CIRCUITS

AN **ELECTRICAL CIRCUIT** IS A CONDUCTING PATH, EXTERNAL TO THE BATTERY, WHICH ALLOWS CHARGE TO FLOW FROM ONE TERMINAL TO THE OTHER.

AN ELECTRICAL CIRCUIT IS A CLOSED LOOP WITH THE FOLLOWING:

1. A POWER SOURCE,

2. FUSE (PROTECTIVE DEVICE)

3. LOAD/RESISTOR

4. CONTROL SWITCH

5. GROUND

6. CONDUCTOR (wire)

THERE ARE **THREE** BASIC TYPES OF CIRCUITS:

1. **SERIES**
2. **PARALLEL**
3. **SERIES-PARALLEL**

A **SERIES CIRCUIT** IS A CIRCUIT WHERE THERE IS ONLY **ONE PATH** FROM THE SOURCE THROUGH ALL OF THE **LOADS** AND BACK TO THE SOURCE.

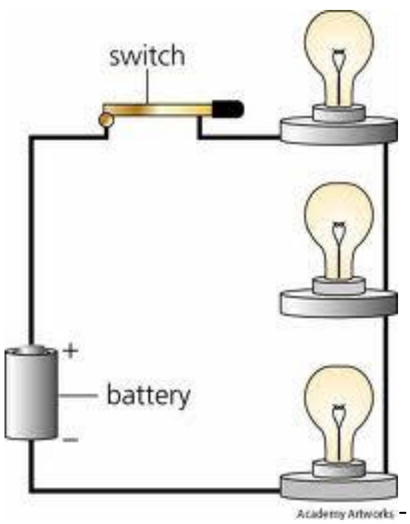
https://video.search.yahoo.com/yhs/search?fr=yhs-adk-adk_sbnt&hsimp=yhs-adk_sbnt&hspart=adk&p=how+to+calculate+resistance+in+a+series+circuit&guccounter=1#id=37&vid=67bca05f16dda01c600a07c34f600d01&action=view

THIS MEANS THAT ALL OF THE CURRENT IN THE CIRCUIT MUST FLOW THROUGH ALL OF THE **LOADS/resistors**.

THERE IS ONLY **ONE PATH** FOR ELECTRONS TO FLOW IN A SERIES CIRCUIT.

IF ONE **RESISTOR**/LOAD IS BURNT OUT, THE ENTIRE CIRCUIT WOULD BE BURNT OUT AND NO ELECTRICITY WOULD FLOW.

IF YOU REMOVE A RESISTOR, YOU MUST DECREASE THE VOLTAGE. IF YOU ADD AN EXTRA RESISTOR YOU MUST INCREASE THE VOLTAGE.



www.youtube.com/watch?v=ymRwIUNlEL4

Awesome video

https://www.youtube.com/watch?v=RPOpv915fhs

THE AMOUNT OF CURRENT IS THE SAME THROUGH ANY COMPONENT IN THE CIRCUIT.

A SERIES CIRCUIT IS MADE UP OF **THREE** PARTS:

1. **A SOURCE**
2. **RESISTOR**, IN WHICH THE ELECTRICAL ENERGY IS UTILIZED AND IS CALLED THE **LOAD**.
3. **CONDUCTORS**.

THE CURRENT FLOW IN A SERIES CIRCUIT IS THE SAME THROUGH EACH ELEMENT.

THE COMBINED RESISTANCE OF THE VARIOUS LOADS IN SERIES IS THE SUM OF THE SEPARATE RESISTANCES.

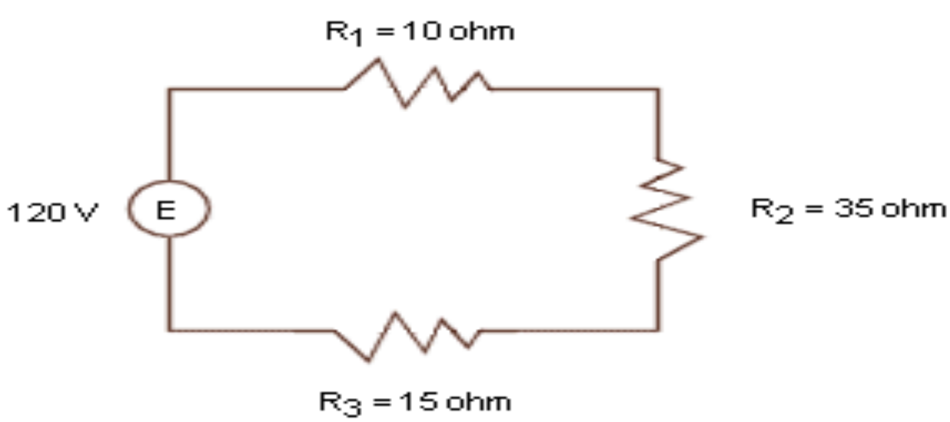
THE VOLTAGE ACROSS THE SOURCE OR POWER IS EQUAL TO THE SUM OF THE VOLTAGE DROP ACROSS THE SEPARATE LOADS IN SERIES.

PROBLEM:
SERIES CIRCUIT

Show this one
https://video.search.yahoo.com/yhs/search?fr=yhs-adk-adk_sbnt&hsimp=yhs-adk_sbnt&hspart=adk&p=how+to+calculate+resistance+in+a+series+circuit&guccounter=1#id=33&vid=183072c5bfdb340afd15521b3e9a84e7&action=view

1. What is the total resistance on the circuit?
2. What is the total current?
3. What is the voltage drop for each resistor?

https://video.search.yahoo.com/yhs/search?fr=yhs-adk-adk_sbnt&hsimp=yhs-adk_sbnt&hspart=adk&p=how+to+calculate+resistance+in+a+series+circuit#id=38&vid=2328fcdcd203eae95f02f7696ecd01c3&action=view



$$R_T = R_1 + R_2 + R_3 = 10 \text{ ohm} + 35 \text{ ohm} + 15 \text{ ohm} = 60 \text{ ohm}$$

APPLYING OHM'S LAW FOR THE TOTAL CIRCUIT, WE USE THE FOLLOWING FORMULA:

$$I_T = E_T / R_T = \frac{120 \text{ Volts}}{60 \text{ ohm}} = 2 \text{ amps}$$

I = CURRENT
E = **ELECTROMOTIVE FORCE**/VOLTS
R = RESISTANCE

THE CURRENT IN EACH RESISTOR IS:

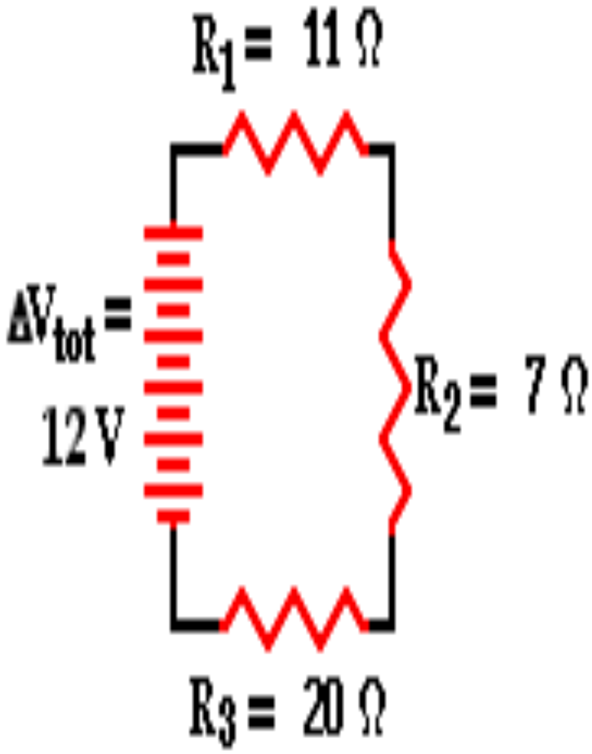
$$I_T = I_1 = I_2 = I_3 = 2 \text{ amps}$$

YOU CAN FIND THE **<u>VOLTAGE DROP</u>** FOR EACH RESISTOR BY APPLYING OHM'S LAW TO EACH OF THE RESISTORS.

$$E_1 = I_1 R_1 = 2 \text{ amps x } 10 \text{ ohms} = 20 \text{ volts}$$
$$E_2 = I_2 R_2 = 2 \text{ amps x } 35 \text{ ohms} = 70 \text{ volts}$$
$$E_3 = I_3 R_3 = 2 \text{ amps x } 15 \text{ ohms} = 30 \text{ volts}$$

NOTE WE CAN CHECK OUR CALCULATIONS:

$$E_T = E_1 + E_2 + E_3$$
$$120 \text{ volts} = 20 \text{ volts} + 70 \text{ volts} + 30 \text{ volts}$$

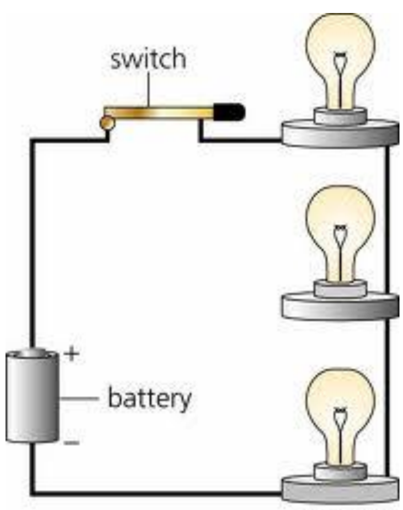


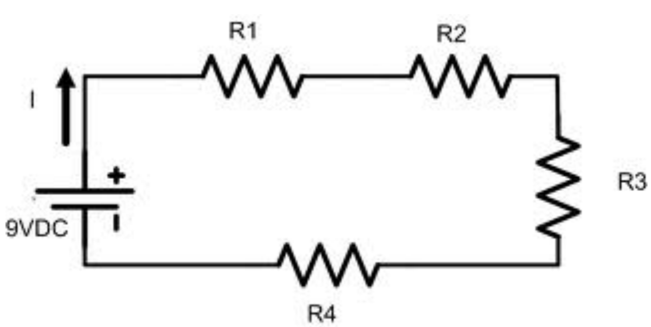
R_{eq} = ______ Ω I_{tot} = ______ A

I_1 = ______ A ΔV_1 = ______ V

I_2 = ______ A ΔV_2 = ______ V

I_3 = ______ A ΔV_3 = ______ V

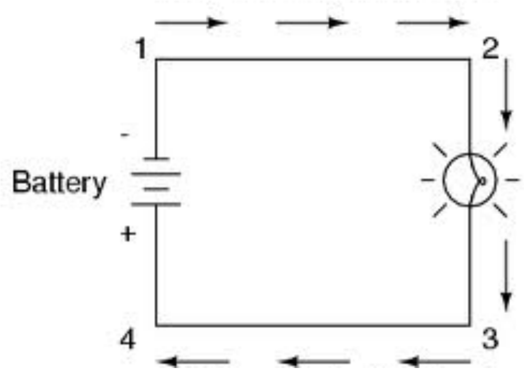


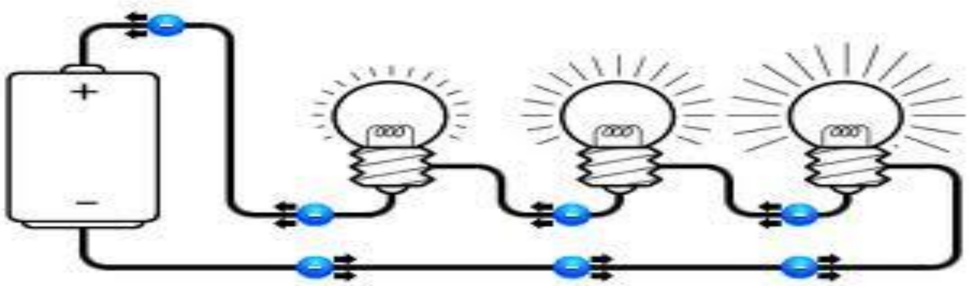


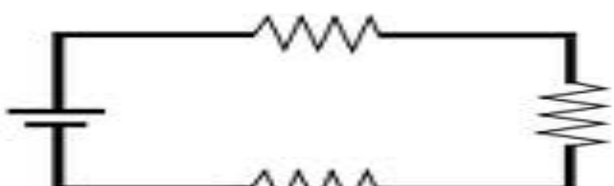
http://scienceofeverydaylife.discoveryeducation.com/views/other.cfm?guidAssetId=D1507F6E-09C3-4E7B-B1E9-16708E402009

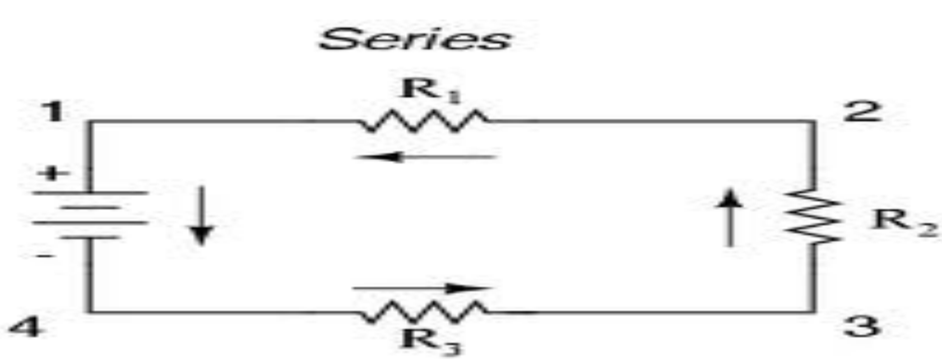
https://video.search.yahoo.com/yhs/search?fr=yhs-adk-adk_sbnt&hsimp=yhs-adk_sbnt&hspart=adk&p=how+to+calculate+resistance+in+a+series+circuit&guccounter=1#id=49&vid=d0801df5b033f1ed9de9f735e64f338f&action=view

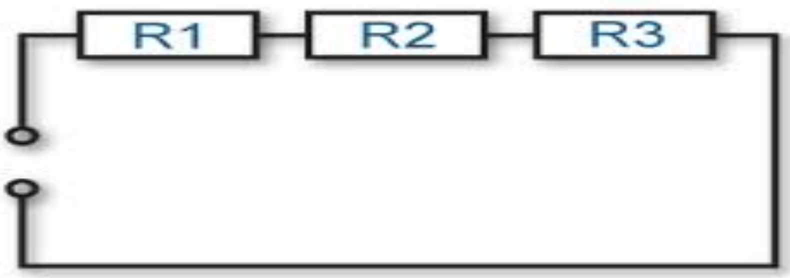
TYPES OF SCHEMATIC DIAGRAMS FOR SERIES CIRCUITS

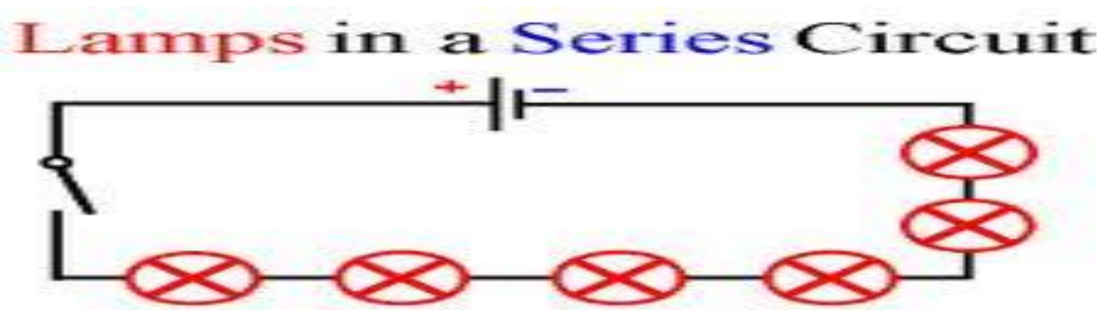

1
2
Battery
-
+
4
3

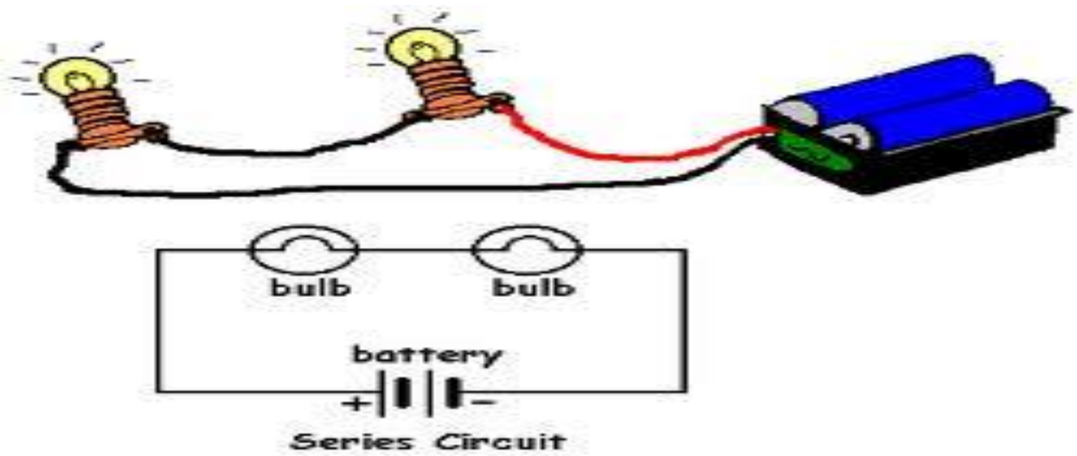

+
–

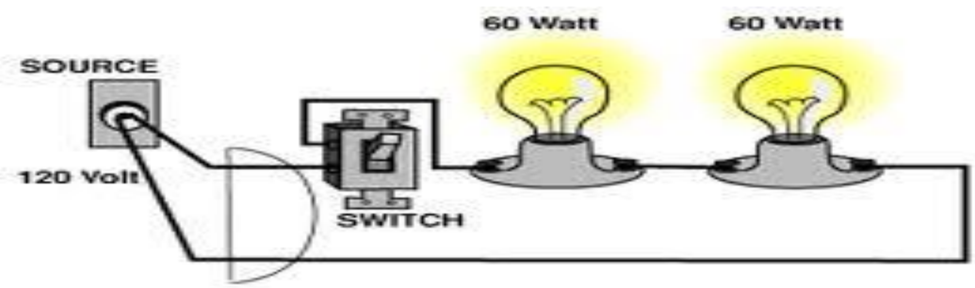



Series
1
R1
2
+
-
R2
4
R3
3


R1
R2
R3


Lamps in a Series Circuit
+
−





THE LOSS IN ELECTRIC POTENTIAL IS REFERRED TO AS A VOLTAGE DROP.

IT OCCURS AS THE ELECTRICAL ENERGY OF THE CHARGE IS TRANSFORMED TO OTHER FORMS OF ENERGY (THERMAL, LIGHT, MECHANICAL, ETC.) WITHIN THE RESISTORS OR LOADS.

IF AN ELECTRIC CIRCUIT POWERED BY A 1.5-VOLT CELL IS EQUIPPED WITH MORE THAN ONE

RESISTOR, THEN THE CUMULATIVE LOSS OF ELECTRIC POTENTIAL IS 1.5 VOLTS.

THERE IS A VOLTAGE DROP FOR EACH RESISTOR, BUT THE SUM OF THESE VOLTAGE DROPS IS 1.5 VOLTS - THE SAME AS THE VOLTAGE RATING OF THE POWER SUPPLY.

THIS CONCEPT CAN BE EXPRESSED MATHEMATICALLY BY THE FOLLOWING EQUATION:

VBATTERY = V1 + V2 + V3 + ...

TO ILLUSTRATE THIS MATHEMATICAL PRINCIPLE IN ACTION, CONSIDER THE TWO CIRCUITS SHOWN BELOW IN DIAGRAMS A AND B.

SUPPOSE THAT YOU WERE ASKED TO DETERMINE THE TWO UNKNOWN VALUES OF THE ELECTRIC POTENTIAL DIFFERENCE ACROSS THE LIGHT BULBS IN EACH CIRCUIT.

TO DETERMINE THEIR VALUES, YOU WOULD HAVE TO USE THE EQUATION ABOVE. THE BATTERY IS DEPICTED BY ITS CUSTOMARY SCHEMATIC SYMBOL AND ITS VOLTAGE IS LISTED NEXT TO IT.

Diagram A

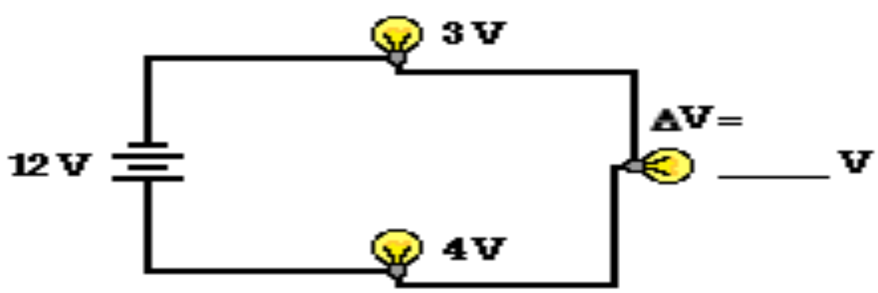
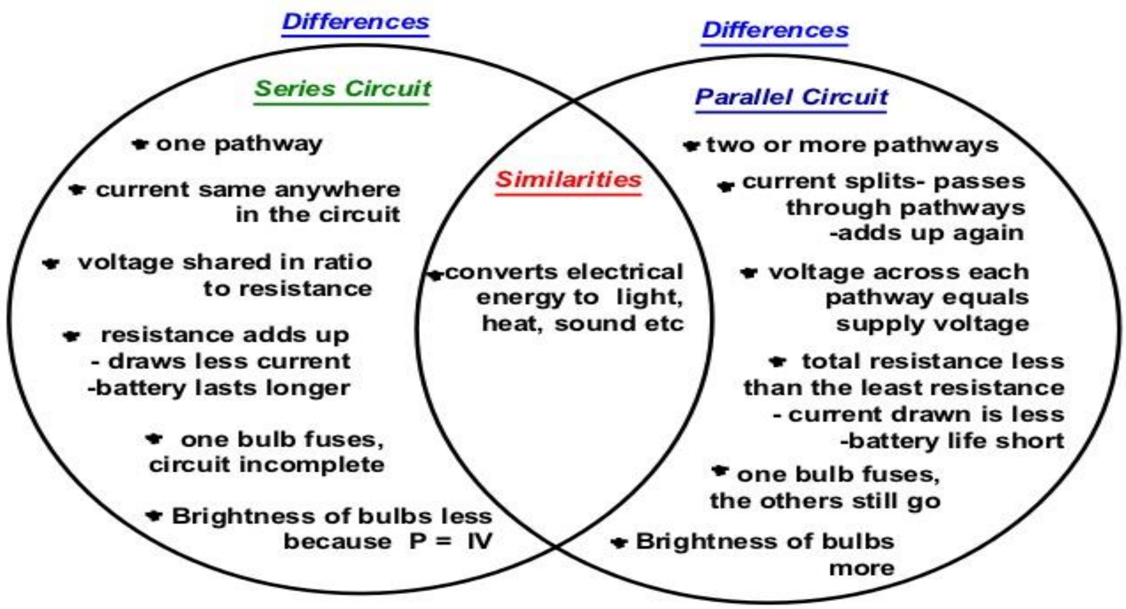
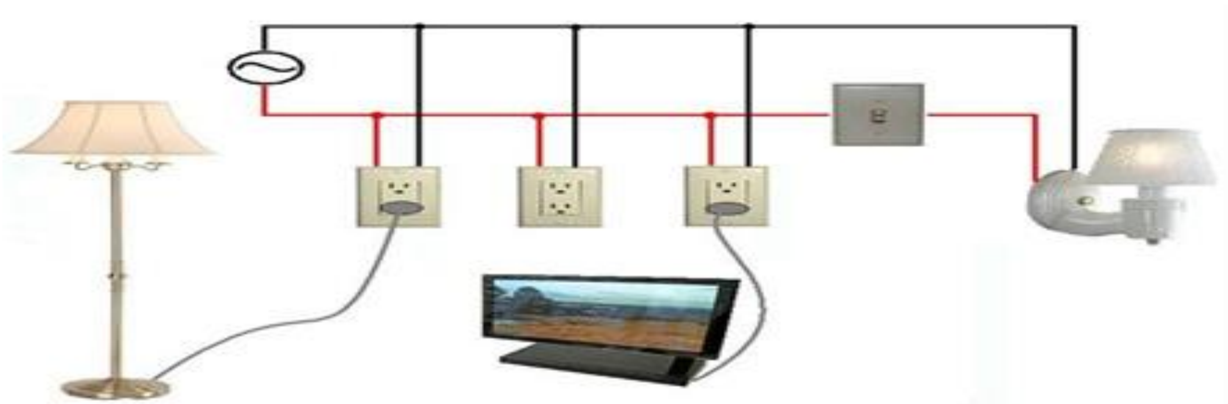


Diagram B



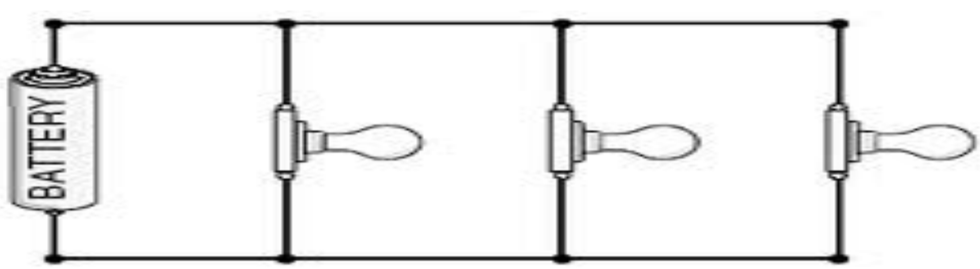
PARALLEL CIRCUIT

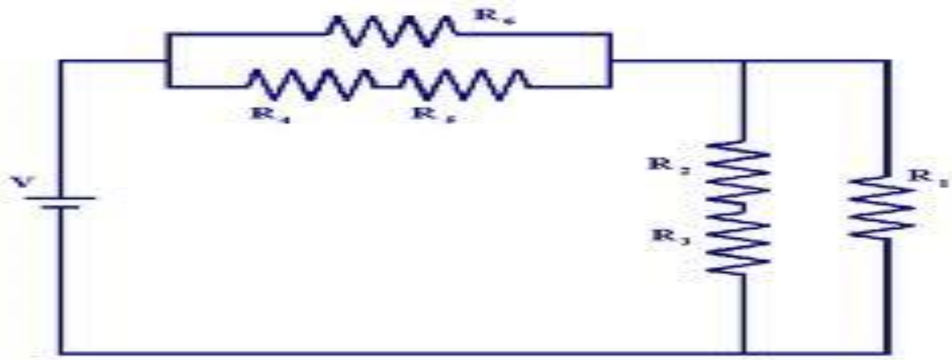
A **PARALLEL CIRCUIT** IS AN ELECTRIC CIRCUIT IN WHICH THE **ELEMENTS**, **BRANCHES** (HAVING ELEMENTS IN SERIES), OR **COMPONENTS** ARE CONNECTED BETWEEN TWO POINTS, WITH ONE OF THE TWO ENDS OF EACH COMPONENT CONNECTED TO EACH POINT.



A PARALLEL CIRCUIT IS ALSO CONSIDERED A CLOSED ELECTRICAL CIRCUIT IN WHICH THE CURRENT IS DIVIDED INTO TWO OR MORE PATHS OR **BRANCHES** AND THEN RETURNS VIA A COMMON PATH TO COMPLETE THE CIRCUIT.

IN A PARALLEL CIRCUIT THE **VOLTAGE** IS EQUAL ACROSS ALL COMPONENTS IN THE CIRCUIT.




R
R
R
R
V
R
R
R

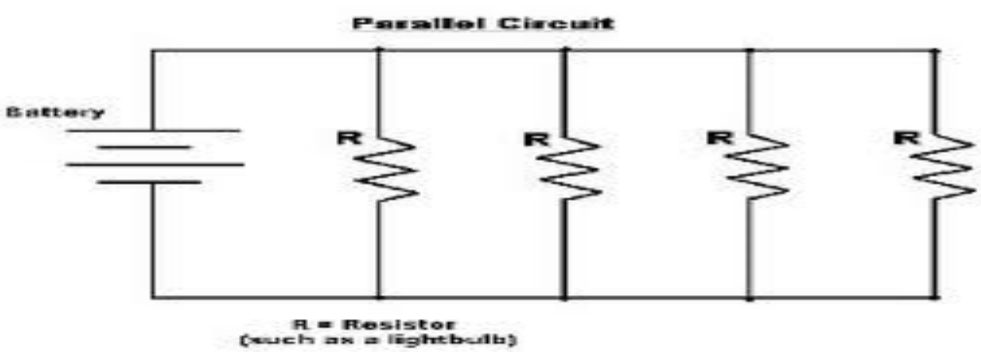
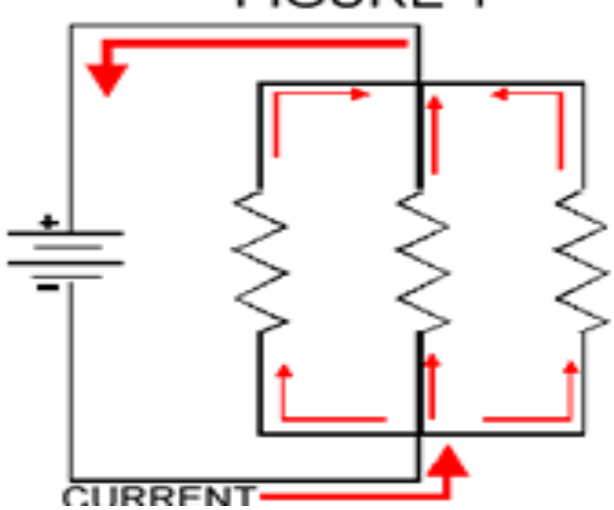

Parallel Circuit
Battery
R
R
R
R
R = Resistor
(such as a lightbulb)

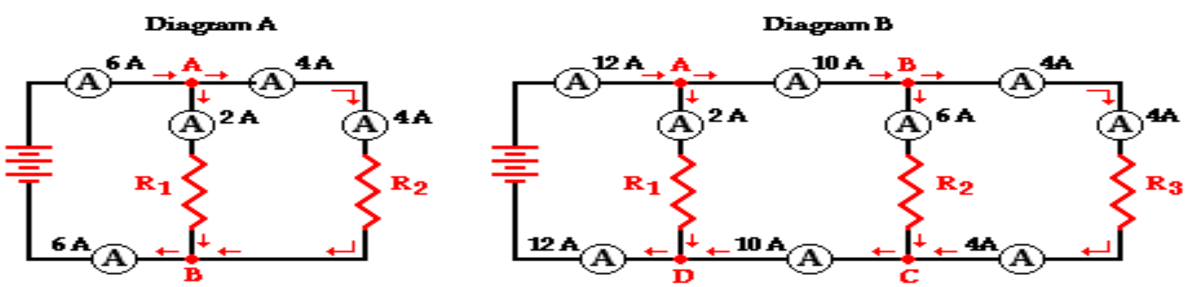
FIGURE 1


+
-
CURRENT

calculations

https://www.youtube.com/watch?v=mMxLzaDuWOE

https://www.youtube.com/watch?v=CZgqGTxL9cA



Series-Parallel Circuit

https://www.youtube.com/watch?v=mtTlCL3pb-w

TO FIND THE **TOTAL RESISTANCE** USE THE FOLLOWING FORMULA:

$$\frac{1}{1/R_0 = 1/R_1 + 1/R_2 + 1/R_3 \;\ldots 1/R_N}$$

$= 1/15\Omega + 1/15\Omega + 1/30\Omega = 5/30$

$1/5/30$

OR $1 \times 30/5$

$= 6\ \Omega$

TO FIND THE TOTAL VOLTAGE, YOU MUST FIRST FIND THE **TOTAL RESISTANCE**

THE AMPS ON THE UNIT POWERING THE CIRCUIT IS 5 A

$V = I \times R$

$= 5\text{ A} \times 6\Omega$

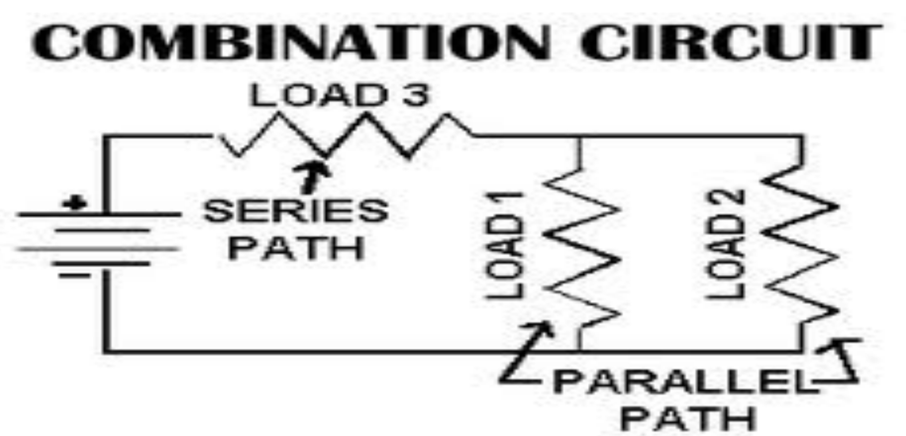
$= 30\text{ V}$

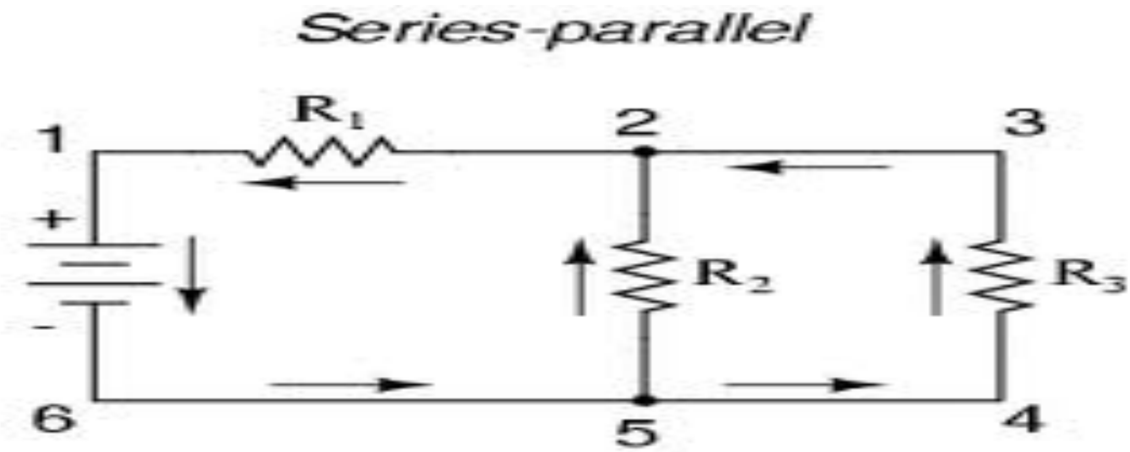
USING $V_0 = V_1 = V_2 = V_3$ ETC ER KNOW THE VOLTAGE ON A, B, & C

$I_A = 30V/15\Omega = 2A$

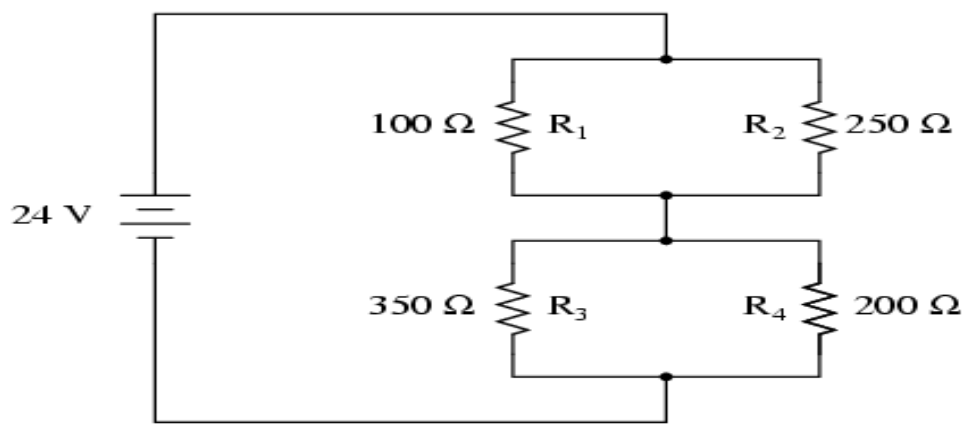
$I_B = 30V/ 15\Omega = 2A$

$I_C = 30V / 30\Omega = 1A$





A series-parallel combination circuit



VOLTAGE: (V)

A MEASURE OF THE AMOUNT OF ELECTRICAL POTENTIAL ENERGY AN ELECTRON FLOWING IN A CIRCUIT CAN GAIN-MEASURE IN VOLTS.

RESISTANCE: (R)

A MEASURE OF HOW DIFFICULT IT IS FOR ELECTRONS TO FLOW IN A MATERIAL- WIRE. Unit ohms (Ω)

ELECTRICAL CURRENT (I)

THE FLOW OF ELECTRICAL CHARGES. Unit (Amps)

CIRCUIT SAFETY

THE TWO MOST COMMONLY USED SAFETY DEVICES ARE:

FUSES

A FUSE CONTAINS A THIN STRIP OF METAL THROUGH WHICH THE CHARGES FOR A CIRCUIT FLOW.

HIGH VOLTAGE FUSE CUTOUT

IF THE CURRENT IS TOO HIGH, THE METAL IN THE FUSE WARMS UP AND MELTS.

A BREAK IN THE CIRCUIT IS PRODUCED, AND THE CHARGES STOP FLOWING. THE FUSE MUST BE REPLACED.

CIRCUIT BREAKERS

A CIRCUIT BREAKER IS A SWITCH THAT OPENS IF THE CURRENT IN THE CIRCUIT IS TOO HIGH.

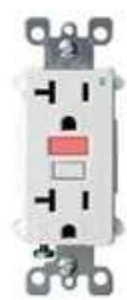
IF A CURRENT IS TOO HIGH, A STRIP OF METAL IN THE CIRCUIT BREAKER WARMS UP AND BENDS AWAY FROM THE WIRES IN THE CIRCUIT. A BREAK IN THE CIRCUIT RESULTS.

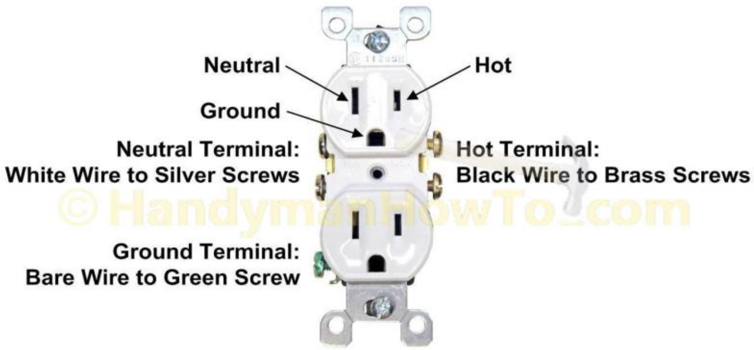
THE OPEN CIRCUIT CAN BE CLOSED BY FLIPPING A SWITCH INSIDE THE BREAKER BOX.

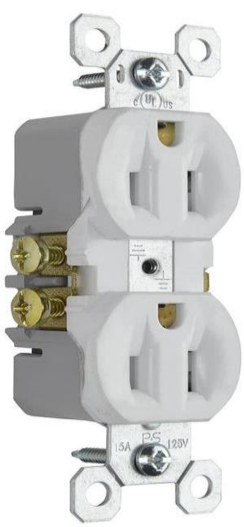
A DEVICE THAT ACTS AS A MINITURE CIRCUIT BREAKER IS A **GROUND FAULT CIRCUIT INTERRUPTER.**

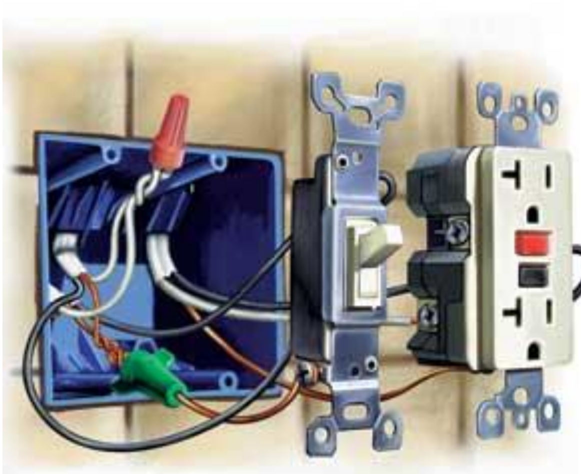
IT PROVIDES PROTECTION BY COMAPRING THE CURRENT IN ONE SIDE OF AN OUTLET WITH THE CURRENT IN THE OTHER SIDE.

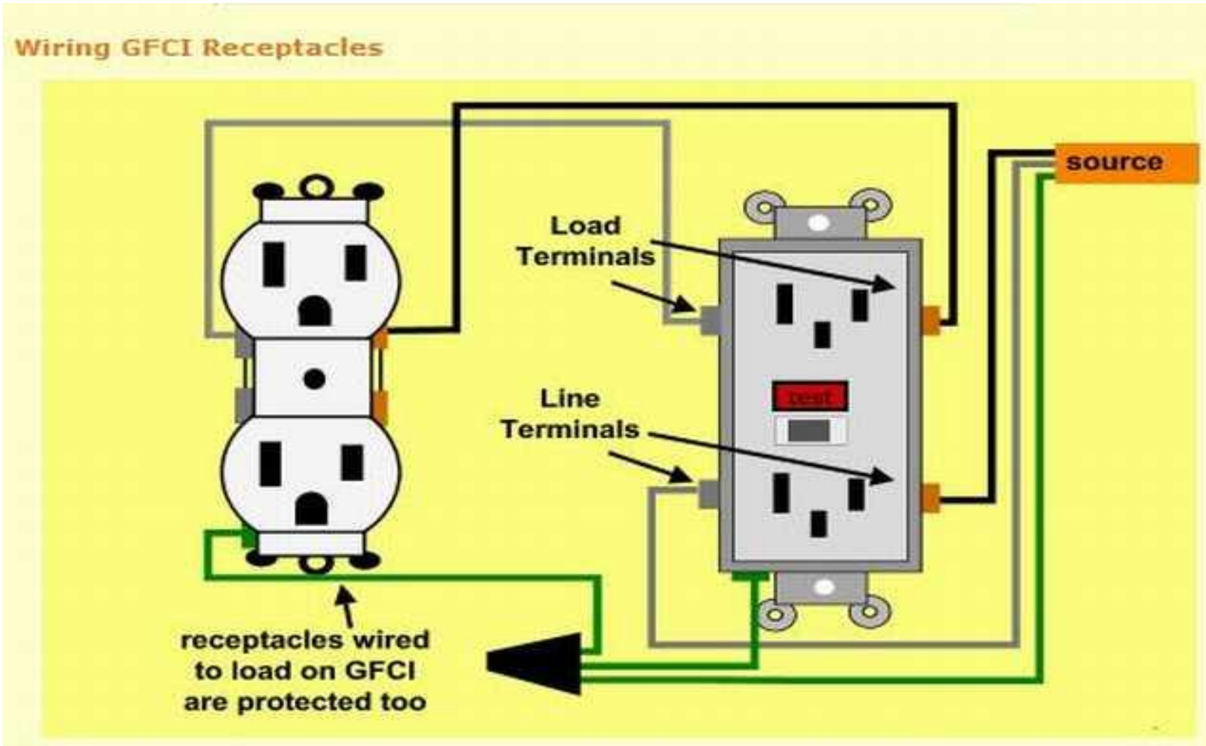
IF THERE IS EVEN A SMALL DIFFERNCE, THE UNIT OPENS THE CIRCUIT. TO CLOSE THE CIRCUIT, YOU MUST PUSH THE **RESET** BUTTON




Neutral
Hot
Ground
Neutral Terminal:
White Wire to Silver Screws
Hot Terminal:
Black Wire to Brass Screws
© HandymanHowTo.com
Ground Terminal:
Bare Wire to Green Screw

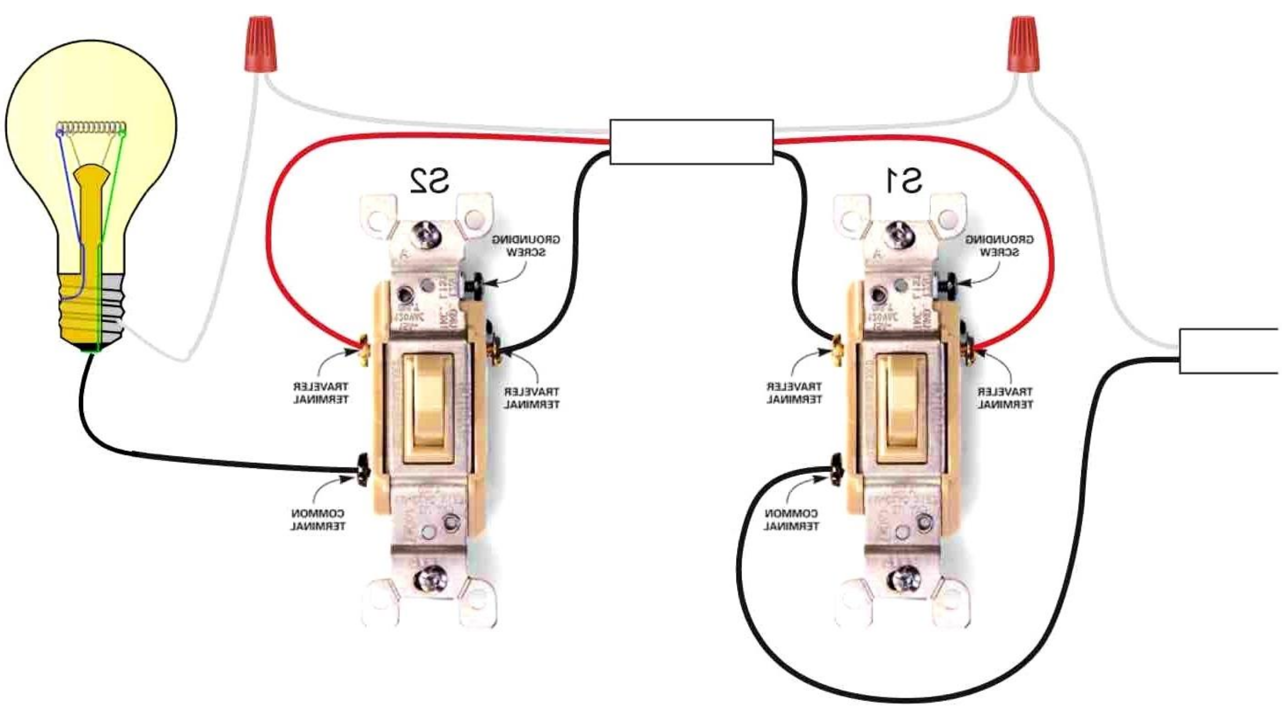






https://www.youtube.com/watch?v=jDRgGUHzw7Q

https://www.youtube.com/watch?v=-R8EhNDd738



CIRCUITS MAY FAIL IF THEY ARE OVERLOADED.

A CIRCUIT IS OVERLOADED WHEN TOO MANY LOADS OR ELECTRICAL DEVICES ARE ATACHED TO IT.

EACH TIME YOU ADD A LOAD TO A PARALLEL CIRCUIT, THE ENTIRE CIRCUIT DRAWS MORE CURRENT. THIS CAUSES THE TEMPERATURE IN THE WIRES TO INCREASE AND CAUSE A FIRE.

ELECTRICAL SAFETY

- DO NOT ALLOW CHILDREN TO PLAY IN PROXIMITY TO SMALL OR LARGE ELECTRIC APPLIANCES.
- REPLACE ANY TOOLS THAT PUT OFF EVEN MILD ELECTRIC SHOCKS.
- REPLACE ANY LIGHT SWITCHES THAT HAVE A TENDENCY TO FLICKER.
- REPLACE ANY LIGHT SWITCHES THAT ARE HOT TO THE TOUCH.
- AVOID OVERLOADING EXTENSION CORDS, SOCKETS AND PLUGS.
- DO NOT EVER FORCE A THREE-PRONG PLUG INTO A TWO-RECEPTACLE SOCKET.
- KNOW WHERE FUSE BOXES AND CIRCUIT BREAKERS ARE LOCATED AS WELL AS HOW TO PROPERLY OPERATE THEM.
- NEVER ATTEMPT ELECTRICAL REPAIRS OR REWIRING WITHOUT PROPER CERTIFICATION AND EXPERIENCE.
- DO NOT PUT **WATER** ON AN ELECTRICAL FIRE; USE A DRY FIRE EXTINGUISHER OR BAKING SODA INSTEAD.

ELECTRICAL SAFETY TIPS FOR CHILDREN

ALL CHILDREN, REGARDLESS OF THEIR AGE, NEED TO BE AWARE OF THE DANGERS OF ELECTRICITY. WHILE THE FOLLOWING SAFETY TIPS ARE FOR ALL CHILDREN, THERE ARE SOME TIPS THAT ARE MORE APPLICABLE FOR OLDER CHILDREN.

AT HOME

* NEVER STICK YOUR FINGERS OR ANY OBJECT INTO AN ELECTRICAL OUTLET OR LIGHT BULB SOCKET.

* KEEP FINGERS AND OTHER OBJECTS OUT OF SMALL APPLIANCES, SUCH AS TOASTERS, EVEN IF THE APPLIANCE IS OFF.

* NEVER USE AN APPLIANCE NEAR A SINK, BATHTUB OR OTHER SOURCE OF WATER.

* KEEP ELECTRICAL WIRES AND APPLIANCE CORDS AWAY FROM SOURCES OF HEAT.

* KEEP ELECTRICAL CORDS AWAY FROM SINKS, BATHTUBS AND OTHER SOURCES OF WATER.

* NEVER TOUCH ANY ELECTRICAL APPLIANCE OR DEVICE, SUCH AS A LIGHT SWITCH, HAIR DRYER, OR TOASTER, IF YOU ARE TOUCHING WATER.

* NEVER PULL AN ELECTRIC PLUG OUT OF THE WALL OUTLET BY YANKING ON THE ELECTRIC CORD.

* UNPLUG AN ELECTRICAL APPLIANCE BEFORE CLEANING IT.

* NEVER USE ANY ELECTRICAL APPLIANCE IF YOU ARE WET.

* IF YOU SEE A WORN, FRAYED OR DAMAGED ELECTRICAL CORD, TELL AN ADULT IMMEDIATELY.

OUTDOORS

* DO NOT CLIMB TREES THAT ARE NEAR POWER LINES OR HAVE POWER LINES RUNNING THROUGH THEM.

* IF YOU ARE FLYING A KITE, OR HAVE MYLAR OR HELIUM-FILLED BALLOONS ON STRINGS, MAKE SURE TO KEEP AWAY FROM POWER LINES. IF THE KITE LINE OR

BALLOON STRINGS ARE TANGLED IN POWER LINES, THE ELECTRICITY CAN TRAVEL DOWN THE LINE AND CAUSE A SHOCK OR START A FIRE.

* NEVER GO SWIMMING DURING AN ELECTRICAL STORM.

* IF YOU SEE SOMETHING STUCK OR TANGLED IN A POWER LINE, HAVE AN ADULT CALL THE POWER COMPANY. NEVER TRY TO REMOVE THE ITEM FROM THE POWER LINES YOURSELF.

* DO NOT CLIMB UTILITY POLES.

* KEEP AWAY FROM ELECTRIC SUBSTATIONS.

* DO NOT CLIMB ON FENCES AROUND ELECTRIC SUBSTATIONS.

* IF YOU SEE A FALLEN ELECTRICAL WIRE, STAY AWAY FROM IT. HAVE AN ADULT CALL THE POWER COMPANY TO REPORT THE DOWNED WIRE OR CALL 911.

* NEVER TOUCH ANYTHING OR ANYONE TOUCHING A WIRE THAT IS DOWN. CALL 911 OR HAVE AN ADULT CALL 911 IMMEDIATELY.

* BE CAREFUL TO AVOID TOUCHING OVERHEAD ELECTRICAL WIRES IF YOU ARE CARRYING A LONG OBJECT SUCH AS A POOL SKIMMER OR LADDER.

* NEVER THROW OBJECTS, SUCH AS SNEAKERS, AT OR ONTO ELECTRIC POWER LINES.

* NEVER TOUCH A POWER LINE WITH ANY PART OF YOUR BODY OR ANY OBJECT.

* NEVER FLY MODEL AIRPLANES OR REMOTE CONTROLLED AIRPLANES OR HELICOPTERS NEAR OVERHEAD POWER LINES. PLAY WITH THEM IN OPEN AREAS SUCH AS PARKS OR FIELDS.

* NEVER GO INTO AN ELECTRIC SUBSTATION FOR ANY REASON. IF A PET HAS GONE INTO THE AREA, DO NOT TRY TO GET IT YOURSELF. HAVE AN ADULT CALL THE POWER COMPANY.

* DO NOT HANG SIGNS OR BANNERS ON ELECTRIC UTILITY POLES.

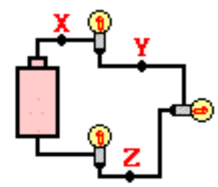
* IF A FRIEND, FAMILY MEMBER OR PET IS IN CONTACT WITH A DOWNED ELECTRICAL LINE OR ANY TYPE OF ELECTRICAL EQUIPMENT, CALL 911 OR HAVE AN ADULT CALL 911 IMMEDIATELY.

* IF YOU ARE OPERATING AN ELECTRICAL TOOL, USING AN ELECTRICAL APPLIANCE OR PLAYING WITH AN ELECTRICAL TOY OUTSIDE, STAY AT LEAST 10 FEET AWAY FROM ANY WET SURFACE OR SWIMMING POOL.

* DO NOT TOUCH ANY ELECTRICAL TOOLS, APPLIANCES OR TOYS IF YOU ARE WET, STANDING IN A PUDDLE OR ARE IN A POOL.

3. Consider the following two diagrams of series circuits. For each diagram, use arrows to indicate the direction of the conventional current. Then, make comparisons of the voltage and the current at the designated points for each diagram.

1. Three identical light bulbs are connected to a D-cell as shown at the right. Which one of the following statements is true?



a. All three bulbs will have the same brightness.

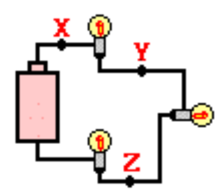
b. The bulb between X and Y will be the brightest.

c. The bulb between Y and Z will be the brightest.

d. The bulb between Z and the battery will be the brightest.

ANS A

5. Three identical light bulbs are connected to a battery as shown at the right. Which adjustments could be made to the circuit that would increase the current being measured at X? List all that apply.



a. Increase the resistance of one of the bulbs.

b. Increase the resistance of two of the bulbs.

c. Decrease the resistance of two of the bulbs.

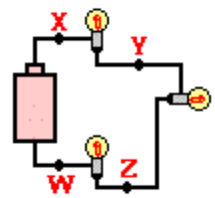
d. Increase the voltage of the battery.

e. Decrease the voltage of the battery.

f. Remove one of the bulbs.

C, D, F

6. Three identical light bulbs are connected to a battery as shown at the right. W, X,Y and Z represent locations along the circuit. Which one of the following statements is true?



a. The potential difference between X and Y is greater than that between Y and Z.

b. The potential difference between X and Y is greater than that between Y and W.

c. The potential difference between Y and Z is greater than that between Y and W.

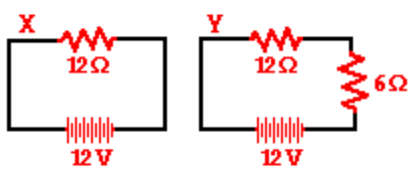
d. The potential difference between X and Z is greater than that between Z and W.

e. The potential difference between X and W is greater than that across the battery.

f. The potential difference between X and Y is greater than that between Z and W.

ANS: D

7. Compare circuit X and Y below. Each is powered by a 12-volt battery. The voltage drop across the 12-ohm resistor in circuit Y is ____ the voltage drop across the single resistor in X.



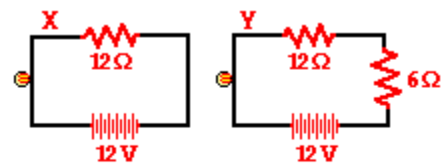
a. smaller than

b. larger than

c. the same as

ANS: A

8. A 12-V battery, a 12-ohm resistor and a light bulb are connected as shown in circuit X below. A 6-ohm resistor is added to the 12-ohm resistor and bulb to create circuit Y as shown. The bulb will appear ____.



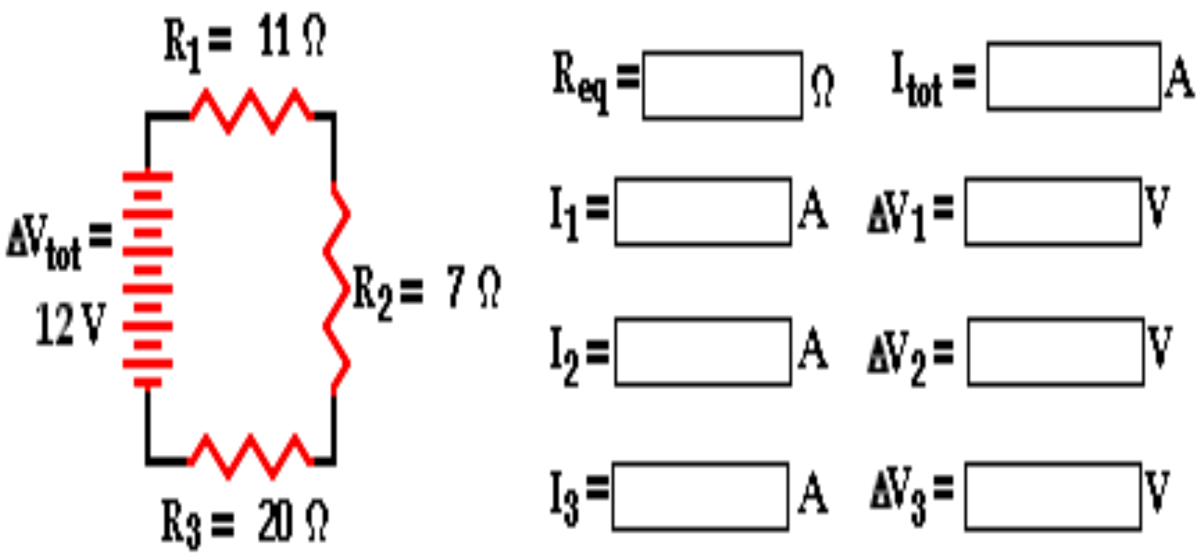
a. dimmer in circuit X

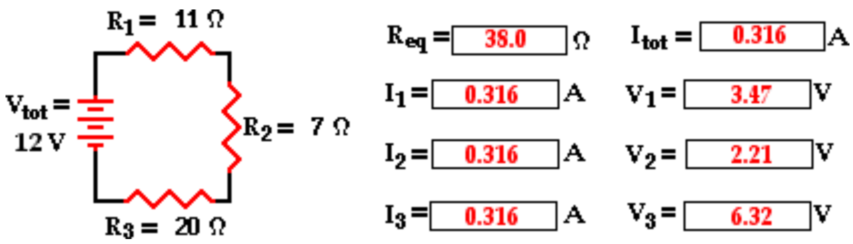
b. dimmer in circuit Y

c. the same brightness in both circuits

ANS: B

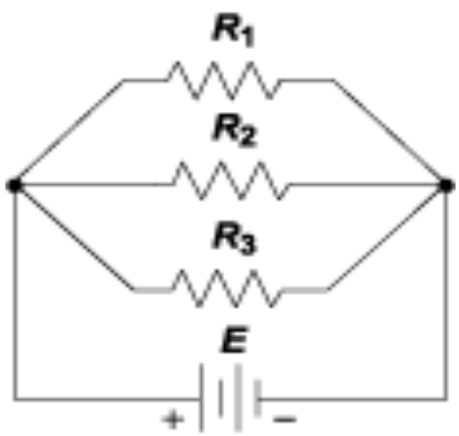
9. Three resistors are connected in series. If placed in a circuit with a 12-volt power supply. Determine the equivalent resistance, the total circuit current, and the voltage drop across and current at each resistor.

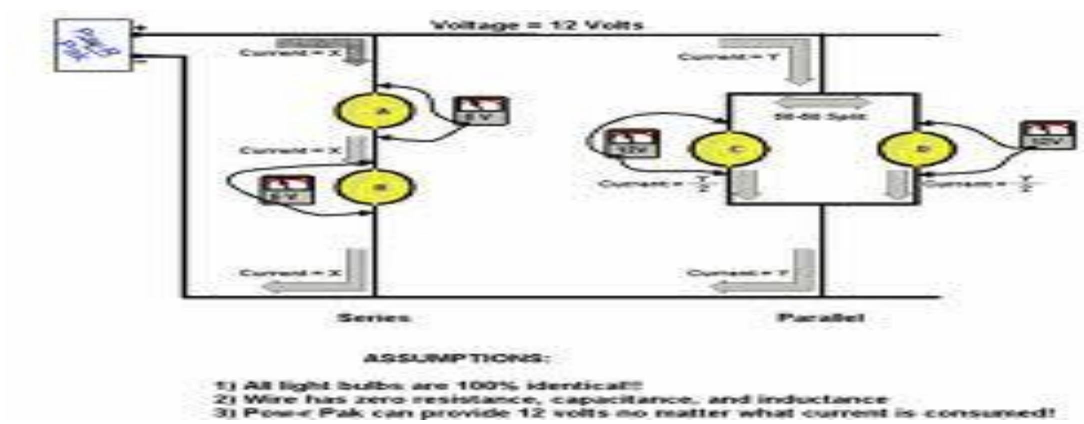


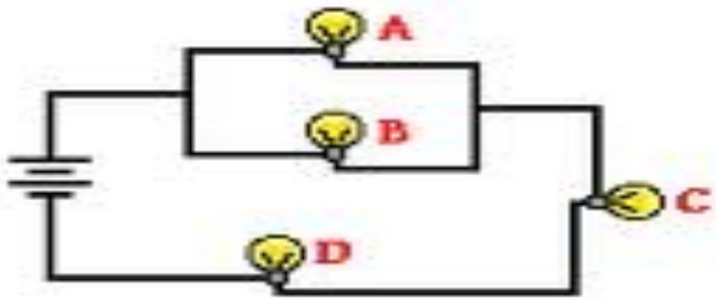


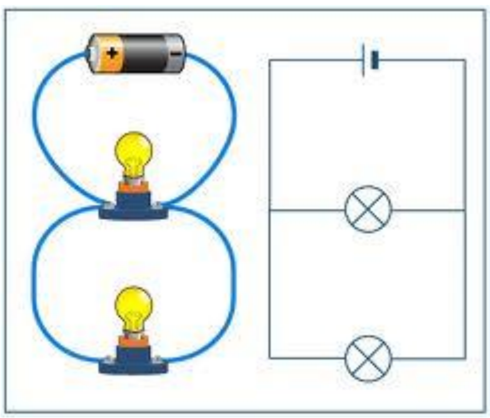
12/38 = .316

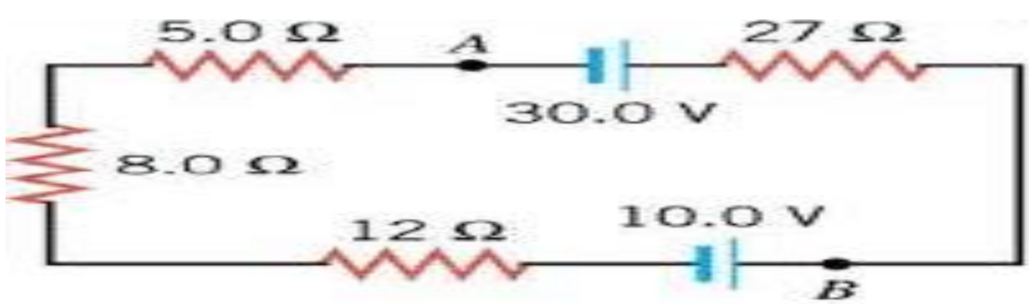
[Next Section: Parallel Circuits](#)
[Back to the Physics Tutorial Table of Contents](#)

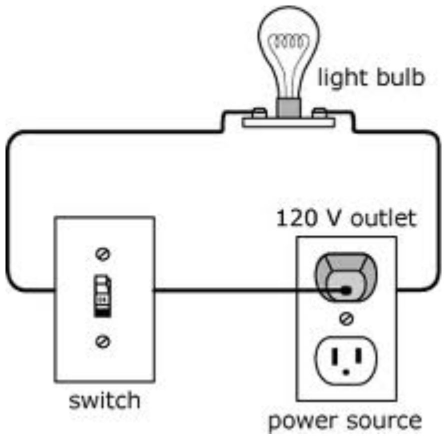


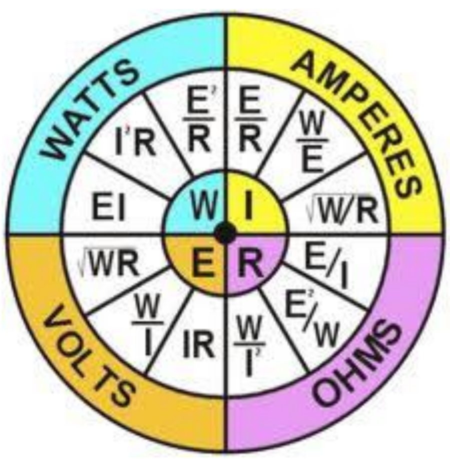



A
B
C
D



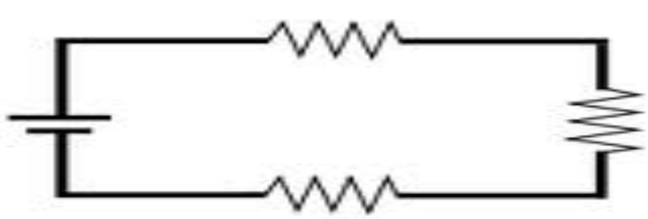

5.0 Ω
A
27 Ω
30.0 V
8.0 Ω
12 Ω
10.0 V
B


light bulb
120 V outlet
switch
power source


WATTS
AMPERES
VOLTS
OHMS
W
I
E
R
EI
I²R
E²/R
E/R
W/E
√W/R
E/I
E²/W
W/I²
IR
W/I
√WR

The voltage source on the series circuit below is 120 V.

R_1 = 10 ohm



R_2 = 35ohm

R_3 = 15 ohm

1. What is the total resistance of each load?

2. What is the total current in each resistor?

3. What is the voltage drop for each resistor?

The voltage source on the series circuit below is 9 V.

This series circuit has three resistors, R_1, R_2, and R_3 located between points 1 and 2. Resistor 1 has a resistance of 100-Ω, resistor two has a reisitance of 300-Ω, and resistor three has a resistor of 50-Ω. Draw the diagram and solve the problem 1, 2, and 3.

1. Calculate the total resistance.

2. Calcualte the circuit current.

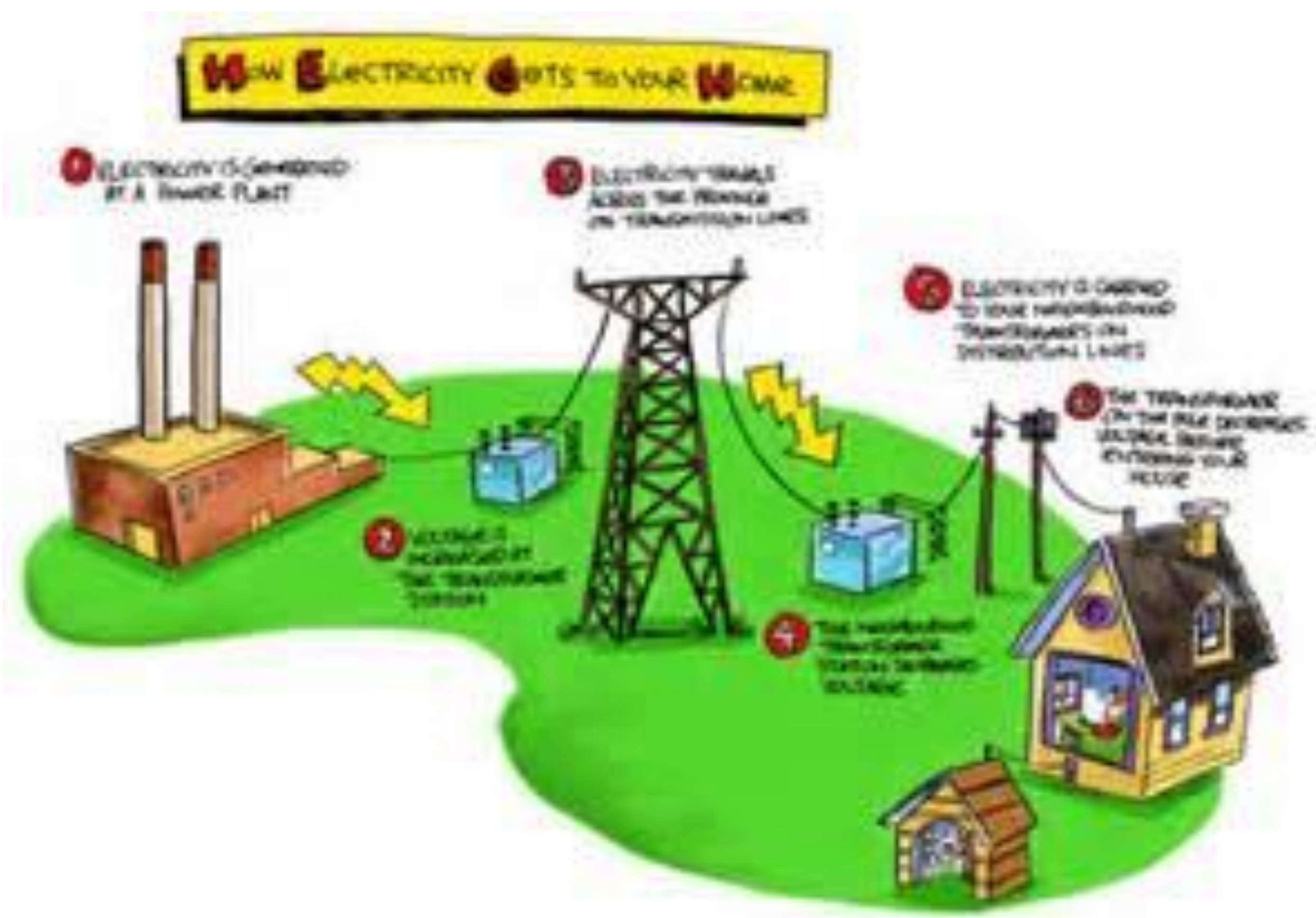
3. Calculate the voltage drop.

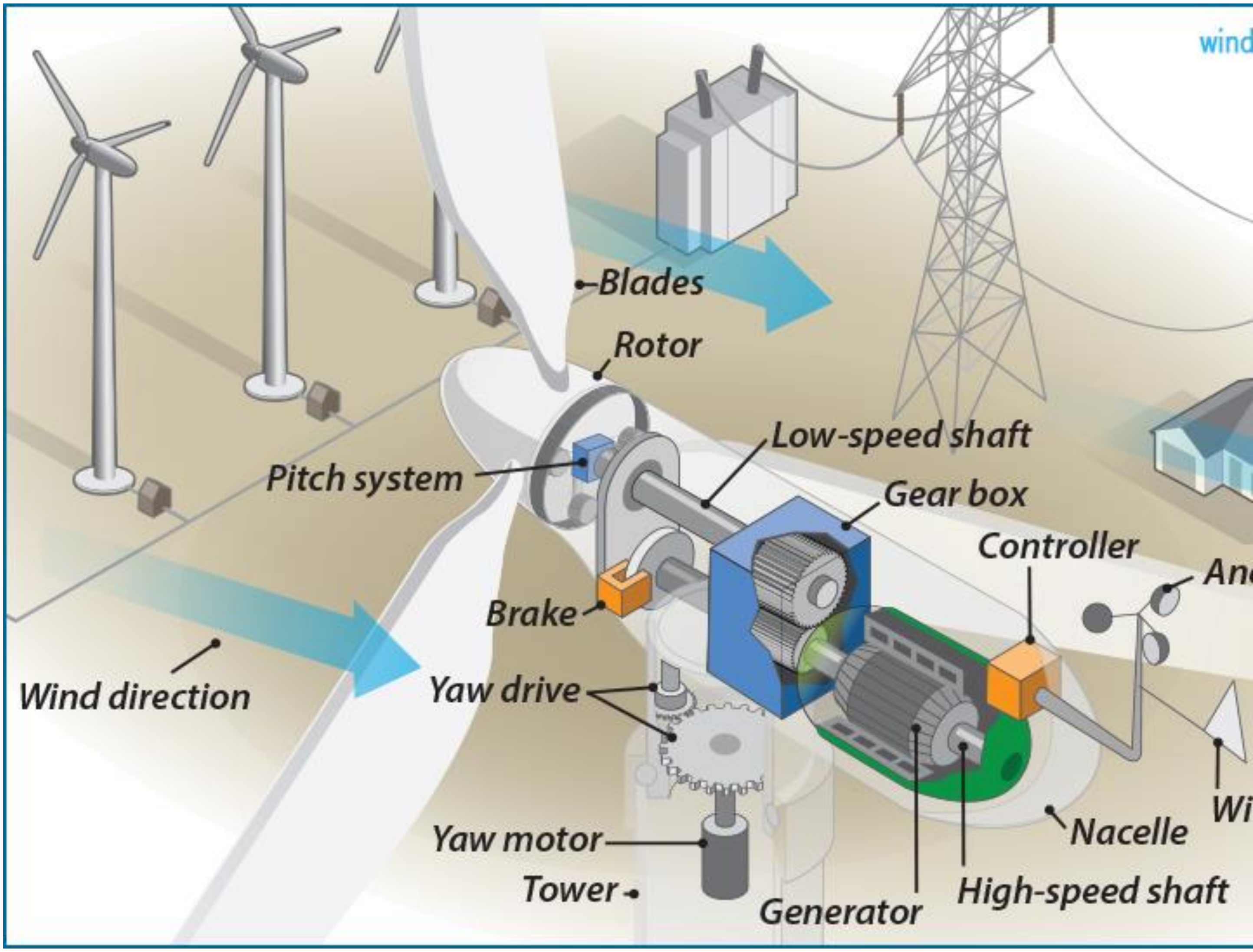
Three appliances are connected in parallel; a lamp with a resistance of 60 ohms, an iron with a resistance of 20 ohms, and a heating coil with a resistance of 80 ohms. Find the total resistance.

12.63 ohms

Eight lights on a decorated tree are connected in series. Each has a resistance of 12 ohms. What is the total resistance?

Rt =8(12) 96 ohms



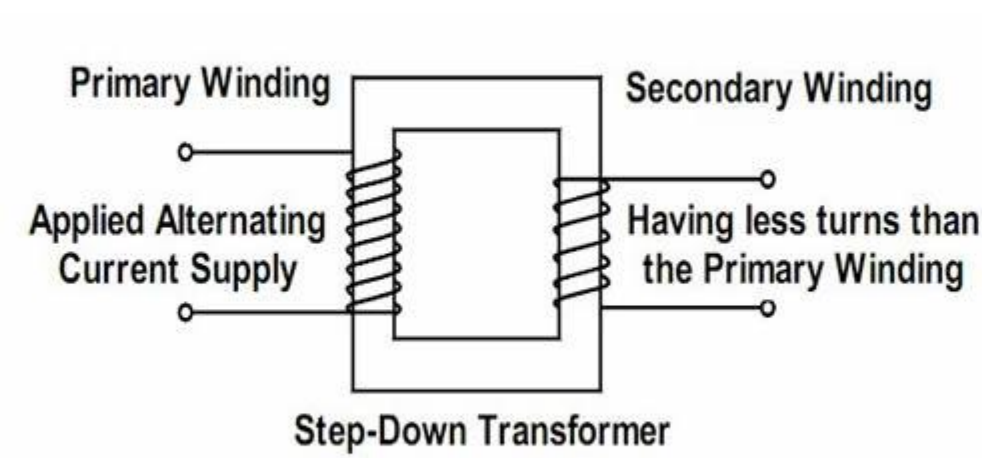


Three identical light bulbs are connected to a battery and the light bulbs are parallel. If the middle bulb burns out, what happens?

So the answer is: the light intensity of the other two bulbs remain the same (of course when I think about real life this makes perfect sense). However, I thought the intensity of the other two would increase. I thought so because if one bulb burns out, then total Resistance in the circuit decreases, and the total current for the circuit would then increase (I=V/R). This led me to believe that each of the remaining batteries in the circuit would get more current and have more light intensity. To my surprise, the explanation in TPR was (to paraphrase) that since there are only two bulbs left and not three, the current the battery provides decreases as their individual currents stay the same. To me it sounds like the battery can control how much voltage it supplies and I don't get that. Can anyone help me see where my thinking is incorrect or help explain it in a different way? I hate getting these concept type of questions wrong!

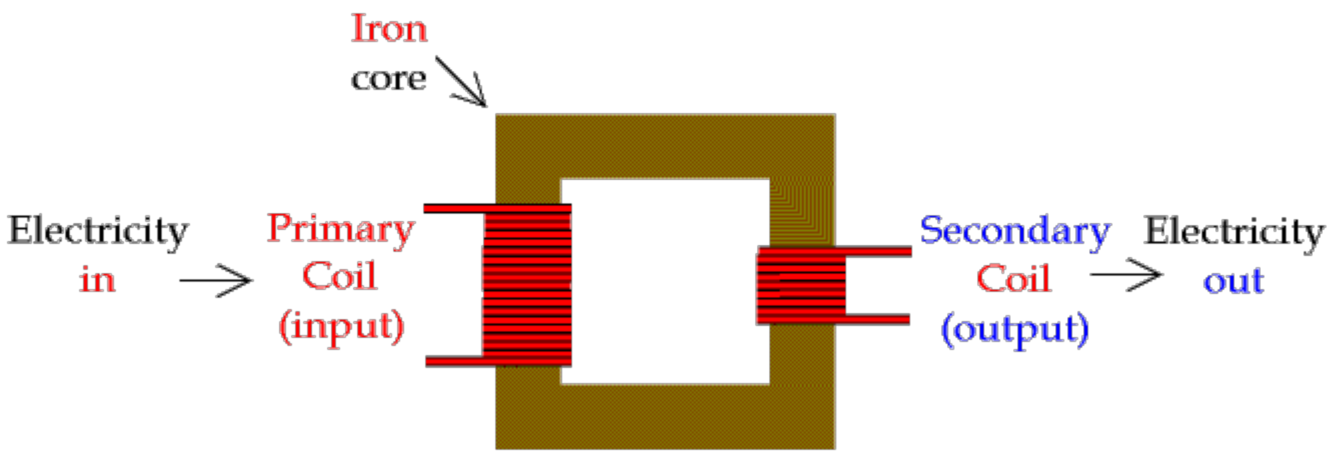
TRANSFORMERS

A TRASNFORMER IS A DEVICE USED TO CHANGE A LOWER VOLTAGE INTO A HIGHER VOLTAGE OR TO DO JUST THE OPPOSITE.



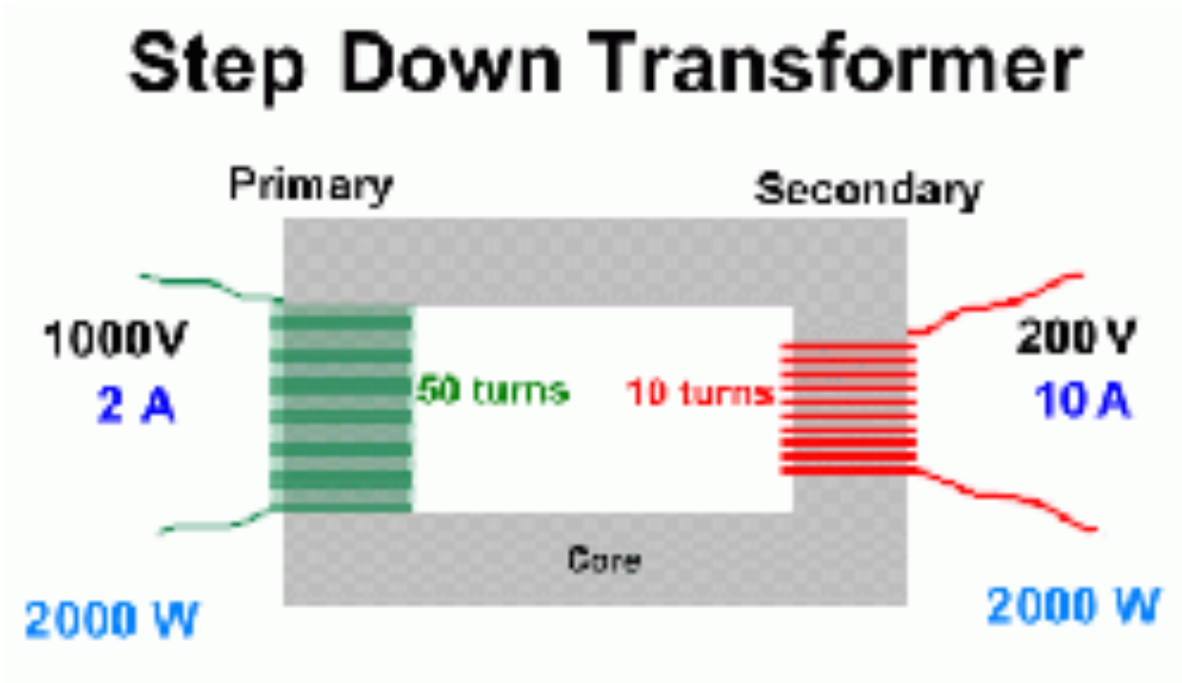
Step-Down Transformers

A step down transformer has more turns of wire on the primary coil and less turns of wire on the secondary coil. This makes a smaller induced voltage in the secondary coil. Compare this with a step up transformer.



It is called a step down transformer because the output voltage is smaller than the input voltage. If the secondary coil has half as many turns of wire then the output voltage will be half the input voltage. See the transformer equation.

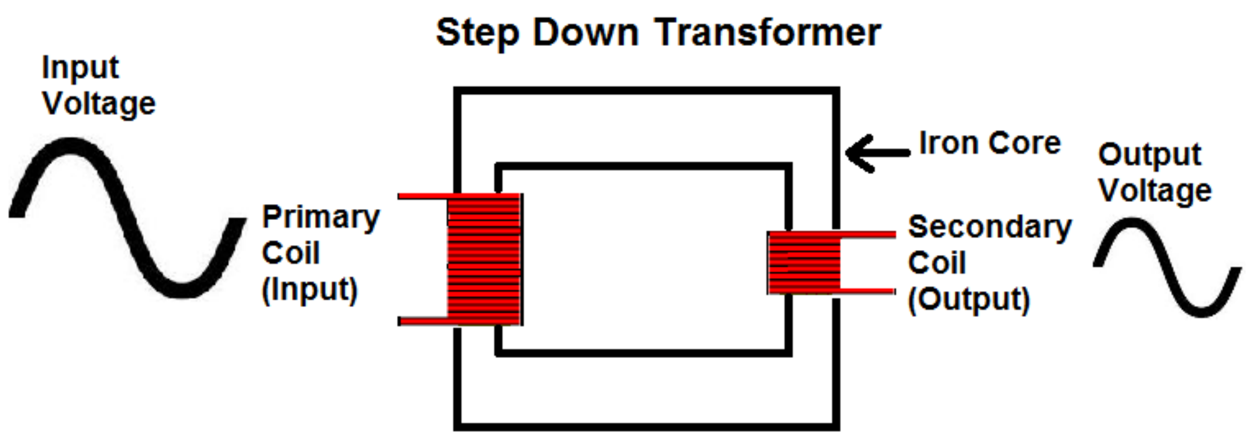
Decreasing the voltage does not decrease the power. As the voltage goes down, the current goes up.



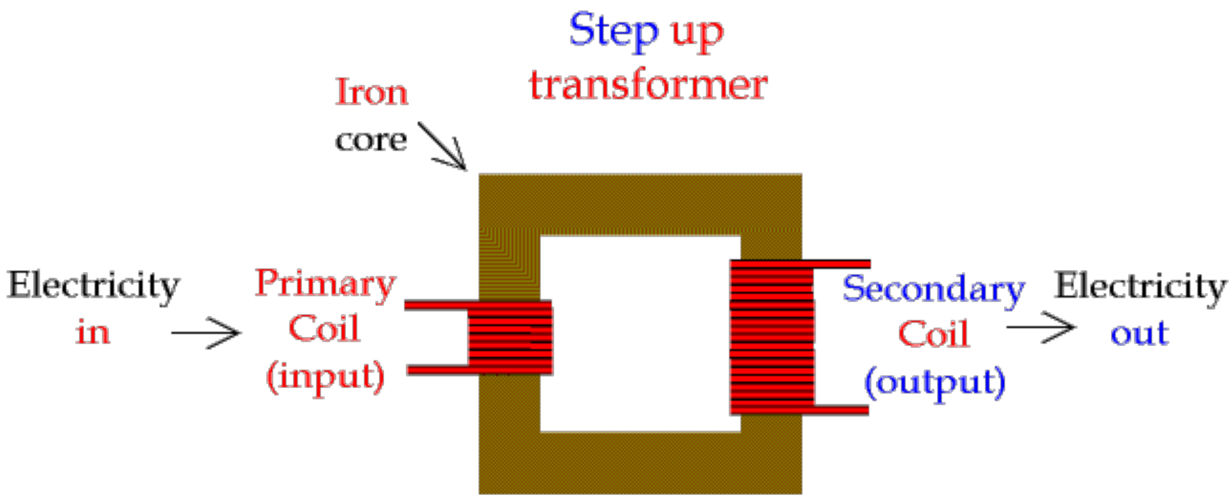
Step down transformers are designed to reduce electrical voltage. Their primary voltage is greater than their secondary voltage. This kind of transformer "steps down" the voltage applied to it. For instance, a step down transformer is needed to use a 110v product in a country with a 220v supply.

Step down transformers convert electrical voltage from one level or phase configuration usually down to a lower level. They can include features for electrical isolation, power distribution, and control and instrumentation applications. Step down transformers typically rely on the principle of magnetic induction between coils to convert voltage and/or current levels.

Step down transformers are made from two or more coils of insulated wire wound around a core made of iron. When voltage is applied to one coil (frequently called the primary or input) it magnetizes the iron core, which induces a voltage in the other coil, (frequently called the secondary or output). The turns ratio of the two sets of windings determines the amount of voltage transformation.

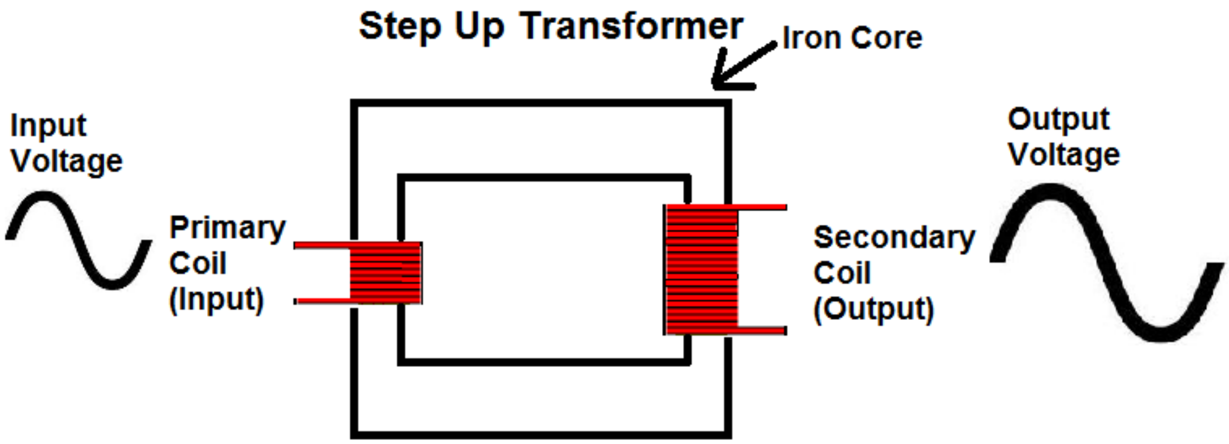


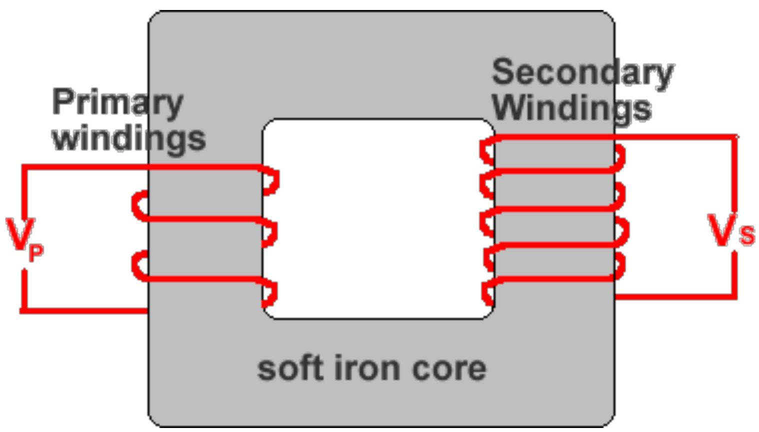
Step-Up Transformers

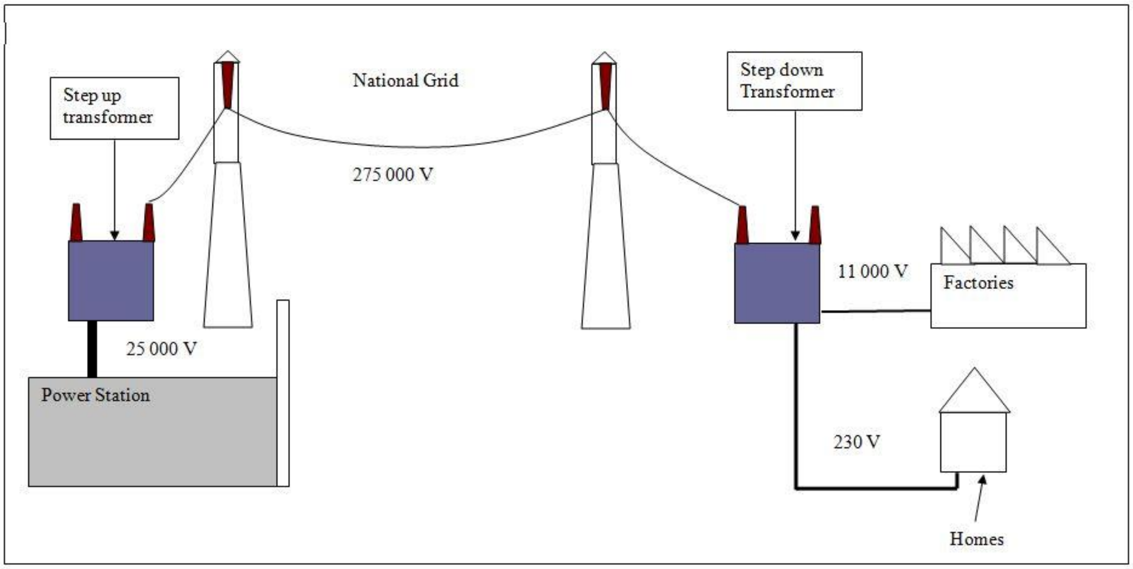


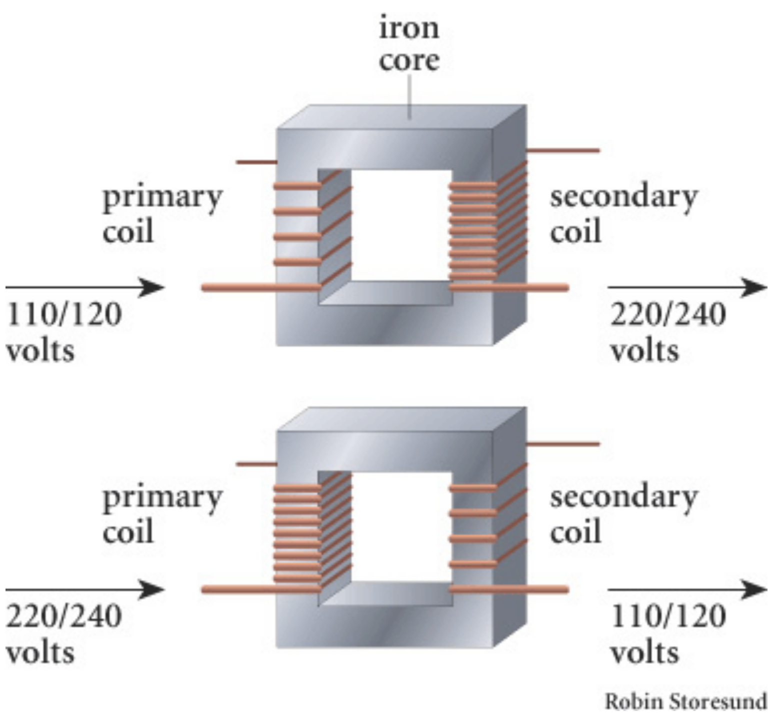
A step up transformer has more turns of wire on the secondary coil, which makes a larger induced voltage in the secondary coil.

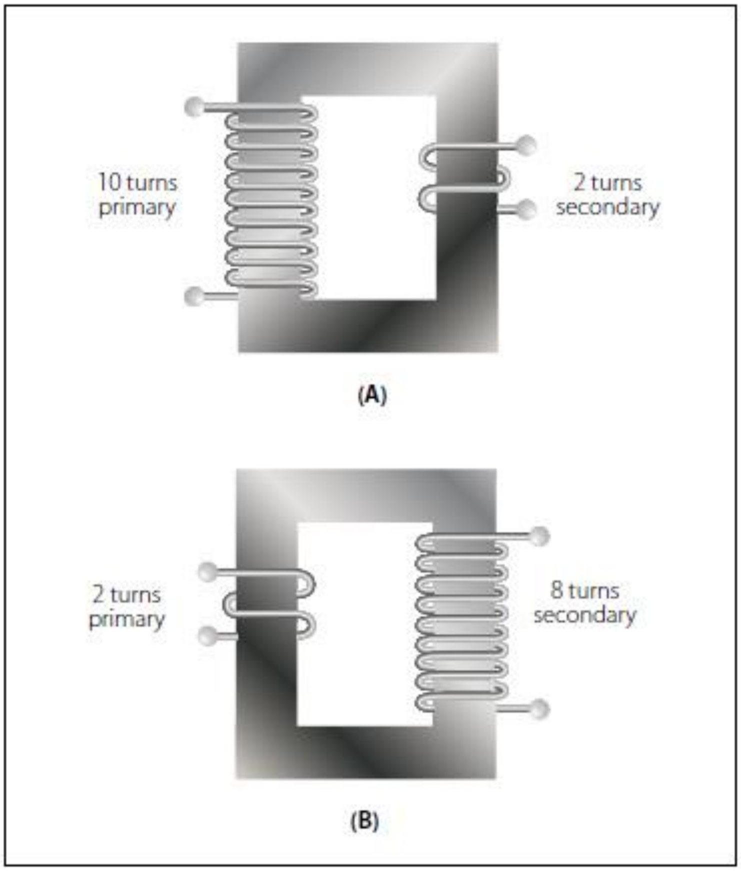
It is called a step up transformer because the output voltage is larger than the input voltage. If the secondary coil has twice as many turns of wire then the output voltage will be twice the input voltage.


Step Up Transformer
Iron Core
Input
Voltage
Primary
Coil
(Input)
Secondary
Coil
(Output)
Output
Voltage

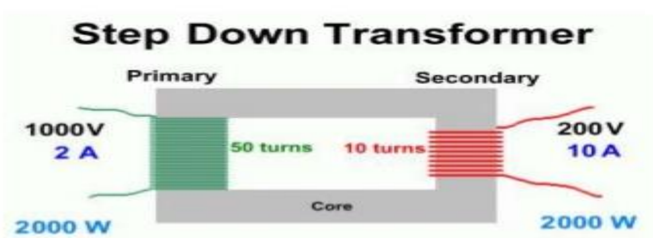

Primary
windings
Secondary
Windings
V_P
V_S
soft iron core


Step up
transformer
National Grid
275 000 V
Step down
Transformer
11 000 V
Factories
25 000 V
Power Station
230 V
Homes

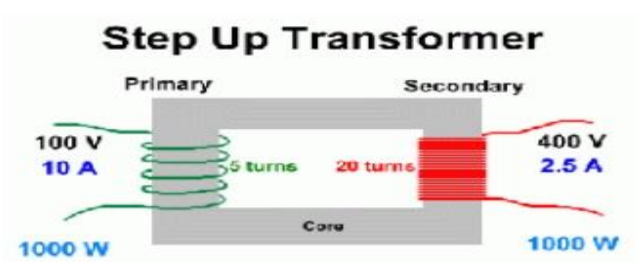

iron
core
primary
coil
secondary
coil
110/120
volts
220/240
volts
primary
coil
secondary
coil
220/240
volts
110/120
volts
Robin Storesund



transformer in reality steps down the current & a step down transformer steps up the current.



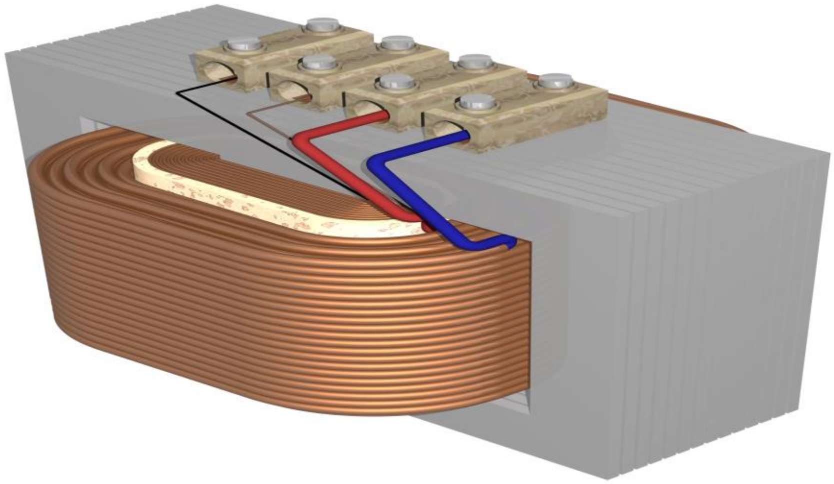
BASIC IDEA OF STEP DOWN TRANSFORMER

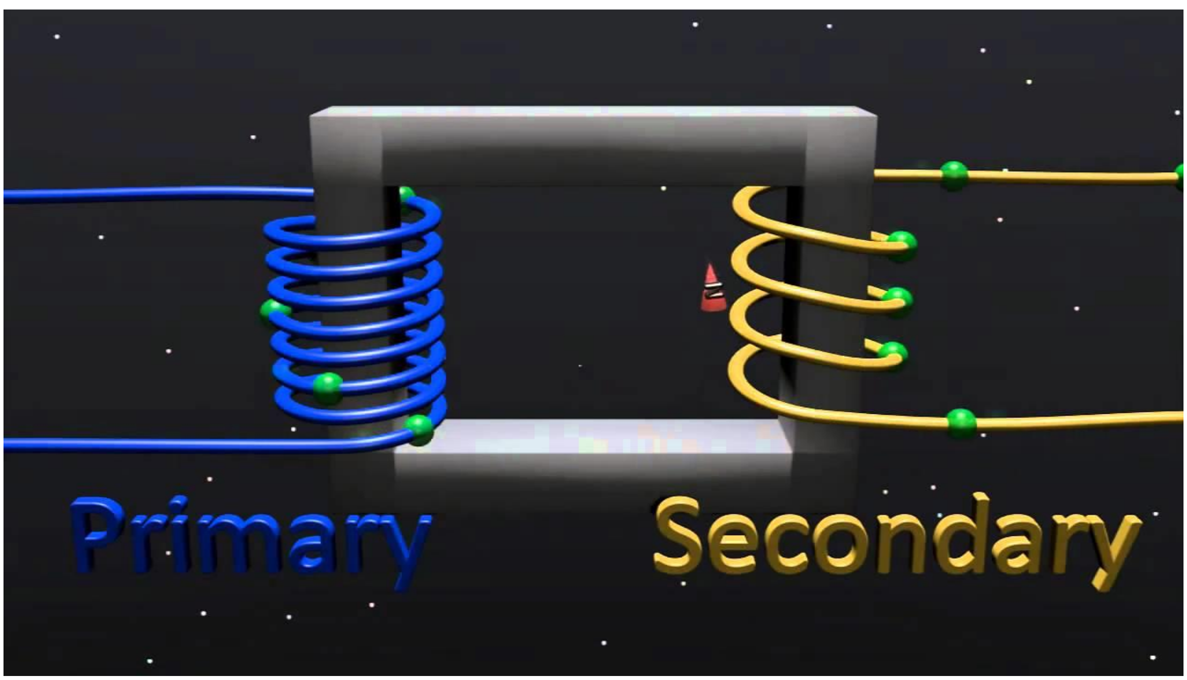


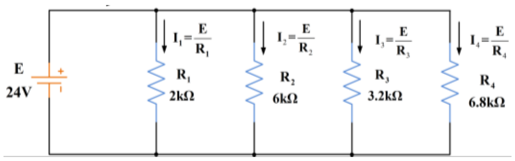
BASIC IDEA OF STEP UP TRANSFORMER


170


50
16




Primary
Secondary


E
24V
$I_1 = \frac{E}{R_1}$
R_1
2kΩ
$I_2 = \frac{E}{R_2}$
R_2
6kΩ
$I_3 = \frac{E}{R_3}$
R_3
3.2kΩ
$I_4 = \frac{E}{R_4}$
R_4
6.8kΩ


ELECTRICAL SAFETY


ELECTRICAL
FUSE