_1			100 Ω
R_2			150 Ω
Total	12 V		

May 26-2:06 PM

May 26-2:02 PM