

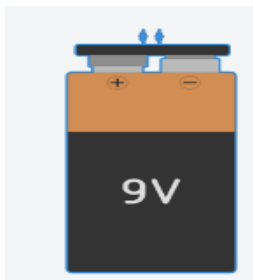
Paul Roseway

21272721

Electronics principles and concepts,

Module: ACDA4015,

Electronics component and their use.



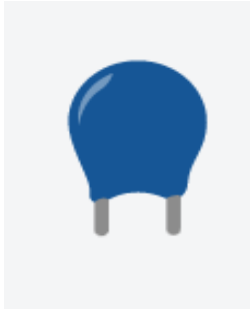
TASK 1

Battery, the battery stores power, it converts chemical energy into electricity, battery is the source of electric supply.

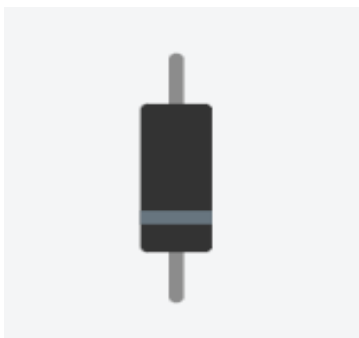


Resistor is the component used to Resist the circuit flow. You have different types of resistors, high resistors, and low resistors. You have, (Potentiometers Variable Resistors). A resistor is a Passive divide, which is a two terminal component that regulates the flow of electronical current in an electronic circuit. Resistor can be either fixed or variable resistors. Resistors measures in Ohm's = (Ω).

TASK 1 Capacitors



Capacitors are used to synchronize voltage; it is a component that can store electric charge in the form of an electric field. The Capacitor is used to rectify a circuit, convert the current from AC to DC conversion. capacitors store electrical energy, there are variable capacitor, adjustable capacitance. **(Polar Capacitor and Non-Polar Capacitor)**, **multimeter** is used to measure capacitors. capacitor measures in **Farad (F)**.

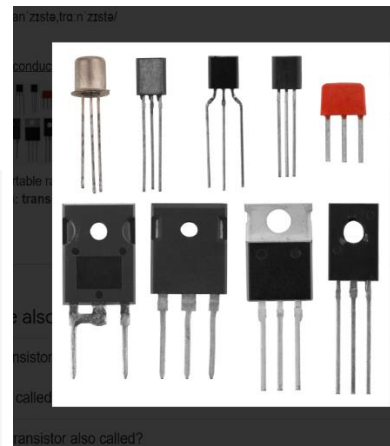
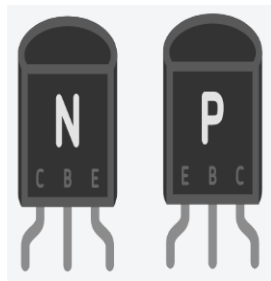


Diodes are an electric component that allows current to flow in one way but restricts It from flow in the opposite direction. Diode is a semiconductor that has two terminals, **(Anode and the Cathode)**. You all so have the Zener diodes and the Light Emitting diodes.

TASK1

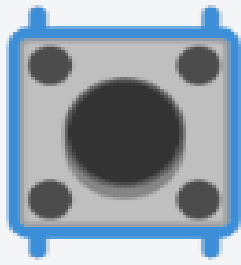


Inductor an inductor is a passive electronic component that stores energy in a magnetic field. Inductor opposes change in the electric current flowing through it. Inductance also depends on the radius of the coil and on the type of material around which the coil is wound. There are variable inductors, the units inductors (**Henry H**).



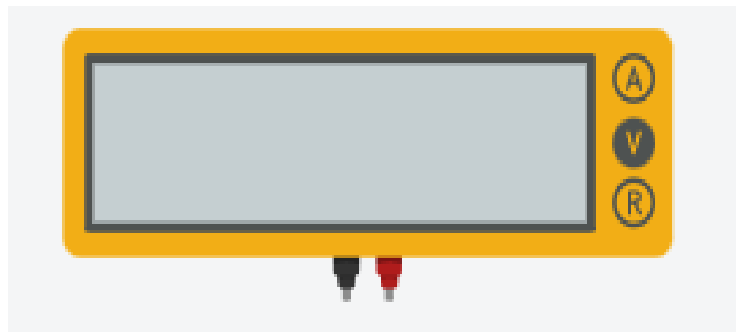
TRANSISTOR

It is an electronic component that can act as a switch and an amplifier. Transistor is a device that controls the flow of electricity in an electronic equipment. There are two types of Transistors, (**NPN AND PNP TRANSISTORS**).



TASK 1

Switch is a component that creates a break in a circuit, by open or close the circuit when activated. You have the SPST toggle single pole switch that disconnects current when open and the SPDT toggle double pole switch this selects between two connections, and the push button switch (N.O), is a momentary normally open.



Multimeter

A multimeter or an Ohmmeter can be used to measure the value of the resistance.

TASK 1

RELAY



A relay is a component that works in a way that receives an electrical signal and sends that signal to another component by turning the switch on and off. A relay is an electrical switch that is used to convert electrical current from a lower to a higher current.

Task 1

LED



LED is an abbreviation for Light Emitting Diode, LED is a small Junction diode that give off light when voltage is applied to it. LED have two pins, the Anode (P) and the Cathode (N). LED works on Electroluminescence Principle.

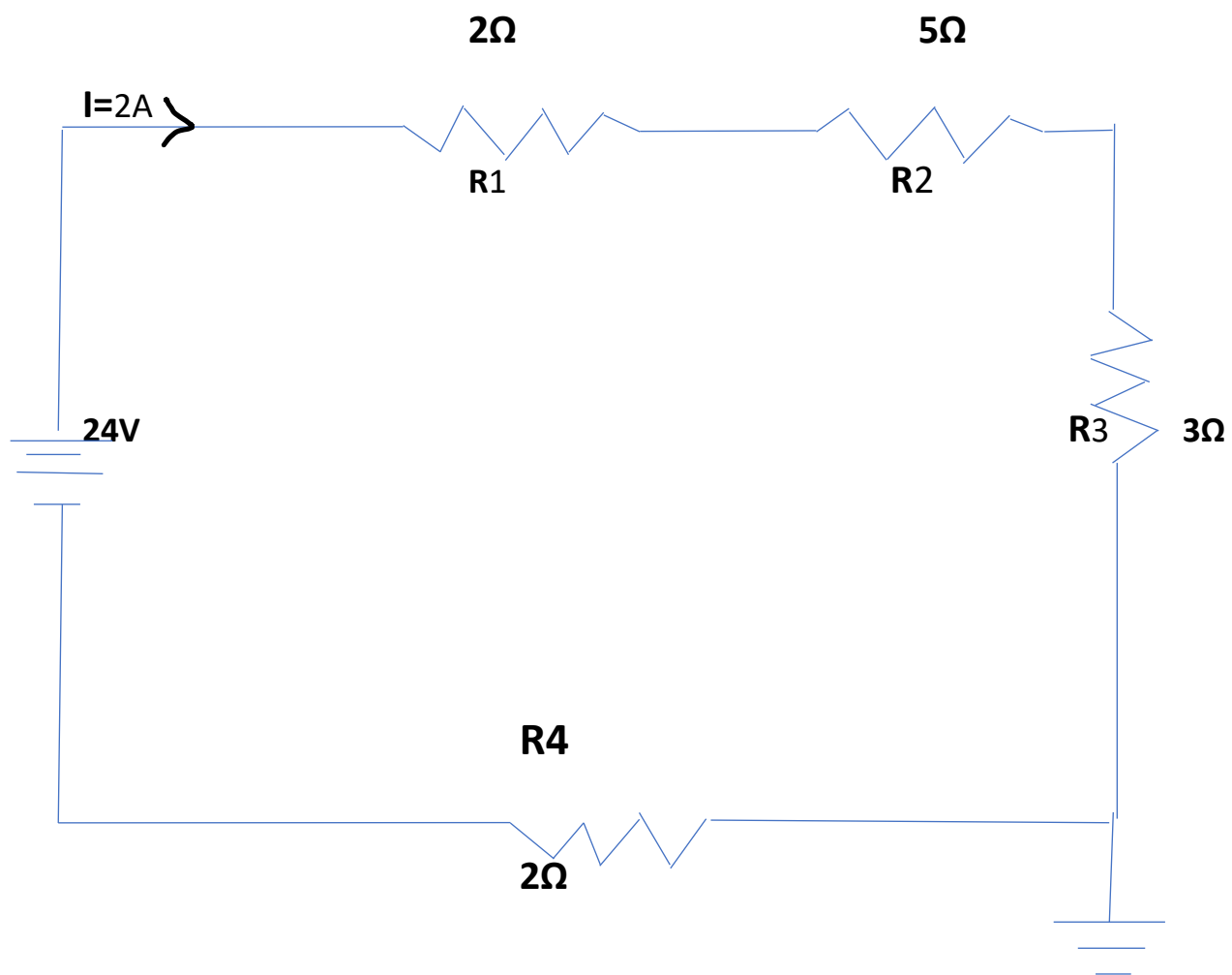
Task 1

IC



An IC is an integrated circuit component, it is an electronic circuit component, that is compacted with resistors, transistors, capacitors and more connected together to achieve a great goal, its electronic circuits on one small flat piece of semiconductor material silicon. It's the integration of large numbers of small transistors into chips that are small and faster.

TASK 2 (A)



(TASK 2A)

measurements of Resistance, Current, and voltage

$$V = I \times R$$

$$R_1 + R_2 + R_3 + R_4 = R_t$$

$$2 + 5 + 3 + 2 = 12\Omega \text{ (R total = } 12\Omega \text{)}$$

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

$$= 2A$$

$$R_t = 12\Omega \quad I = 2A \quad V = 24V$$

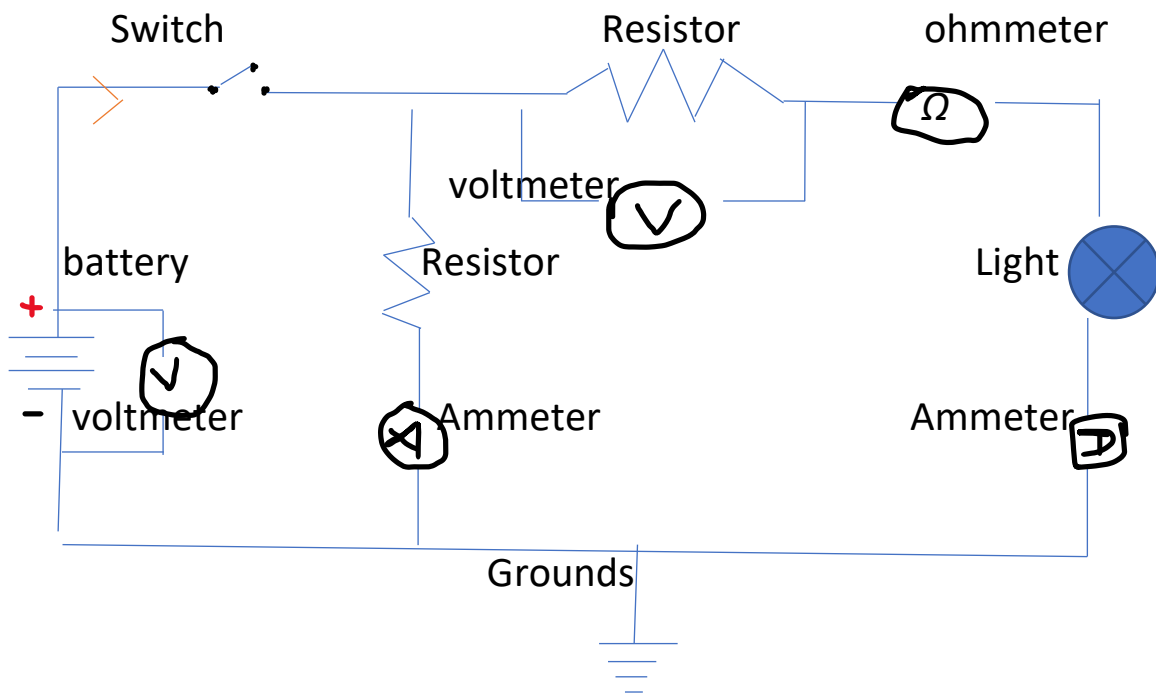
$$R_1 = 2\Omega \quad I = 2A \quad V = 4V$$

$$R_2 = 5\Omega \quad I = 2A \quad V = 10V$$

$$R_3 = 3\Omega \quad I = 2A \quad V = 6V$$

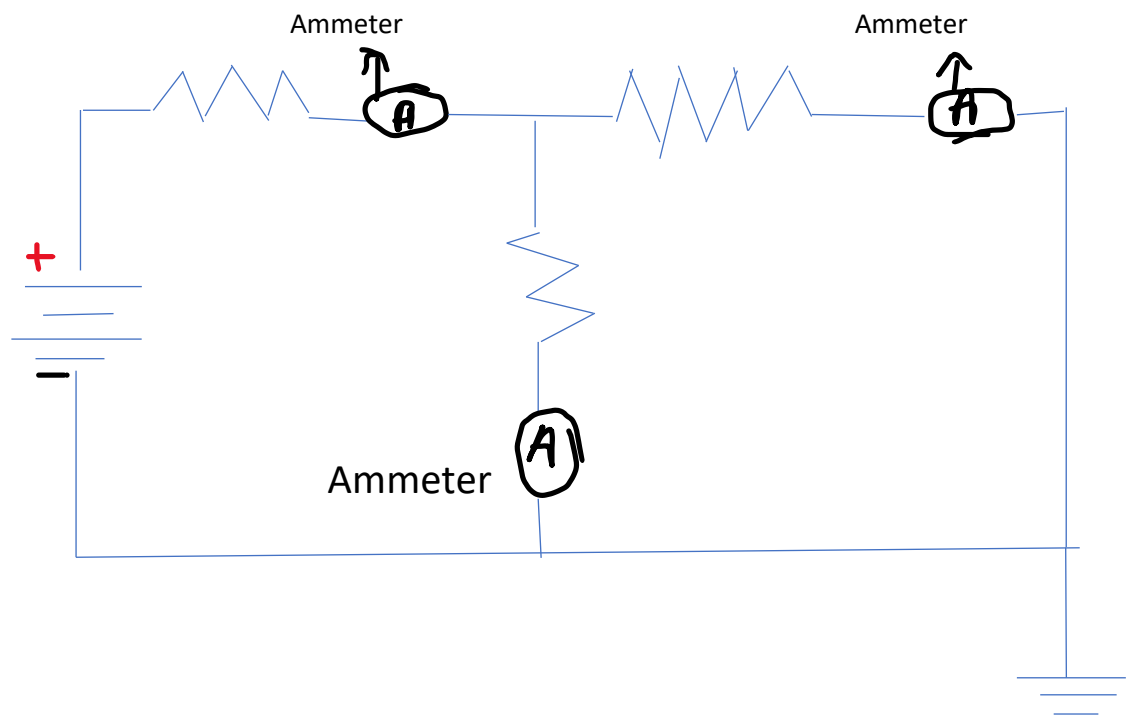
$$R_4 = 2\Omega \quad I = 2A \quad V = 4V$$

TASK 2B



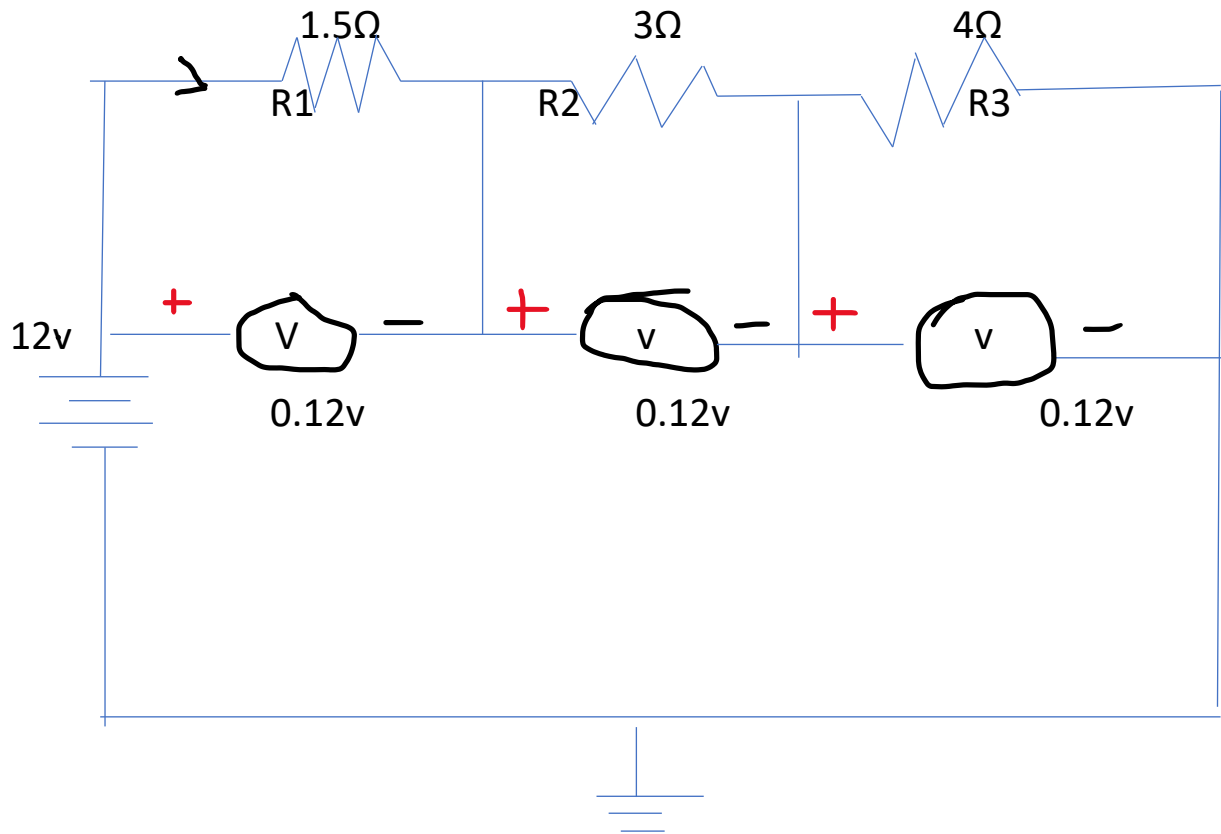
Task 2

Ammeter to measure the current across a circuit.



Task 2

Voltmeter is used to measure voltage going through a circuit.



$$V1 = 12/1.5 =$$

$$V1 = I = 8$$

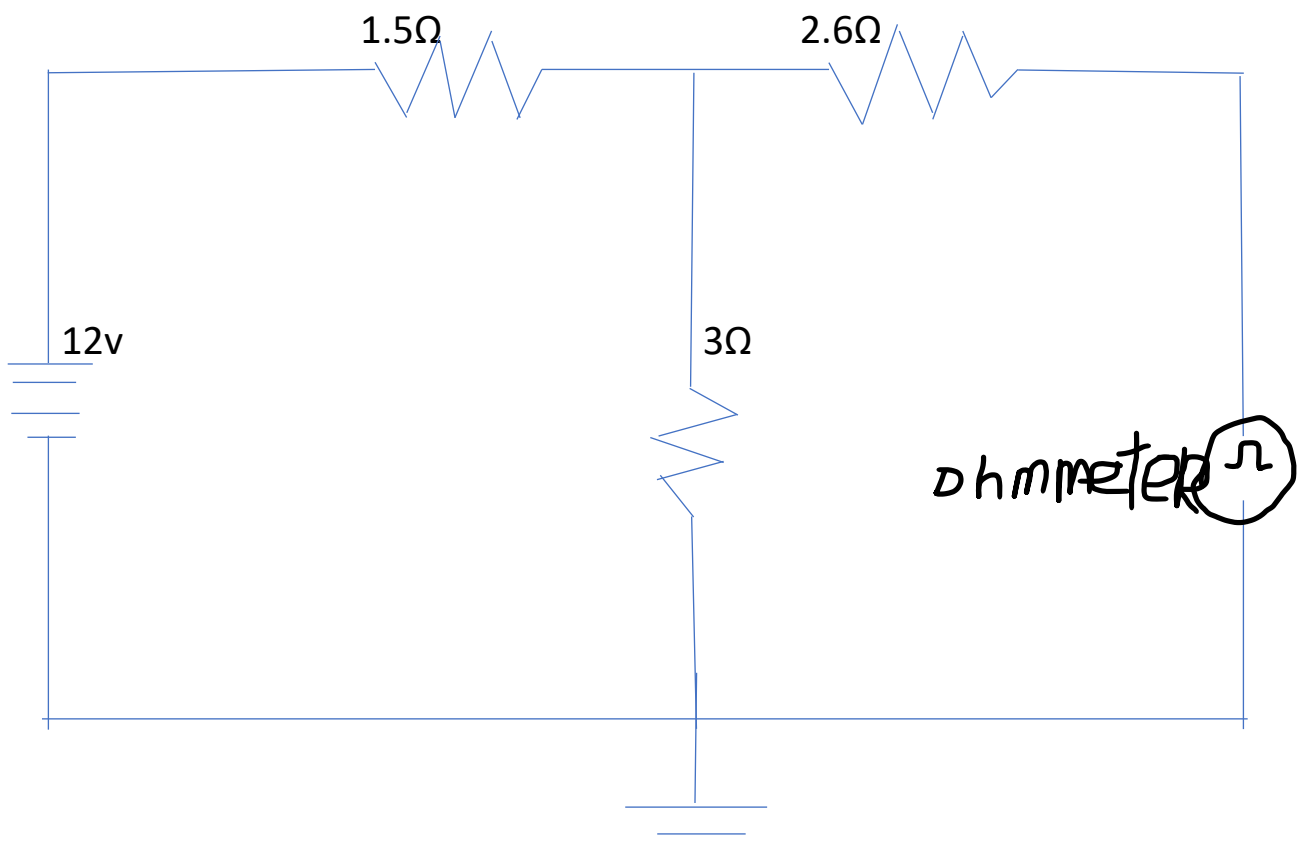
$$V2 = I = 4$$

$$V3 = I = 3$$

Task 2

Ohmmeter is a measuring device that used to measured electrical resistance in a direct DC current circuit.

The the symbol for ohmmeter is (Ω).



TASK 3

How will you identify the power supply requirements of an electrical / electronic equipment.

You can identify a power supply requirement by looking at the back of the item there is a sticker, a note or a label come with the item. On those labels you can find and identify the power supply requirements.

This information is important to know the specifies voltage, current and wattage and about the model number. These details tell you how much voltage power wattage and current the item can used. This rating tells you the maximum amount of power that can be supply to the items without damaging it.

AMP × Voltage =Watts



TASK 4

Benefits of the using electrical laws and the theorem in electrical circuit.

Electronics circuit theorems laws is very useful, it helps to find and determine the flowing of voltage and current through any branch or component of a network. These formulas help you to find resistance, the voltage source by using the theorems basic formulas calculation.

What is one Ohm?

When an electric current of one ampere passes through a component across which a potential difference voltage of one volt exists, then the resistance of that component is one ohm.

Resistor

- ① Resistor is the component used to resist the flow of current.
- ② A Resistor is a passive device, which is a two terminal component, that limits or regulates the flow of electrical in an electric circuit.
- ③ Resistor can be either fixed or variable in nature.

What is Resistance

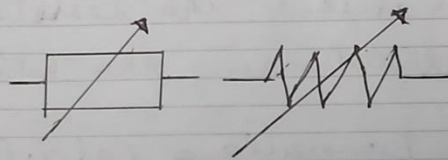
Resistance is the opposition that a substance offers to the flow of electric current.

It is represented by the R or r .
The standard unit of resistance is the Ohm (Ω).

Resistor

Variable Resistors are called as Potentiometers.

Symbol of Variable Resistor



Measuring Resistance

The value of the Resistance
be measured using a Ohmmeter
or multimeter.

Resistance

The value of the resistor can be
identified using the colour codes.

The Formula of Calculate Resistance
using Ohm's Law is :-

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

V = voltage

R = Resistance

I = Current

What is capacitance?

Capacitance is defined as the ability of a device to store electric charge.

The capacitance is directly proportional to the surface areas of the plates, and is inversely proportional to the separation between the plates.

② Units of Capacitance is =
 $\text{Farad} = 1 \text{ Farad} = \text{Coulomb/Volts}$
 Coulomb/Volts

Capacitor is a passive electronic component that stores energy in the form of an electric field.

Capacitor Circuit

- ① In this circuit the battery is connected to the LED through a switch, resistor and a capacitor. When the switch is closed, the LED will glow and capacitor charge.

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Resistor

- ① Resistor is the component used to resist the flow of Current.
- ② A Resistor is a Passive device, which is a two Terminal component, that limits or Regulate the flow of Electrical in an electric circuit
- ③ Resistor can be either fixed or Variable in nature.

What is Resistance

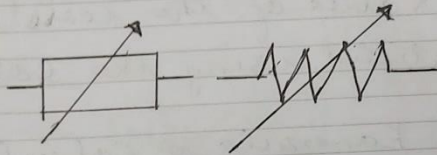
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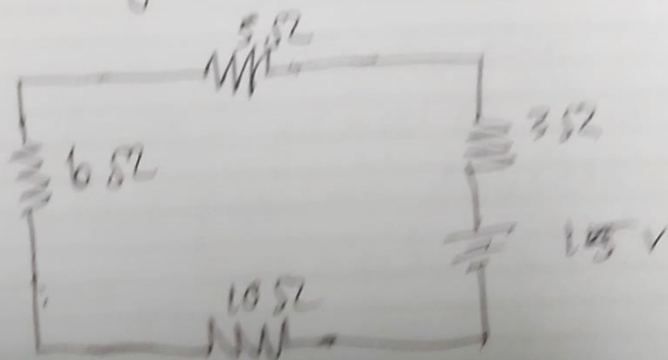
$$R = \frac{V}{I}$$

V = voltage

R = Resistance

I = Current

Apply KVL



Passive devices

- ① components which does not require electricity to control the flow of current are called passive devices. Resistors, capacitors, inductors, transformers, diodes, and more.

Active Devices

- ① An active device is a type of circuit elements with the ability to electrically control the flow of electricity.
- ② In order for a circuit to be called active circuit, it must contain at least one active device.

Differentiate Active and Passive Devices

- Active devices need an external source of energy.
- They create energy in the form voltage or current.
- need an extra source to maintain and manage their operations.
- An active component regulate the current flow.
- Eg power supply, transistors, amplifiers and transmitters
- Passive components does not need extra source of energy.
- Certain passive components stores energy in the form of magnetic field or electric field.
- There is no requirement for an additional source of operations or manage their operations
- Does not regulate the current flow
- Resistors, capacitors inductors, transformers, diodes etc.

when the circuit

$$I = \frac{V}{R_1 + R_2 + R_3}$$

$$V_1 = I R_1$$

Sub 1 in above.

$$V_1 = \frac{V}{R_1 + R_2 + R_3} \cdot R_1$$

$$V_1 = \frac{V}{R_1} \cdot R_1$$

$$V_1 = \frac{V}{R_1} \cdot R_1$$

$$V_2 = \frac{V}{R_2} \cdot R_2$$

$$V_3 = \frac{V}{R_3} \cdot R_3$$

KVL Apply



$$20I + 8I + 20I + 15I = 63.5I$$

$$\frac{63}{20} = 3.15I$$

$$3.15/20 =$$

$$\frac{20}{3.15} = 6.35I$$

what is Inductor

An inductor is a passive electronic component that stores energy in the form of magnetic field.

calculations

current across the inductor is,

$$di = \frac{1}{L} dt \quad i = \int_0^t v dt$$

$$L \frac{di}{dt} = v(t) \quad i(t) = \int_0^t \frac{v(t)}{L} dt$$

Inductance is measured using Oscilloscope and function generator or LCR multimeter.

Parallel circuit

When Inductors are connected in parallel the equivalent Inductance can be obtained using the Formula

$$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \frac{1}{L_n}$$

When capacitors are connected in parallel the equivalent capacitance can be obtained using the Formula,

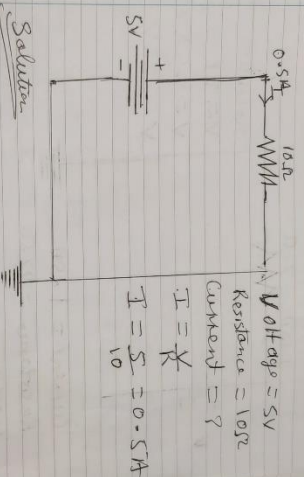
$$C_{eq} = C_1 + C_2 + C_3 + C_n$$

Parallel circuit

When a number of resistors are connected in such a way that both the ends of individual resistors are connected to other parts of the circuit then the circuit is called Parallel circuit.

In ~~parallel~~ Parallel circuit the current will be different because it has multiple paths to flow and the voltage constants.

Calculate the current flowing through the resistor in the following circuit diagram



$V_{0.54V} = 5V$
 Resistance = 10Ω
 Current = ?
 $I = \frac{V}{R}$
 $I = \frac{5}{10} = 0.5A$

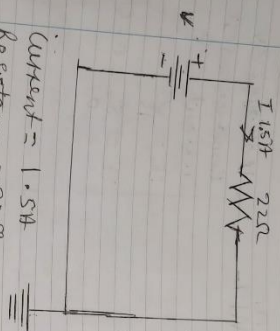
Solution

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

$$I = \frac{5}{10}$$

$$I = 0.5A$$

Calculate the voltage across the resistor



$$\text{Current} = 1.5A$$

$$\text{Resistance} = 22\Omega$$

$$\text{Voltage} =$$

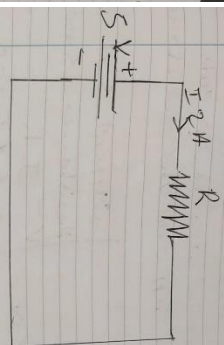
$$V = IR$$

$$= 1.5 \times 22$$

$$V = 33V$$

Solution
 $V = IR$
 $V = 1.5 \times 22$
 $V = 33V$

Calculate the resistance across the resistor



$$\text{Voltage} = 5V$$

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

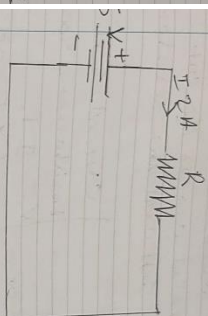
$$\text{Resistance} =$$

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

$$= \frac{5}{2} = 2.5\Omega$$

Solution
 $R = \frac{V}{I}$
 $R = \frac{5}{2}$
 $R = 2.5\Omega$

Calculate the resistance across the resistor



$$\text{Voltage} = 5V$$

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

$$\text{Resistance} =$$

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

$$= \frac{5}{2} = 2.5\Omega$$

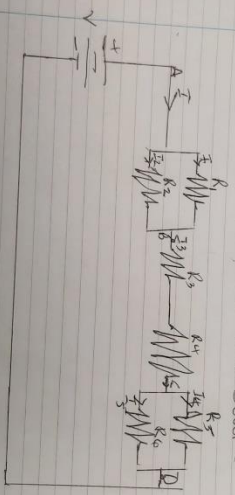
Solution
 $R = \frac{V}{I}$
 $R = \frac{5}{2}$
 $R = 2.5\Omega$

calculate the potential difference across a circuit, if the current across the circuit is $5A$ and the resistance is $5k\Omega$

$V = IR$	Current $5A$
$V = 5 \times 5000$	Resistance $= 5000\Omega$
$V = 25000V$	$V = IR$
$V = 25KV$	$= 5 \times 5000$
	$= 25000$

Series and Parallel Circuit
 ① A circuit which has resistors or other components connected in parallel and series is called a combined series and parallel circuit.

② The circuit below shows the Series - Parallel Circuit.



Parallel Circuits

$$C_1 = 1 \times 10^{-3} \quad \therefore \frac{1}{1000} = 0.001$$

$$C_2 = 5 \times 10^{-3} \quad = \frac{5}{1000}$$

$$C_3 = 6 \times 10^{-3} \quad = \frac{6}{1000}$$

$$C_4 = 3 \times 10^{-3} \quad = \frac{3}{1000}$$

$$C_1 = 1 \text{ mF}$$

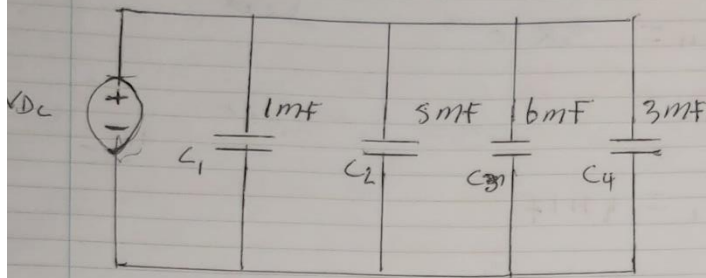
$$C_2 = 5 \text{ mF}$$

$$C_3 = 6 \text{ mF}$$

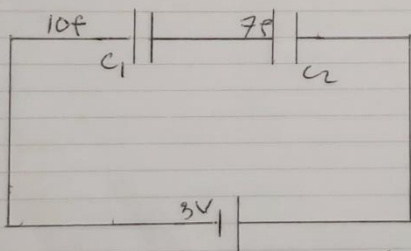
$$C_4 = 3 \text{ mF}$$

Series and Parallel Circuits

~~Calculate~~ Calculate the total capacitance in the following circuit:



Calculate the total capacitance in the following circuit



$$\frac{1}{C_1} + \frac{1}{C_2} = C_T + \frac{1}{0.24}$$

$$\frac{1}{10} + \frac{1}{7} = \frac{1}{0.24} = 4.17\text{F}$$

Electric Power

Power is given by the formula

$$P = VI \quad \text{Ohm's Law}$$

V, I if $V = IR$ (Ohm's Law) $V = IR$

I, R Then Electric Power Sub $V = IR$ in P

is given by

$$P = I^2 R$$

$$P = (IR)$$

$$P = I^2 R \quad \left(\frac{10 \times 10}{10^2} \right)$$

V, R

when Electric

Power is given by

$$P = \frac{V^2}{R}$$

Power Energy Relation

Power is ~~diff~~ defined as the rate of energy consumption.

The Power and Energy relation is given by $P = \frac{E}{T}$

when

P = Power in Watts

E = Energy consumption
in Joules

T = Time in Seconds

Assignment

$$R_1 + R_2 + R_3 + R_4$$

$$2 + 5 + 3 + 2 = 12 \Omega \quad \text{Resist} = 12 \Omega$$

$$V = I \times R \quad \frac{24}{12} = 2 A$$

$$\frac{V=24}{R=12} = 2 A$$

$$I = 2 A$$

Assignment

Voltage

$$R_2 = (5 \Omega) (2 A) \quad 5 \times 2 = 10 A$$

$$R_3 = (2 A) (3 \Omega) \quad 2 \times 3 = 6 A$$

$$R_3 = (2 A) (2 \Omega) \quad 2 \times 2 = 4$$

$$R_1 = (2 \Omega) (2 \Omega) \quad 2 \times 2 = 4$$

Calculate the current flowing through the variable resistor in the circuit.

$$I_1 = \frac{I R_2}{R_1 + R_2}$$

$$I_1 = 10 \times 5 = 50$$

$$I_2$$

$$= \frac{2 \times 10}{5 + 10}$$

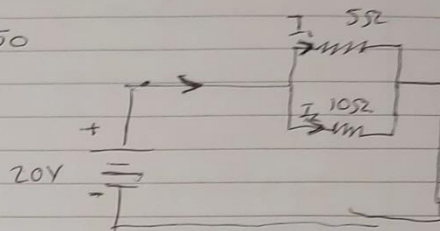
$$= \frac{20}{15}$$

$$= \frac{20}{15}$$

$$I = 1.33 A$$

$$I = I_1 + I_2 = 1.33 A$$

$$5 \Omega$$

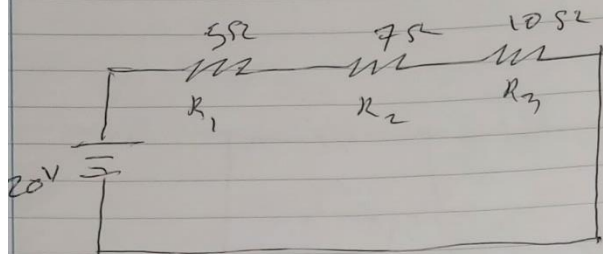


$$I_2 = \frac{I R_1}{R_1 + R_2}$$

$$= \frac{2 \times 5}{5 + 10}$$

$$= \frac{10}{15} = 0.67 A$$

Calculate the Voltage across
the various Resistor in the Circuit



$$V_1 = \frac{V R_1}{R_T} = \frac{20 \times 5}{5 + 7 + 10}$$

$$V_2 = \frac{V R_2}{R_T} = \frac{20 \times 7}{5 + 7 + 10} = 6.36$$

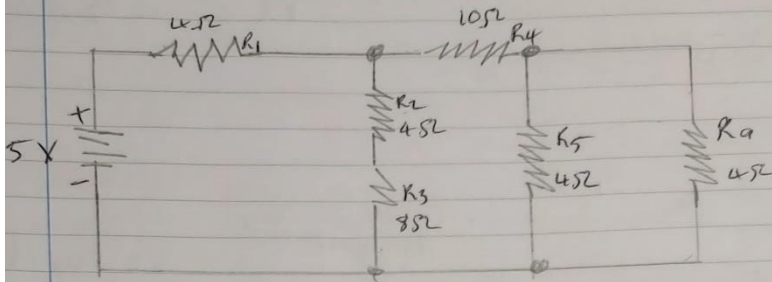
$$V_3 = \frac{V R_3}{R_T} = \frac{20 \times 10}{5 + 7 + 10} = 9.09$$

=

= 4.65

(17)

calculate the total resistance in the following circuit.



$$R_t = \frac{1}{\frac{1}{R_3} + \frac{1}{R_5}}$$
$$= 0.25 + 0.25$$

$$R_t = 0.5\Omega = \frac{1}{0.5} = 2\Omega$$

$$R_t = 2\Omega$$

$$R_t = R_2 + R_3 + R_4 + R_5$$
$$= 4 + 8 + 10 + 2$$

$$R_t = 24\Omega$$

$$R_t = R_1 + R_t$$
$$= 4 + 24$$

$$R_t = 28\Omega$$

Formula

Formula to calculate
Capacitance

$$\text{Charge} = C = \frac{q}{V}$$

W

where
 $C = \text{Capacitance}$

$q = \text{Charge in Coulomb}$

$V = \text{Voltage in Volts}$

Capacitance has
on Formula

$$C = \frac{q}{V}$$

$$V = IR$$

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

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

$$P = V \times I$$

$$P = I^2 \times R$$

$$P = \frac{V^2}{R}$$

$$P = \frac{E}{T}$$

$$C = \frac{q}{V}$$

Symbols

The value of voltage is $1,000\text{V}$

The current is $0.000,006\text{A}$

The power is $1,000,000,000\text{W}$

The inductance is 0.003H

The Resistance is $20\text{k}\Omega$

The Power is $5 \times 10^6\text{W}$

The capacitance is 10^{-12}F

The value of resistance is $3,000,000$
 ohm

The capacitance is $0.000,000,005\text{F}$

The current is $4.4 \times 10^3\text{A}$

31

Symbols

1,000 $= 10^3$ K(Kilo) 1K

1,000,000 $= 10^6$ M(Mega) 1M

1,000,000,000 $= 10^9$ G(Giga) 1A

0.001 $= 10^{-3}$ m(milli) 1m

0.000001 $= 10^{-6}$ μ (micro) 1 μ

0.000000001 $= 10^{-9}$ N(Nano) 1N

0.000000000001 $= 10^{-12}$ P(Pico) 1P

1K m 10A

1000 m 10mA

1000 x 100 10 μ A 10 μ A

= 100,000 m = 100 Km

100 Km

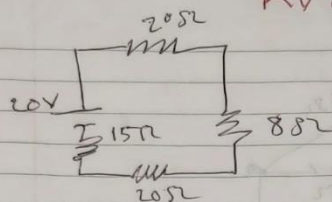
Symbols

Km	1,000	10^3	K (Kilo) $\downarrow$ K = 10 ³
oom	1,000,000	10^6	m (mega) $\downarrow$ m = 10 ⁶
	1000x100		

Sign Conversion

- ① Rise in potential - Positive(+)
 - ② Fall in potential - Negative(-)
 - ③ The reverse is also possible, both the conversion gives the same result.
- if we go from a positive terminal of the source to the negative terminal (fall in potential),
So emf, assigned is negative sign

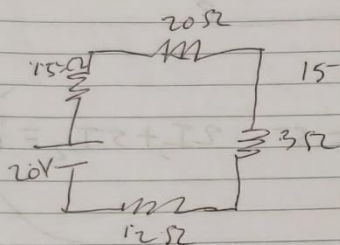
KVL 2A.W



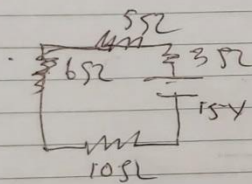
$$20I + 8I + 20I + 15I$$

$$20I + 8I + 20I + 15I = 20$$

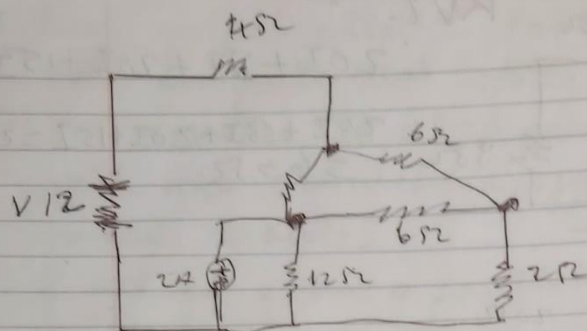
$$= 63I$$



$$15I + 20I + 3I + 12I = 20$$



$$10I + 6I + 5I + 3I = 15$$

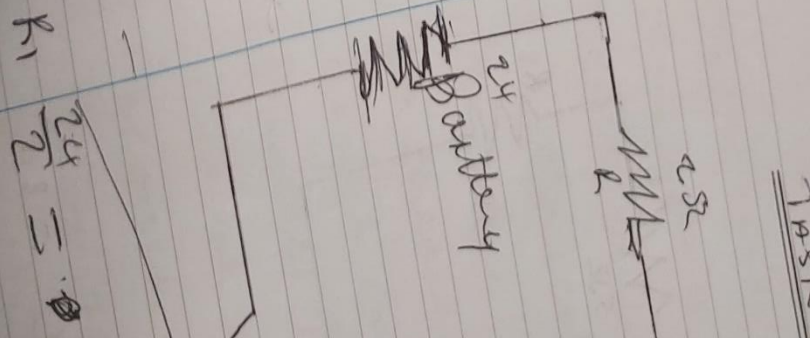
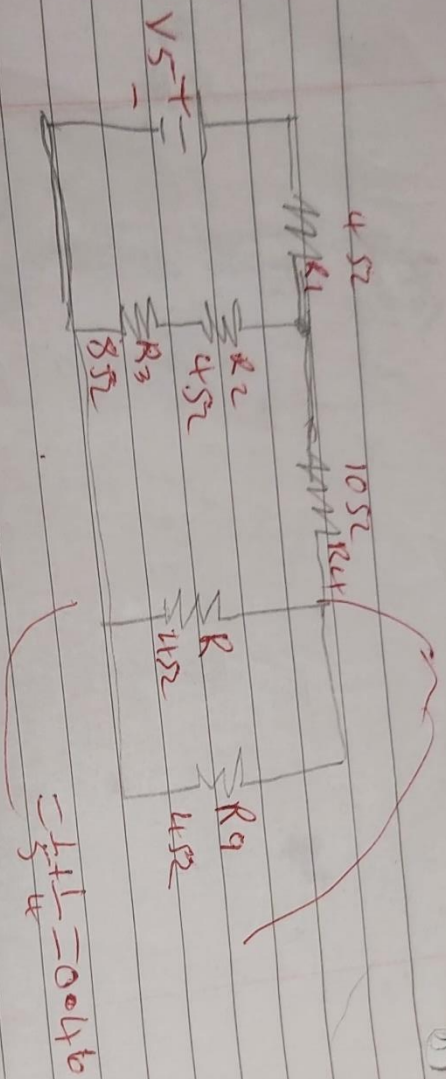


$$2I_1 + 3I_2 = 5 \quad 2I_1 + 5I_2 = 6$$

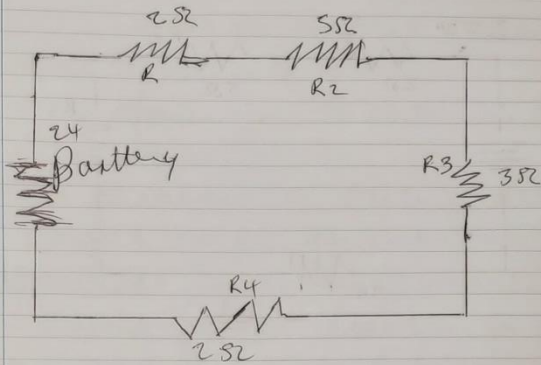
$$I_1 + 3 - 3 =$$

$$2I_1 + 3I_2 = 5$$

$$2I_1 + 5I_2 = 6$$



Task 3 2A



$$R_1 \quad \frac{24}{2} = 12 \Omega = 2A$$

$$I=2A \quad V=24$$

$$R_2 \quad \frac{24}{5} = 4.8 = 4.8A$$

$$I=2A \quad V=4V$$

$$R_3 \quad \frac{24}{3} = 8 = 8A$$

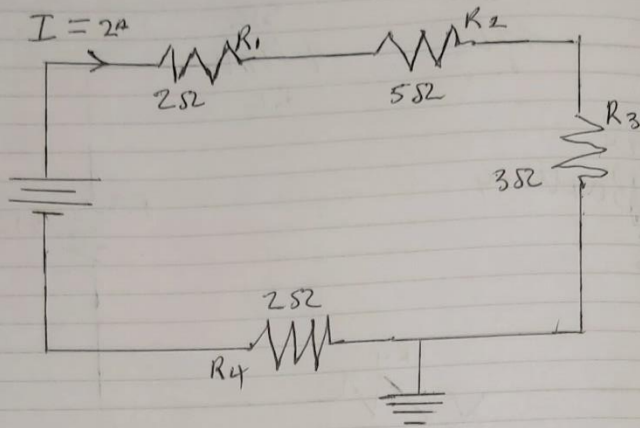
$$I=2A \quad V=10V$$

$$I=2A \quad V=6V$$

$$I=2A \quad V=2V$$

$$\frac{24}{2} = 12 = 12$$

TASK 3 2A



$$V = I \times R$$

$$R_1 + R_2 + R_3 + R_4 = R_T \quad \frac{24V}{12\Omega} = 2A$$

$$R_T = 12\Omega \quad I = 2A \quad V = 24V$$

$$R_1 = 2\Omega \quad I = 2A \quad V = 4V$$

$$R_2 = 5\Omega \quad I = 2A \quad V = 10V$$

$$R_3 = 3\Omega \quad I = 2A \quad V = 6V$$

$$R_4 = 2\Omega \quad I = 2A \quad V = 4V$$

Thevenin's theorem

Advantages

- ① It reduces a complex circuit to a simple circuit.
- ② It is applicable to both DC and AC network.
- ③ The theorem is particularly useful to find current in a ~~particular~~ Particular branch of a network as the resistance of that branch is varied while all other resistance and E.M.F. ~~go~~ source remain constant.

Disadvantages or limitations

- ① It is applicable only for linear and bilateral networks.

Superposition Theorem

Super position theorem states, that, a linear network containing more than one source, the current flowing in any branch is the algebraic sum of current that would have been produced by each source taken separately, with all the other source replaced by their respective internal resistance. In case the internal resistance is not provide the voltage source will be short circuited and the current source will be open circuited.

Superposition theorem - steps

- ① 1st Step:
current obtained at step 1 in A Branch is equal to the sum of current obtained at the same branch at step 2 and step 3.

- ② The current across ~~the~~ the Branch EFA B

$$I_{A_1} = I_{B_1} + I_{C_1}$$

~~Then~~

The current across the Branch B.C.B.E

$$I_{A_2} = I_{B_2} + I_{C_2}$$

The current across the branch BE

$$I_{A_3} = I_{B_3} + I_{C_3}$$

- ③ Provided the value of current is in the same direction.

- ④ if the current direction is opposite ~~the~~ to each other (subtract the currents)

- ⑤ if the direction of current I_{B_1} and I_{C_1}

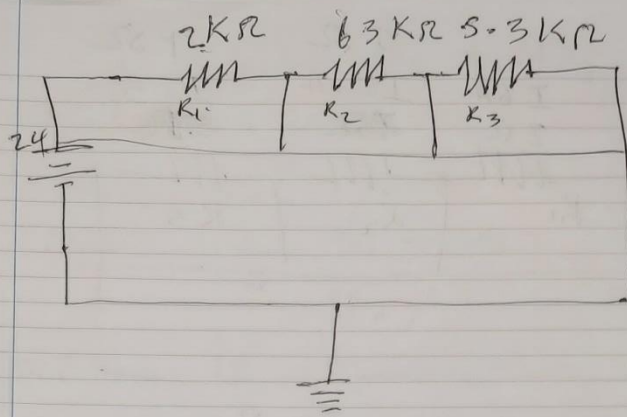
- are opposite to each other

$$I_{A_1} = I_{B_1} - I_{C_1}$$

Voltage Rating

Voltage rating is defined as the maximum voltage an electrical appliances can withstand for a duration of time.

- ② All the electrical equipments and components can withstand a particular amount of voltage, which is mentioned in the equipment



$$R_1 + R_2 + R_3 \Omega$$

$$= 2 + 6 + 5.3 = 13.3 \Omega$$

$$= 1.805$$

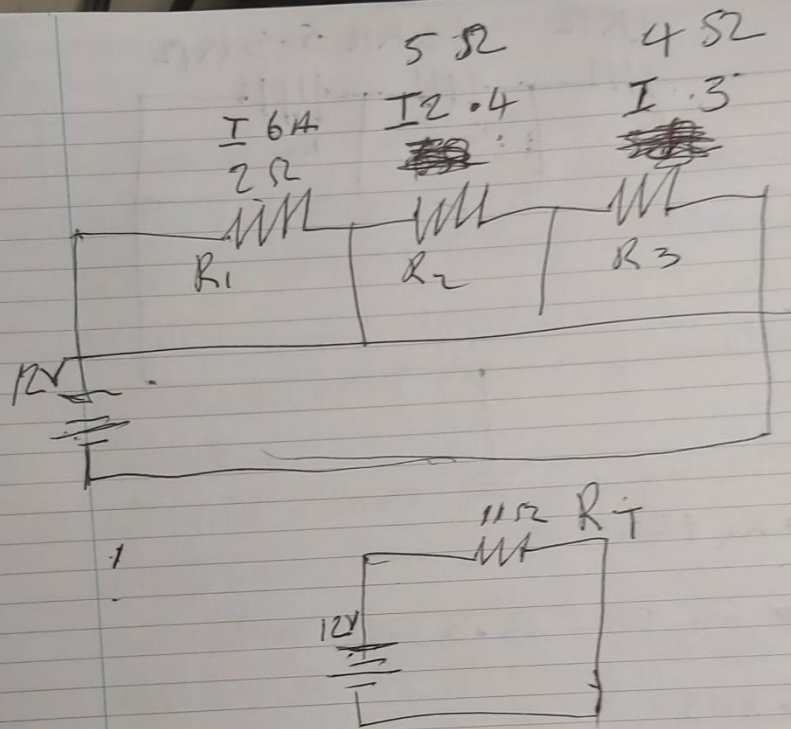
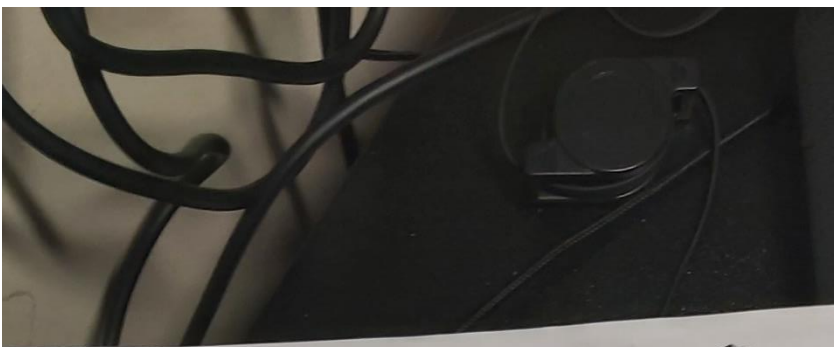
$$R_T = 13.3 \Omega =$$

$$\frac{24}{13.3} = 1.805$$

$$R_1 = \frac{12V}{2} = 6A$$

$$R_2 = \frac{12V}{6} = 2A$$

$$R_3 = \frac{12V}{5} = 2.4A$$



Kirchhoff's Voltage Law

15/November 2022

November 1/2022

November 8/2022

22, 15, 29

October 18, 25

Electronics Breadboard

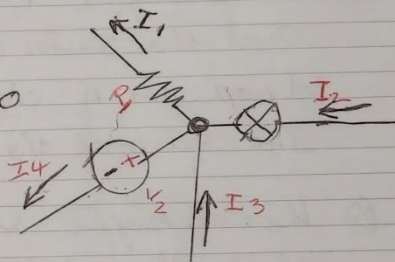
December 13 - 2022

Kirchhoff's Current Law

- ① The Law is applied in the Node of the network.
- ② The current entering any junction is equal to the current ~~that is~~ leaving that junction.

$$I_1 + I_4 = I_2 + I_3$$

$$I_1 + I_4 - I_2 - I_3 = 0$$



Sum of the current entering
 $I_2 + I_3 = I_4 + I_1$

Kirchhoff's voltage law (KVL)

Kirchhoff's Voltage Law (KVL) ①

- ① is Kirchhoff's second law that deals with the conservation of energy around a closed circuit path.

- ② Kirchhoff's voltage law states that the sum of the potential drop in a circuit is equal to the sum of the potential rise. (or)

- ③ Kirchhoff's voltage Law states that the algebraic sum of the Product of current and resistance of various branches of a closed mesh of a circuit Plus the algebraic sum of the e.m.f in that closed mesh is equal to zero.
- $$\sum IR + \sum V = 0$$

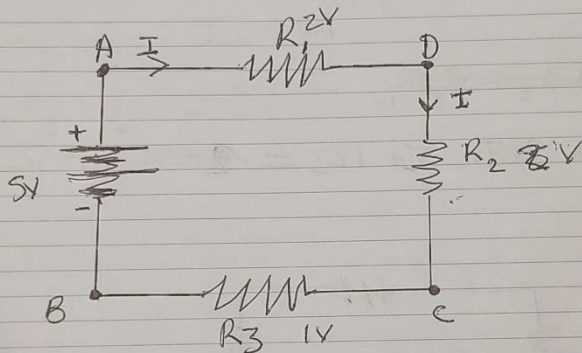
Kirchhoff's Voltage Law (KVL)

- ① Potential drop $= IR_1 - IR_2 + IR_3$
- ② Potential rise $= V$
- ③ Applying $= KVL$

$$IR_1 + IR_2 + IR_3 = V$$

or

$$IR_1 + IR_2 + IR_3 - V = 0$$

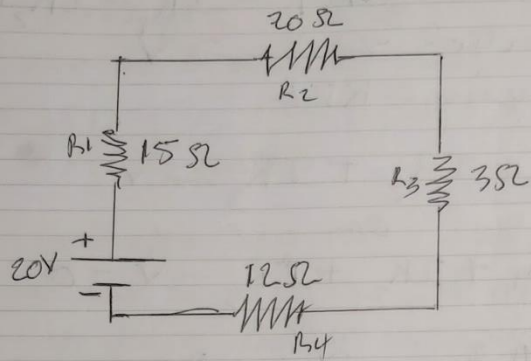


$$5 = 2 + 2 + 1$$

$$5 - 2 - 2 - 1 = 0$$

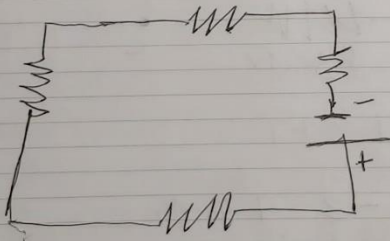
$$IR_1 + IR_2 + IR_3 = V$$

EXERCISE



$$R_1 + R_2 + R_3 + R_4 =$$

$$15\Omega + 20\Omega + 3\Omega + 12\Omega = \cancel{20\Omega} 20\Omega$$



$$10I + 6I + 5I + 3I = 15$$

$$10I + 6I + 5I + 3I = 15$$

Apply KCL

$$I_2 - I_4 - I_5 - 2 = 0$$

$$I_3 + I_5 - I_6 = 0$$

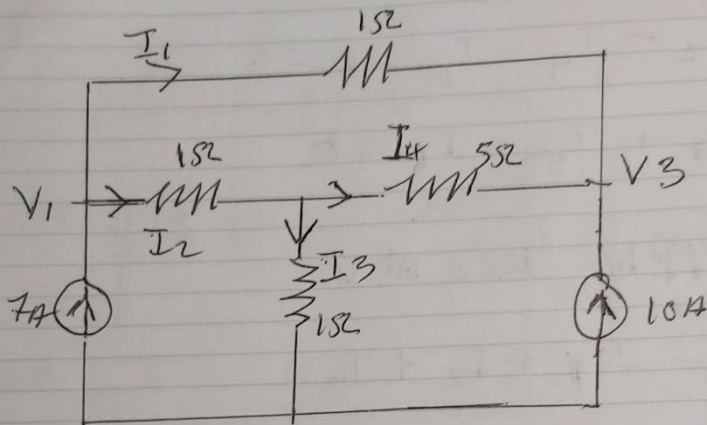
Apply KCL at V

$$0 = I_1 + I_2 + I_3$$

$$I_2 + 2 = I_4 + I_5$$

$$I_3 + I_5 = I_6$$

KCL

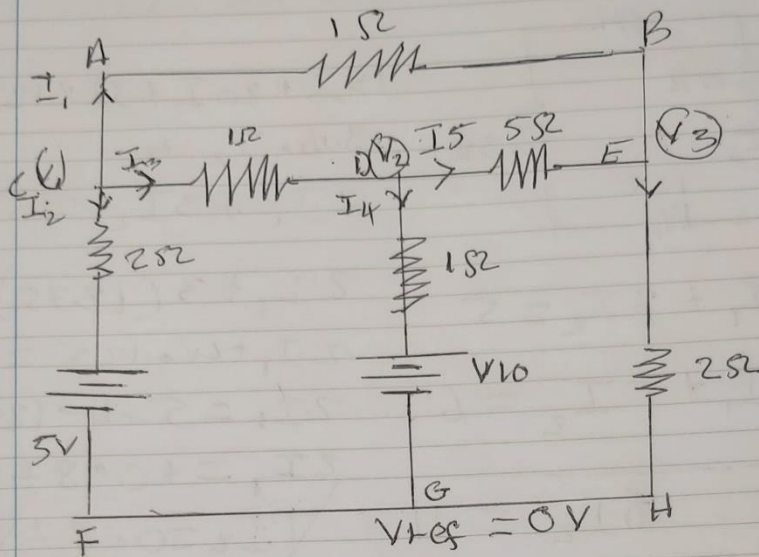


$$V_1 = I_1 + I_2$$

$$V_2 = I_3 + I_4 = I_2$$

$$V_3 = I_1 + I_4 + 10 = 0$$

KCL

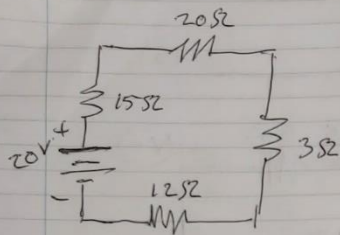


$$V_1 = 0 = I_1 + I_2 + I_3$$

$$V_2 = I_3 = I_4 + I_5$$

$$V_3 = I_1 + I_5 = I_6$$

KVL



$$15I + 20I + 3I + 12I = 20$$

Sub. I_2 in

$$2I_1 + 3I_2 = 5$$

$$2I_1 + 3I_2 = 5$$

$$-2I_1 + 5I_2 = 6$$

$$2I_1 + 3(1.375) = 5$$

$$2I_1 + 4.125 = 5$$

$$2I_1 = 5 - 4.125$$

$$2I_1 = +0.875$$

$$0 \quad 8I_2 = 11$$

$$I_2 = \frac{11}{8}$$

$$I_2 = 1.375$$

$$I_2 = \frac{0.875}{2}$$

$$R_1 + R_2 + R_3 =$$

$$10 + 3 + 4 = 17 \Omega$$

$$\frac{12V}{17 \Omega} = 0.705 \text{ A} \quad I = 0.705 \text{ A}$$

$$V_1 = 7.26 \text{ V}$$

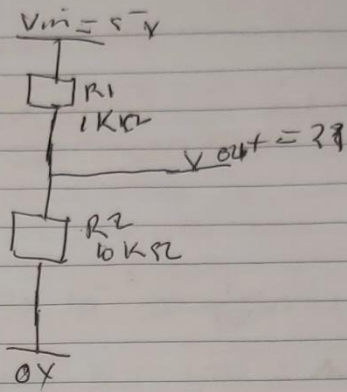
$$V_2 = 2.115 \text{ V}$$

$$V_3 = 2.82 \text{ V}$$

$$V_1 \quad I = 0.705$$

$$V_2 \quad I = 0.705$$

$$V_3 \quad I = 0.705$$



$$V_{out} = V_{in} \frac{R_2}{R_1 + R_2}$$

$$R_1 + R_2 = 5 + 10 = \frac{15}{10} = 1.5$$

$$V_{out} = V_{in} + \frac{R_2}{R_1 + R_2} = \frac{10K\Omega}{1K\Omega + 10K\Omega}$$

Power = To find Power

$$P = VI =$$

$$I^2 R =$$

$$\frac{V^2}{R}$$

Energy stored (PE)

$$W = \frac{1}{2} QV \quad Q = CV$$

$$W = \frac{1}{2} CV^2 \quad V = \frac{Q}{C}$$

$$W = \frac{1}{2} \frac{Q^2}{C}$$

$$10^{-3} \text{ is } 10 \text{ To The Power}$$

$$10^2 = 10 \times 10 = 100$$

$$10^3 = 10 \times 10 = 100$$

$$10^4 = 10 \times 10^3 = 10 \times 1000$$

$$10^5 = 10 \times 10^4 = 10 \times 10000$$

$$5 \text{ mH is } 5 \times 10^{-3} = \frac{5}{1000}$$

$$10 \text{ To The Power } 3 = 100 = 10 \times 10 = 100$$

$$10 \text{ To The Power } 10^2 = 10 \times 10 = 100$$

$$10 \text{ To The Power } 10^3 = 1000$$

$$10^{-3} = \frac{1}{10^3}$$

$$10^5 = \frac{1}{10^5}$$

Electric Current:

is defined as a flow of charge particles (electrons and ions) moving through a conductor.

It is also defined as the flow rate of electric charge ~~thg~~ through a conducting medium concerning time.

The unit of electric current is = Ampere = A and the current is defined $I \propto A = I^A$

Courses Modules

- ① Electronics Principles and Concepts
- ② Introduction to Programmable Logic Controllers
- ③ Introduction to Digital electronics
- ④ Integrated Project
- ⑤ Technical Skills Development
- ⑥ Digital Technologies
Technologies
- ⑦ Work Based Learning
- ⑧ Professional Development
- ⑨ Applied Analytics

The student upon completion of the lecture will be able to

- 1) Define Electricity, Electron, Charge, Voltage and current. Differentiate electrical and Electronics. Define the Types of current. Define Voltage, Current Rating.

What is electricity?

It is a type of energy that occurs due to the movement of electrons or protons in an oscillating pattern.

It is the energy transported by the motion of electrons.

We convert other form of energy into electrical energy.

Electric Power

Power is the rate of energy supplied by an electric circuit unit respect to time.

$$Power = P = \frac{dw}{dt} = dw \div dt$$

For DC system:

$$P = VI$$

$$P = I^2 R$$

For single-phase system

$$P = VI \cos \phi$$

$$P = 3 V_L I_L \cos \phi$$

$$P = I^2 R \cos \phi$$

$$P = \frac{V^2}{R} \cos \phi$$

$$Power = Watts = W$$

$$Power = V \times I = P$$

Ohms Law

$$V \times I$$

$$Voltage = V = V_{oh} \times I \times R$$

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

$$= \Omega \text{ Ohm}$$

$$Current = \frac{V}{R} = I \text{ ampere}$$

~~$$V = \frac{P}{I}$$~~

$$V = I \times R = V_{ohm}$$

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

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

Differentiate Electrical and Electronics

1 Electrical devices work with high voltage and current (110V or 220V or 440V) etc

2 Electrical does not control current and voltage.

3 Electrical devices work AC

Eg Fan, Iron Mixer grinder, Air Conditioner, Refrigerator, Microwave oven, etc.

Electric Charge

Charge (Q)

1 Electric charge is the physical property of matter that causes it to experience a force when placed in an electromagnetic field.

2 There basic charges Positive and negative

3 The unit of electric charge is Coulomb

Atom

1 Atom has three particles

2 Neutron - No Charge

3 Electron - Negative Charge
(-1.6×10^{-19} coulomb)

4 Proton - Positive Charge
(1.6×10^{-19} coulomb)

Nucleus has Proton and Neutrons.

Electrons Revolve round the Nucleus.

What is electric current?

① Electric current is defined as the flow of electric charges ~~carriers~~ in an electric circuit.

② The charge carriers are usually electrons (negative charge) or holes (positive charge).

③ The electric current is represented by (I) .

④ The unit of electric current is ampere (A).

Direction of Current flow

① The direction of current flow is opposite to that of the direction of flow of charge particles.

Voltmeter Voltage Rating

① The voltage rating of the ~~Sharp~~ TV is 120V. Alternate current.

② If the voltage increases above 120V, this projector may get damaged. So it must be supplied with the rated voltage.

Voltmeter

① ~~Measuring~~ Voltmeter is used for measuring the voltage.

② The voltage can be calculated using the formula $V = IR \Rightarrow \frac{V}{R} = I$

Ammeter

① Ammeter is used for measuring the current.

The current can be calculated using the formula.

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

Differentiable Electronics

① Electronics devices work with low voltage and current (3V, 5V, 8V, 12V etc.)

② Electronic devices control current and voltage.

③ Electronic devices work with DC. Eg. Mobile phone, Laptop, etc.

Direct Current

- ① DC is the unidirectional flow or movement of electric charge carriers.
- ② the intensity of the current can vary with time, but the general direction of movement always stays the same.

Current Rating

- ① Current rating is defined as the maximum current an electrical appliance can carry continuously for a duration of time with complete safety.
- ② All the electrical equipments and components can withstand a particular amount of current which is mentioned in the equipment.

Types of current

- ① AC current = Alternating current
- ② DC current = Direct current

Alternating current

Alternating current is an electric current in which the flow of electric charge periodically reverses direction.

- ① A AC waveform can be sinusoidal wave, or sawtooth shaped. Some AC waveforms are irregular or complicated.

- ② An example of sine wave AC is common household utility current.

Current Rating

- ① The current rating of the LG projector is 1.7A. Direct current.
- ② If the current increased above 1.7A, this projector may get damaged so it must be supplied with the rated current.
- ③ Resistors are used to resist the flow of current which helps the current to be within the rated range.

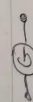
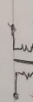
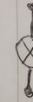
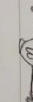
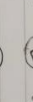
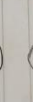
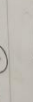
Voltage Rating

- ① Voltage rating is defined as the maximum voltage an electrical appliance can withstand for a duration of time.
- ② All the electrical equipment and components can withstand a particular amount of voltage, which is mentioned in the equipment.

Symbols

-  = Wattmeter
-  = Voltage source
-  = Current source
-  = Variable voltage source
-  = Battery cell
-  = Battery
-  = Inductor
-  = Variable inductor
-  = Capacitor
-  = Variable capacitor
-  = SPST Toggle switch

Symbols

-  = Fuse
-  = FUSE
-  = Microphone
-  = Motor = Electric motor
-  = Generator
-  = Transformer
-  = Loudspeaker = Sound wave
-  = Lamp/Light bulb
-  = Lamp/Light bulb
-  = Lamp/Light bulb
-  = Voltmeter
-  = Ammeter
-  = Ohmmeter

25/10/2022 Circuit Diagram Circuit Element Symbols and Passive Device

-  = Ammeter = current
-  = Resistor
-  = Resistor
-  = Capacitor
-  = Voltmeter
-  = Ohmmeter
-  = Diode
-  = LED = Light Emitting Diode
-  = Transistor = Amplifies the Electrical Signal

$$V = S$$

$$F = 2.5$$

$$\text{---} \text{---} \text{---} = \text{Resistor} = \text{Ohm} = \Omega$$

$$\text{---} | \text{---} = \text{Capacitor} = \text{Farad} = F$$

$$\text{---} \text{---} \text{---} = \text{Inductor} = \text{Henry} = H$$

$$\text{---} \text{---} \text{---} \text{---} = \text{Voltage Source} = \text{Volt} = V$$

$$\text{---} \text{---} \text{---} \text{---} \text{---} = \text{Current Source} = \text{Ampere} = A$$

18/10/2022 Lecture 2
Electronics Principles
and Concepts (ACB44015)

Content = Power, units

① Resistance Ohms

② Capacitance Farad

③ Inductance Henry

④ Current Ampere

① Define Electric Power, Resistance, Capacitance and Inductance;

② List out the functions of Resistor, Capacitor and Inductance.

Symbols

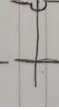
 = SPST Toggle switch

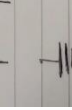
 = SPDT Toggle switch

 = Push button switch (NO)

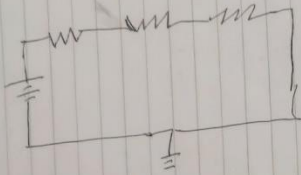
 = Electric wire

 = Connected wires

 = Not connected wires

 = Earth ground

Ohm's Law Calculate



Ohm's Law to calculate Voltage
 $V = I R$

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

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

$$V = \text{Voltage} = V$$

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

$$R = \Omega = \text{ohms}$$

25/10/2022 Ohm's Law Exercises

Ohm's Law name after

George Simon Ohm

Ohm's Law provides the relation between

Voltage, Current and Resistance

Ohm's State the the Current through a conductor is directly proportional to the Voltage across the same conductor and inversely proportional to the Resistance provided the physical properties and the temperature remains constant.

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

25/10/2022 Ohm's Law Exercises

Ohm's Law name after

George Simon Ohm

Ohm's Law provides the relation between

Voltage, Current and Resistance

Ohm's State the the Current through a conductor is directly proportional to the Voltage across the same conductor and inversely proportional to the Resistance provided the physical properties and the temperature remains constant.

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

Electric Power

① Power is given by the Formula

$$P = VI - \text{ohms}$$

$$P = V = IR \text{ (ohms Law)}$$

② Then Electric Power is given by $P = I^2 R$ $P = I^2 R$

$$I = \frac{V}{R} \text{ (ohms Law)}$$

③ then Electric Power is given by $P = \frac{V^2}{R}$ $P = \frac{V^2}{R}$

$$P = VI$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

Electric Power

① Power is given by the Formula

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② Then Electric Power is given by $P = I^2 R$ $P = I^2 R$

$$I = \frac{V}{R} \text{ (ohms Law)}$$

③ then Electric Power is given by $P = \frac{V^2}{R}$ $P = \frac{V^2}{R}$

$$P = VI$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

$$P = \frac{V^2}{R}$$

$T = \text{Time in Seconds}$

$E = \text{Energy Consumption in (Joules)}$

$P = \text{Power in Watts}$

$$P = \frac{E}{T}$$

Power and energy Relation is given by

Power is defined as the rate of energy consumption

Power energy Relation

$Q = \text{Charge in Coulomb}$

$V = \text{Voltage in Volts}$

$C = \text{Capacitance}$

Formula to calculate capacitance

$$C = \frac{Q}{V}$$

25/10/2021

Types of Circuit Diagram

- ① Schematic circuit diagrams using industry standard
- ② pictorial circuit diagram using basic images.
- ③ Each component in a circuit is called a circuit element. Resistor, capacitors, inductors, capacitors, Battery, Ammeter.

30 J 2s what is power
when fan starts moving
30 J of work is done by the

$$E = 30 \text{ J}$$

$$T = 2 \text{ s}$$

$$P = \frac{E}{T}$$

$$\frac{30 \text{ J}}{2 \text{ s}} = 15 \text{ W}$$

what is the power of the
toaster that can toast a bread
in 20 s by doing 40 J
of work

$$P = \frac{E}{T}$$

$$\frac{40 \text{ J}}{2 \text{ s}} = 20 \text{ W}$$

$$20 \times 2 = 40 \text{ J}$$

$$20 \text{ W} = 20 \text{ J/s}$$

Capacitor = F

Inductor = Henry = H

$P = \frac{E}{T}$
Time per second

$$V = 15 \text{ V} \quad R = 10 \Omega = 10 \text{ Amps}$$

$$R = 10 \quad P = I^2 R$$

$$V = 15 \quad P = (15)^2 \times 10$$

$$I = \quad P = 2.25 \times 10$$

$$P = \quad P = 22.5 \text{ W}$$

11/11/2022

Electronics Principles and Concepts

A bulb can light up a free space area in 0.2s by doing 0.03 kJ of work. Calculate the power of the bulb.

$$E = 0.03 \text{ kJ}$$

$$= 0.03 \times 1000 \text{ J}$$

$$= 30 \text{ J}$$

$$T = 0.2 \text{ s}$$

Work Done

$$= 0.03 \text{ kJ}$$

$$= 0.03 \times 100$$

$$= 30 \text{ J}$$

$$P = \frac{E}{T}$$

$$P = \frac{30}{0.2}$$

$$P = 150 \text{ W}$$

A Television does 6000 J work in 1 min to create an

$$\frac{6000 \text{ J}}{1}$$

$$E = 6000 \text{ J}$$

$$T = 1 \text{ min}$$

$$= 60 \text{ s}$$

$$T = 1 \text{ min}$$

$$= 1 \times 60$$

$$= 60 \text{ s}$$

$$= \frac{6000}{60}$$

$$= 100 \text{ W}$$

$$P = \frac{6000}{60} = 100 \text{ W}$$

$$P = \frac{E}{T}$$

Calculate the Power of an ~~atom~~ atom, if the Voltage supplied is 440V and the resistance offered 200 Ω

$$\frac{440^2 \times P}{200} = \frac{V^2}{R} = 968 \text{ W}$$

$$P = P$$

$$P = (5)$$

$$P = 2$$

Series Circuits

When a number of resistors are connected end to end across a source of supply, there will be only one path for the current to flow, this is called a series circuit.

In a series circuit, there is only one part for the current to flow.

The current will be constant flow but the voltage will drop.

(In series circuit the current remains the same.)

$$V = \text{different}$$

I - Constant
Voltage drop

What capacitance is needed to store 3C of charge at a voltage of 120V

$$C = \frac{Q}{V}$$

$$\text{Charge} = 3 \text{ coulombs}$$

$$C = \frac{Q}{V} \quad Q = 3C \quad V = 120V$$

$$C = \frac{3}{120} \quad C = \frac{1}{40}$$

$$C = 0.025 \text{ F}$$

$$P = I^2 R$$

$$P = I^2 R$$

$$P = (5)^2 \cdot 110$$

$$P = (5)^2 \cdot 110$$

$$P = 2750 \text{ W}$$

$$P = 2750$$

$$I = 5 \text{ A}$$

$$R = 100$$

Parallel Circuit

When a number of resistor are connected in such a way that both the ends of individual resistors are connected to other points of the end two terminals of the resistor one, ~~the~~ current connected to other part of the circuit then the circuit is called parallel circuit.

In parallel circuit the current differ because the current flows in different areas of the circuit.

formula

$$\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$I + I + I = \text{Total}$$

When Inductors are connected in series the equivalent inductance can be obtained

$$L_{eq} = L_1 + L_2 + L_3$$

using the formula

$$\frac{1}{L} = \frac{1}{L_1 + L_2 + L_3}$$

Capacitor

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \frac{1}{C_4}$$

Capacitor formula

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} =$$

Series Circuit

$$R_{eq} = R_1 + R_2 + R_3 = 5\Omega$$

$$= R_1 + R_2 + R_3 + R_4 = 13\Omega$$

$$= 50V, I R_1, V_2 = I R_2, V_3 = I R_3$$

Total V.

Inductor Parallel circuit

$$\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \frac{1}{L_4}$$

Capacitor in Parallel

$$C = C_1 + C_2 + C_3 + C_4$$

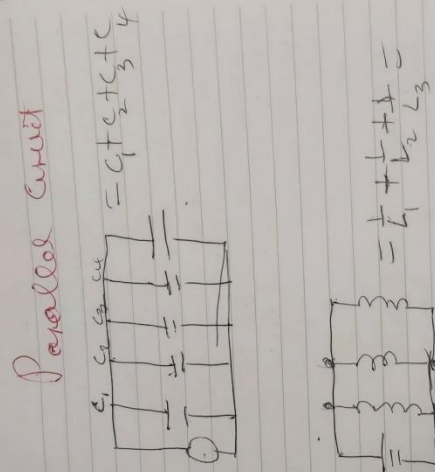
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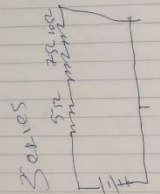
Electronics Principles and Concepts (ACD141015)

Lecture

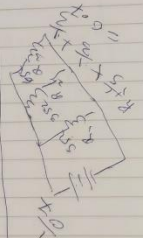
Series		Parallel	
V	differs	constant	differs
	constant	differs	constant
	1 path	more paths	
$R_1 + R_2 + R_3$		$\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	

current	Series	Parallel
Voltage	constant	differs
current	differs	constant
Total voltage	$V = V_1 + V_2 + \dots$	—
Total current	—	$I = I_1 + I_2 + I_3 + \dots$
Reg	$R_{eq} = R_1 + R_2 + \dots$	$R_{eq} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}}$



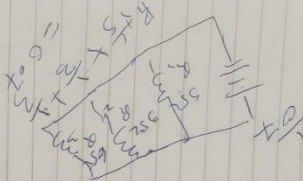


$$\begin{aligned} R_1 &= 552 \text{ R}_2 = \\ &= R_1 + R_2 + R_2 \\ &= 5 + 7 + 10 \\ R_3 &= 22 \text{ R}_2 = \end{aligned}$$



Parallel
 $= 0.2 + 0.33 + 0$
 $= 0.7 - 0.2$

$$\epsilon_{H01} = 2\epsilon_{01} = \frac{1.0}{T} \frac{1}{g}$$

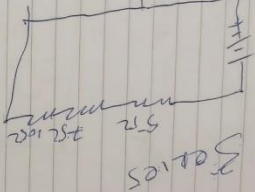


parallel
 $= 0.2 + 0.3 + 0.17$
 $= 0.67$

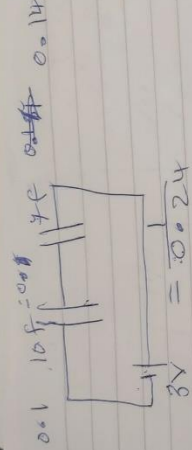
$$K^+ = 22 \text{ } S_2$$

$$\frac{1}{5} = k + k_2 + k_3$$

$$R_1 = S_2 - S_2 = 0$$

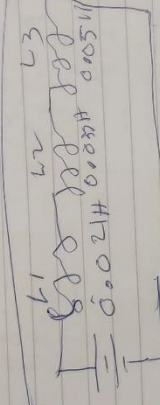


$$t=0 = \frac{01}{x}$$



$$= \frac{1}{0.24}$$

$$R/t = 40.17\%$$

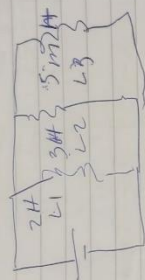


1

$$1.1 = 0.0214$$

12

inductance

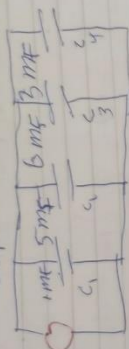


$$\begin{array}{r} 21 \\ 11 \overline{) 251} \\ \underline{22} \\ 31 \\ \underline{33} \\ 20 \\ \underline{22} \\ 0 \end{array}$$

$$L_3 = 5 \text{ in H}$$

$$\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$$

inductance calculate



$$\frac{1}{1000000000}$$

5/10

1000 - 0005

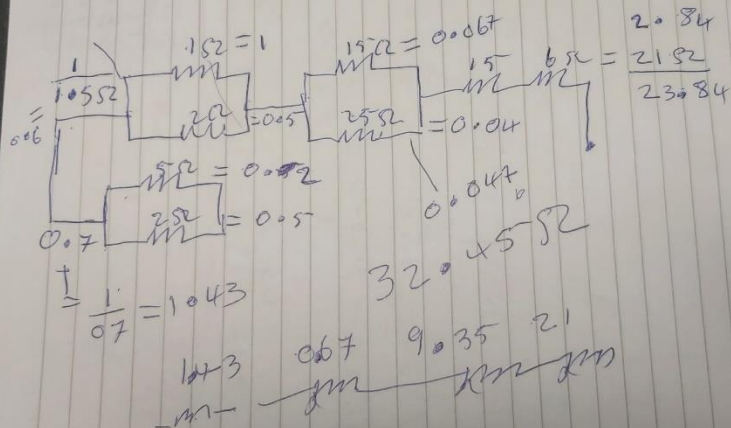
$$\frac{1000}{1000} = 1.000$$

$$C_T = C_1 + C_2 + C_3 + C_4$$

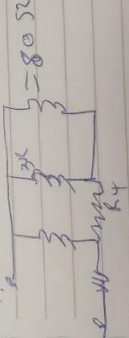
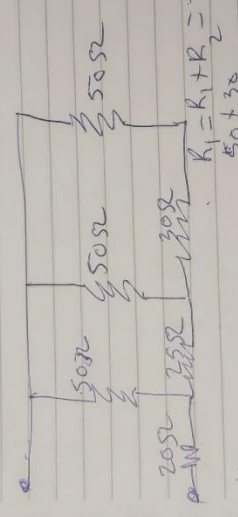
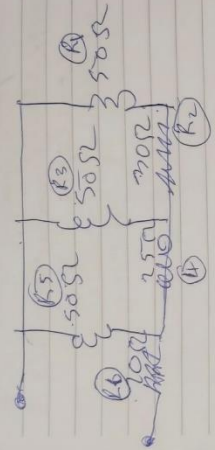
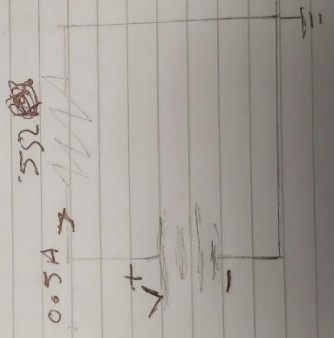
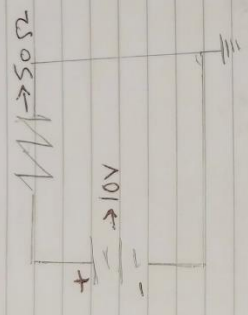
- ①
- ②
- ③
- ④

1.43 0.067 1000

Series and Parallel circuits



Paul Roseway
Electronic Principles and
Concepts,
Module Code ACDA4015
Assignment-1

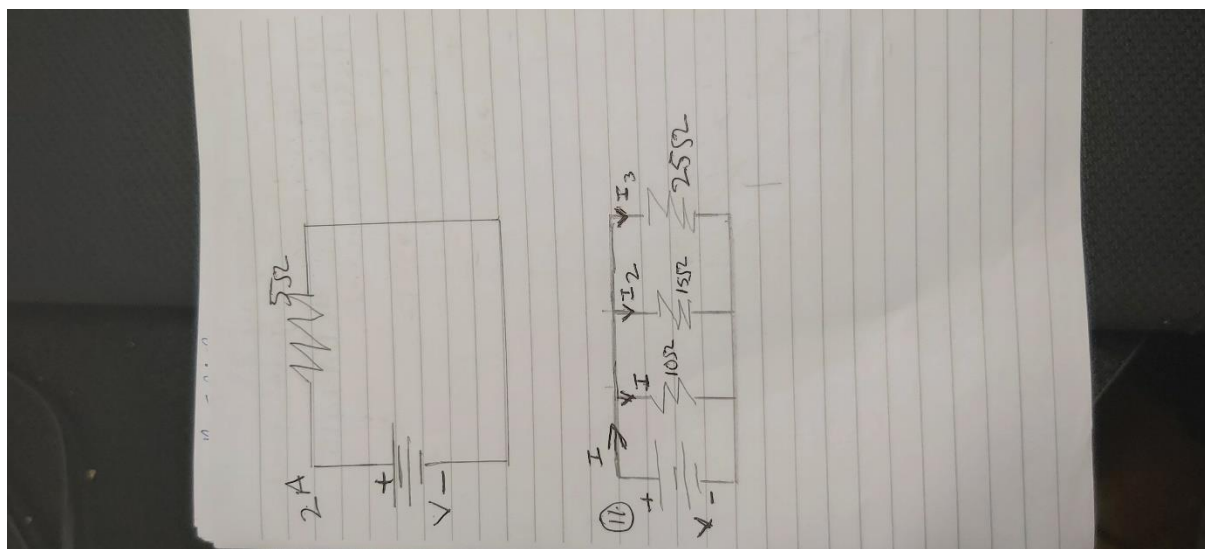
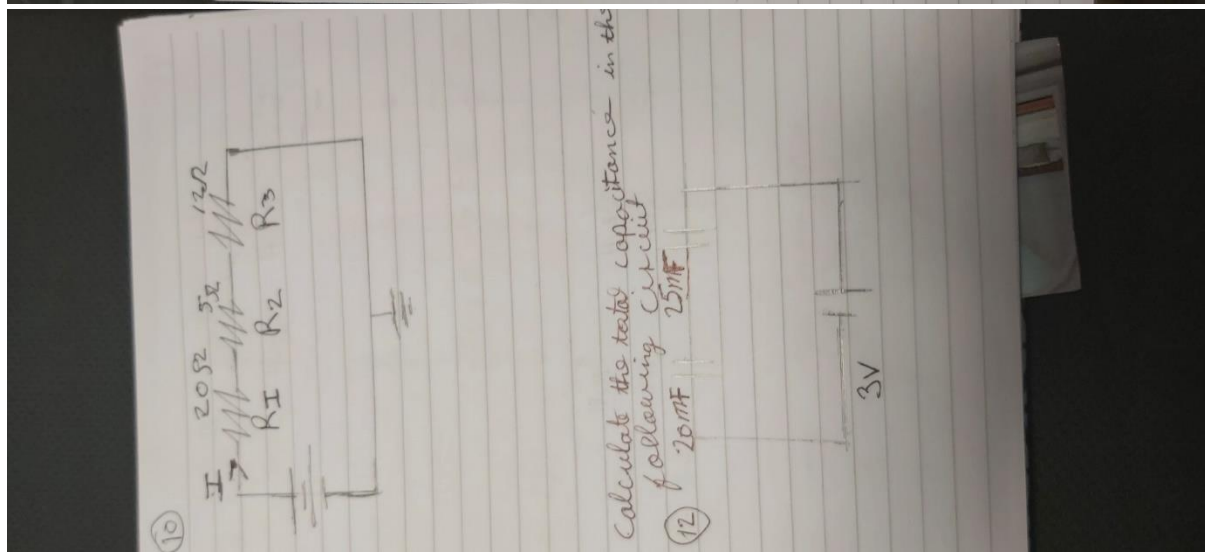
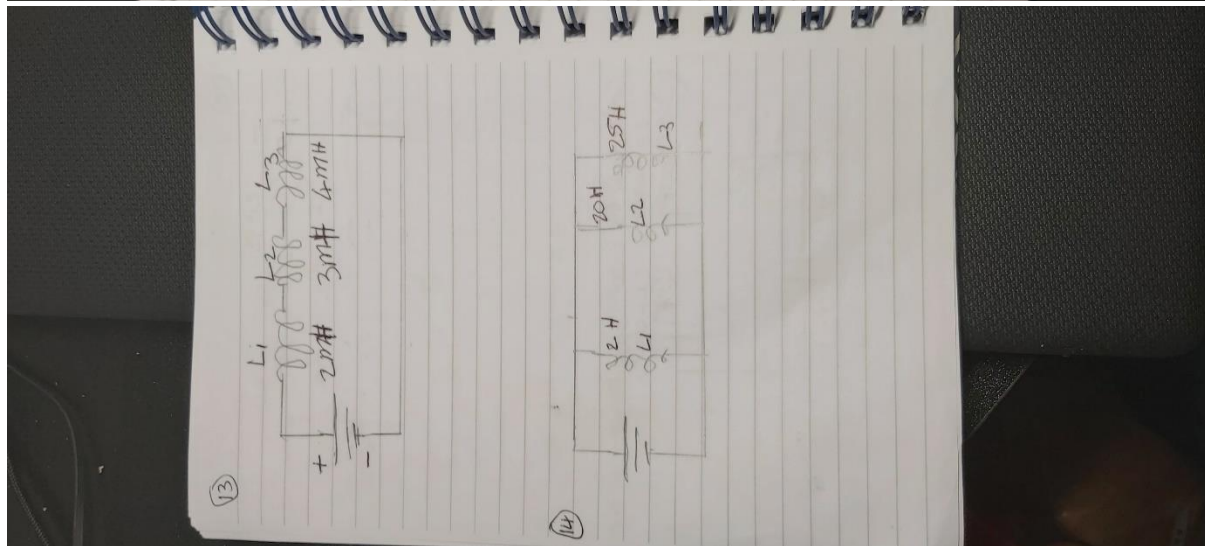


$$R_{Total} = 10 + 35 = 45 \Omega$$

$$R_{T2} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}} = 0.0$$

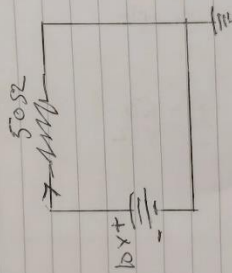
$$55.7 \times 10^{-3} = 0.0538 \approx 53.8 \Omega$$

$$= 46.32 \Omega$$



Assignments Electronics

1 calculate the current flowing through the resistor in the following circuit diagram.

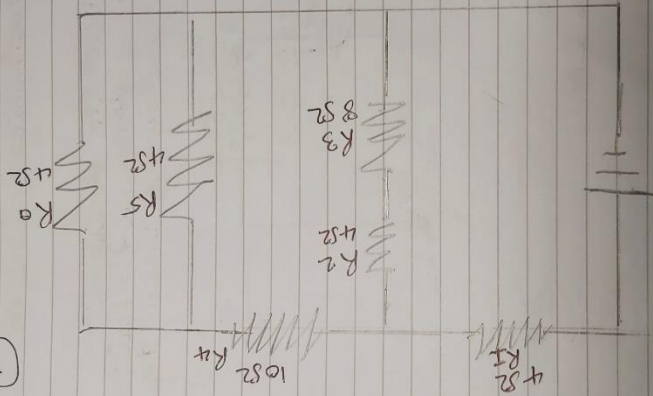


$$I = \frac{V}{R}$$

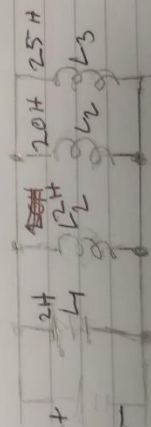
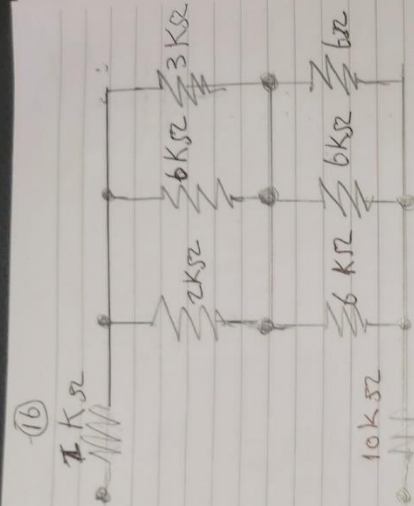
$$= \frac{10}{50}$$

$$I = 0.2A$$

(17)



(16)



③ Calculate the resistance in a circuit if the current across the circuit is 2A and potential difference is 20V

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

$$= \frac{20V}{2A}$$

$$= 10\Omega$$

$$R = 10\Omega$$

Potential difference

$$is \frac{20V}{2A}$$

$$= 10V$$

④ Calculate the Potential difference across the current across 5A and the resistance is 10K Ω

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

$$= 5A \times 10K\Omega$$

$$= 50V$$

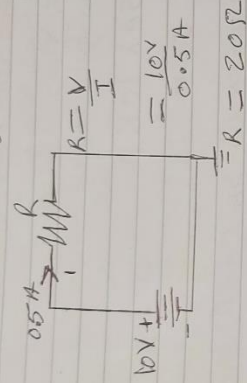
5A goes in 5A series out

the Potential difference

$$= 50V$$

$$= 50V$$

② Calculate value of the resistor in the following circuit diagram



③ Calculate the Voltage supplied by the battery

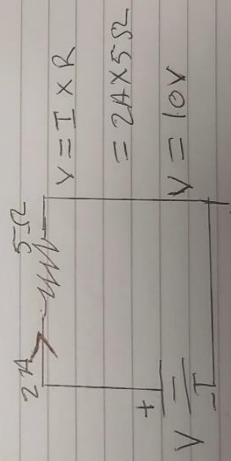


Table Symbols

$$1000V = 1KV = 1 \text{ Kilo Volt}$$

$$\text{current} = 0,000,006A = 6 \times 10^{-6} \text{ mA}$$

$$\text{Power} = 1,000,000,000W$$

$$\text{Inductance} = 0.003H = 3mH = 3 \times 10^{-3}$$

$$\text{Resistance} = 20K\Omega = 20,000\Omega$$

$$\text{Power} = 5 \times 10^6 W = 500,000W$$

$$\text{or } 5mW$$

$$\text{Capacitance} = 10^{-12}F = 1pF$$

$$\text{Value Resistance} = 3,000,000\Omega$$

$$= 3,000,000 = 3M\Omega$$

$$\text{Capacitance} = 0.000,000,005F$$

$$5nF$$

$$\text{The Current} = 4.04 \times 10^{-3}A$$

$$= 4.04mA$$

Symbols Table

Description Notation

The value of voltage is $1000V$

The current is $0.000,006A$

The power is $1,000,000,000W$

The Inductance is $0.003H$

The Resistance is $20K\Omega$

The capacitance is $10^{-12}F$

The Power is $5 \times 10^6 W$

The value of Resistance is $3,000,000\Omega$

The Capacitance is $0.000,000,005F$

The current is $4.04 \times 10^{-3}A$

(6)

A $20A$ battery is connected to resistor having a resistance of 100Ω calculate the current and power across the resistor.

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

$$I = \frac{20A \times 100}{100} = 2000V$$

$$V = 2000V$$

$$P =$$

- 8) Calculate the Power of an refrigerator, if the voltage applied is 220V and the Resistance offered is 2000Ω

$$P = \frac{V^2}{R} = \frac{220^2}{2000} = 24.2 \text{ W}$$

- 7) What is the Power of the kettle that can heat water in 100s, by doing 600J of work

$$P = \frac{E}{T} = \frac{600}{100} = 6 \text{ W}$$

Symbols Table

$$1,000 = 10^3 = K(Kilo) \quad 1K(10^3) = 10^3$$

$$1,000,000 = 10^6 = M(Mega) \quad 1M(10^6) = 10^6$$

$$1,000,000,000 = 10^9 = G(Giga) \quad 1G = 10^9$$

$$0.001 = 10^{-3} = m(milli) \quad 1m = 10^{-3}$$

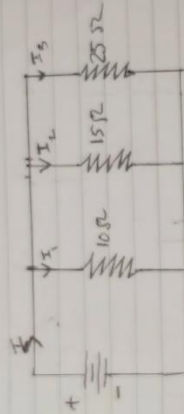
$$0.000,001 = 10^{-6} = (\mu) \text{ Micro} \quad 1\mu = 10^{-6}$$

$$0,000,000,001 = 10^{-9} = n(Nano) \quad 1n = 10^{-9}$$

$$0,000,000,000,001 = 10^{-12} = p(Pico) \quad 1p = 10^{-12}$$

$$1Km = 1000 = 10^3 \times 1000$$

11) Calculate the total Resistance in the following circuit.



$$R_{total} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}}$$

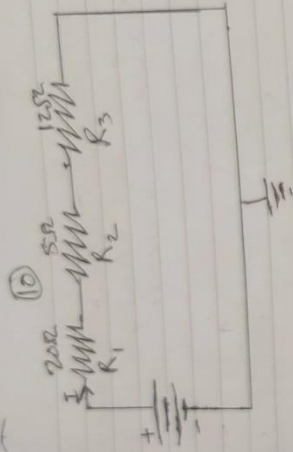
$$= \frac{1}{\frac{1}{10} + \frac{1}{15} + \frac{1}{15} + \frac{1}{25}} = 0.01$$

$$= \frac{1}{0.01} = 100$$

$$= \frac{1}{0.01} = 100$$

$$R_T = \frac{1}{0.01} = 100$$

$$R_T = 100 \Omega$$



$$R_{total} = R_1 + R_2 + R_3$$

$$R_T = 20 + 50 + 125$$

$$= 195$$

$$R_T = 195 \Omega$$

9)

What capacitance is needed to store 20C charge at a voltage of 400V.

$$C = \frac{Q}{V}$$

$$= \frac{20}{400}$$

$$= 0.05 \text{ F}$$

$$C = 0.05 \text{ F}$$

$$= \frac{20}{400}$$

$$= 0.05$$

$$C = 0.05 \text{ F}$$

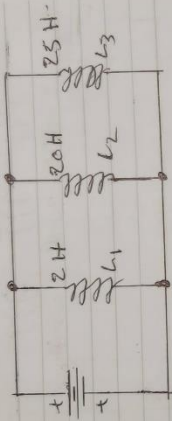
$$V = E$$

$$U = Q \cdot V$$

$$U = 1.6 \cdot 10^{-19} \text{ J}$$

Work is the taken by the charge

11) Calculate the total inductance in the following circuit.



$$R_{total} = L_1 + L_2 + L_3$$

$$= 2 + 10 + 25$$

$$= 37$$

$$= 37 \text{ H}$$

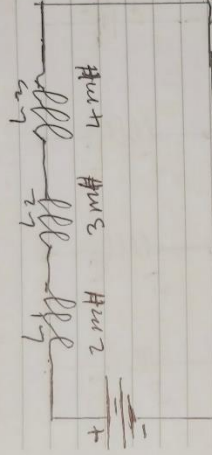
$$R_T = 0.5 + 0.005 + 0.04$$

$$= 0.545 \text{ H}$$

$$= 1.0694 \text{ H}$$

$$R_T = 1.069 \text{ H}$$

13) Calculate the total inductance in the following circuit.



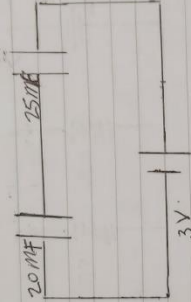
$$L_{total} = L_1 + L_2 + L_3$$

$$= 2 + 3 + 4$$

$$= 9 \text{ mH}$$

$$L_{Total} = 9 \text{ mH}$$

12) Calculate the total capacitance in the following circuit.



$$R_T = \frac{1}{C_1} + \frac{1}{C_2}$$

$$= \frac{1}{20} + \frac{1}{15}$$

$$= \frac{1}{12} = 0.0833 \text{ mF}$$

$$= \frac{1}{12} = 0.0833 \text{ mF}$$

$$= 0.09 \text{ mF}$$

$$R_T = 11.1 \text{ mF}$$

(16)

$$R_2 = 20k\Omega$$

$$R_1 = \frac{1}{2} = 0.5\Omega$$

$$= \frac{1}{6} = 0.16\Omega$$

$$= \frac{1}{6} = 0.16\Omega$$

$$= \frac{1}{6} = 0.16\Omega$$

$$= \frac{1}{3} = 0.33\Omega$$

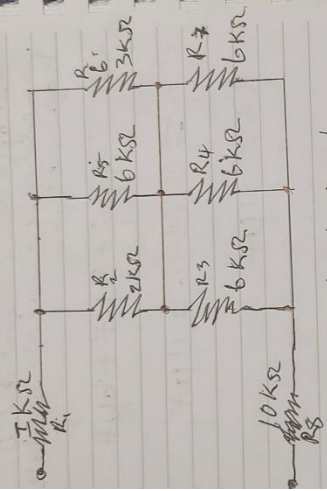
$$= \frac{1}{6} = 0.16$$

$$R_4 = 1.05\Omega \cdot \frac{1}{1.05} = 0.6$$

$$= 0.6\Omega + 1.1\Omega$$

$$= 11.6\Omega$$

(16) Calculate the total Resistance for the following circuit



$$R_T = \frac{1}{\frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} + \frac{1}{R_6} + \frac{1}{R_7}}$$

$$= \frac{1}{\frac{1}{2k\Omega} + \frac{1}{6k\Omega} + \frac{1}{6k\Omega} + \frac{1}{6k\Omega} + \frac{1}{3k\Omega} + \frac{1}{6k\Omega}}$$

$$= R_1 = 1k\Omega + R_2 = 10\Omega$$

$$= 11\Omega$$

(15)

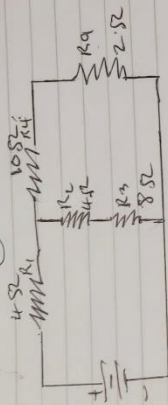
Three capacitors 2μF, 3μF and 6μF are connected in parallel. Calculate the total capacitance.

$$C_T = 2\mu F + 3\mu F + 6\mu F$$

$$= 2 + 3 + 6 = 11\mu F$$

$$C_T = 11\mu F$$

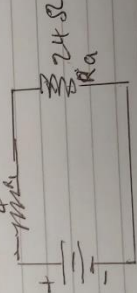
(17)



$$R_t = R_1 + R_2 + R_3 + R_4$$

$$= 10 + 4 + 8 + 2$$

$$R_t = 24 \Omega$$



$$R_t = R_1 + R_2$$

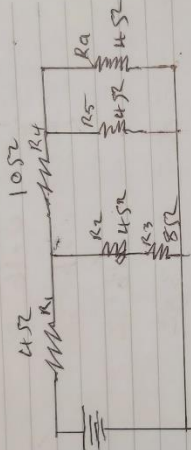
$$R_t = 4 + 24$$

$$= 28 \Omega$$

$$R_t = 28 \Omega$$

(17)

Calculate the total Resistance in the following Circuit.



$$R_t = R_1 + R_2$$

$$= \frac{1}{\frac{1}{4} + \frac{1}{4}} = 0.5 \Omega$$

$$= \frac{1}{0.5} = 2 \Omega$$

Voltage is call.

Voltage is also called as electromotive force (EMF) or Potential

Voltage Rating

~~Voltage~~ Voltmeter

Measuring the voltage the voltage can be calculated using the formula
Analog meter, and digital

That is the Electric current

Electric current is defined as the flow of electric charge carriers in an electric circuit (I)
(electric current is ampere (A))

Direction of current flow

The direction of current flow is opposite to that of the direction of charge particles.

Alternating Current flow of elect

Direct Current

- ① DC is the unidirectional flow or movement of electric charge carriers. The intensity of the current can vary with time but the general direction of movement always stays the same.

Current Rating
The current rating of the LG Projector
1.7A Direct Current.

Ammeter
Ammeter is used for measuring the
current

The current can be calculated using
the formula $I = V/R$

Current Rating

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Ammeter

Ammeter is used for measuring the current.

The current can be calculated using the formula $I = V/R$

Electronics Principles and Concepts

① Unit of Current Ampere

Electrical Power is the Rate.

Electronics is the rate at.

① 1 Watt = 1 Volt * 1 Ampere

The electrical Power

② ^{that is watt} 1 Watt = 1 Joule = one Second

③ Power = $P = VI$
P - Electrical Power
V - Voltage in volts
I - Current in Ampere

Power
 $P = \frac{E}{T}$
Energy

Power is defined as the rate energy consumption

Power and Energy Relation is given by

4 energy consumption in joules
5 T - Time is second

Voltage is call.
Voltage is also called as electromotive force (EMF) or Potential

Voltage Rating

~~Voltage~~ Voltmeter

measuring the voltage the voltage can be calculated using the formula
analog meter, and digital

That is the Electric current

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The direction of current flow is opposite to that of the direction of charge particles.

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The current rating of the LG Projector is 1.7A Direct current.

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Ammeter is used for measuring the current

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Ammeter is used for measuring the current

The current can be calculated using the formula $I = V/R$

UPC
1015# 11/10/2022 Class
with Stalin Jacob Wilson

multimeter =

over in.

What is Resistance

Resistance is the opposition that a substance offers to the flow of electric current, it ~~opposes the flow~~ of current.

~~One~~ One Ampere = 1 Volt / ~~ohm~~
One Ohm

Resistor - Variable Resistors are called as Potentiometers

The Value of the Resistor can be Identified using the Colour Codes.

Ohmmeter or Multimeter used to measure the value of the Resistance.
multimeter.

Lecture
ACDA4015# 11/10/2022 CLASS
with Stalin Jacob Wilson

Wattmeter =

Power in.

What is Resistance

Resistance is the opposition that
A substance offers to the flow of
electric current, it opposes the flow
- of current.

~~One~~ One Ampere = 1 Volt / ~~ohm~~
One ohm

Resistor - variable resistors are
called as potentiometers

The value of the Resistor can be
Identified using the colour codes.

ohmmeter or Multimeter used to
measure the value of the Resistance

multimeter.

Electronics Principles and Concepts
unit of current amper

Electrical Power is the Rate
electronics is the rate at.

$$1 \text{ Watt} = 1 \text{ Volt} \times 1 \text{ Ampere}$$

The electrical Power

that is watt
① $1 \text{ Watt} = 1 \text{ joule} = \text{one Second}$

③ $\text{Power} = P = VI$
 P - electrical Power
 V - Voltage in volts
 I - Current in Amper

Power
 $P = \frac{E}{T}$
energy

Power is defined as the rate energy
consumption

Power and Energy Relation is given
By

energy consumption in joules
 T - Time is Second

Electronics Principles and Concepts

① Unit of current is ampere

Electrical Power is the rate.

Electronics is the rate at.

① $1 \text{ Watt} = 1 \text{ Volt} \times 1 \text{ Ampere}$

The electrical Power

that is watt
② $1 \text{ Watt} = 1 \text{ joule} = \text{one second}$

③ Power = $P = VI$
 P - electrical Power
 V - Voltage in volts
 I - current in Amperes

Power
 $P = \frac{E}{T}$
energy

Power is defined as the rate energy consumption

Power and Energy Relation is given by

4. energy consumption in joules
5. T - Time is second

ecture

DAVID # 11/10/2022 CLASS
with Stalin Jacob Wilson

multimeter =

Power in

What is Resistance

Resistance is the opposition that a substance offers to the flow of electric current, it ~~opposes~~ the flow of current.

~~One~~ One Ampere = 1 Volt
One Ohm

Resistor - variable resistors are called as potentiometers

The value of the Resistor can be identified using the colour codes.

Ohmmeter or Multimeter used to measure the value of the Resistance
multimeter,

That is Capacitance
is a store device, it stores
electric charge

$$\text{unit} = 1 \text{ Farad} = \text{Coulomb} / \text{Volt} = \frac{C}{V}$$

unit Coulomb is the unit of charge

Capacitor Circuit

in this circuit, the battery is
connected to the LED through a
switch resistor and a capacitor

$$C = \frac{q}{V}$$

C - capacitance
q - charge in Coulombs
V - Voltage in Volts

Uses of Capacitor

used used to Synchronize Voltage
and current.

2 used in Rectifier (AC to DC
conversion)

3 used to Store Electrical energy

Uses ..

① Used to Synchronize Voltage
and current (Power factor Correction)

② used in Rectifier Circuit (AC to DC
conversion)

Uses of inductance

used in inductive proximity sensors (used in traffic lights to detect traffic density).
used in tuning circuits to select the desired frequency.

Power

$$\frac{20A \times 100\Omega}{100}$$

$$= \frac{20 \times 100}{100}$$

$$\frac{I^2 R}{2}$$

Power

600J in 100 seconds

$$P = \frac{E}{T}$$

$$E = 600J$$
$$T = 100s$$

✓

Potential difference

$$= 5A \ 10K\Omega$$

$$= 5A \times 100 = 500$$

$$5 \times 500\Omega = 2500V$$

$$= V = 2500V$$

$$I = 5V \times 10K\Omega$$

$$5 \times 10^3 = 11000$$

$$1000 \times 5$$

$$I = 5 \times 1000$$

$$= 5000V$$

$$V = 5000V$$

$$V = 5000V$$

$$10K$$

$$10000 \times 5 = 2000$$

$$2000$$

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

$$= \frac{20}{2} = 10$$

$$R = 10\Omega$$

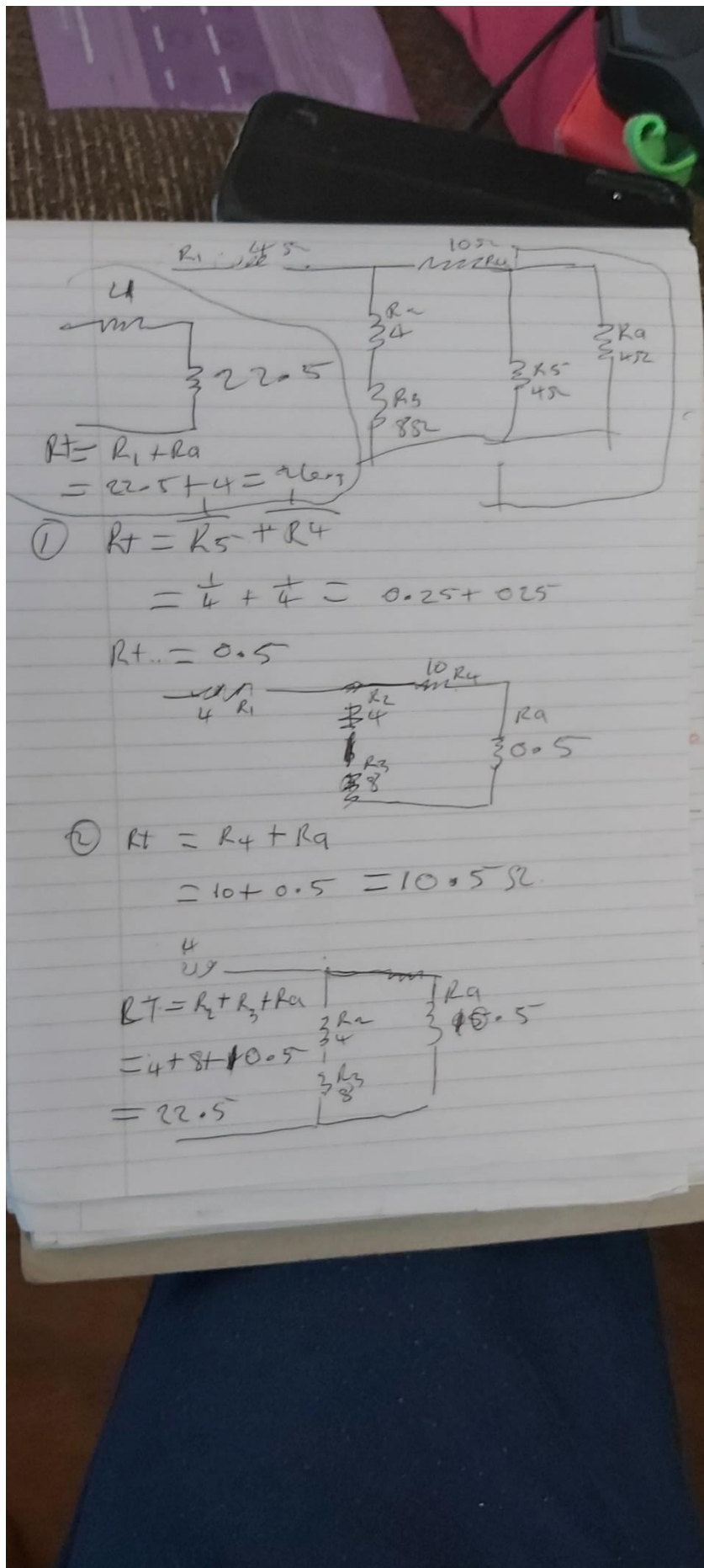
$$20V \text{ and } 2A$$

$$P = VI$$

$$= I^2 R = \frac{V^2}{R}$$

$$20 \times 100\Omega =$$

Power is $\pm 10 \text{ Volts} \times$
by $C \ T$



① Calculate. Voltage Reman the Same

$$V = I_1 \times R_2 = 3 \times 10 = 3V$$

$$R_3 = \frac{V}{I_3} = \frac{3}{0.06} = 16.6 \Omega$$

∴

Voltage across $R_1, R_2, R_3 = 3V$

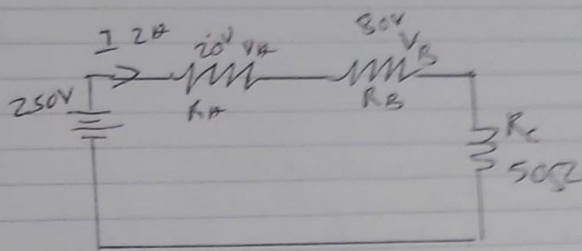
Total $V = 30V$

$$I_1 = \frac{V}{R_1} = \frac{30}{5} = 6A$$

$$I_3 = \frac{V}{R_3} = \frac{30}{15} = 2A$$

$$R. I = I_1 + I_2 + I_3 = 6 + 3 + 2$$

$$I = 11A$$



$$V_2 = \frac{V_{A2}}{R_T}$$

$$V_C = I R_C = 2 \times 50 = 100V$$

According to KVL

$$250 = V_A + V_B + V_C$$

$$250 = V_A + 80 + 100$$

$$250 = V_A + 180$$

$$V_A = 250 - 180 = 70V$$

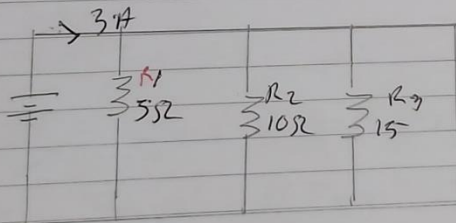
$$R_A = \frac{V}{I} = \frac{70}{2} = 35$$

$$R_B = \frac{VB}{I} = \frac{80}{2} = 40\Omega$$

28/11/

5Ω, 10Ω

Three resistors 5Ω, 10Ω and 15Ω are connected in parallel. If the current in 10Ω resistor is 3A. Calculate the current in other resistor, total current also the voltage applied to the circuit.



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

$$R_T = \frac{1}{\frac{1}{5} + \frac{1}{10} + \frac{1}{15}}$$

$$= 2.7$$

$$\frac{1}{5} = 0.2$$

$$\frac{1}{10} = 0.1$$

$$\frac{1}{15} = 0.06$$

$$= 0.36$$

$$\frac{1}{0.36}$$

