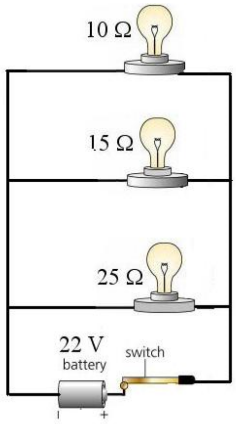
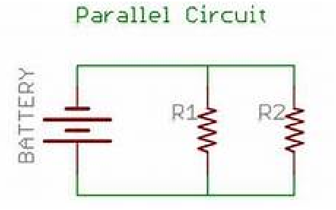
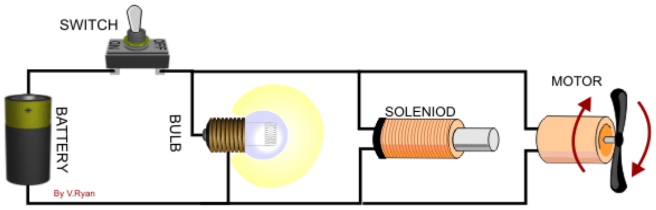




Unit 13
Solving The Parallel Circuit

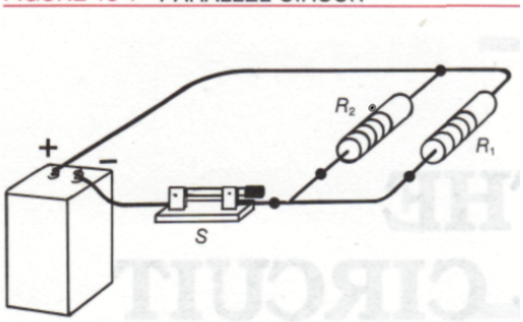


Mar 17-10:01 PM

Parallel Circuit Connection

-Two or more loads are connected across the voltage sources leads (+ and -) post not end to end

FIGURE 13-1 PARALLEL CIRCUIT



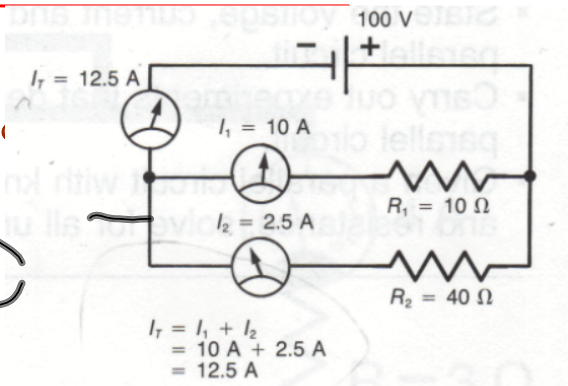
- Each load acts independently
- MORE than 1 Pathway
  * # of paths = # of parallel loads

Mar 17-10:06 PM

Parallel Circuit: Current

Current is the divided among each l

$$I_T = I_1 + I_2 \ \ldots$$



- The higher the resistance of the load, the lower the amount of current taken.

* acts independently of other loads, as far as current is concerned.

Mar 15-11:11 AM

Parallel Circuit: Voltage

- Voltage in a parallel circuit is the same across each load.

  -because each load is connected directly across the 2 lines(+ & -)

- **Total Voltage Drop**: is equal to value on voltage source (votage total)

$$V_T = V_1 = V_2 = V_3 \ldots$$

FIGURE 13-3 THE VOLTAGE ACROSS EACH BRANCH OF A PARALLEL CIRCUIT IS THE SAME AS THE SOURCE VOLTAGE

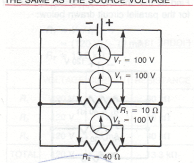
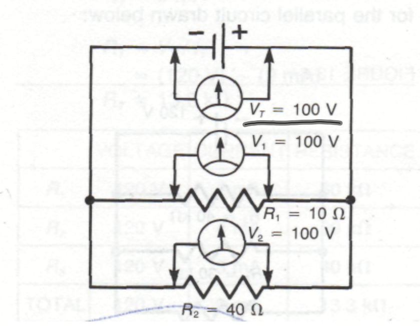


FIGURE 13-3 THE VOLTAGE ACROSS EACH BRANCH OF A PARALLEL CIRCUIT IS THE SAME AS THE SOURCE VOLTAGE



Mar 15-11:25 AM

Parallel Circuit: Resistance

- **Total Resistance**: is less than any individual load resistors

For 2 loads

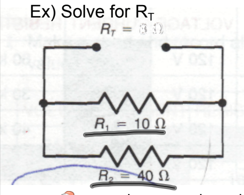
$$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$$

For 3 or MORE loads

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

Mar 15-11:26 AM

Ex) Solve for R_T



need common denominators with fract

now add top of fractions

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

$$= \frac{1}{\frac{1}{10} + \frac{1}{40}}$$

$$= \frac{1}{\frac{4}{40} + \frac{1}{40}}$$

$$= \frac{1 \times 40}{\frac{5}{40}}$$

flip

divide $= \frac{40}{5}$

= 8 Ω

$$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$$

$$= \frac{10\,\Omega \times 40\,\Omega}{10\,\Omega + 40\,\Omega}$$

$$= \frac{400\,\Omega}{50\,\Omega}$$

$$= 8\,\Omega$$

Mar 26-11:32 AM

Parallel Circuit Equations

$I_T = I_1 + I_2$ ....

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

} different from Unit 12

$R_T = \frac{V_T}{I_T}$ $R_1 = \frac{V_1}{I_1}$ $I_1 = \frac{V_1}{R_1}$ ... same from Unit 12

Give R_1 , R_2 , R_3

For 2 loads

$$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$$

different from Unit 12

For 3 or MORE loads

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

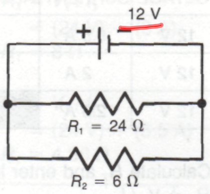
May 28-10:09 PM

Example 1

Problem:

Find all the unknown values of *V*, *I*, and *R* for the parallel circuit drawn below:

Try



$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$

$R_T = \frac{24 \times 6}{24 + 6}$

$= \frac{144}{30}$

$= 4.8\Omega$

	Voltage	Current	Resistance
R_1	12V	0.5A	24Ω
R_2	12V	2A	6Ω
Total	12V	2.5A	4.8Ω

$I_1 = \frac{V_1}{R_1}$ $= I_1 = 0.5A$

$= \frac{12V}{24\Omega}$

$I_2 = \frac{V_2}{R_2}$

$= \frac{12V}{6\Omega}$

$I_2 = 2A$

$I_T = I_1 + I_2$

$= 2 + 0.5$

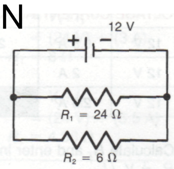
$= 2.5A$

Mar 28-11:32 AM

Example 1 SOLUTION

Problem:

Find all the unknown values of V, I, and R for the parallel circuit drawn below:



Step 1 Make a chart and record all known values.

	VOLTAGE	CURRENT	RESISTANCE
R_1			24 Ω
R_2			6 Ω
TOTAL	12 V		

Step 2 Calculate V_1 and V_2 and enter in chart.

$V_T = V_1 = V_2 = 12$ V

	VOLTAGE	CURRENT	RESISTANCE
R_1	12 V		24 Ω
R_2	12 V		6 Ω
TOTAL	12 V		

Step 3 Calculate I_1, I_2 and I_3 and enter in chart.

$I_1 = V_1 / R_1$
$= (12\text{ V}) \div (24\ \Omega)$
$I_1 = 0.5$ A

$I_2 = V_2 / R_2$
$= (12\text{ V}) \div (6\ \Omega)$
$I_2 = 2$ A

$I_T = I_1 + I_2$
$= (0.5\text{ A}) + (2\text{ A})$
$I_T = 2.5$ A

	VOLTAGE	CURRENT	RESISTANCE
R_1	12 V	0.5 A	24 Ω
R_2	12 V	2 A	6 Ω
TOTAL	12 V	2.5 A	

Step 4 Calculate R_T and enter in chart.

$R_T = V_T / I_T$
$= (12\text{ V}) \div (2.5\text{ A})$
$R_T = 4.8\ \Omega$

OR

$$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$$
$$= \frac{(24\ \Omega)(6\ \Omega)}{(24\ \Omega) + (6\ \Omega)}$$
$$= \frac{144}{30}$$
$R_T = 4.8\ \Omega$

	VOLTAGE	CURRENT	RESISTANCE
R_1	12 V	0.5 A	24 Ω
R_2	12 V	2 A	6 Ω
TOTAL	12 V	2.5 A	4.8 Ω

Mar 28-11:32 AM

STOP

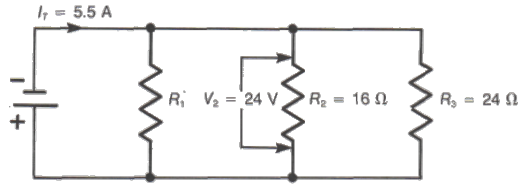
Read Unit 13 from textbook

May 28-10:17 PM

Example 3

Problem:

Find all the unknown values of V, I, and R for the parallel circuit drawn below:



	Voltage	Current	Resistance
R_1	24v		
R_2	24v	1.5	16Ω
R_3	24v	1	24Ω
Total	24v	5.5A	

$I_2 = \frac{V_2}{R_2}$

$I_2 = \frac{24}{16} = 1.5A$

$I_3 = \frac{24V}{24\Omega}$

$= 1A$

$5.5 - 1 - 1.5 = 3.$

Mar 28-11:40 AM

Solution:

Step 1 Make a chart and record all known values.

	VOLTAGE	CURRENT	RESISTANCE
R_1	24 V		
R_2	24 V		16 Ω
R_3	24 V		24 Ω
TOTAL	24 V	5.5 A	

Step 2 Calculate I_2, I_3, I_1, R_1, and R_T and enter in chart.

$I_2 = V_2 / R_2$
$= (24 \text{ V}) \div (16\ \Omega)$
$I_2 = 1.5 \text{ A}$

$I_3 = V_3 / R_3$
$= (24 \text{ V}) \div (24\ \Omega)$
$I_3 = 1 \text{ A}$

$I_1 = I_T - (I_2 + I_3)$
$= (5.5 \text{ A}) - (2.5 \text{ A})$
$I_1 = 3 \text{ A}$

$R_1 = V_1 / I_1$
$= (24 \text{ V}) \div (3 \text{ A})$
$R_1 = 8\ \Omega$

$R_T = V_T / I_T$
$= (24 \text{ V}) \div (5.5 \text{ A})$
$R_T = 4.36\ \Omega$

	VOLTAGE	CURRENT	RESISTANCE
R_1	24 V	3 A	8 Ω
R_2	24 V	1.5 A	16 Ω
R_3	24 V	1 A	24 Ω
TOTAL	24 V	5.5 A	4.36 Ω

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#1,2,3,

Do the wire numbering chart and then solve for the missing values.

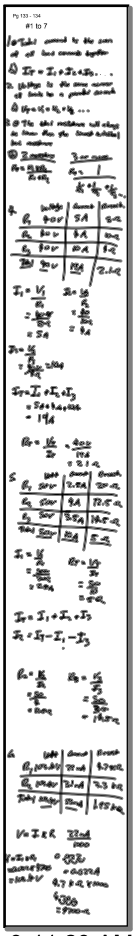
	Voltage	Current	Resistance
R_1			
R_2			
Total			

#4 & 5

Do the wire numbering chart and then solve for the missing values.

	Voltage	Current	Resistance
R_1			
R_2			
R_3			
Total			

Apr 9-11:19 AM



Apr 9-11:23 AM

3.3 kΩ x1000

3300 R_2 = 3300 Ω

V_2 = 103.4 V

$I_2 = \frac{V_2}{R_2}$

$= \frac{103.4V}{3300\Omega}$

= .031A x1000

= 31mA

$\frac{53mA}{1000}$

0.053 = 0.053 A = I_T

V_T = 103.4 V

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

$= \frac{103.4V}{0.053A}$

$= \frac{1951}{1000}$ Ω

= 1.95 kΩ

Jun 2-2:38 PM

Test

Apr 9-11:27 AM

	Series	Parallel
Voltage	$V_T = V_1 + V_2 + V_3 \ldots$	$V_T = V_1 = V_2 = V_3 \ldots$
Current	$I_T = I_1 = I_2 = I_3 \ldots$	$I_T = I_1 + I_2 + I_3 \ldots$
Resistance	$R_T = R_1 + R_2 + R_3$	2 Resistors $R_T = \frac{R_1 \times R_2}{R_1 + R_2}$ 3 or More $R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$

Apr 9-11:32 AM