

Chapter 3

Electricity - Circuits and their Components

Topics

- ★ Electric cell
- ★ Electric lamp
- ★ Electric circuit
- ★ LED
- ★ Electric switch
- ★ Circuit diagram
- ★ Conductors and Insulators
- ★ DC and AC

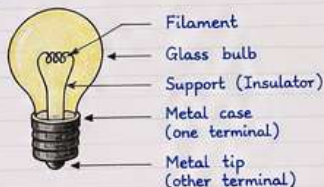
1. Electric Cell

- An electric cell is a portable source of electrical energy.
- An electric cell has two terminals; one is called positive (+ve) while the other is negative (-ve).



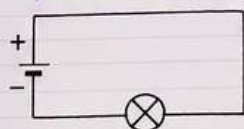
2. Electric Lamp (Bulb)

- An incandescent electric lamp has a thin wire called the filament.
- The filament becomes hot and glows to produce light when electric current passes through it.
- If the filament breaks, the lamp does not glow. Such a lamp is said to be fused.



3. Electric Circuit

- The lamp glows when one terminal of the lamp is connected to one terminal of the cell and the other terminal of the lamp is connected to the other terminal of the cell.
- This forms an electric circuit.
- An electric circuit provides a complete path for electric current to flow.
- The direction of electric current in a closed circuit is taken to be from the positive terminal to the negative terminal of the cell.

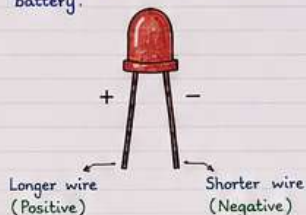


Closed circuit
→ Lamp
glows

Open circuit
→ Lamp
does not glow

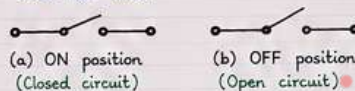
4. LED (Light Emitting Diode)

- An LED has two terminals.
- One is positive (longer wire) and the other is negative (shorter wire).
- Electric current can pass through LED in one direction only.
- An LED lights up only when its positive terminal (longer wire) connects to the positive terminal of the battery and its negative terminal (shorter wire) connects to the negative terminal of the battery.



5. Electric Switch

- A switch is a simple device that either completes or breaks a circuit.
- When the switch is in ON position, the circuit is closed and current flows.
- When the switch is in OFF position, the circuit is open and current does not flow.



6. Circuit Diagram

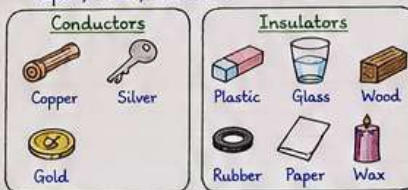
- Electrical components are represented by symbols.
- A representation of an electrical circuit using symbols is called a circuit diagram.

Table 3.2: Electrical components and their symbols

Component	Symbol	Component	Symbol
Electric cell		Switch in ON position	
Battery		Switch in OFF position	
Electric lamp		Wire	
LED			

7. Conductors and Insulators

- Materials through which electric current can flow easily are called good conductors or conductors of electricity.
- Examples - Copper, Silver, Gold, Metals.
- Materials through which current cannot pass are called insulators or poor conductors of electricity.
- Examples - Plastic, Rubber, Glass, Wood, Paper, Wax, Ceramic.



3. In Fig. 3.17, if the filament of one of the lamps is broken, will the other glow? Justify your answer.

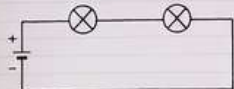
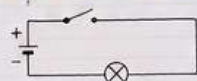


Fig. 3.17

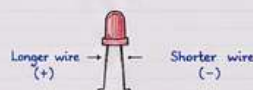
- Ans. No, the other lamp will not glow.
Justification: A broken filament breaks the circuit and makes it an open circuit. Therefore, electric current cannot flow through the circuit. ★

4. A student forgets the correct use of insulator covering from after closing the circuit, the lamp does not glow. What can be the possible reasons? List as many possible reasons as you can for this faulty operation. What will you do to find out why the lamp did not glow?



11. Vidhyut has made the circuit as shown in Fig. 3.19. Even after closing the circuit, the lamp does not glow. What can be the possible reasons? List as many possible reasons as you can for this. Is it a faulty operation? Can you find out for this faulty operation?

9. Suppose the '+' and '-' symbols cannot be read from the connecting wires without identifying the two terminals of this battery. Ans. Connect the battery with an LED. If the LED glows, the terminal connected to longer wire is positive (+) and the other is negative (-). If it does not glow, reverse the connections.



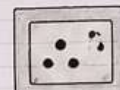
10. You are given six cells marked A, B, C, D, E and F. Some of these are working and some are not. Design an activity to identify which of them are working.
- (i) Items required: Cell holder, lamp, lamp holder, connecting wires.
- (ii) Procedure: Make a simple circuit. Insert each cell one by one and observe the lamp.
- (iii) Observation: If lamp glows, the cell is working. If lamp does not glow, the cell is not working.

8. DC and AC

- Electricity from a cell or battery is called Direct Current (DC).
- Electricity supplied through wall sockets is called Alternating Current (AC).



Cell / Battery
(DC)



Wall Socket
(AC)

In a Nutshell

- ★ An electric cell is a portable source of electrical energy.
- ★ An electric cell has two terminals, positive (+ve) and negative (-ve).
- ★ An incandescent lamp has a thin wire called filament.
- ★ An LED has two terminals, longer wire is positive and shorter wire is negative.
- ★ Current passes through LED in one direction only.
- ★ A switch completes or breaks a circuit.
- ★ Electric current flows from positive to negative terminal of the cell in a closed circuit.
- ★ A circuit diagram is a representation using symbols.
- ★ Materials that allow current to flow are conductors.
- ★ Materials that do not allow current to flow are insulators.

LET US ENHANCE OUR LEARNING

1. Choose the incorrect statement.

- A switch is the source of electric current in a circuit.
- A switch helps to complete or break the circuit.
- A switch helps us to use electricity as per our requirement.
- When the switch is in 'OFF' position, there is an air gap between its terminals.

Ans. (i) A switch is the source of electric current in a circuit.

2. Observe Fig. 3.16. With which material connected between the ends A and B, the lamp will not glow?

Ans. The lamp will not glow if an insulator is connected between A and B.
Examples - Rubber, Plastic, Glass, Wood, Paper, Wax, Ceramic.

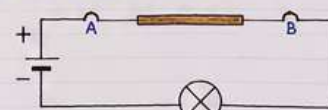


Fig. 3.16

6. In Fig. 3.18:

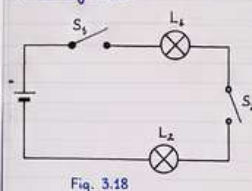


Fig. 3.18

- If S_1 is ON, S_2 is OFF, which lamp(s) will glow?

Ans. No lamp will glow.

- If S_2 is OFF, S_1 is ON, which lamp(s) will glow?

Ans. No lamp will glow.

- If S_1 and S_2 both are ON, which lamp(s) will glow?

Ans. Both lamps (L_1 and L_2) will glow.

- If both S_1 and S_2 are OFF, which lamp(s) will glow?

Ans. No lamp will glow.

EXPLORATORY PROJECT

Suppose that due to some problem, the power supply is disrupted in your area for two days. List out which actions from your daily life you would not be able to do.

- Switch on lights
- Watch television
- Use computers/laptops
- Pump water using motor
- Iron clothes
- Use Wi-Fi / internet
- Use fans
- Charge mobile phones
- Operate refrigerator
- Use washing machine
- Use mixer grinder
- Charge batteries

EXERCISE

1. Choose the incorrect statement.

- A switch is the source of electric current in a circuit.
- A switch helps to complete or break the circuit.
- A switch helps us to use electricity as per our requirement.
- When the switch is in 'OFF' position, there is an air gap between its terminals.

Ans. (i) A switch is the source of electric current in a circuit.

2. Observe Fig. 3.16. With which material connected between the ends A and B, the lamp will not glow?

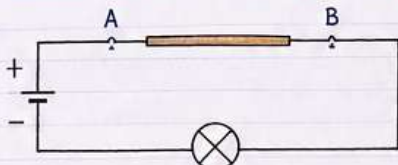


Fig. 3.16

Ans. The lamp will not glow if an insulator is connected between A and B.

Examples - Rubber, Plastic, Glass, Wood, Paper, Wax, Ceramic.

3. In Fig. 3.17, if the filament of one of the lamps is broken, will the other glow? Justify your answer.

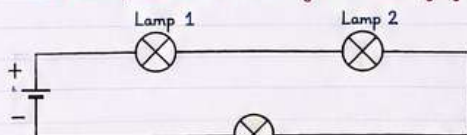
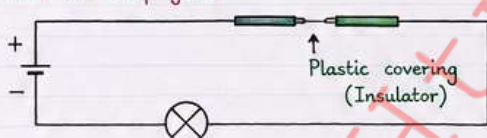


Fig. 3.17

Ans. No, the other lamp will not glow.

Justification : A broken filament breaks the circuit and makes it an open circuit. Therefore, electric current cannot flow through the circuit and the other lamp also does not glow.

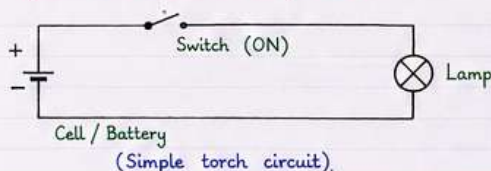
4. A student forgot to remove the insulator covering from the connecting wires while making a circuit. If the lamp and the cell are working properly, will the lamp glow?



Ans. No, the lamp will not glow.

Reason : The plastic covering is an insulator. It does not allow electric current to pass.

5. Draw a circuit diagram for a simple torch using symbols for electric components.



Cell / Battery
(Simple torch circuit),

9. Using an given six cells marked A, B, C, D, E and F some of & batteng, working and some are not. Design an activity to identify which of them working.

General: Is?

- List the items that you require.

Ans. Cell holder, lamp, lamp holder, connecting wires.

- Write the procedure that you will follow.

Ans.

- Make a simple circuit as shown.
- Insert one cell at a time in the cell holder.
- Close the switch.
- Observe whether the lamp glows.
- Repeat the above steps for all the cells.

Cell	Lamp glows	Cell condition
A	Yes	Working
B	No	Not working
C	Yes	Working
D	No	Not working
E	Yes	Working
F	No	Not working

(Working cells are A, C and E.)

6. In Fig. 3.18 :

- If S_2 is in 'ON' position, S_1 is in 'OFF' position, which lamp(s) will glow?

Ans. No lamp will glow.

- If S_2 is in 'OFF' position, S_1 is in 'ON' position, which lamp(s) will glow?

Ans. No lamp will glow.

- If S_1 and S_2 both are in 'ON' position, which lamp(s) will glow?

Ans. Both lamps (L_1 and L_2) will glow.

- If both S_1 and S_2 are in 'OFF' position, which lamp(s) will glow?

Ans. No lamp will glow.

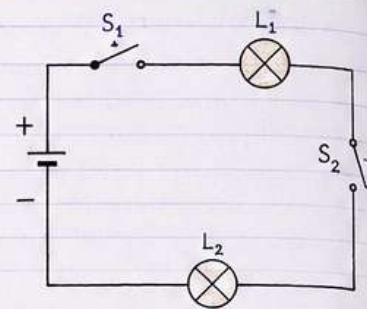


Fig. 3.18

7. Vidyut has made the circuit as shown in Fig. 3.19.

Even after closing the circuit, the lamp does not glow.

What can be the possible reasons? List as many possible reasons as you can for this faulty operation.

What will you do to find out why the lamp did not glow?

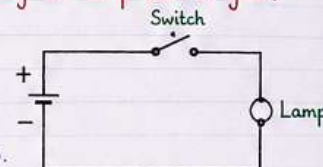


Fig. 3.19

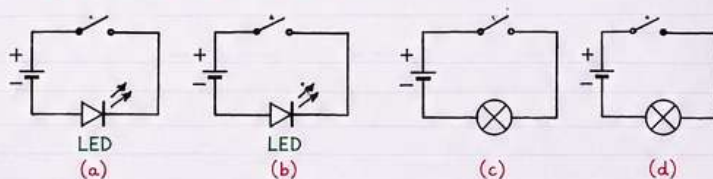
Ans. Possible reasons :

- The cell is discharged.
- The bulb is fused (filament is broken).
- The switch is faulty.
- The connections are loose.
- The ends of the wires are not properly connected.
- The insulator covering is not removed from the wire ends.
- The circuit is not complete.

What I will do :

- Check the cell.
- Check the bulb.
- Check the switch.
- Check all the connections and tighten them.
- Ensure that the insulator covering is removed from the wire ends.
- Make the circuit again and test it.

8. In Fig. 3.20, in which case(s) the lamp/LED will not glow when the switch is closed?



Ans. LED does not glow when it is connected in the reverse direction (wrong polarity). Lamp glows in both directions.

11. Using an LED that requires two cells in series to glow, Tanya made the circuit as shown in Fig. 3.21. Will the lamp glow? If not, draw the wires for correct connections.

Ans. No, the LED will not glow.

Reason : The LED is connected incorrectly.

Correct connection :

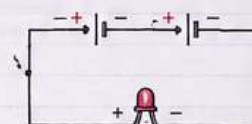


Fig. 3.21
(Wrong connection)

