

ACTIVITY (Fun with flexible wires)

Subject	PHYSICS
Class	XII
Chapter/Unit	Current Electricity
Topic	Fun with flexible wires-a) Factors affecting Resistance of a conductor b) Short circuiting and overloading c) behavior of bulbs of different power ratings connected in series and parallel connections
Time	40 min
Nature of Activity	Pair activity

What will I learn (Learning Outcome)?

To experimentally identify

a) Factors affecting Resistance of a conductor

b) Short circuiting and overloading

c) behavior of LEDs of different power ratings in series and parallel connections

Skills:

Experimenting, Problem solving, observing. calculating

What I have to do?

To study

a) the effect of changing cross-section area and length of a conductor ("Atta wires") on its resistance.

b) the difference between short circuiting and overloading

c) the behavior of LEDs of different power ratings in series and parallel connections

What do I require?

Salt, Dry wheat flour, water, 2 V Battery eliminator and LEDs of different and identical power rating, few crocodile clips

What do I need to know?

- Every conductor offers resistance to the flow of current. Apart from material and temperature the resistance of the conductor also depends on length and cross-section area of a conductor.
- The features of series and parallel connections
- Bulbs of same voltage rating but different power rating- Resistance of such bulbs is inversely proportional to their Power

➤ **Teacher's Activity**

Teacher will ask students to recall

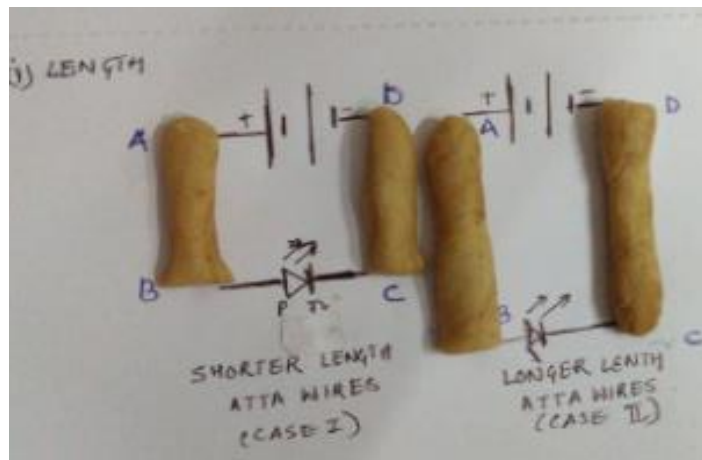
- the definition of Resistance and its role in controlling current and factors on which resistance of a conductor depends
- The features of series and parallel connections

- Bulbs of same voltage rating but different power rating- Resistance of such bulbs is inversely proportional to their Power
- also guide students on how to perform the activity

How will I proceed?

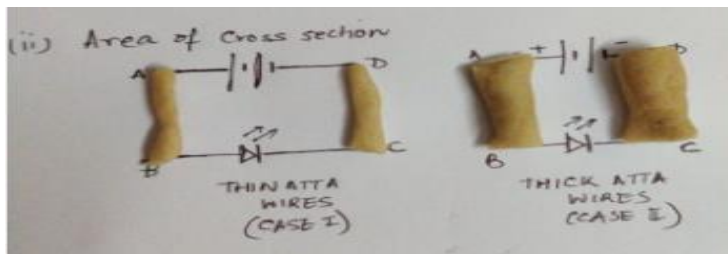
➤ Student's Activity

- Prepare the dough with the help of salt, flour and water.
 - Factors affecting Resistance of a conductor**
 - (i) Length of a conductor**



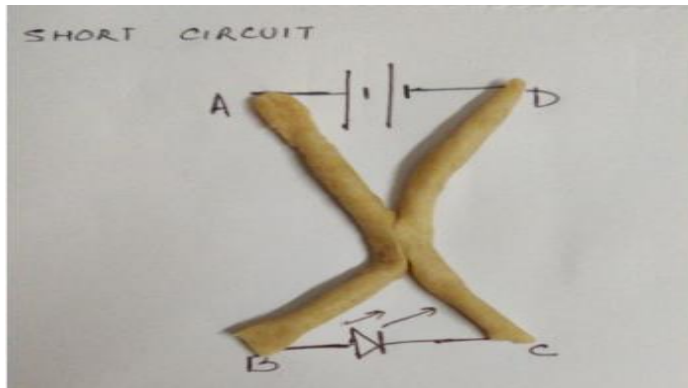
- Make Atta wires of different length but same thickness with the dough.
- Connect positive terminal of the battery eliminator with the longer leg of the LED (p) using an Atta wire(AB).
- Connect negative terminal of the battery eliminator with the shorter leg of the LED (n) using another Atta wire(CD).
- Turn the battery ON and observe the brightness (intensity) of the LED.
- Now keep replacing (AB) and (CD) with atta wires of longer length but same thickness.
- Observe how the brightness of the LED changes with the Length of the wire.

(ii) Area of cross section of a conductor



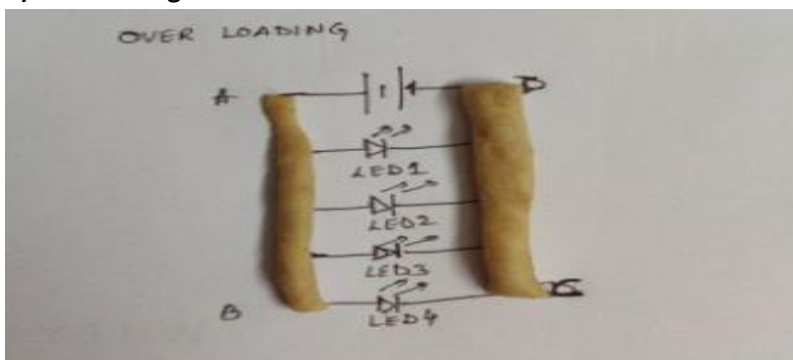
- Make Atta wires of same length but different thickness with the dough.
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- Turn the battery ON and observe the brightness (intensity) of the LED.
- Now keep replacing (AB) and (CD) with atta wires of same length but different thickness.
- Observe how the brightness of the LED changes with the thickness of the wire.

b) Short circuiting



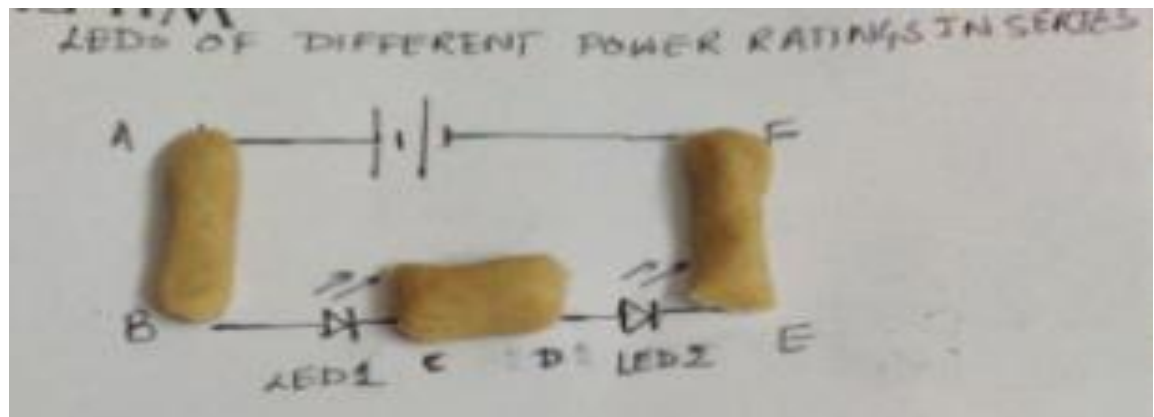
- Connect positive terminal of the battery eliminator with the longer leg(p) of the LED using an Atta wire(AB) and negative terminal of the battery eliminator with the shorter leg(n) of the LED using another Atta wire(CD). Observe the brightness of the LED
- Now bring wire AB and CD close to each other so that they start touching each other at a point. Observe how the brightness of the LED changes

C) overloading

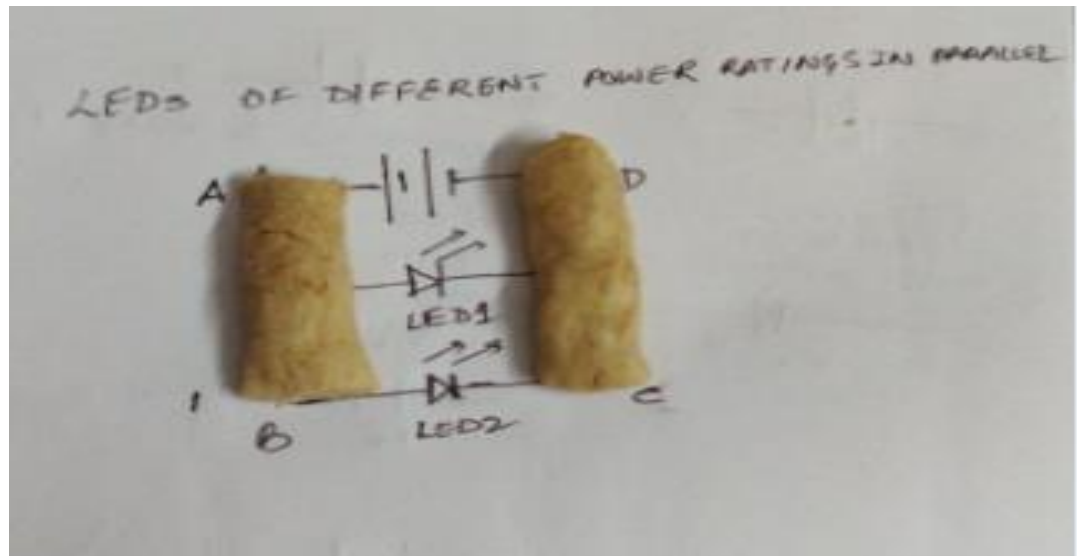


- Connect positive terminal of the battery eliminator with the longer leg(p) of the LED1 using an Atta wire(AB) and negative terminal of the battery eliminator with the shorter leg(n) of the LED using another Atta wire(CD). Observe the brightness of the LED1
- On wire AB insert longer leg of LED 2 and shorter leg of LED 2 in wire CD and observe the brightness of the LED1 and LED 2
- Repeat the above steps for LED 3 and LED4 and observe the brightness of LEDs after every step.

c) LEDs of different wattage ratings connected in series (Power of LED1 > Power of LED2)



- Connect positive terminal of the battery eliminator with the longer leg(p) of the LED1 using an Atta wire(AB) and insert the shorter leg(n) of the LED1 at C of another Atta wire(CD) and insert longer leg of LED2 at D and its shorter length at E of another atta wire EF and F to negative terminal of the battery eliminator. Observe the brightness of the LED1 and LED2
- d) LEDs of different wattage ratings connected in parallel (Power of LED1 > Power of LED2)**



- Connect positive terminal of the battery eliminator with the longer leg(p) of the LED1 using an Atta wire(AB) and insert the shorter leg(n) of the LED1 at C of another Atta wire(CD) and insert longer leg of LED2 at B and its shorter length at C and connect D to negative terminal of the battery eliminator. Observe the brightness of the LED1 and LED2

What have I observed?

a) Factors affecting Resistance of a conductor

(i) Length of a conductor

S. No.	Change in Length	Effect on the intensity of LED as length is
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		changed
1	Short wire	
2	Long wire	

(ii) Area of cross section of a conductor

S. No.	Change in cross-section Area	Effect on the intensity of LED as cross-section area is changed
1	thick wire	
2	thin wire	

b) Short circuiting

S. No.	Brightness of LED before AB and CD are made to touch each other	Brightness of LED after AB and CD are made to touch each other
1		

c) overloading

S. No.	LEDs connected between AB and CD with each LED's longer leg inserted at B and shorter leg at C	Brightness of LEDs
1	LED1	
2	LED1, LED2	
3	LED1, LED2, LED3	
4	LED1, LED2, LED3, LED4	

d) LEDs of different wattage ratings connected in series(Power of LED1> Power of LED1)

S. No.	LED	Brightness of LED
1	LED1	------(more/less)than LED2
2	LED2	------(more/less)than LED1

e) LEDs of different wattage ratings connected in Parallel(Power of LED1> Power of LED1)

S. No.	LED	Brightness of LED
1	LED1	------(more/less)than LED2
2	LED2	------(more/less)than LED1

What have I learnt?

- a)i)As Length of a conductor increases , brightness of LEDs goes on -----(decreasing/increasing) because resistance of a conductor -----(increases/decreases) with its length
- ii)As area of cross section of a conductor increases, brightness of LEDs goes on -----(decreasing/increasing) because resistance of a conductor -----(increases/decreases) with its area of cross section
- b) When AB and CD are made to touch each other at some point the intensity of LED----- (increases/decreases/becomes zero) , this is known as----- (short circuiting/overloading)because current prefers to flow through a path of----- (lowest/highest) resistance
- c) As the number of LEDs connected between AB and CD go on increasing the intensity of LEDs goes on----- (increasing/decreasing) ,As the current drawn from the battery goes on increasing in the main branch and when it exceeds the permitted limit it is known as ----- (short circuiting/overloading)
- d) when two LEDs of different wattage ratings are connected in series the LED of higher power will glow with----- (greater/lower) brightness as it's resistance is----- (low/high) and----- (same/different) current flows through both the LEDs and hence power dissipated across it is ----- (less/more) than the power dissipated across the LED with lower power rating
- e) when two LEDs of different wattage ratings are connected in parallel, the LED of higher power will glow with----- (greater/lower) brightness as its resistance is----- (low/high) and potential difference across both the LEDs is----- (same/different) hence resulting into----- (greater/lower) power dissipation across the LED with higher power rating

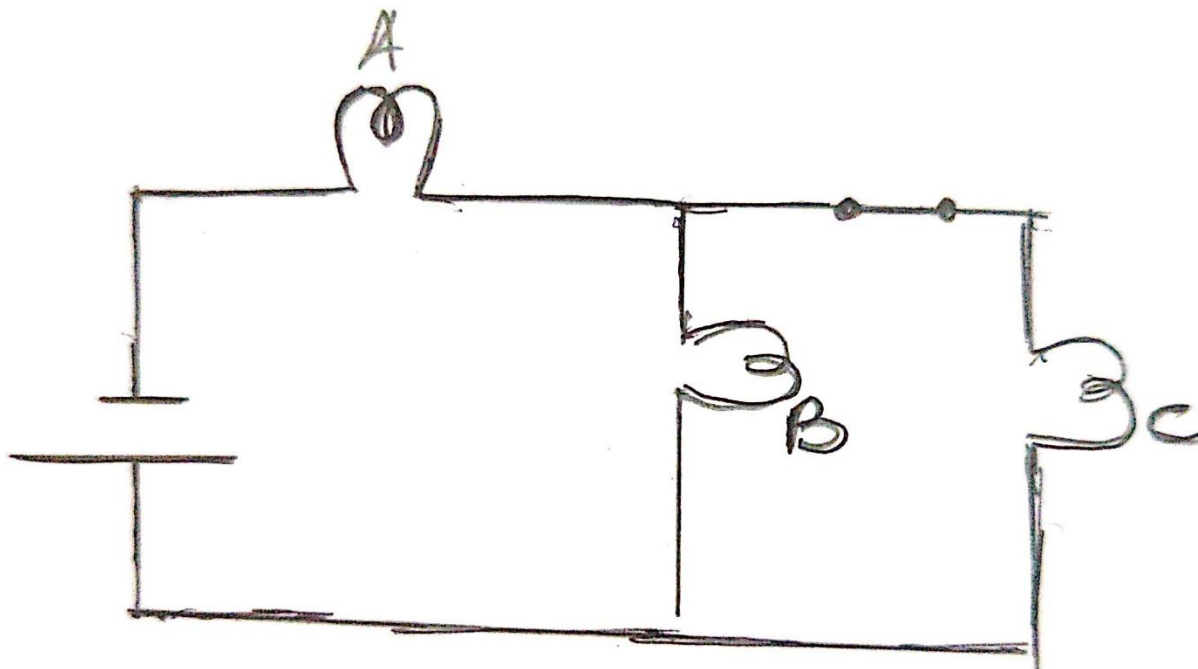
What am I curious to learn?

In the above activity if a student uses a 9 V battery then what problems might be faced by her/him and the precautionary measures to be taken to perform the activity with a 9 V battery.

Let me evaluate myself

- Q1** Why resistance of a conductor increases on increasing its length?
- Q2** Why resistance of a conductor decreases on increasing its cross-section area?
- Q3** A wire of copper maintained at room temperature is stretched to double its length. Will there be any change in its resistance and resistivity? Elaborate your answer.
- Q4** Two different types of wires namely A and B are used in two different circuits connected to ammeters P & Q respectively. If wire A is thicker than B, then which ammeter will show a higher reading of current? Explain your answer.
- Q5** If three light bulbs of different wattage are connected in parallel to a battery,
- (a) the voltage drop across each bulb will be the same.
 - (b) the current in each light bulb will be the same.
 - (c) the resistance of each light bulb will be the same.
 - (d) the power consumed by each light bulb will be the same.
 - (e) the light output of each bulb will be the same.

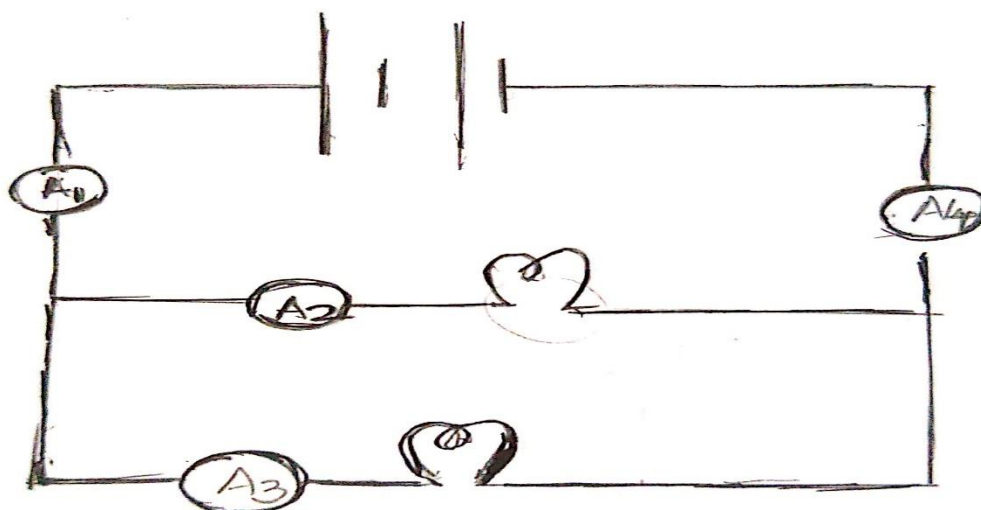
Q6).Look at the circuit diagram below. Each light bulb is identical.



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- (a) Is this a series or parallel circuit? Explain your answer
- (b) How do the brightness of bulbs A, B and C compare? (which is the brightest?)
- (c) What would happen to the brightness of the bulbs if the switch was opened? Explain your answer

Q7) Study the following diagram. Each light bulb is identical.



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- (a) What is the relationship between the ammeter readings on A1 and A4? In other words, how do the current strengths compare at these points in the circuit? Explain your answer
- (b) What is the relationship between the ammeter readings on A1, A2 and A3? In other words, how do the current strengths compare at these points in the circuit? Explain your answer

