Topic: _____ Date: _____

# Current Electricity

→ Current: Rate of flow of charges.

$$I = \frac{Q}{t}$$

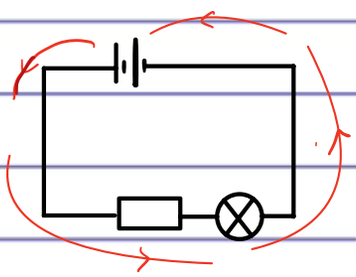
I = Current, Q = Charge, t = time.

Current depends on 2 things
→ quantity of charge
→ Speed of flow.

## Current

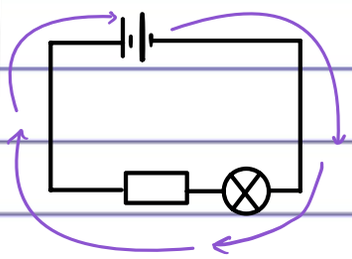
### Conventional Current

Conventional current is concidered to move from +ve to -ve



### Electron flow

Electrons flow from -ve terminal to +ve terminal.



## Current

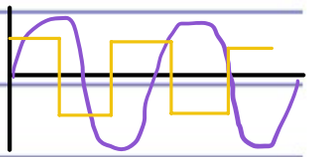
(Thomas Edison) Direct Current

* Current flows in one direction
* Battery
* Cell
* DC supply

Comection of battery is reversed.

(Nikola tesla) Alternating Current

* Direction of current changes many time in a second
* AC supply



Voltage: Strength of Electricity.

Energy that a coulomb charge has in a circuit.

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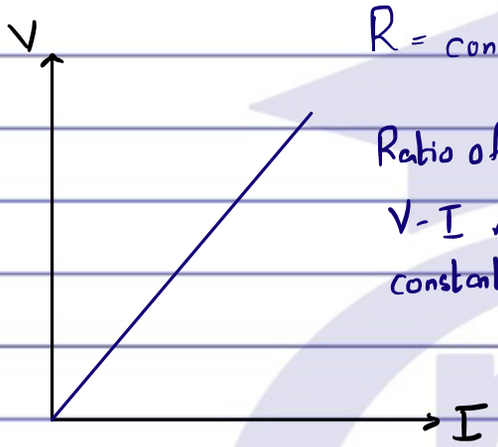
## Ohm's law: $V \propto I$

Voltage is directly proportional to current provided that Area and temperature remains constant.

**Resistance:** Ratio of Voltage - Current

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

## Ohmic conductor




$R$ = constant

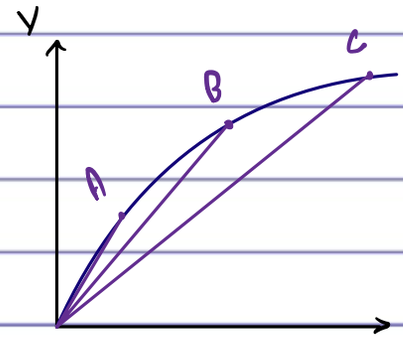
Ratio of V - I remains constant.

1) Fixed resistor
2) All metals

Constant temperature.

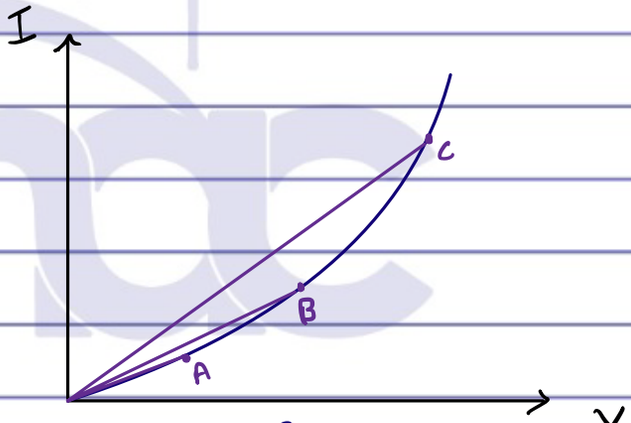
## Non Ohmic conductor

1) Thermistor ⊘ as temperature increases Resistance decreases.




Since Ratio of $\frac{V}{I}$ decreases. Resistance decreases.

* Never use term gradient decreases




Since Ratio of $I/V$ increase. Therefore ratio of $\frac{V}{I}$ decrease hence resistance decrease.

$$R = \frac{V}{I} \quad \frac{I}{V} = \frac{1}{R}$$

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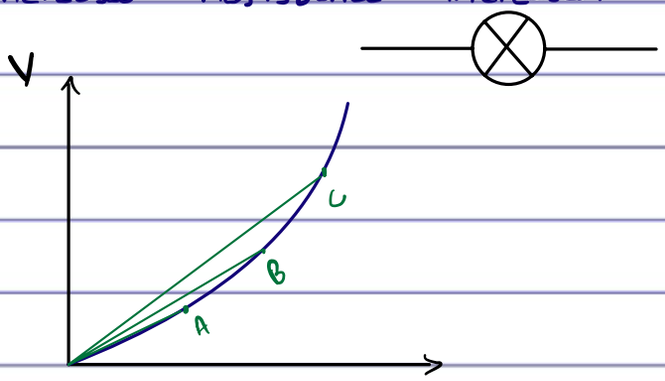
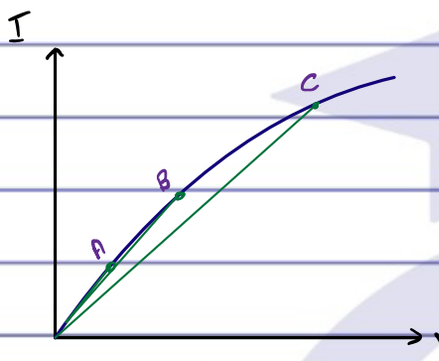
## 2) Filament lamp : As temperature increase Resistance increase.

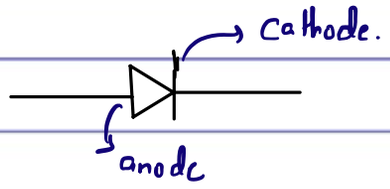


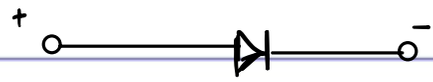

As ratio of $\frac{V}{I}$ increase hence resistance increase




Since ratio of $\frac{I}{V}$ decrease hence ratio of $\frac{V}{I}$ increase hence resistance increases.

## 3) Diode




Forward biased

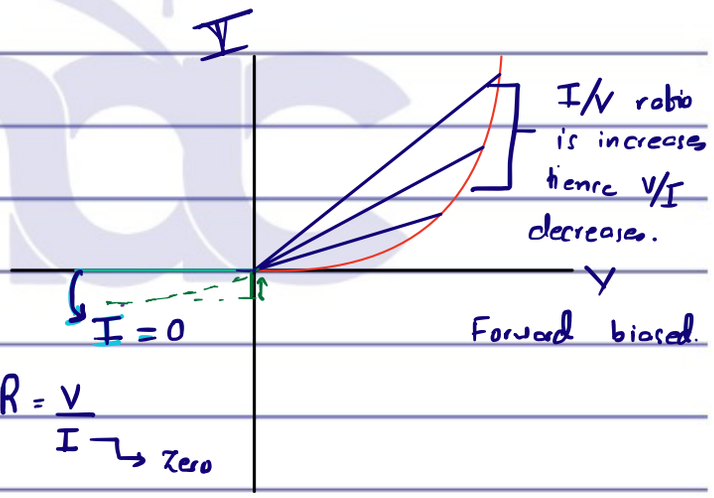
⇒ It offers a very low Resistance.

∴ Current flows.


Reverse biased

⇒ It offers infinite Resistance.

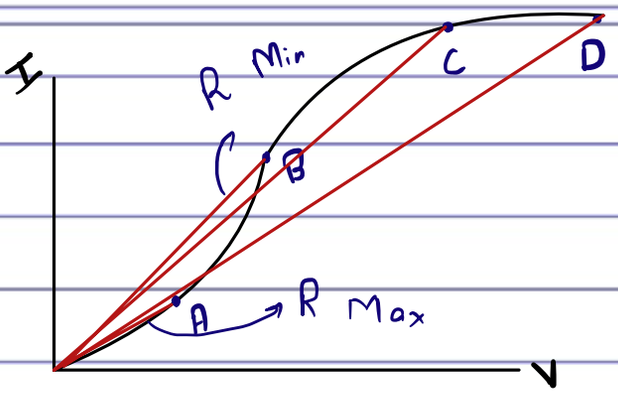
∴ No current flows




$R = \frac{V}{I}$ → zero

Reverse biased

Topic: _____ Date: _____

Ex. 


* $\frac{I}{V}$ ↑ resistance Minimum

* $\frac{V}{I}$ ↑ Resistance Maximum.

Factors Affecting Resistance.

$R \propto l$ $\quad R \propto \frac{1}{A}$ $\quad R \propto \frac{kl}{A}$

$R = \frac{\rho l}{A}$ ($l \to 1$, $A \to 1$) $\quad \rho$ = Resistivity.

SI unit = $\Omega\, m$ $\left(\frac{\Omega \times m^2}{m}\right)$

* Resistivity of the materid is said to be equd to its resistance provided that materid is of unit length and of for a unit cross sectiond area.

$$\rho = \frac{RA}{l}$$

Conductivity: It is the inverse of Resistivity

$$\sigma = \frac{L}{RA}$$

$\sigma = \Omega^{-1} m^{-1}$ $\quad (\Omega m)^{-1}$

→ A wire offers a resistance of 10 Ω calculate the resistance of the wire when the length is doubled and Volume remains unchanged.

$\Rightarrow V = l \times B \times W$ (Constant)

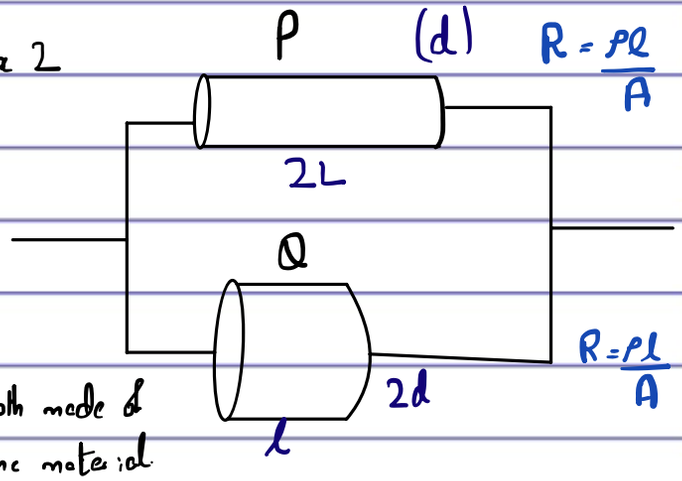
$2l \times \frac{A}{2}$

$R = \frac{\rho l (2)}{\frac{A}{2}}$

4 times

$R = 4\left(\frac{\rho l}{A}\right)$

40 Ω

Ex 2 


$R = \frac{\rho l}{A}$

$R = \frac{\rho l}{A}$

Both made of same material

Calculate a) $\frac{I_P}{I_Q}$ b) $\frac{V_P}{V_Q}$

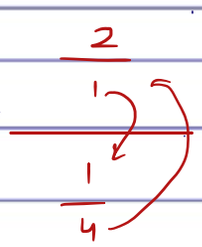
Topic: _____ Date: _____

$R_p = \frac{\rho 2l}{A}$

$R_q = \frac{\rho l}{4A}$

$\frac{I_p}{I_q} = \frac{1}{8}$

$\frac{R_p}{R_q} = \frac{8}{1}$




b) In Parallel voltage remains same

1 : 1

Ex3 Copper Steel

$2L$ $L$

$3R$ $R$

$\rho$ $2\rho$

⇒ Calculate the diameter of $\frac{d_c}{d_s}$ copper ÷ diameter of steel

$3R = \frac{\rho \cdot 2l}{\pi \frac{d_c^2}{4}} = R = \frac{2\rho \cdot l}{\pi \frac{d_s^2}{4}}$

$3\left(\frac{2\rho l}{\pi \frac{d_s^2}{4}}\right) = \frac{\rho 2l}{\pi \frac{d_c^2}{4}}$

$\frac{3}{d_s^2} = \frac{1}{d_c^2}$

$\frac{d_c^x}{d_s^x} = \sqrt{\frac{1}{3}}$

$\frac{}{d_s^2}$

Current: Rate of Flow of charge.

$I = \frac{Q}{t}$ $\boxed{Q = It}$

Unit = A or C/s

$\boxed{Q = It}$ This can only be used when current remains constant

If current is not constant

$\boxed{Q = I_{Avg} \times t}$

Q) A current of 200mA flows for 8 s calculate charge.

$Q = 200 \times 8$

$= 1600\ mC$

Q) A current uniformely increases from 200mA to 1000mA in 12s.

$Q = \frac{200 + 1000}{2} \times 12$

$600 \times 12$

$\Rightarrow 7200\ mC$

Topic: _____ Date: _____

Voltage Amount of workdone in moving a unit charge through the external circuit.

$$V = \frac{W}{q} \qquad \boxed{W = qV}$$

Volts V or J/c

Power (Electrical)

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

$P = VI$
- generated
- developed
- produced

$P = I^2R$
- Power loss
- Power dissipated

Electrical Energy

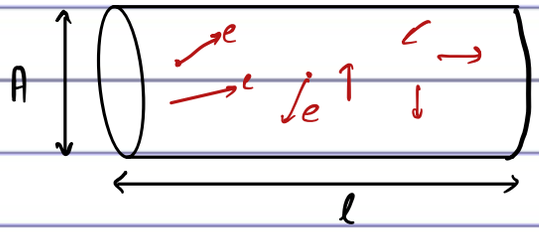
$$\mathcal{E} = Pt$$

$\mathcal{E} = VIt$ , $\mathcal{E} = I^2Rt$ $\mathcal{E} = \frac{V^2}{R}t$

$\mathcal{E} = VIt$
- generated
- developed
- produced

$\mathcal{E} = I^2Rt$
- Power loss
- Power dissipated

⇒Concept of Drift velocity:




When no potential difference is applied the electrons move in the conductor moves completly randomly. such that the net current flowing through the conductor is zero Amperes.

When the ends of the conductors are connected to the powe supply Battery creates a electric field this electric field causes electrons to start moving in one direction as a result flow of current occurs. the speed with which the electron now move through the conductor is referred to as the drift velocity of "electrons."

V = mean drift velocity: the average speed of the charged particles. when there is a current in the conductor

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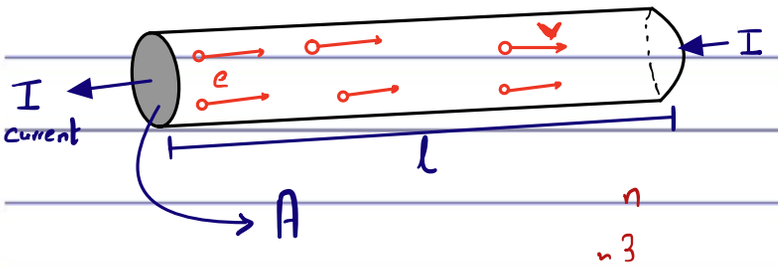
Topic: _____ Date: _____

# Concept of Drift velocity




n

n 3

Show that Current I in this Conductor can be given by this equation $I = nAve$

Length = L

Area = A

charge on electron = e

drift velocity = v

n = no of electrons present in $1m^3$ of this conductor (number of electrons per unit volume)

① $1_{m^3}$ ⟶ n electrons

Al ⟶ nAl electrons.

② 1 electron charge ⟶ e

nAl electrons ⟶ nAle

③ Current = $\frac{\text{Total charge}}{\text{time}}$

$$I = \frac{nAle}{t}$$

$$I = nAve.$$

$$I = n Ave.$$

⇒ no of electrons depends on the conductor if good conductor n is high and bad conductor n is low.

$$v = \frac{I}{nAe}$$

v = velocity V capital thats Voltage.

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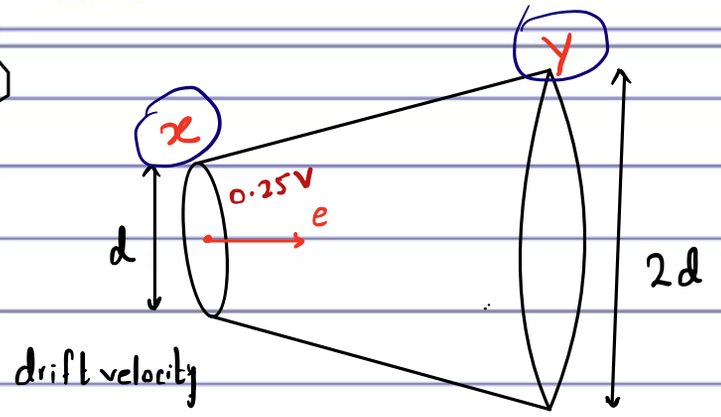
1




drift velocity (v)

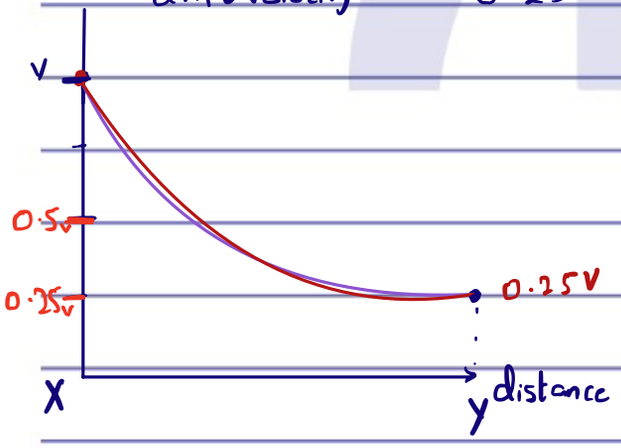
$V = \frac{I}{nAe}$

I, n, e ⇒ Constant in this case.

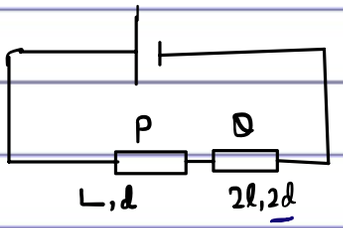
$v \propto \frac{1}{A}$

* If diameter is doubled A is increased by a factor of 4

drift velocity = 0.25V




2 How to compare drift velocity in a series circuit.




* Same material

n = Same.

Calculate ratio of

$\frac{\text{drift velocity of P}}{\text{drift velocity of Q}} = \frac{v_P}{v_Q}$

$\frac{v_P}{v_Q} = \frac{I/nAe}{I/n(4A)e} = \frac{\frac{I}{nAe}}{\frac{I}{n4Ae}} = \frac{4}{1}$

$\frac{\frac{1}{A}}{\frac{1}{4A}} \quad \frac{4}{1}$

* The drift velocity of electron will be four times greater as they travel through Q.

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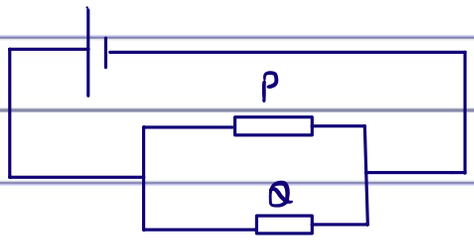
## Compare Drift velocity in a parallel combination.




P = 2ρ , ℓ , 3L , n  A = A

Q = 3ρ , 3ℓ , 2L , 2n  A = 9A

i) $\frac{R_p}{R_q}$  ii) $\frac{I_p}{I_Q}$  iii) $\frac{v_P}{v_Q}$

i) $\frac{\frac{2\rho \cdot 3\ell}{A}}{\frac{3\rho \cdot 2\ell}{9A}} \Rightarrow \frac{9}{1}$

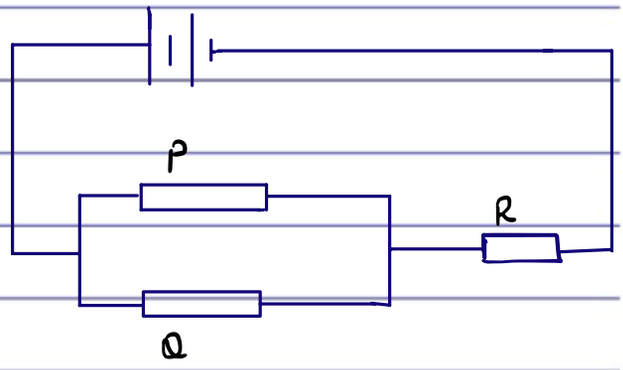
$\frac{\frac{6}{1}}{\frac{2}{9}} \quad \frac{9}{1}$

ii) $\frac{I_p}{I_q} = \frac{1}{9}$

iii) $\frac{v_p}{v_q} \quad \frac{\frac{1I}{n\,1A\,e}}{\frac{9I}{2n\,9A\,e}}$

$\frac{1}{\frac{1}{2}} = \frac{2}{1}$ Answer.

## Compare drift velocity in series and parallel circuits.




| Resistor | length | diameter | Area |
|---|---|---|---|
| P | L | d | |
| Q | 2L | 2d | |
| R | L | 3d | |
| | | | |

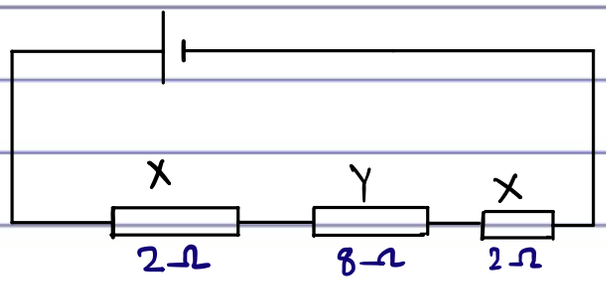
* P, Q and R made of same materials

i) $\frac{R_p}{R_q}$  ii) $\frac{I_p}{I_Q}$

iii) $\frac{V_Q}{V_R}$

Topic: _____ Date: _____

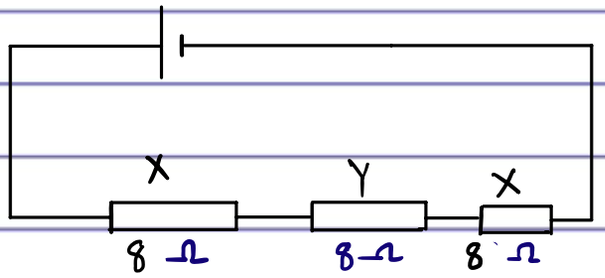
**Case 5:** Compare drift velocity in a series circuit whose resistance is changed




Both Resistors $x$ are replaced with two identical Resistors $z$ made of same material as $x$ but having half the diameter calculate new value of current.

Area = $\frac{1}{4}$

Resistance $\times 4$




Current =

* Compare drift velocity in $z$ with drift velocity in $x$ =?

$$v = \frac{I}{nAe}$$

$$\frac{V_z}{V_x} = \frac{\frac{0.5I}{0.25Ae}}{\frac{1I}{1Ae}}$$

$$\frac{\frac{0.5I}{0.25A}}{\frac{I}{A}}$$

$$\frac{\frac{1/2\ I}{1/4\ A}}{\frac{I}{A}}$$

$$\frac{4}{2} \qquad 2:1$$

* Explain how drift velocity in $z$ compares with drift velocity of $x$

$I$ = half , Area = quater.

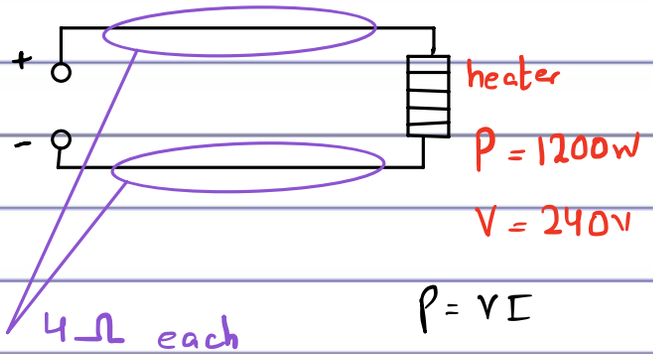
* We can say that change in Area out weighs the change in current

$$v \propto \frac{1}{A} \quad \text{as area } z$$

decreases drift velocity increases.

Topic: _____ Date: _____

⇒ How to calculate efficiency in Electrical Circuits.




$P = VI$

$\frac{1200}{240} = I$

i) Calculate the current supplied to the heater

$P = VI$

$\frac{1200}{240} = I$ $\quad I = 5A$

ii) Calculate the voltage across both the connecting wires

$V = IR$

$V = 5A\ (4\Omega)$

$20\ V$

* Each wire utilizes 20V hence 40V voltage is wasted.

iii) Calculate the voltage supplied by the power supply for the heater to operate at its normal capacity

$240 + 20 + 20 = 280V$

iv) Efficiency of Circuit

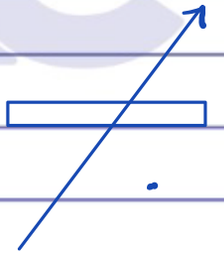
$$\frac{\text{Useful voltage}}{\text{Total voltage}} \times 100$$

$$\Rightarrow \frac{240}{280} \times 100$$

v) How to increase efficiency.

1) By using wires with more diameter.

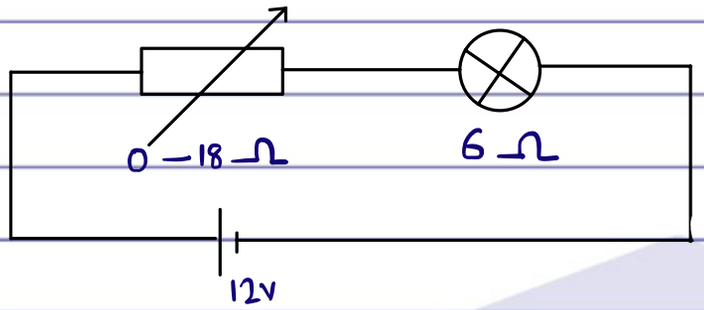
2) Use wire of good conductor



Topic: _____ Date: _____

Comparing b/w a variable resistor circuit and a potential divider circuit.

## 1) Variable Resistor Circuit.




i) Calculate minimum current in the bulb

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

$I = \frac{12}{24}$ $0.5\ A$

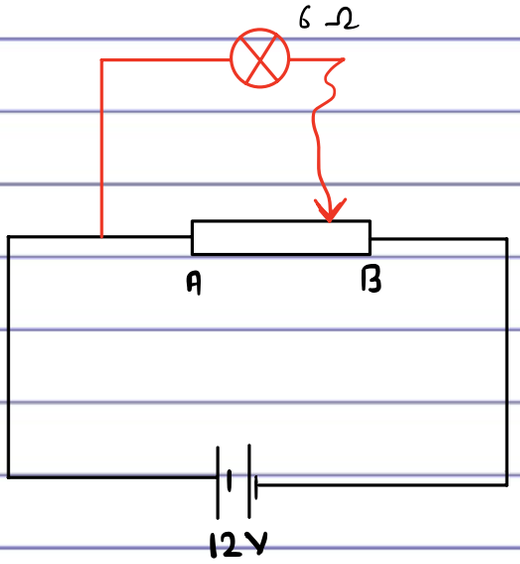
ii) Calculate maximum current in the bulb.

$I = \frac{12}{6}$ $2A$

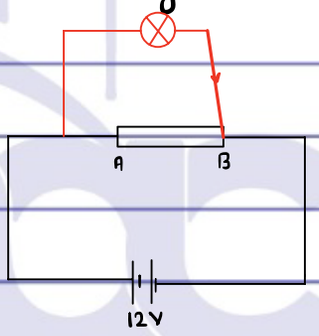
$0.5 \leq I \leq 2A$

Both circuit can be used to adjust brightness but Potential divider gives wide range and you can switch it off.

## 2) Potential divider circuit



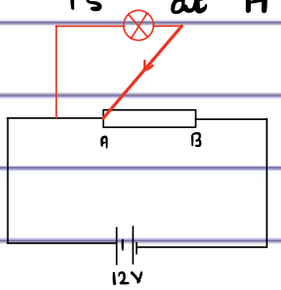

i) Calculate the current when sliding contact is placed at B, Bulb get 12V ; $R = 6\Omega$




$B \Rightarrow V = 12$

$I = \frac{12}{6} = 2A$

ii) Calculate the current in the bulb when sliding contact is at A.




$A \Rightarrow V = 0$

$I = \frac{0}{6}$ $0A$

$0 \leq I \leq 2A$

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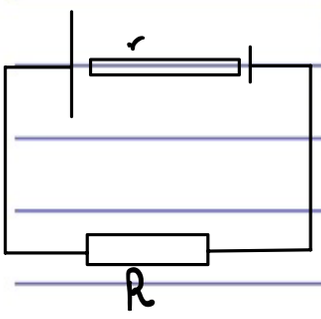
Topic: _____ Date: _____

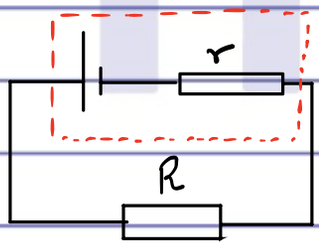
Concept of External Resistor R
internal resistor r
Voltage V
potential drop V
Electromotive force E

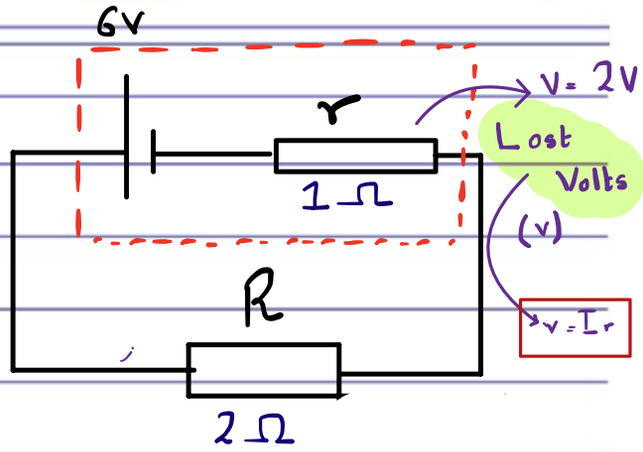
External Resistor (R) : Resistance of any component appliance connected in the circuit.

Internal Resistance (r) : Resistance offered by the chemicals inside the battery to the flow of current

OLD Exams vs New Exams




$V = IR$

4V ⇒ Terminal potential Difference V OR Voltage OR PD

i) Calculate Current Supplied?

$V = IR$

$\frac{6V}{3\Omega} = I$

$I = 2A$

Voltage / PD / Termind Potentid difference : Amount of Electrical Energy converted into other forms when a unit charge flows through the external circuit.

Lost volts (v) : The energy dissapated or lost in the form of heat when a unit charge flows through the internal resistance / internal circuit. also known as Potential Drop

Topic: _____ Date: _____

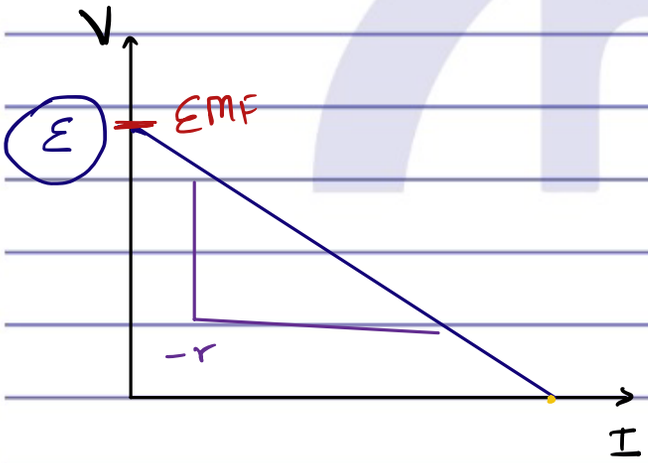
# EMF (Electromotive force)

Sum of terminal potential difference (V) and lost volts (v) is EMF

$$EMF = V + v$$

Defination: It is defined as the amount of chemical energy converted into Electrical forms when a unit charge flows through a complete circuit

Plot graph of V against I




$E = V + v$

$E = V + Ir$

$V = \mathcal{E} - Ir$

$V = -rI + \mathcal{E}$

$y = mx + c$

* Straight line graph with negative gradient and a positive y intercept.

## Terminal Potential Difference

$$V = IR$$

## Lost Volts/Potential Drop

$$v = Ir$$

## EMF

$$EMF = V + v$$

$EMF = IR + Ir$

$EMF = I(R + r)$

$E = V + v$

$E = V + Ir$

$\mathcal{E} - Ir = V$

$E = V + v$

$E = V + Ir$

$V = E - Ir$

$V = -rI + E$

$y = mx + c$

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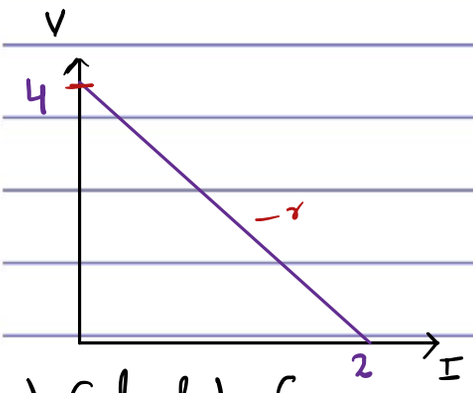
## Worked Example:




i) Calculate $\mathcal{E}$

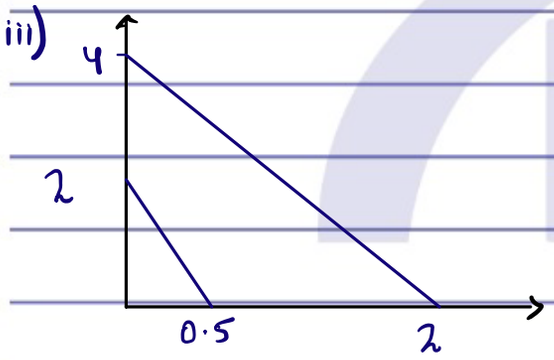
ii) r ✓

iii) Sketch a new graph where $\mathcal{E}$ = halved r = doubled.

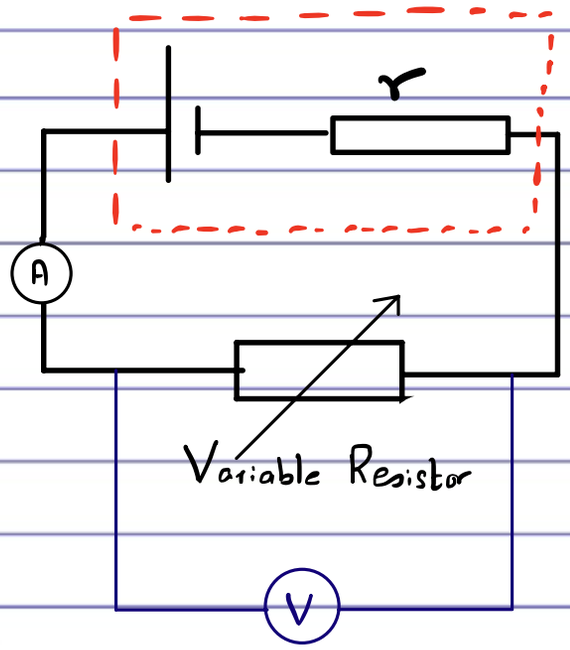
i) $\mathcal{E} = 4V$ ✓

ii) $r = 2\,\Omega$

iii)




$R = \frac{V}{I}$ $\quad 4\Omega = \frac{2}{I}$ $\quad 0.5A$




Q) When V.R is set at $R_1$, Voltmeter reads 1V and Ammeter reads 0.25A

When V.R is set at $R_2$, voltmeter reads 0.9V and Ammeter reads 0.3A

i) Calculate $R_1$, $R_2$, E, r

i) $V = IR_1$

$1 = 0.25\ R_1$

$\boxed{4\,\Omega = R_1}$

ii) $V = IR_2$

$\frac{0.9}{0.3} = R_2$

$3\,\Omega = R_2$

iii) $E = V + Ir$

$E = 1 + (0.25)(r)$ —①

$E = 0.9 + (0.3)(r)$ —②

$r = 2\,\Omega$

$E = 1.5V$

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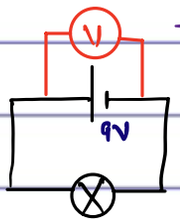
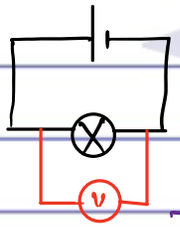
⇒ How can we determine weather or not a battery had internal Resistance. and how to calculate its value.




EMF

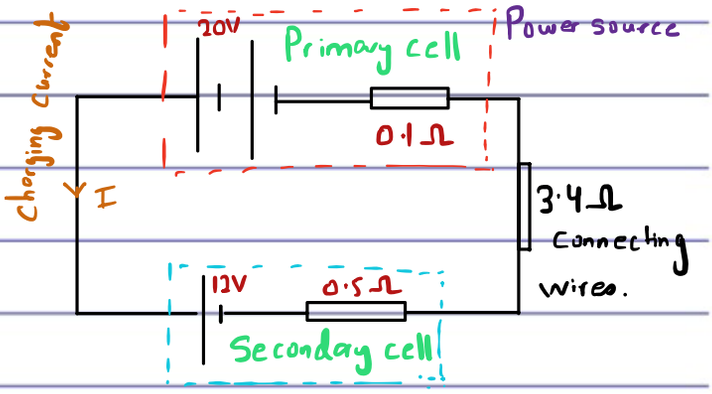
lost volts = 1V




Termind potential difference

For Ided battery lost volts = 0V

How to charge an uncharged battery using a powe source.




Battery that needs to be charged.

i) Calculate Charging current

$V = IR$

$20 - 12 = I(0.5 + 0.1 + 3.4)$

$I = 2A$

ii) Calculate Power supplied by Primary cell.

$P = VI$

$P = 20(2)$

40 Watt

iii) Calculate Power dissapated in the circuit.

$P = I^2 R$

$P = (2)^2 (0.1 + 3.4 + 0.5)$

$= 4(4)$

$= 16\ W$

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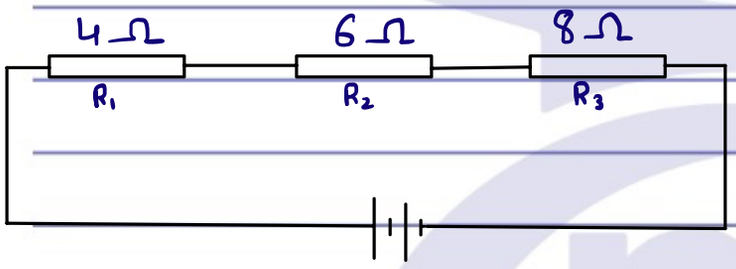
iv) Calculate the efficiency.

$$\mathcal{E} = \frac{24}{40} \times 100$$

$\mathcal{E}$ = 60% efficient.

→ Properties of Resistors in Series and Parallel.




i) $R_T = R_1 + R_2 + R_3$

ii) In Series current remains constant at every point

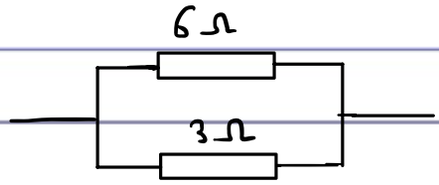
iii) Voltage is divided asper resistance.

$$V \propto R$$

$$V_A = \frac{R_A}{R_T} \times V_T$$

iv) If resistance of Any resistor increase its corresponding voltage will increase and voltage across other resistors will decrease.

Resistors in Parallel




$\frac{6 \times 3}{9}$

i) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$

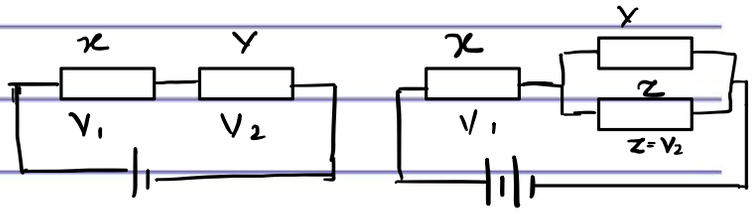
$= \frac{1}{6} + \frac{1}{3}$

$R_T = 2\Omega$

If you have 2 resistors use $\frac{POR}{SOR}$

$\frac{18}{9}$ $2\Omega$

* If you add more Resistors in Parallel combined resistance would decrease




v) Suggest what happens to $V_1$ and $V_2$ when extra Resistor Z is added in combination.

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⇒ If there are many Resistors of same Resistance in parallel (identical)

$$R_T = \frac{R}{N}$$

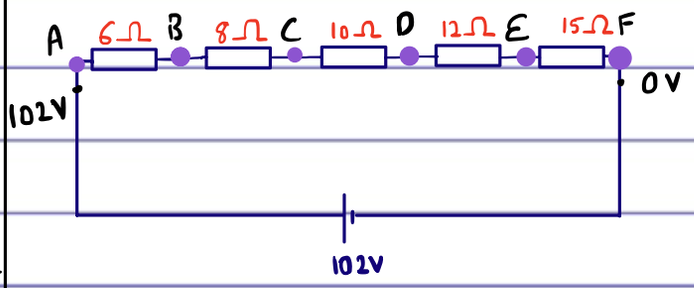
⇒ If two resistors have Significant difference b/w them (1000 times or more) total resistance will be resistance of lesser value.

3) Voltage in Parallel remains Constant

4) Current in parallel gets divided such that the branch containing higher resistance gets lesser current

$$I \propto \frac{1}{R}$$

## How to calculate Voltage/ Potential at any point in an Electrical circuit




A = 102V

B = $102 - \frac{6}{51} \times 102$ = 90V

C = 74

D = 54

E = 30

F = 0V

* While moving from a higher potential towards lower potential calculate voltage drop accross each resistor and keep on subtracting from previous value.

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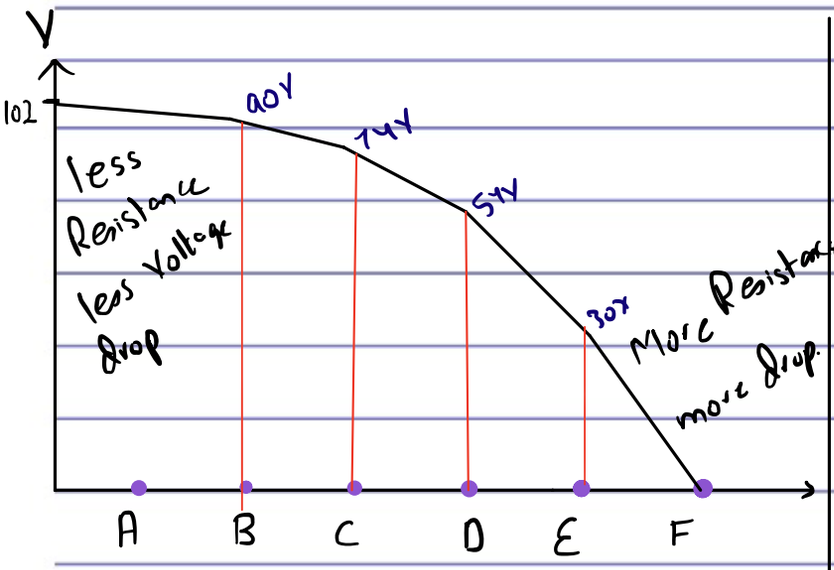
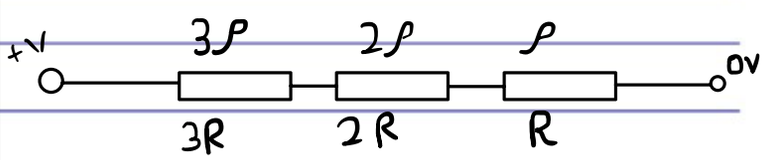
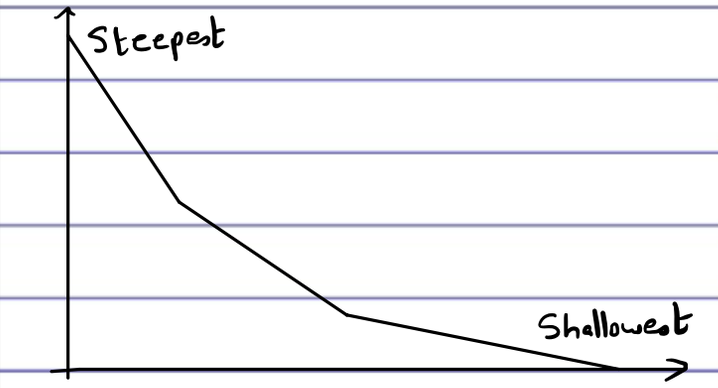
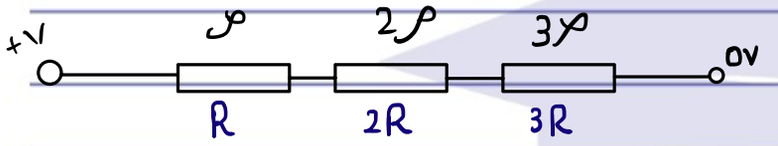
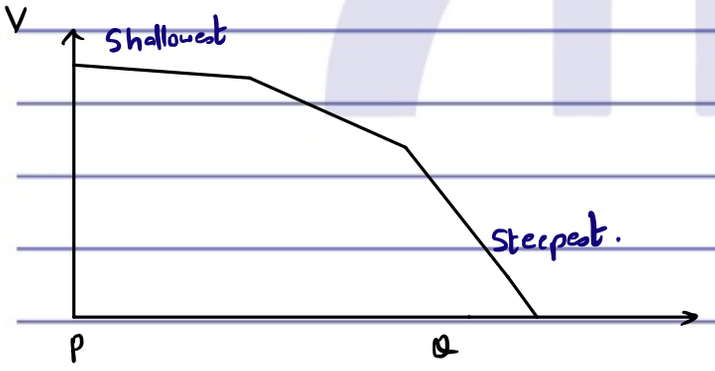


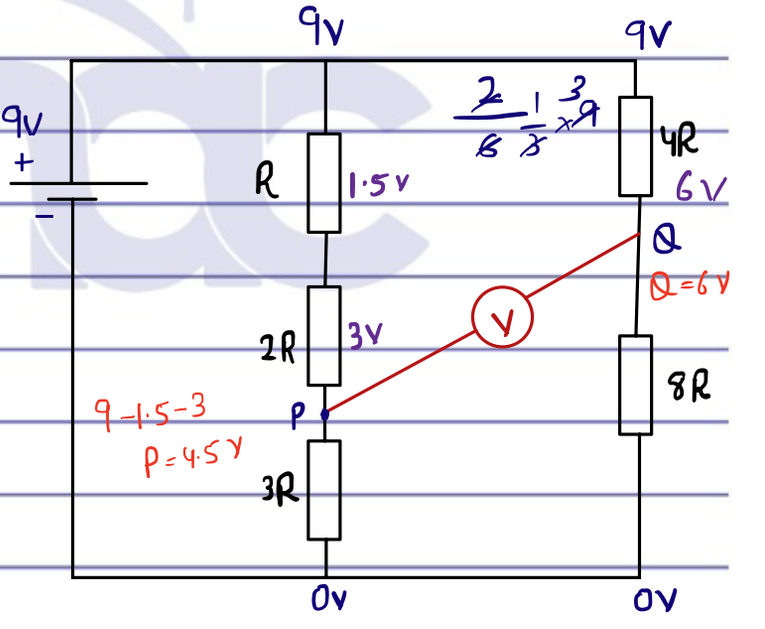




Suggest graph to show how voltage varies as it moves from P to Q




How to calculate the Potential difference b/w 2 points.




$V \text{ in } R = \frac{R}{6R} \times 9$

Voltmeter measures potential difference b/w 2 points.

$6 - 4.5 = 1.5V$

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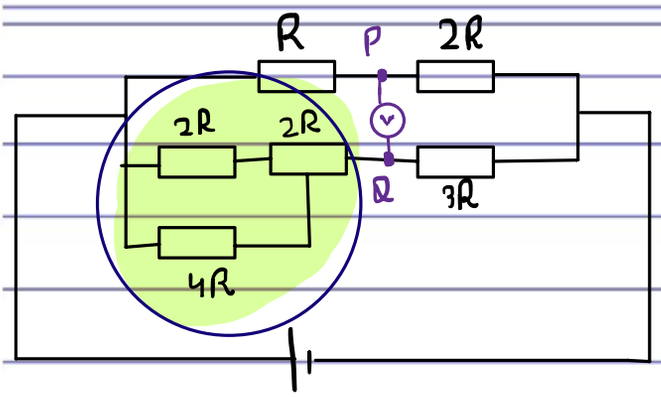
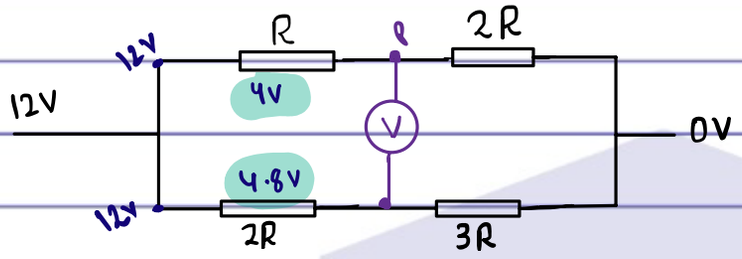



$\frac{1}{4R} + \frac{1}{4R}$

$\frac{2}{4R}$ $\frac{1}{2}$

$2R$

* Combined Resistance is $2R$ = R Total

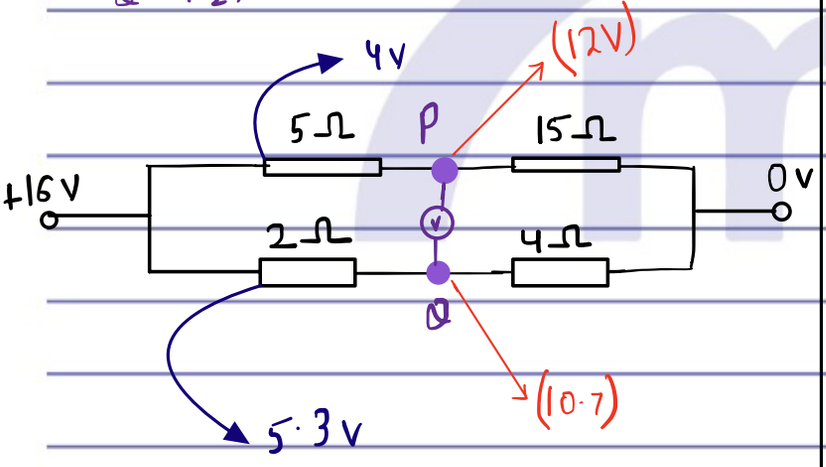



$\frac{2R}{5R} \times 12$

P = 8V

Q = 7.2V

8 − 7.2 = 0.8V




12 − 10.7 = 1.3V

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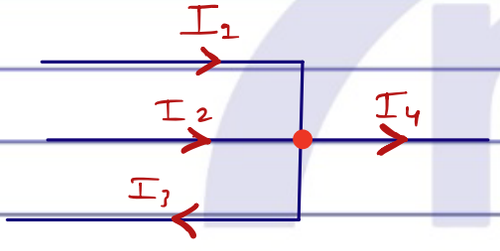
DC circuit: Kirkhoof

Kirchoff's law:

⇒ Purpose: to help us determine the value of current in Electrical circuit involving multiple batteries.

① KCL :— This law states that current arriving at a node or a junction must be equal to the node or junction leaving the node or Junction.

Node / Junction: refers to any point of a circuit where multiple wires meet or intersect.



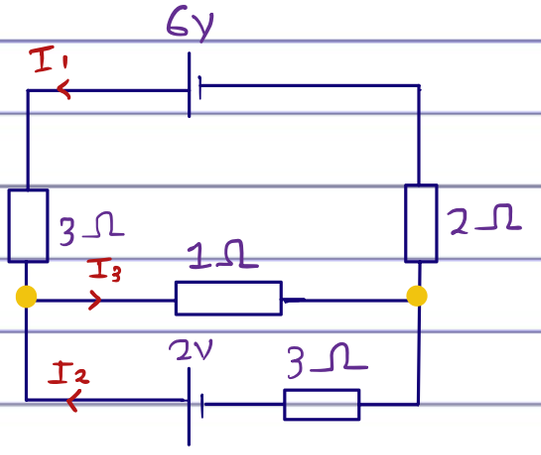

Form an equation for a current based on KCL

Current arriving = Current Leaving

$$I_1 + I_2 = I_3 + I_4$$

* This Law of KCL is based on law of conservation of charge which states that charge cannot be created nor it can be destroyed.

* KCL




1) Label the circuit (CW or ACW)
2) Identify the nodes.
3) Randomly mark direction in all the branches. and based on that form an equation for current.

$$I_1 + I_2 = I_3$$

Note: Every current is limited to its respective branch extending from one node to the other node.

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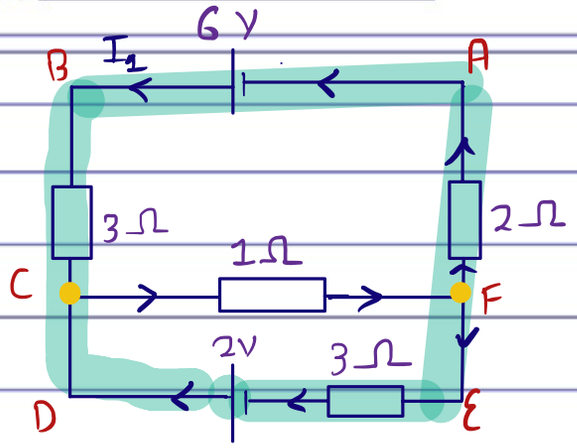


- while moving in the circuit you came across a Resistor then use rule 3 and 4

3) If your direction of movement is the same as the direction of current in that branch, then write down voltage of the resistor with a negative sign. (ie = $-IR$)

4) If your direction of movement is opposite to the direction of current in that branch then write down the voltage with (+ve) sign (ie = $+IR$)

## Kirchoff's Voltage law: (KVL)

Consider any closed loop and imagine that you are moving in that loop

1) If you see a battery such that you observe the negative terminal first and then the positive terminal, assume that the voltage is getting raised and write down this voltage as a positive value.

2) If insted you observe the positive terminal of the battery first and then the negative terminal assume that the voltage is getting dropped and write down the voltage as a negative value.

* When you return back to your starting pt, equate your equation to zero. This law is based on law of conservation of energy which states that voltage provided by the battery is consumed by the resistor

Sum of voltage in a closed loop is equal to zero.

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Note: Solve Simultaneously to obtain current in each branch.

Note: If Incase you get a negative answer for current then this will indicate that the flow of current is opposite to the direction marked on the diagram.

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DC circuit

1. KCL KVL
2. Potentiometer.

Potentiometer:

Topic: _____ Date: _____

**Potentiometer:** A potentiometer circuit is used to calculate voltage (Unknown) of power supply

⇒ How is the circuit constructed and how does it work?

Fig 1

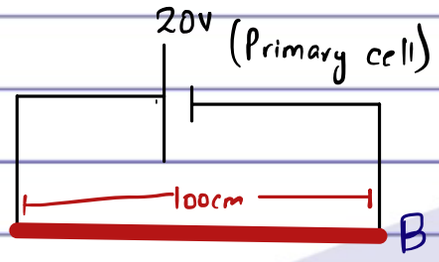


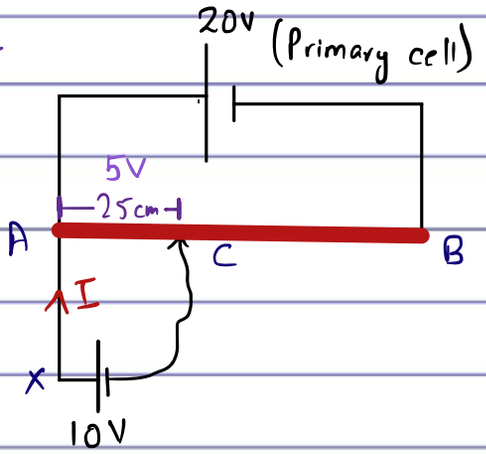

Fig 1 shows a resistance wire AB connected to a 20V primary cell length of the wire AB is 100 cm Connecting wire have zero resistance.

Q) how much Voltage will be availible for this resistance wire AB

Ans) 20V (Entire Amount)

No other component with Resistance

Fig 1




Secondary cell

Q) How much voltage is available for the wire AC .

Voltage across AC = 5V

Q) For the shaded portion of the diagram suggest with a reason, should the current flow from A to x or x to A

Ans: Current flows from a higher potential to a lower potential.

It flows from x to A

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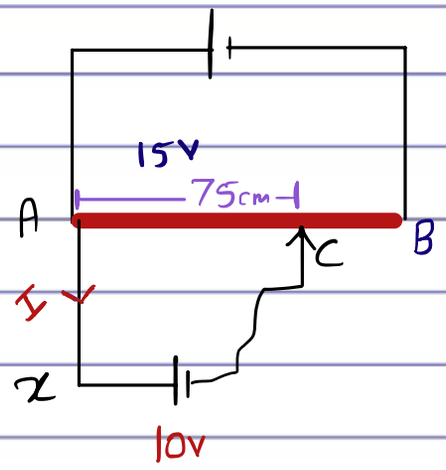
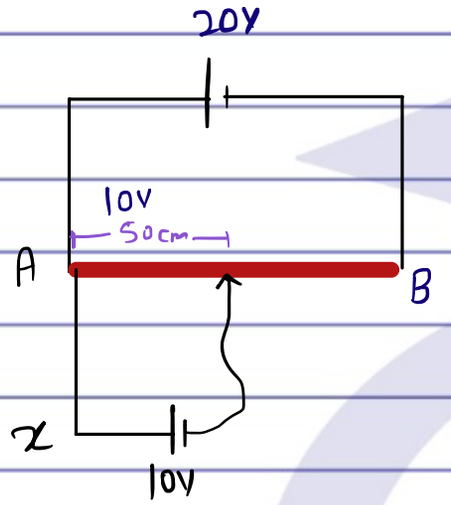



How much voltage is avelible across wire of length AC

$AC = \frac{3}{4} AB$ ∴ Voltage across AC = 15V

Hence determine the current in the branch AX?

Current flows from A to X

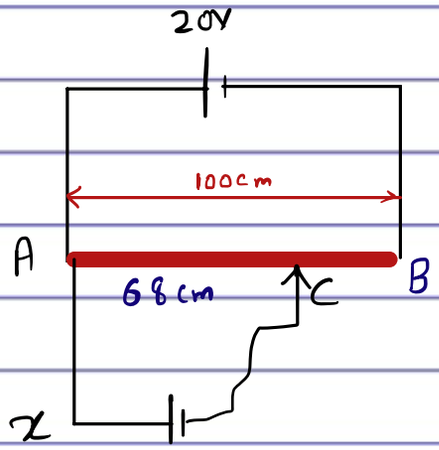



What voltage is available for length AC of the wire $AC = \frac{1}{2} AB$ hence voltage across AC = 10V

Hence determine the direction of current in the branch AX

Ans:- Null deflection / Zero deflection

Why:- Voltage across AC is equal to the voltage of secondary cell.




Unknown Voltage.

Q) Given that a null deflection / Zerocurrent / Balance pt is achieved for length AC = 68cm. Use this info to calculate the unknown voltage of secondary cell.

Topic: _____ Date: _____

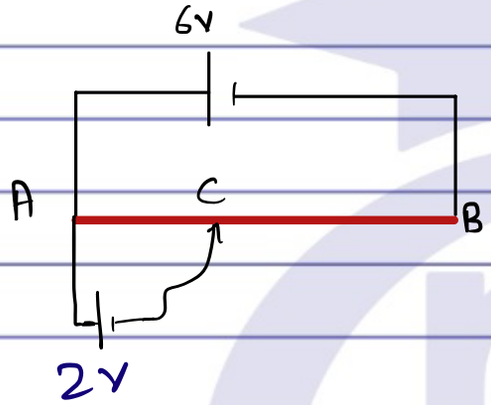
$$V = \frac{68}{100} \times 20 = 13.6\,V$$

$$V = \frac{l_{AC}}{l_{AB}} \times V_{PC}$$

PC = Primary Cell.

$$V = \frac{R_{AC}}{R_{AB}} \times V_{PC}$$

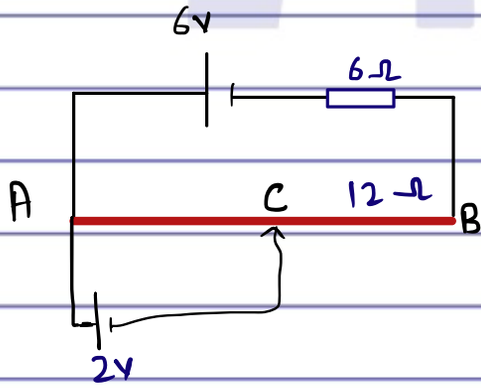
$$R = \frac{\rho l}{A} \qquad R \propto l$$




180cm, 12Ω

Q) what is the length of AC to achive Null point

60cm




4V

Calculate the new length of AC now required if an additional 6Ω resistor is placed with the primary cell.

Step 1 : Find the voltage now avalible for the length AB using ratio method.

$$V_A = \frac{R_A}{R_T} \times V_T$$

Step 2 : Find length.

Conclusion : If an extra resistor is placed in the primary circuit it causes the length of balance point to increase.

Topic: _____ Date: _____

Q) Give an Explaination as to why the length of balance pt has increased i.e From (60cm ⟶ 90cm)

Ans: If an additiond resistor is placed in the primary circuit the voltage now avdible for the resistance wire reduces. ∴ for some voltage of secondary cell a much longer length is now required to achive a balance point

Q) What happens if 6Ω resistor is replaced by 8Ω Resistor ?

Step 1 = Calculate Voltage across AB

$V_p = \frac{R_B}{R_T} \times V_T \Rightarrow \frac{12}{12+8} \times 6 = 3.6V$

Step 2 : 180V ⟶ 3.6V

$l$ ⟶ 2V $\quad l_{AC} = 100cm$

Q) What happens if 6Ω resistor is replaced by 30 Ω resistor.

$V_{wire} = \frac{12}{42} \times 6 \Rightarrow 1.7V$

No possibility of achiving balancing point in this case

Conclusion :- Certain Rules must be kept in mind for a potentiometer circuit to work properly.

Rule 1 : +ve terminal of the Primary cell must be connected to the +ve terminal of the secondary cell

Rule 2 : Voltage of secondary cell has to to be less then or equd to the voltage avalible for the wire.

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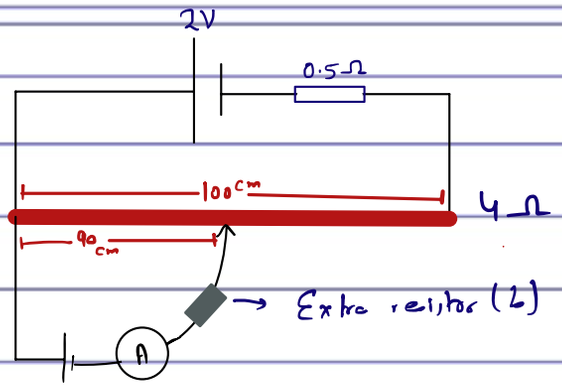


i) In case Ammeter reads zero amperes (null deflection) calculate the unknown voltage V ?

Ans: $V_{(2y)} = \frac{4}{4+0.5} \times 2 = 1.78\,V$

Step2: 100 ⟶ 1.78

90 ⟶ V

V = 1.6V

ii) Suggest why placing an extra resistor in the secondary circuit as shown will not have any effect on the balance point.

Ans) The term balancing pt indicates that there is zero current in the secondary circuit. Hence even if you place a resistor, based on V=IR the voltage across this resistor will be V=(0)R ie 0V ∴ it will not consume/develope any voltage across it self hence its presence or absence doesnot affect the length of the balance point.

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