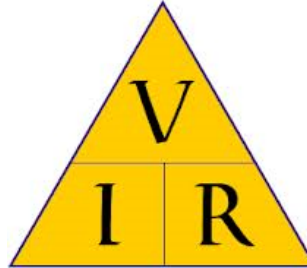
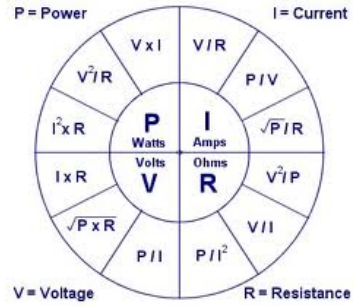


# Unit 11 OHM'S LAW



Jan 29-10:29 AM

TABLE 11-1 COMMON ELECTRICAL SI METRIC UNITS AND SYMBOLS

QUANTITY	BASIC UNIT	SYMBOL
Electric potential energy difference	volt	V
Electric charge	coulomb	C
Electric current	ampere	A
Resistance	ohm	$\Omega$
Power	watt	W
Energy	joule	J

Mar 12-9:14 PM

- Canada uses the "International System of Units" or SI Metric System

- Based on the decimal system

- related by powers of 10  
 example) related by 10, 100, 1000, 10 000, etc.

- Most conversions only require shifting the decimal point.



- Prefixes are used to represent smaller and larger quantities

Example) 0.000 0012 5 V = 1.25  $\mu$ V  
 volts                      microvolts

Example) 36 000 V = 36 kV  
 volts                      kilovolts

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**TABLE 1.5 Selected Prefixes Used in the Metric System**

Prefix	Abbreviation	Meaning	Example
Giga	G	$10^9$	1 gigameter (Gm) = $1 \times 10^9$ m
Mega	M	$10^6$	1 megameter (Mm) = $1 \times 10^6$ m
Kilo	k	$10^3$	1 kilometer (km) = $1 \times 10^3$ m
Deci	d	$10^{-1}$	1 decimeter (dm) = 0.1 m
Centi	c	$10^{-2}$	1 centimeter (cm) = 0.01 m
Milli	m	$10^{-3}$	1 millimeter (mm) = 0.001 m
Micro	$\mu^a$	$10^{-6}$	1 micrometer ( $\mu$ m) = $1 \times 10^{-6}$ m
Nano	n	$10^{-9}$	1 nanometer (nm) = $1 \times 10^{-9}$ m
Pico	p	$10^{-12}$	1 picometer (pm) = $1 \times 10^{-12}$ m
Femto	f	$10^{-15}$	1 femtometer (fm) = $1 \times 10^{-15}$ m

<sup>a</sup>This is the Greek letter mu (pronounced "mew").

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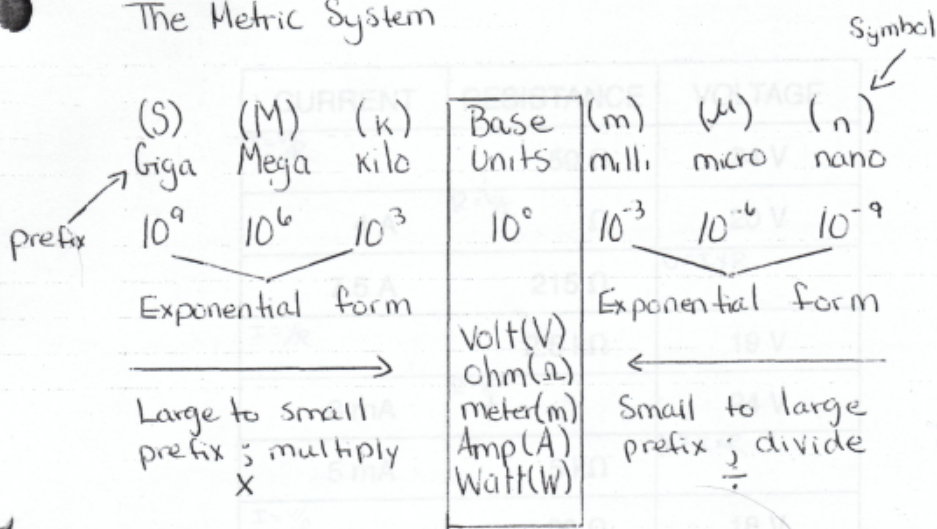
### 4 Basic Prefixes in Electronics:

TABLE 11-2 TABLE OF COMMON PREFIXES

PREFIX	SYMBOL	MULTIPLIER	MEANING
mega	M	1 000 000 or $10^6$	one million
kilo	k	1 000 or $10^3$	one thousand
milli	m	0.001 or $10^{-3}$	one thousandth
micro	$\mu$	0.000 001 or $10^{-6}$	one millionth

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### The Metric System



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Examples:

$0.003V = \frac{3}{1000} V = \frac{3}{10} mV$   
 Difference of 3, so you move the decimal spots 3 places.

$0.47 n\Omega = \frac{47}{100} n\Omega = \frac{47}{10} m\Omega$   
 Difference of 2, so you move the decimal spots 2 places.

---

$0.091 A = \frac{91}{1000} A = \frac{91}{100} mA$

$81000 W = \frac{81000}{1000} W = 81 kW$

$81,000 W = 81 kW$

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Example) Changing from Amperes (A) to milliamperes (mA)

Step 1) Which direction are you going? (do you have to X or ÷)

to

$0.024 A = \underline{\hspace{1cm}} mA$

- by (move decimal place to the )

$0.024$

$0.024 A = \underline{\hspace{1cm}} \underline{\hspace{1cm}} mA$

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Example) Changing from millivolts (mV) to Volts (V)

Step1) Which direction are you going? (do you have to X or  $\div$  )

\_\_\_\_\_ to \_\_\_\_\_

$$8\,700\text{ mV} = \underline{\hspace{2cm}}\text{ V}$$

- \_\_\_\_\_ by \_\_\_\_\_ (move decimal \_\_\_\_\_ place to the \_\_\_\_\_)

$$8\,700$$

$$8\,700\text{ mV} = \underline{\hspace{2cm}}\text{ v}$$

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Example) Changing from megaohms (M $\Omega$ ) to ohms ( $\Omega$ )

Step1) Which direction are you going? (do you have to X or  $\div$  )

\_\_\_\_\_ to \_\_\_\_\_

$$4.65\text{ M}\Omega = \underline{\hspace{2cm}}\Omega$$

- \_\_\_\_\_ by \_\_\_\_\_ (move decimal \_\_\_\_\_ place to the \_\_\_\_\_)

$$4.65$$

$$4.65\text{ M}\Omega = \underline{\hspace{2cm}}\Omega$$

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## Ohm's Law

- Ohm's law is the relationship between current, voltage and resistance in a circuit
- The amount of current that flows in a circuit is directly proportional to the applied voltage and inversely proportional to the resistance.

means:

- if voltage increase then so does current
- if resistance increases then the current decreases

and vice versa

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## Ohm's Law Formulas

$$V = IR$$

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

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

V : voltage in volts (V)

I : Current in Amperes (A)

R : Resistance in ohm's ( $\Omega$ )

You now have to make  
sure all unit are in V, A  
or  $\Omega$

-still expected to know Unit 5 material  
what happent to R if I increase or decreases?

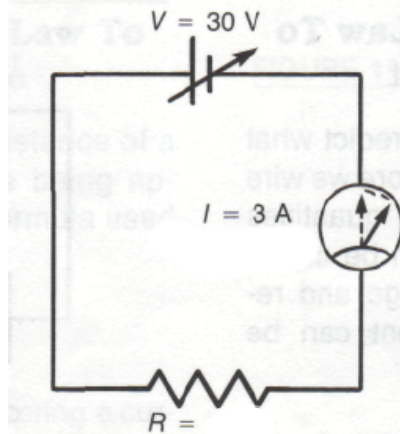
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Example) Suppose that a portable electric heater with resistance of  $10\Omega$  is connected to a  $100V$  electrical outlet. What is the current flow in the circuit?

$$\begin{aligned}
 V &= 100V \\
 R &= 10\Omega \\
 I &= \frac{V}{R} \\
 &= \frac{100V}{10\Omega} \\
 I &= 10A
 \end{aligned}$$

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Example 2)



$$\begin{aligned}
 V &= 30V \\
 I &= 3A \\
 R &=?
 \end{aligned}$$

$$\begin{aligned}
 R &= \frac{V}{I} \\
 &= \frac{30V}{3A} \\
 R &= 10\Omega
 \end{aligned}$$

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When units are not in the base unit value you have to use conversion first before doing any calculations

**Example)** Suppose a  $20\text{ k}\Omega$  carbon resistor is connected to a  $10\text{ V}$  Battery. What is the value of the current flow in the circuit?

Step 1) change units to base units  $\text{k}\Omega$  to  $\Omega$

$$20\text{ k}\Omega = \underline{20000}\Omega$$

$\times 1000$

Step 2) Now use basic values to do calculations

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

$$I = \frac{10\text{ V}}{20000\Omega}$$

$\div 1000$

$$I = 0.0005\text{ A}$$

Step 3) Now convert to more accurate units

$$I = 0.5\text{ mA}$$

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**Example)** Suppose a DC generator is delivering a current of  $2\text{ A}$  to a lamp bank that a combined resistance of  $25\Omega$ . What is the voltage input?

$$V = ?$$

$$V = I \times R$$

$$I = 2\text{ A}$$

$$= 2\text{ A} \times 25\Omega$$

$$R = 25\Omega$$

$$V = 50\text{ V}$$

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Example) Suppose an electrical kettle draws a current of 5 kA when connected to a 10 V AC electrical outlet. What is the resistance?

$I = 5 \text{ kA} \leftarrow 5 \times 1000$   
 $V = 10 \text{ V}$   
 $I = 5000 \text{ A}$   
 $R =$

$$R = \frac{V}{I} = \frac{10 \text{ V}}{5000 \text{ A}}$$

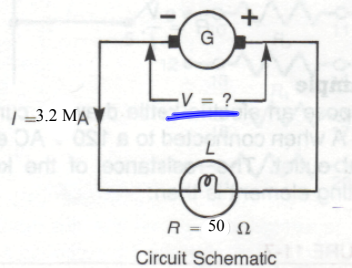
$$= 0.002 \text{ } \Omega$$

$$= 2 \text{ m}\Omega$$

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Example)

$V = ?$   
 $I = 3.2 \text{ MA}$   
 $R = 50 \text{ } \Omega$



$3.2 \text{ MA} = 3200000 \text{ A}$

~~3200000~~

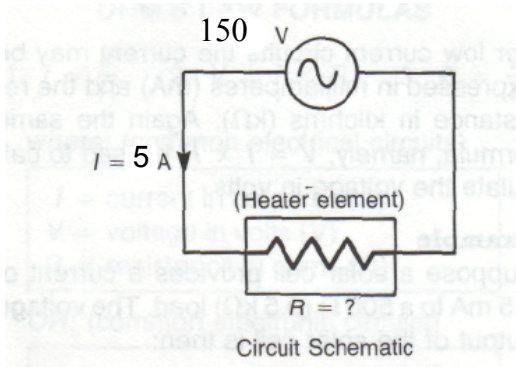
$V = 3200000 \times 50$

$V = 160,000,000 \text{ V}$

$E = 160 \text{ MV}$  love  
 Eosin Shle!

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Example)

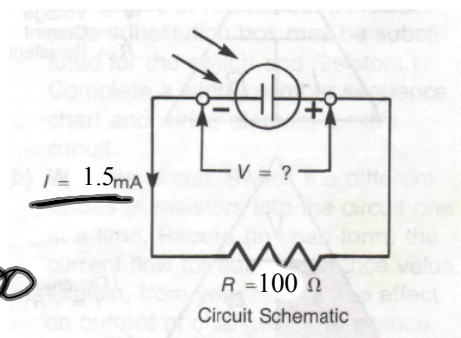


$V = 150V$   
 $I = 5A$   
 $R = ?$

$$R = \frac{V}{I} = \frac{150}{5} = 30 \Omega$$

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Example)

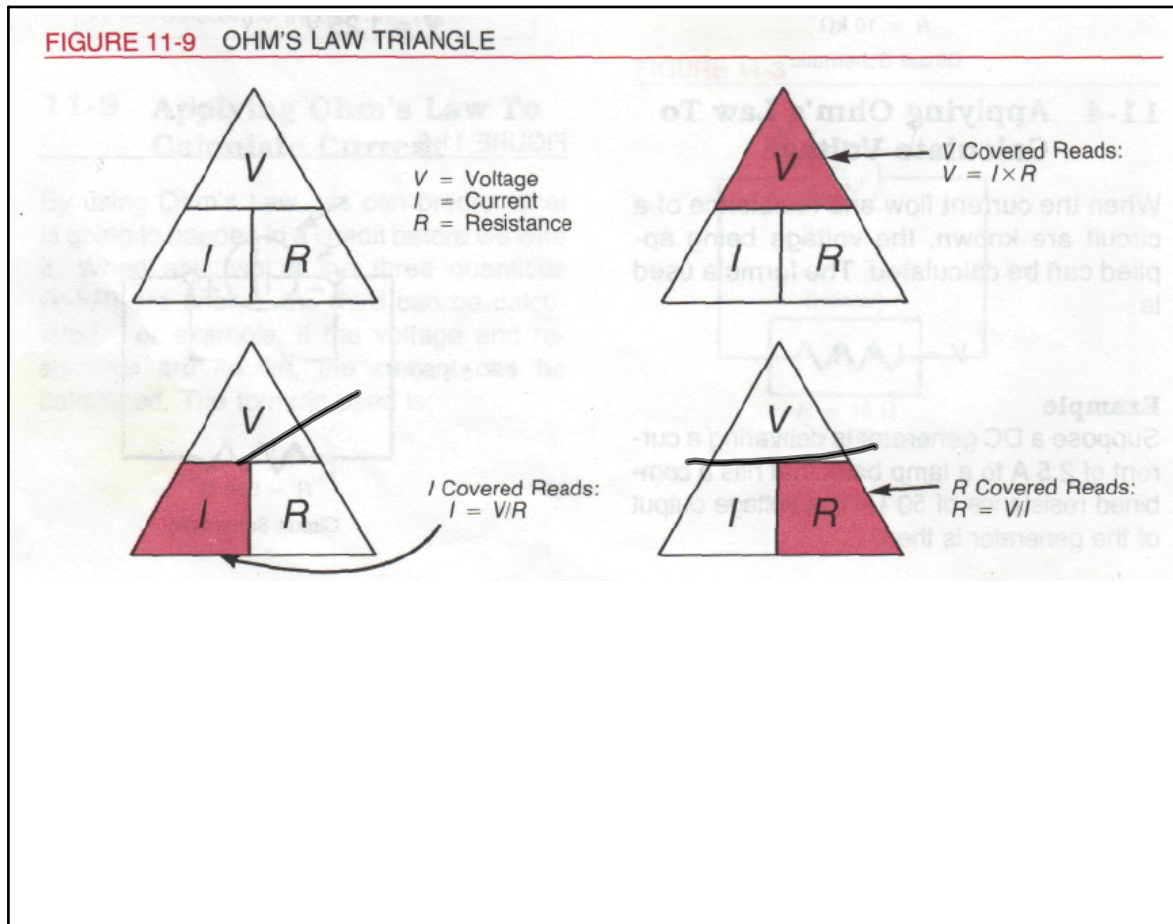


$\div 1000$   
 $1.5 \div 1000$   
 $1.5 \times 10^{-3}$

$V = I \times R$   
 $= 0.015 A \times 100 \Omega$   
 $= ~~1.5V~~ 0.15V$

$0.15V \text{ to } KV$   
 $\times 1000$   
 $= 150 mV$

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### Page 109 Practical assignment

- 1(a) & 2(a) Just the wiring number sequence chart
- 3 For the chart calculate the Current calculated (Watch Units)  
MUST SHOW ALL WORK
- 3(b) Complete the wiring number sequence chart
- 4 For the chart calculate the Voltage calculated (Watch Units)  
MUST SHOW ALL WORK
- 4(b) Complete the wiring number sequence chart

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## Page 112 Self Evaluation Test

Do all Questions and Hand them in

Show all work for the calculations

Page 112 # 1-13

$$V = I \times R$$

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

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

S  
Giga  
 $10^9$

M  
Mega  
 $10^6$

k  
kilo  
 $10^3$

$10^0$   
Baschits

m  
mil:  
 $10^{-3}$   
0.001

$\mu$   
micro  
 $10^{-6}$

n  
Nano  
 $10^{-9}$



A

V

m

W

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