Introduction & Safety

TWO FACTORS WHICH DETERMINE IF A SHOCK IS FATAL

The amount of current entering the body. Amp <u>CAN BE lethal.</u>

_____ through the body. A current path through the is usually FATAL.

What would you do if you observed someone being electrocuted? _____

INTRODUCTION TO ELECTRICITY

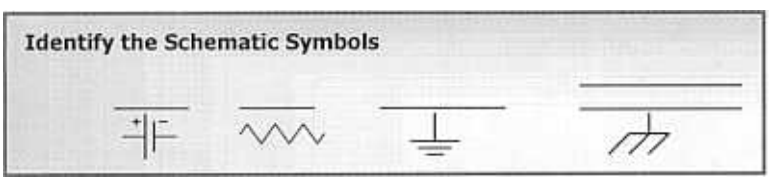
<u>LAW of Electrostatic Force</u>:

_____ Charges <u>Attract</u>.

_____ Charges <u>Repel</u>.

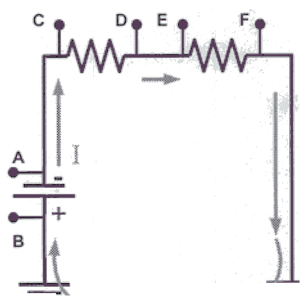
<u>Conductor:</u> A material with (loose or tightly) bound electrons

<u>Insulator:</u> A material with (loose or tightly) bound electrons



Solve for the following:

Point c is ___ with respect to point e
Point f is ___ with respect to point c
Point e is ___ with respect to point f



Numerical Notations

Solve the following

$5^3 =$

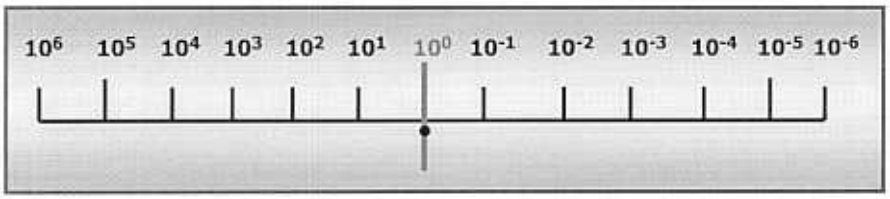
$3^3 =$ $3^5 =$

Exponents & The powers of 10

100,000 = $10^4 =$

1,000 = $10^2 =$

$10^0 =$



234,000 = 234 *

234,000 = 23.4 *

234,000 = .234 *

$2 * 10^6$

$15 * 10^4 =$ _____

$10 * 10^6 =$ _____

Converting a Fraction, to a NEGATIVE Pwr of 10, the Decimal is moved and is indicated in the exponent of the Pwr of 10.

Converting a NEGATIVE Pwr of 10, to a Fraction, the Decimal is moved as is indicated in the exponent of the Pwr of 10

Indicate the directions of the arrows in relation to the letters given

D R I L

____ ____ ____ ____

When ADDING the Powers of 10 the Exponents must be.

$26 * 10^3 + 26 * 10^3 =$ $5 * 10^2 + 15 * 10^2 =$

$6 * 10^3 + 120 * 10^2 =$ $65 * 10^4 + 22 * 10^6 =$

SUBTRACTION; All rules apply as w/ Addition.

$64 * 10^3 - 26 * 10^3 =$ $25 * 10^2 - 15 * 10^2 =$

$600 * 10^3 - 120 * 10^2 =$ $28 * 10^4 - 22 * 10^6 =$

Multiplying the powers of 10, the Exponents must be_____ in the problem, to get the Exponent in the solution. PROVIDED the Polarities are the same

$14 * 10^3 * 10 * 10^3 =$ $58 * 10^3 * 2 * 10^3 =$

$30 * 10^3 * 3 * 10^3 =$ $25 * 10^3 * 5 * 10^3 =$

When the Exponents Polarities are <u>NOT the same,</u> . Multiplying the powers of 10, the Exponents must be_____ in the problem, to get the Exponent in the solution.

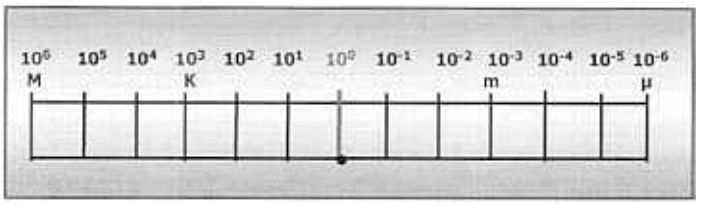
$14 * 10^{-2} * 10 * 10^3 =$ $6 * 10^7 * 2 * 10^{-3} =$

$8 * 10^{-4} * 3 * 10^7 =$ $25 * 10^3 * 5 * 10^{-3} =$

Division: The rule for solving for the exponent is: Cross the line change the ?

$\frac{16 * 10^3}{4 * 10^{-4}}$ $\frac{24 * 10^3}{6 * 10^{-4}}$

$\frac{45 * 10^3}{5 * 10^{-4}}$ $\frac{64 * 10^3}{8 * 10^{-4}}$



Converted the following to a prefix value.

$14 * 10^{3}$ =_____ $56 * 10^{4}$ =_____ $214 * 10^{6}$

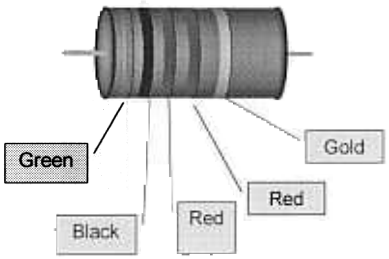
$14 * 10^{-3}$ =_____ $14 * 10^{-8}$ =_____ $14 * 10^{-6}$ =

Solve the following problems, Answer in Prefix Value

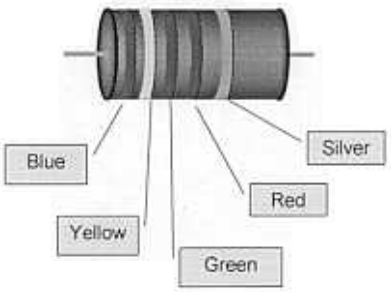
5K + 10K =_____ 15K + 22K =_____ 10K + 90K =_____ or_____

DC: **Ohms Law**

Resistance:
Tolerance:
Amount of tolerance:
Upper limit:
Lower limit:



Resistance:
Tolerance:
Amount of tolerance:
Upper limit:
Lower limit:



Resistance:
Tolerance:
Amount of tolerance:
Upper limit:
Lower limit:

5 Band resistors
The 1st color band indicates _ digit.
The 2nd color band indicates _digit.
The 3rd color band indicates digit
The 4th color band indicates _____.
The 5th color band indicates _____

DC: **Ohms Law**

Voltage: Electromotive Force, EMF, Is a Difference in _____ { or force } between two points + & - That causes electrons to move or flow in a conductor

The letter symbol for voltage is:

The unit of measure for voltage is:

CURRENT Is the MOVEMENT OF ELECTRONS From the most , to the most _____ point in the circuit.

The letter symbol for current is:

Unit of Measure is:

Resistance: Is the _____ Resistance controls the flow of current.

The letter symbol for Resistance is:

Unit of Measure is:

* = **Voltage Applied**

* = **Current**

* = **Resistance**

Fill in the blanks for Ohms Law

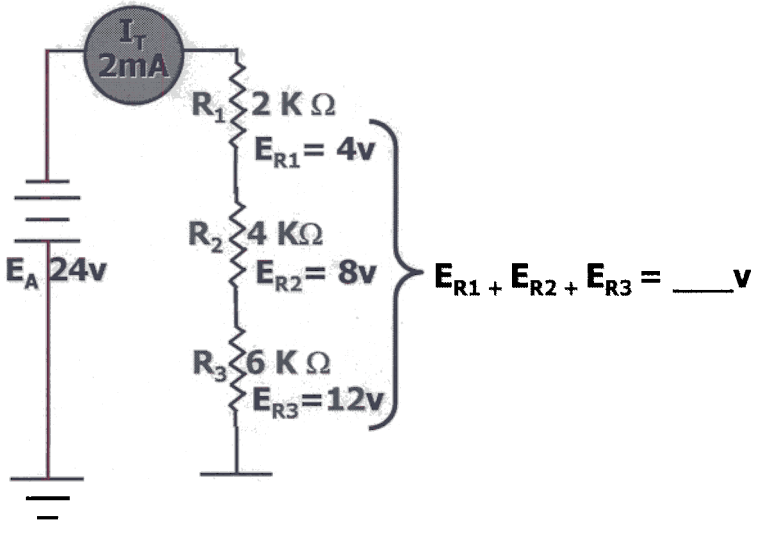
E / =R R * =E I * R =____ E / R =_____

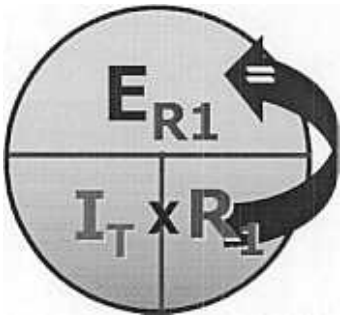
E/ = I / R =____ R * ___ =___ /R =I

Finding Voltage Drops

As current flows, it enters a resistor , and leaves that same resistor in respect to the point of entry.

<u>Kirchhoff's Law</u> for Voltage; The sum of the individual voltage drops =





The Largest Resistor drops the voltage & the Smallest Resistor the

Solve for the voltage value.

3mA * 12KΩ = _____ 5mA * 26KΩ = _____ 2A * 36Ω =

What is the relationship between Resistance and Current?

What is the relationship between Voltage and Current?

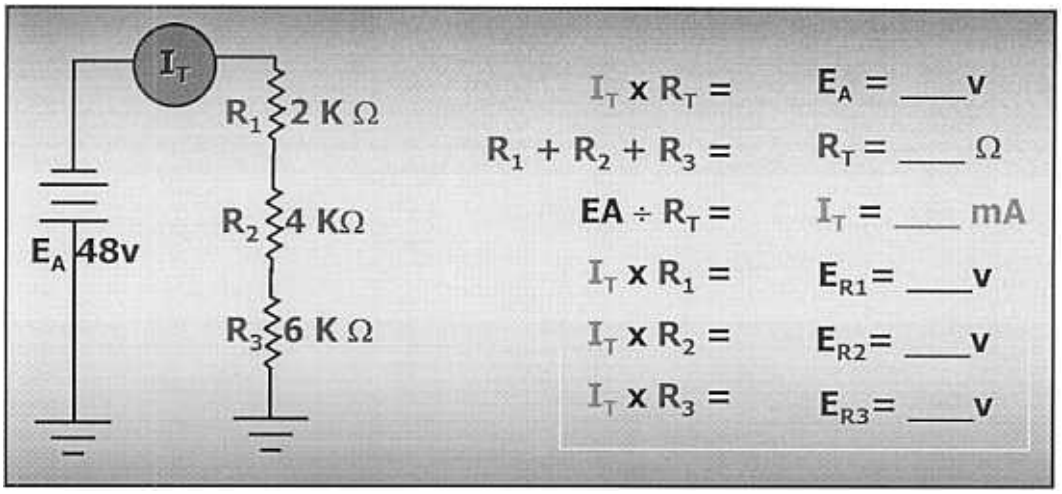
Solve for the current value.

24V / 6KΩ = _____ 40V / 5KΩ = _____ 18V / 3KΩ = _____

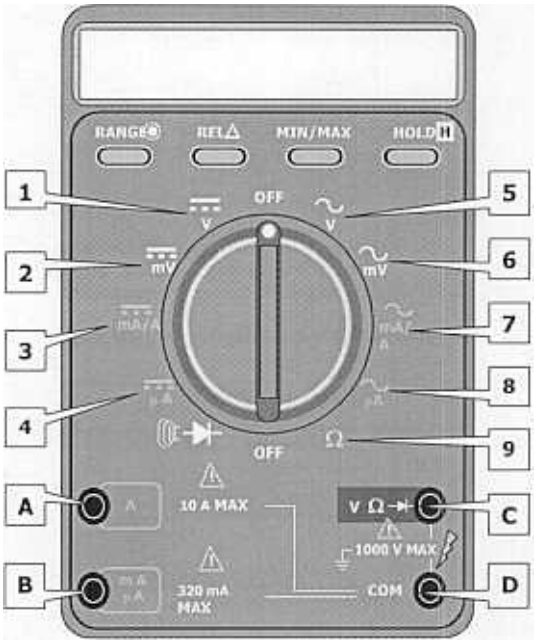
What are the types of resistors? &

Solve for the resistance value given the following information.

11V / 2.5mA = _____ 100V / 5A = _____ 80V / 3.5mA =



DC: **Care & Use Multimeter**



Set the meter up to make the following types of measurement:

100VDC	**Selector switch to** .	**Red probe** _____	**Black Probe** ___
100KΩ	**Selector switch to** .	**Red probe** _____	**Black Probe** ___
10mA AC	**Selector switch to** .	**Red probe** _____	**Black Probe** ___
60VAC	**Selector switch to** _____	**Red probe** _____	**Black Probe** ___
35 µA AC	**Selector switch to** _____	**Red probe** _____	**Black Probe** ___
20VAC	**Selector switch to** _____	**Red probe** _____	**Black Probe** ___
10KΩ	**Selector switch to** .	**Red probe** _____	**Black Probe** ___
30mVAC	**Selector switch to** .	**Red probe** _____	**Black Probe** ___
3A AC	**Selector switch to** .	**Red probe** _____	**Black Probe** ___
26 µA DC	**Selector switch to** .	**Red probe** _____	**Black Probe** ___
50mVDC	**Selector switch to** .	**Red probe** _____	**Black Probe** ___

Travel Position **Selector switch to**

DC: **Series Circuits**

A Series Circuit is defined as Ckt that has only for current flow.

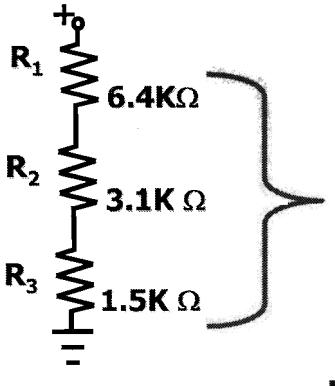
Draw arrows to indicate the correct relationships.

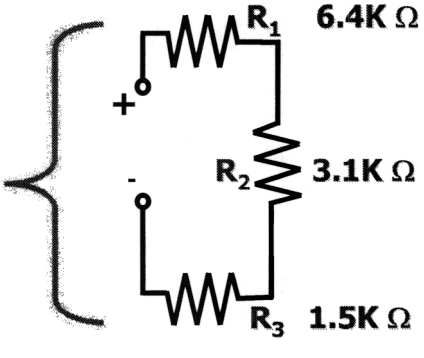
E	**I**	Direct	**R** Remains Constant
R	**I**	Inverse	**E** Remains Constant
R	$\mathbf{E_R}$	Direct	

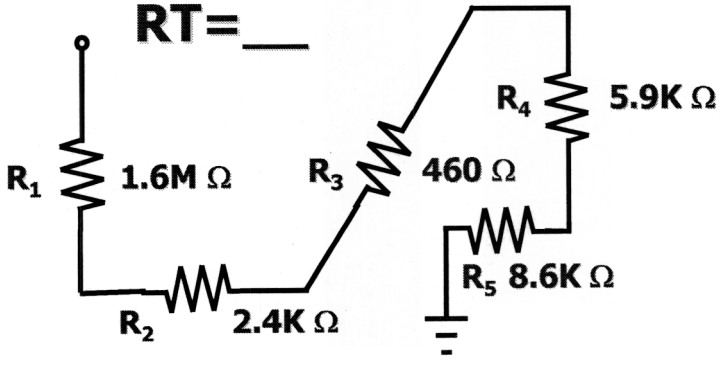
Resistors in Series are

R_T is the of the individual resistors in a series Ckt.

Solve for the following:

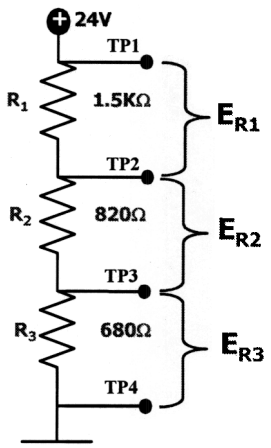






Voltage drops in Series are to solve for Applied Voltage.

EA is the of the individual voltage drops in a series Ckt.



E_A

R_T ____ R1 + 2 + 3

I_T $E_A \div R_T$

E_{R1} ____ $I_T \times R_1$

E_{R2} ____ $I_T \times R_2$

E_{R3} ____ $I_T \times R_3$

IF two or more Resistors are of the same value then they will have the _____ voltage Drop.

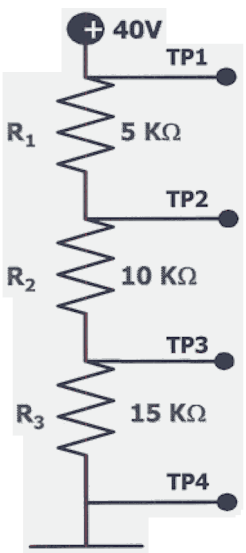
If all the resistors are of the same Value, & EA is known then EA ÷ Number of Resistors = ER# . True or False?

Voltages at Test Points are made in reference to

The voltages at TP are the of the voltage Drops Between the TP & Gnd.

F

Solve for the following:



E_{R1} =

E_{R2} =

E_{R3} =

E_{TP1} = _____

E_{TP2} = _____

E_{TP3} = _____

E_{TP4} =

Current flow in a series Ckt remains

Current is calculated by EA over

Current flows from the most potential to the most

If there is KΩ of Resistance, there will be of Current.

Solve for the following:

12V / 6 KΩ = 24V / 3 KΩ = 60V / 25 KΩ =

DC: Series Circuits Trouble Shooting

4 basic principles in the approach to troubleshooting:

_____ _____

Symptom: A measurement or an obvious indication, which when compared to the normal, is _____ or _____ to its normal operating parameters

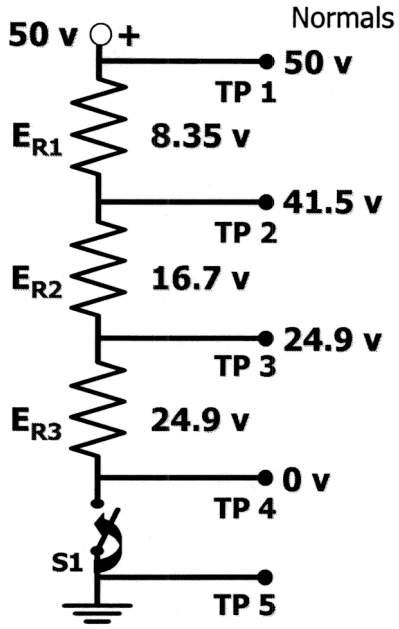
The path has been severed in that component or Ckt. (Open , Short, Changed Value).

The device acts like a piece of wire. (Open , Short, Changed Value).

A component operates outside of it's specified value & tolerance (Open , Short, Changed Value).

Malfunction: Is simply defined based on the symptoms as an _____ _____, or _ value.

Solve for the following malfunction symptoms



A. Symptoms

E_{TP1} = 50 v

E_{TP2} = 50 v

E_{TP3} = 50 v

Ground

Malfunction: _____

C. Symptoms

E_{TP1} = 50 v

E_{TP2} = 50 v

E_{TP3} = 37.5

Ground

Malfunction: _____

B. Symptoms

E_{TP1} = 50 v

E_{TP2} = 50 v

E_{TP3} = 0 v

Ground

Malfunction: _____

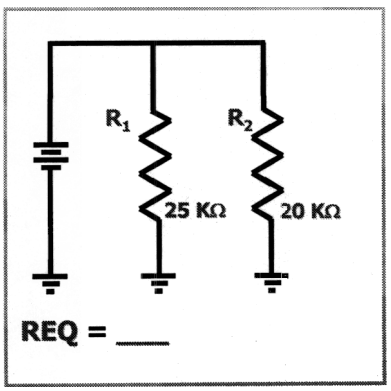
DC: **Parallel Circuits**

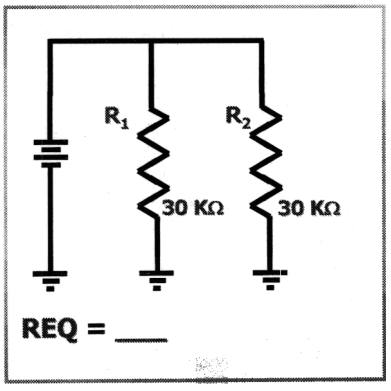
A PARALLEL CKT is defined as an electrical circuit having _____

_____

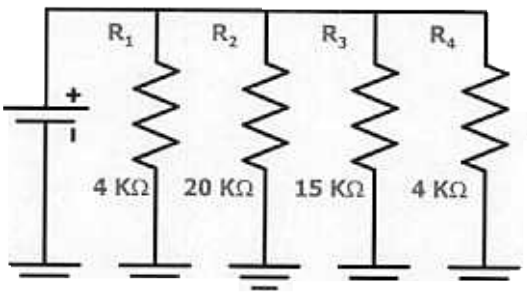
The 3 formulas for solving for REQ are

_____ _____ _____





c.



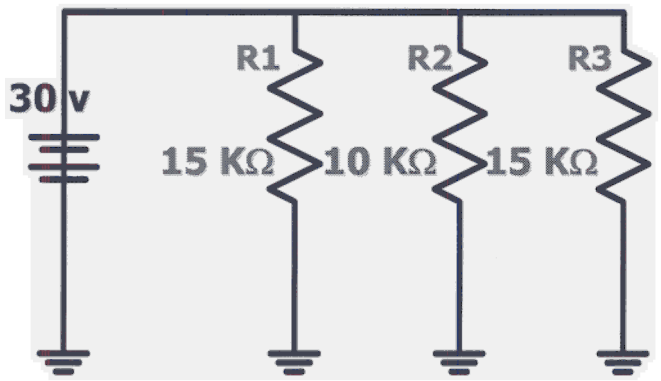
Voltage is in a parallel Ckt.

In a parallel CKT, E_{REQ} / = I_{R1}

In a parallel CKT, REQ * I_T =

The Sum of the Branch Currents is =

EA & EREQ are the in a Pure Parallel Ckt.



E_A =

REQ =

I_T = $E_A \div REQ$

E_{R1} =

E_{R2} = I_T X REQ

E_{R3} =

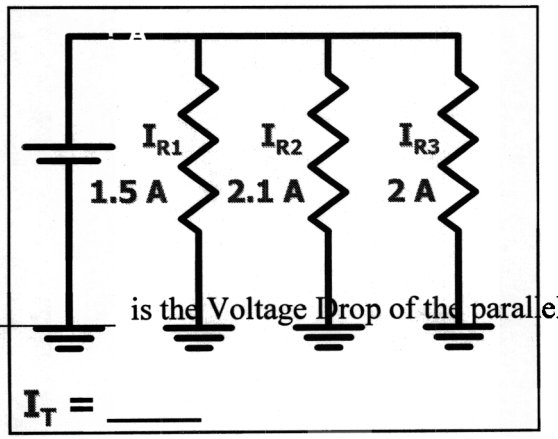
I_{R1} = $E_{REQ} \div R_1$

I_{R2} = $E_{REQ} \div R_2$

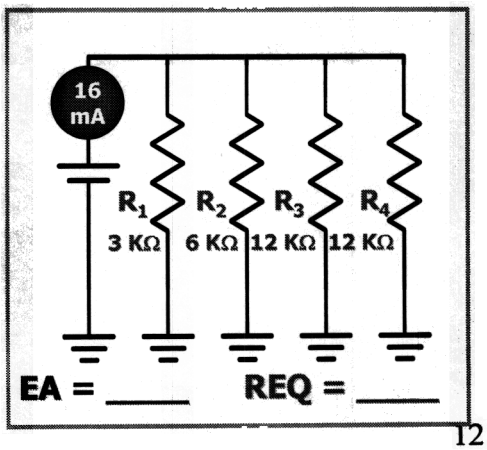
I_{R3} = $E_{REQ} \div R_3$

The Smallest Resistor Carries the Current.

The largest Resistor Carries the



is the Voltage Drop of the parallel Ckt.



DC: Parallel Circuits Trouble Shooting

EA & EREQ are the in a PURE Parallel Ckt.

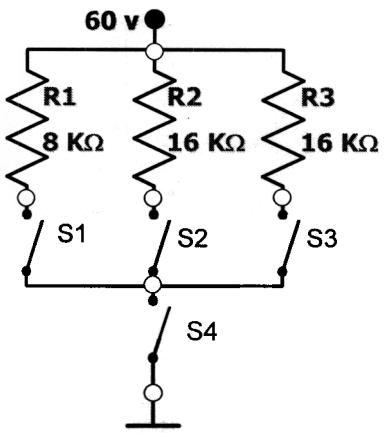
The REQ will always be than the smallest resistor in the Ckt.

3 Methods of calculating REQ;

❶ _____, ❷ __ _, ❸ _____

Solve for the following reading across the open switch:

Solve for the following Malfunction:



Reading across S1 current = 0mA

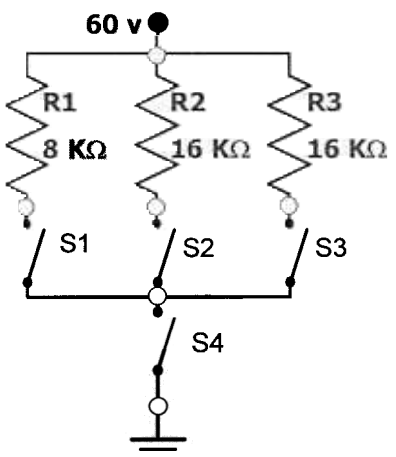
Reading across S4 current = 11.25mA
Reading across S2 current = 3.75mA

Reading across S4 current = 7.5mA
Reading across S2 current = 3.75mA

Current always takes the path of Resistance.

Brach Current is in a parallel CKT and = I_T

Solve for the following:
Malfunction



All switches are closed and REQ = 8KΩ
S3 & S4 switches closed REQ = ∞Ω

All switches are closed and REQ decreased
S2, S3 & S4 switches closed REQ = 8KΩ

All switches are closed and REQ increased
S2, S3 & S4 switches closed REQ = 8KΩ

All switches are closed and REQ decreased
S2 & S4 switches closed REQ = 0KΩ

DC: **Series - Parallel Ckts**

Series Rules:

Resistance is _____ to = R_T

Voltage is the _____ of the Resistors Voltage Drops [ER#], to = EA.

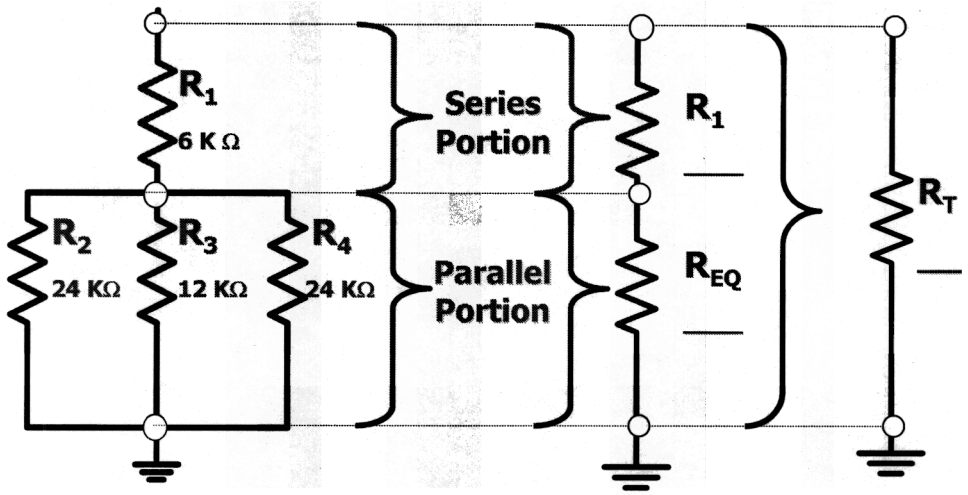
Current is _____, the same throughout the Ckt to = I_T.

Parallel:

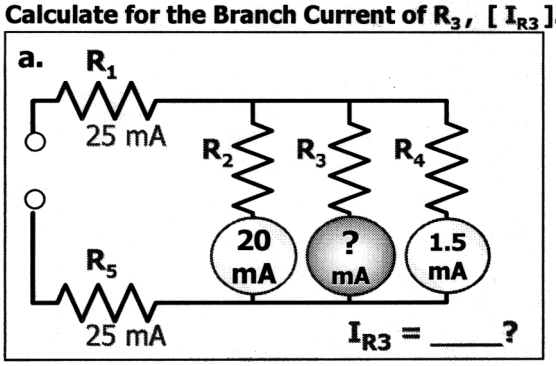
Resistance is an Equivalency, called the _____

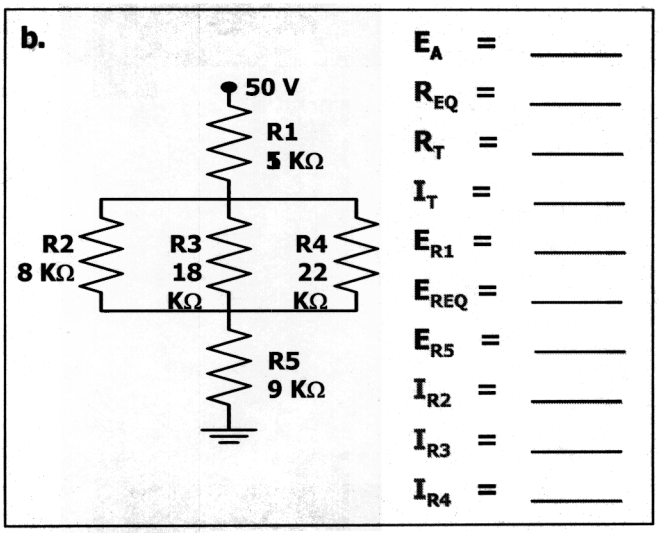
Voltage is _____ on each of the Branches, and is called the

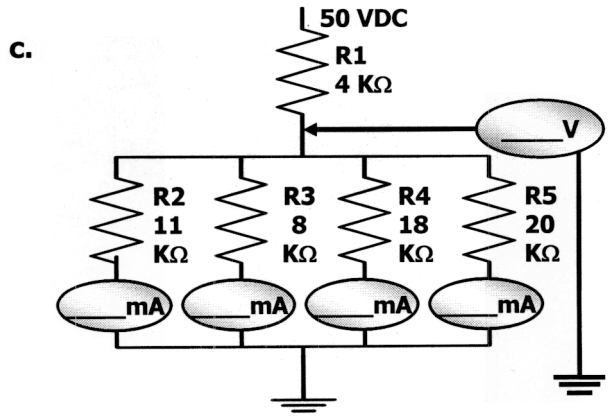
Current is _____, the sum of the Branch currents is = to I_T.



Calculate for the Branch Current of R_3, [I_{R3}].





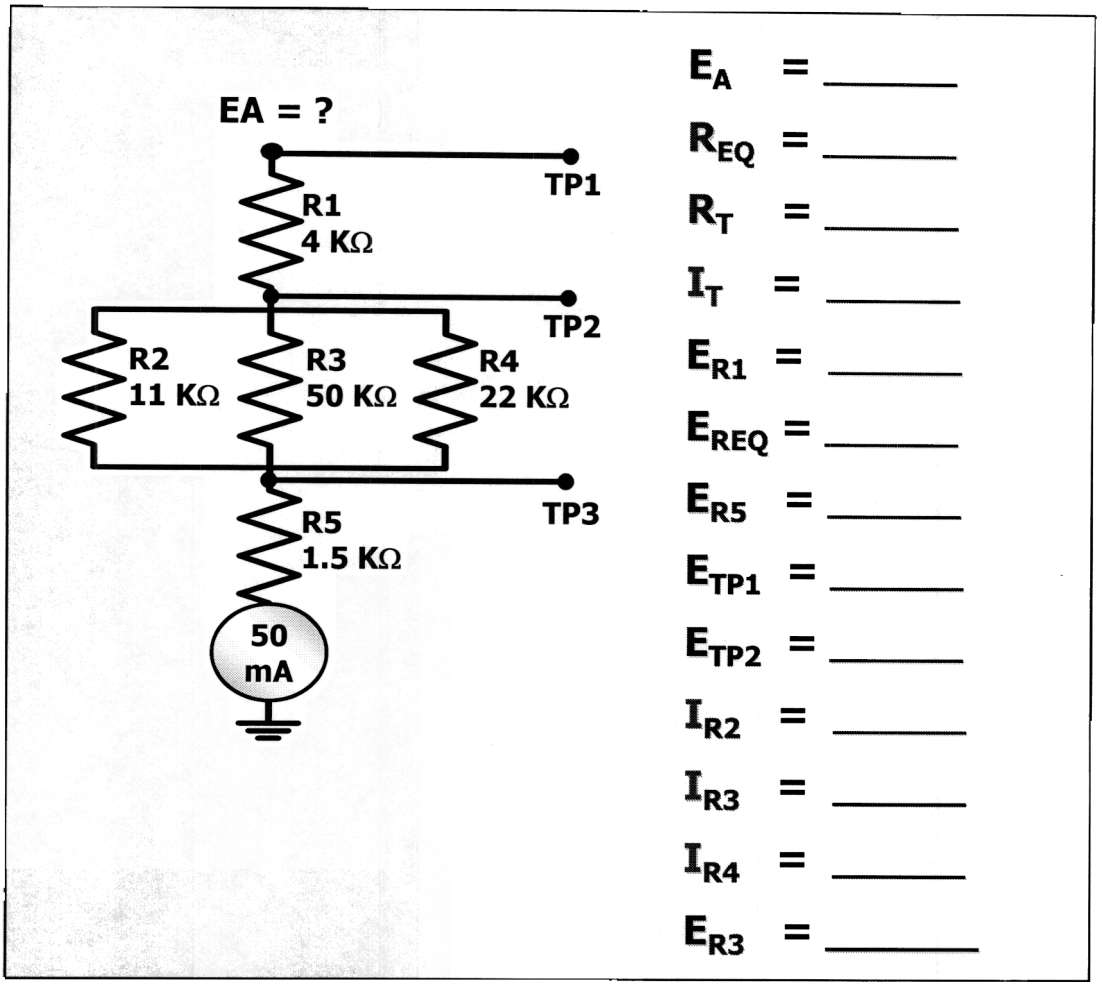


R_{EQ} =

R_T =

I_T =

E_{R1} =



Malfunction	Symptom
	$R_T = \infty\ \Omega$ REQ = 6.3 KΩ I_T = 0mA R1 = 4kΩ
	R_T = 23KΩ REQ = 0 KΩ I_{R2} = 0mA I_{R3} = 0mA
	$R_T = \infty\ \Omega$ REQ = 6.3KΩ I_{R3} = 0mA R1 = ∞KΩ
	R_T = 7.8KΩ REQ = 6.3 KΩ I_T = 75.6mA R1 = 15kΩ