

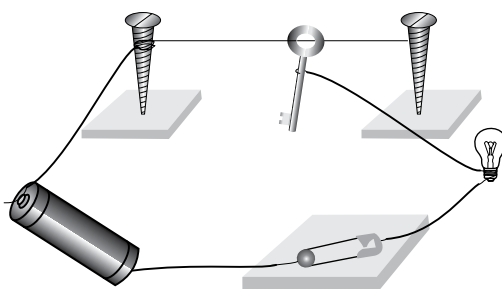
Electric Current and its Effects

Introduction





As we read in previous class about the electric circuit. In this chapter we will study electric components and devices which are represented by symbols in a circuit diagram, heating effect of current and magnetic effects of current. In magnetic effects of current we will deal with magnetic effects erected by current flowing in a wire.

Symbols of Electric Components

An electric circuit can be represented by a simple and clear circuit diagram. The parts of an electric circuits can be drawn using electric symbols shown in figure.

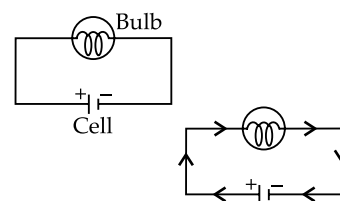


The following table shows some of the commonly used electric components and their symbols.

Component	Description	Symbol
Wire 	Represented by a straight line, provides a medium for the flow of current in a circuit, usually made of copper coated with plastic.	—————
Cell 	The longer line represents the positive terminal and the thicker and shorter one represents the negative terminal of the cell, simpler source of electric current.	— — —
Battery	A combination of two or more cells.	— + + + —
Switch 	Gives the control to open or close the circuit for a long time.	—()—, —(•)—
Electric bulb 	An electric appliance containing filament that glows when the current is passed.	—⊙—

Using the symbols, the electric circuit shown in figure can be drawn as follows.

- In all the circuit diagrams the direction of the current is shown by arrows, starting from the positive terminal of the cell or battery and ending in negative terminal.



Make the following electric circuits using the above symbols :

A closed circuit with an electric bulb, battery of two cells, and a switch.

An open circuit with two bulbs, battery of three cells, and a switch.

A closed circuit with a fan, a cell, and a switch.

An open circuit with a battery of three cells, a fan, a bulb, and a switch.



ACTIVITY CORNER

Usually copper wires are used for making connections in a circuit as they are good conductors of electric current. But they are covered by plastic, which is a bad conductor of current, so that the user does not get a shock.

Many devices such as torches, transistors, toys, TV remote controls use batteries.

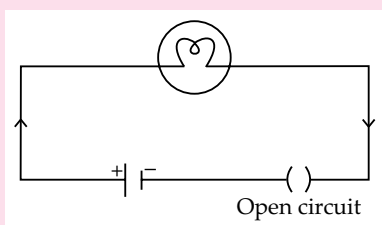
Do You Know



An ammeter is circuit element which is used to measure the current flowing in an electric circuit. Similarly, a 'voltmeter' is used to measure the electric potential difference between two points in an electric circuit.

1 What do you understand by an open circuit?

Ans.: Given figure shows open circuit. An open circuit occurs when there is break in the circuit which stops the current from flowing. Breaks in the circuit can be due to many causes, such as a loose lamp holder or a missing wire in the circuit.



2 Match the items in column I to those in column II:

Column I	Column II
i. conductor	a. a collection of cells
ii. circuit	b. used to open or close a circuit
iii. insulator	c. generates electricity
iv. cells	d. allows electricity to flow through



ILLUSTRATION

v. battery

e. completes path for the flow of electricity

vi. switch

f. substances that do not allow electricity to flow through easily.

Ans.:	(i)	conductor	d.	allows electricity to flow through
	(ii)	circuit	e.	completes path for the flow of electricity
	(iii)	insulator	f.	substances that do not allow electricity to flow through easily
	(iv)	cells	c.	generates electricity
	(v)	battery	a.	a collection of cells
	(vi)	switch	b.	used to open or close a circuit

Effects of Electric Current

When electrically flows through a conductor, it can produce many effects. We make use of these effects in various electrical appliances. As when the current flows through a circuit, we see various effects of current depending on the components being used. We have already observed the lighting effects of the electric current in the glowing of the bulb. Let us study the heating, magnetic and chemical effects of electric current.

Heating Effect of Electric Current

The filament of bulb is the part which gives light, when a bulb is connected in a circuit and switched on, its filament becomes so hot that it gives out light. When bulb glows for a longer time, the current also flows through it for longer time, the longer the bulb glows the hotter it becomes. Therefore it can be concluded that

- (i) The current produces a heating effect.
- (ii) The heating caused is more, if the time for which the current flows is more.

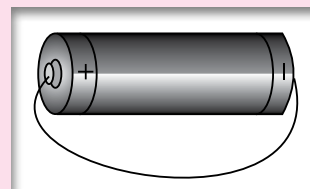
Let us understand heating effect of current

Make the ends of a thin wire touch the terminals of a cell for a short while.

The wire will get hot at once since its resistance is low, and this allows a large current to flow through it. In fact, if the source has a higher voltage, the heat produced will melt the wire. Do not try this, however. Be careful not to hurt yourself even while using a 1.5 V cell. Also, do not repeat the activity too many times because the cell will get used up fast.



ACTIVITY CORNER



Note that it is not only the filament of the bulb, but every wire or component or device, through which the current passes, becomes hot. This is known as the heating effect of current.

Some appliances such as electric heater, electric immersion rod, electric toaster, electric iron, etc. also use this property of heating due to electric current. They have wound coils of wire known as 'heating element' through which current flows resulting in its heating due to resistance offered by the wire.

The amount of heat generated in a wire depends on the length and thickness of the wire. Thus for different requirements, the wires of different materials and different lengths and thickness are used.

For example silver and copper become the least, whereas materials like tungsten and nichrome get too hot on the passage of current through them.

- 3** The heating element of a heater becomes red hot but not the connecting wire. Why?

Ans.: This is because the resistance of a heater wire is high, whereas that of the connecting wire is extremely low.



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Do You Know



The heat generated in a wire is doubled/halved when both the radius and length of the wire are doubled/halved.

Tungsten and Nichrome

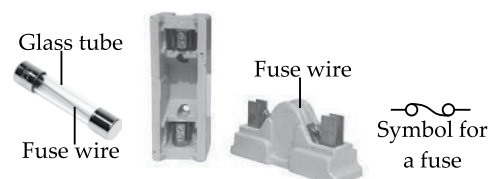
Tungsten and nichrome get too hot on passing current through them. It makes them useful for making filaments of electric bulbs and other heating devices (Heaters, irons, geysers, toasters etc.)

Electric bulbs have a filament made of tungsten while the filaments of electric iron, electric heaters, geysers, toasters are made of nichrome.

Tungsten and nichrome have the ability to withstand very high temperature without getting melted.

Electric Fuses : Electric fuse is a safety device used in electrical circuits. It is used to prevent electrical fires and protect electrical devices from damage.

A fuse is a small piece of wire of an alloy of adequately low melting point (usually 63% tin and 37% lead). There is a maximum limit of the current which can safely flow through a circuit. If the current exceeds the safe limit, then the fuse wire gets hot and melts. This creates a gap in the circuit and the appliance is saved from getting burnt.



To show the working of a fuse

Things required : A battery of four cells, a thin strand of steel wool (steel wool commonly used for cleaning utensils), two connecting wires.

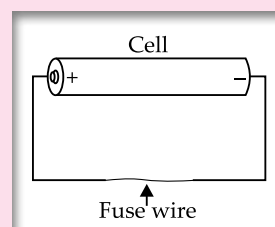
Method :

1. Peel off the end of the two connecting wires and connect the strand of steel wool between them. The steel wool will serve as a fuse wire.
2. Connect the loose end of one connecting wire to the negative terminal of the battery.
3. Now, touch the loose end of another connecting wire to the positive terminal of the battery. Observe the strand of steel wool.

Observation : The steel strand melts down and breaks the circuit. The current stops flowing in the circuit. This is how a fuse works.



ACTIVITY CORNER



Nowadays, a device called a **miniature circuit breaker (MCB)** is also used instead of or in addition to fuses, in the household electric circuits. It is a switch that automatically stops the current in a circuit if the current in it exceeds the specified maximum limit.



4 What is the difference between a fuse wire and a heating wire?

Ans.: The fuse wire has low melting point, whereas the heating wire has a high melting point. Fuse wire is made up of tin-lead alloy, whereas heating wire is made of constantan.



ILLUSTRATION

Caution

Always, use proper fuses which have been specified for particular applications, carrying ISI mark. Never use just any wire or strip of metal in place of a fuse.

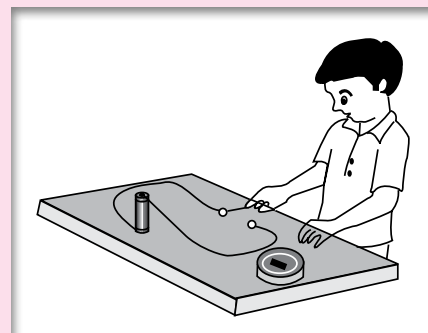
Magnetic Effect of Electric Current

Let us understand the magnetic effect of current.

Take a magnetic compass, place it on a table and allow it to come to rest. Remember, it will always come to rest, pointing in the North-South direction. Take a straight copper wire, about 10-12 inches long. Keep the wire parallel to the compass needle and connect its two ends to a cell and a switch to complete the circuit. Keep the switch of the circuit 'on' to allow the current to flow through it, while carefully observing the direction of the compass needle. You will notice that as soon as the current flows in the circuit, the needle shows a deflection (sudden change in its direction). If you put the circuit off, you'll see that the compass needle gets back into its original North-South direction.



ACTIVITY CORNER



Repeat the experiment a few times, you will notice that the needle deflects when the current is switched on and stays in that position as long as the current flows in the wire. When the current is switched off, the needle comes back to its original North-South direction.

This experiment was first performed by Oersted in 1820 to show the magnetic effect of current. He concluded that when electric current passes through a wire, it behaves like a magnet.

5 Why does a compass needle get deflected when brought near a bar magnet?

Ans.: The compass needle is itself a small magnet. Therefore, when it is brought near a bar magnet it gets deflected.



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Electromagnet

An electromagnet is based on the magnetic effect of current. It indicates that it must be a magnet made by using electricity.

It consists of a long length of insulated copper wire coiled around an iron rod or a bar. When the current is passed through this coil, the iron rod behaves like a magnet. The magnetism of the iron rod disappears as soon as the current through the coil is switched off. Therefore, an electromagnet is a temporary magnet. Along with the current, the magnetism can also be switched 'off' or 'on'.

6 Describe an activity to show that you can make an electromagnet in your school laboratory.

Ans.: Take fifteen long iron nails and wrap an insulated copper wire on it. Connect the coil end with a battery through a key. An electromagnet is ready. When key is pressed current flows in the wire and the heating coil acts as a magnet.



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The Factors on which the Strength of an Electromagnet depends

The strength of an electromagnet depends directly upon

- the amount of current flowing through the coil.

- the number of turns of copper wire in the coil

The strength of electromagnet depends inversely upon the length of the electromagnet, which means lesser the length of electromagnet, more will be the strength of electromagnet.

Uses of Electromagnets

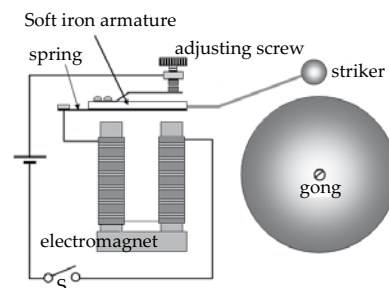
- in cranes to pick magnetic materials from a junkyard.
- in electric bells
- in loudspeakers
- by doctors to remove iron splinters from eyes
- in electric motors

- Electric Bell :** It consists of a coil of wire wound on an iron piece. The coil acts as an electromagnet. An iron strip with a hammer at one end is kept close to the electromagnet. There is a contact screw near the iron strip. When the iron strip is in contact with the screw, the current flows through the coil which becomes an electromagnet.

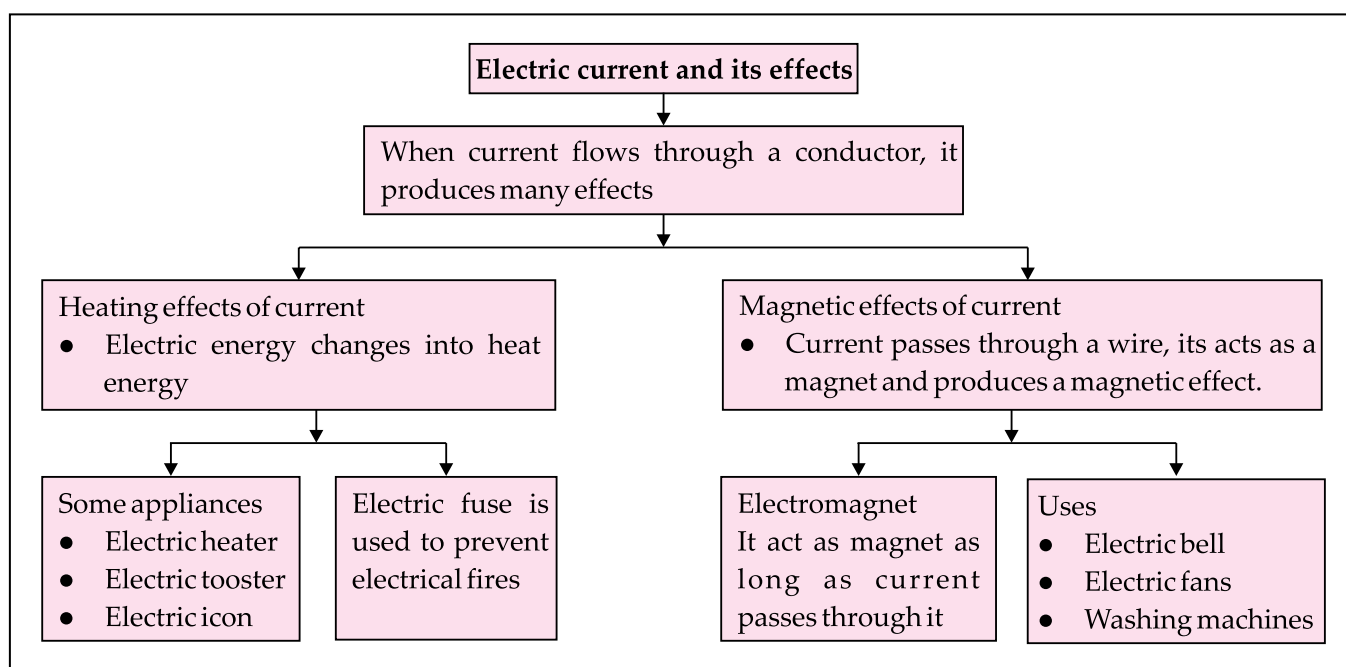
Then it pulls the iron strip. In the process, the hammer at the end of the strip strikes the gong of the bell to produce a sound.

However, when the electromagnet pulls the iron strip, it also breaks the circuit. The current through the coil stops flowing.

The coil is no longer an electromagnet. It no longer attracts the iron strip. The iron strip comes back to its original position and touches the contact screw again. This completes the circuit. The current flows in the coil and the hammer strikes the gong again. This process is repeated in quick succession. The hammer strikes the gong every time the circuit is completed. This is how the bell rings.



CONCEPT MAP



ESSENTIAL POINTS

for COMPETITIVE EXAMS

- An arrangement of devices through which electricity can flow is called an electrical circuit. A circuit diagram is a representation of circuit using symbols for electrical components.
 - A switch is a device for opening and closing a circuit.
 - Current produces heat from whatever wire, component or device it flows through.
 - The amount of heat produced by current depends upon the (i) nature of the material of object, (ii) the amount of current flow and (iii) the amount of time for which current flows.
 - The heating effect of current is utilized in the heating devices like electric iron, kettle, geyser, toaster, etc.
 - The filament of a bulb is made of tungsten.
 - The coils of heating devices like geyser are made of nichrome. Materials like tungsten have the ability to withstand high temperatures, without melting.
 - A fuse is a safety device for electrical circuits and appliances, based on heating effect of current.
 - A fuse is a thin small wire made of tin or an alloy of tin and copper whose melting point is low.
 - The function of a fuse is to break a circuit, in case there is overheating due to short-circuiting or overloading.
 - A current carrying wire behaves as a magnet, as long as current flows through it. This is known as magnetic effect of current.
 - Miniature Circuit Breaker (MCB) are now widely used instead of fuses.
 - The property of electric current is used to change magnetic materials like soft iron into magnets by passing electricity through them, such magnets are called electromagnets.
 - The strength of an electromagnet depends directly upon (i) the amount of current flowing through the coil, (ii) the number of turns of the coil. It depends inversely upon the length of the coil.
 - Electromagnets find many uses in our everyday life. Appliances using electromagnets are electric bells, electric motors, cranes, etc.
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SOLVED EXAMPLES

1. What is a battery?

Ans.: The combination of two or more cells is known as a battery.

2. Define electric cell. What is the direction of electric current in a cell?

Ans.: The simplest source of an electric current is an electric cell and it has a positive terminal and a negative terminal. In electric cell the current starts from positive terminal of the cell, passes through the equipment connected to it, and terminates at the negative terminal of the cell.

3. The electric current is complete if there are no breaks in the circuit. Such a circuit is called a _____. If there is a break in the circuit, it becomes incomplete. Such an incomplete circuit is called an _____.

Ans.: closed circuit, open circuit

4. What are the essential components of an electric circuit?

Ans.: Electric cell, Electric bulb, Switch in ON position or in OFF position, battery and wires.

5. What is a fuse ?

Ans.: Fuse is a safety device that is used in household circuits to protect the appliances. It prevents them from getting burnt out in case excess current flows through the circuit.

6. What is heating effect of the electric current?

Ans.: The wire or component or device gets hot when an electric current passes through them. This is known as heating effect of the electric current.

7. Name any two effects of electric current?

Ans.: Electric current has the following effect :

- (i) Electric current can give rise to heating and lighting.
- (ii) Electric current can convert a straight conductor into a temporary magnet.

8. Make a list of such appliances which work on the basis of heating effect of current?

Ans.: Bulb, iron, heater, toaster, geysers etc.

9. On what factors does the heat produced in a wire depends?

Ans.: Amount of heat produced in a wire depends on its material, length and thickness.

10. What do you mean by magnetic effect?

Ans.: When electric current passes through a wire, it behaves like a magnet. This is called magnetic effect of electricity.

11. How does the electric heater or an electric iron work?

Ans.: Electric heater and iron work on the basis of heating effect of electricity. When an electric current passes through the wires they become hot. Electric heater or iron contains a coil of wire. This coil of wire is called an element. When these appliances are switched on after connecting to the electric supply, their elements become red hot and give out heat.

12. What are MCBs? How do they work?

Ans.: MCBs (Miniature circuit breakers) are switches which automatically turn off when current in a circuit exceeds the safe limit. We turn them on and the circuit is once again complete.

13. Write the differences between a bar magnet and an electromagnet.

Ans.:

Bar magnet		Electromagnet	
1.	It is permanent magnet.	1.	It is a temporary magnet.
2.	Its strength cannot be changed.	2.	Its strength can be changed.
3.	Its uses are limited.	3.	Its uses are more wide.

14. What are the uses of electromagnets?

Ans.: Electromagnets are used in cars, speakers, electric motors, electric bells, telephone receivers, television, picture tubes etc.

15. What is an electric fuse made up of? How does it function to prevent a circuit from burning?

Ans.: A fuse is a small piece of wire of an alloy of adequately low melting point (usually 63% tin and 37% lead). There is a maximum limit of the current which can safely flow through a circuit. If the current exceeds the safe limit, then the fuse wire gets hot and melts. This creates a gap in the circuit and the appliance is saved from getting burnt.

NCERT SECTION

1. Draw in your notebook the symbols to represent the following components of electrical circuits: connecting wires, switch in the 'OFF' position, bulb, cell, switch in the 'ON' position and battery.

Ans.: Connecting wires

Switch in 'on' position

—()—

Bulb

—()—

Cell

—| |—

Switch in 'off' position

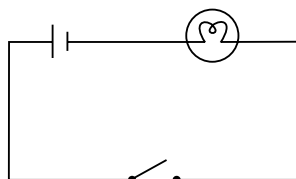
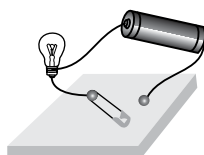
—(•)—

Battery

—| | | |—

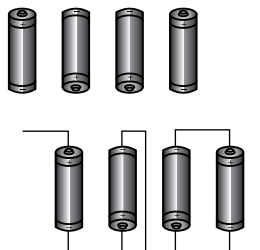
2. Draw the circuit diagram to represent the circuit shown in figure.

Ans.:



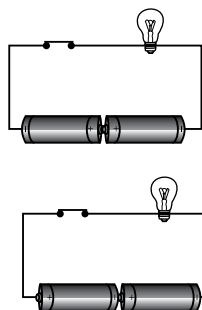
3. In figure shows four cells fixed on a board. Draw lines to indicate how you will connect their terminals with wires to make a battery of four cells.

Ans.:



4. The bulb in the circuit shown in figure does not glow. Can you identify the problem? Make necessary changes in the circuit to make the bulb glow.

Ans.:



5. Name any two effects of electric current.

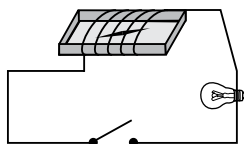
Ans.: Electric current has the following effect:

- (i) Electric current can give rise to heating and lighting.
- (ii) Electric current can convert a straight conductor into a temporary magnet.

6. When the current is switched on through a wire, a compass needle kept nearby gets deflected from its north-south position. Explain.

Ans.: When current is passed through the wire, it deflects the compass near it from its north-south position like a magnet. This is called magnetic effect of the current. As we know that needle of the compass is made up of a thin magnet. When this needle comes in contact with another magnet then the like poles of the magnet repel each other and opposite poles attract each other. So the deflection is seen in the needle. In this case the wire behaves like a magnet and causes deflection in needle of the compass.

7. Will the compass needle show deflection when the switch in the circuit shown by figure closed?



Ans.: No, because there is no source of electric current in this circuit, i.e., there is no battery.

8. Fill in the blanks:

- (a) Longer line in the symbol for a cell represents its _____ terminal.
- (b) The combination of two or more cells is called a _____.
- (c) When current is switched 'on' in a room heater, it _____.
- (d) The safety device based on the heating effect of electric current is called a _____.

Ans.: (a) positive (b) battery (c) becomes red hot and emits heat (d) fuse.

9. Mark 'T' if the statement is true and 'F' if it is false:

- (a) To make a battery of two cells, the negative terminal of one cell is connected to the negative terminal of the other cell. (T/F)
- (b) When the electric current through the fuse exceeds a certain limit, the fuse wire melts and breaks. (T/F)
- (c) An electromagnet does not attract a piece of iron. (T/F)
- (d) An electric bell has an electromagnet. (T/F)

Ans.: (a) F (b) T (c) F (d) T

10. Do you think an electromagnet can be used for separating plastic bags from a garbage heap? Explain.

Ans.: No, the plastic bags do not get attracted by the magnet, so they cannot be separated by an electromagnet. Plastic bags are not magnetic materials, only magnetic materials like iron can be attracted by the magnet.

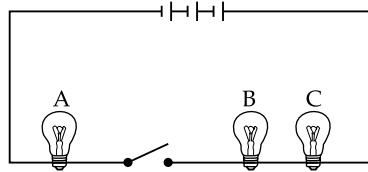
11. An electrician is carrying out some repairs in your house. He wants to replace a fuse by a piece of wire. Would you agree? Give reasons for your response.

Ans.: No, we would not agree to allow to replace the fuse by a wire. Wires in the fuses are of specific melting points. So we should always use ISI marked fuses in our houses to prevent short circuits.

- 12.** Zubeda made an electric circuit using a cell holder shown in figure, a switch and a bulb. When she put the switch in the 'ON' position, the bulb did not glow. Help Zubeda in identifying the possible defects in the circuit.

Ans.: It is important to put the cells in right series. The positive terminal of the first cell should be connected with negative terminal of the second cell. The switch should be closed properly and bulb should not be fused. If Zubeda will check these then the bulb will certainly glow.

- 13.** In the circuit shown in figure.



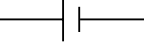


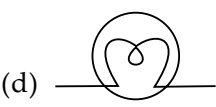
- (i) Would any of the bulb glow when the switch is in the 'OFF' position?
- (ii) What will be the order in which the bulbs A, B and C will glow when the switch is moved to the 'ON' position?

Ans.: (i) No bulb will glow.
(ii) All bulbs will glow simultaneously.

EXERCISE

Multiple Choice Questions

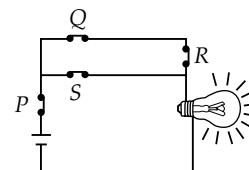
1. An electric component used as a safety device in electric circuits is
(a) switch (b) fuse
(c) cell (d) electric wires.
2. The electric bell makes use of
(a) a U-shaped electromagnet
(b) a bar-shaped electromagnet
(c) a ring-shaped electromagnet
(d) no electromagnet.
3. In an electric circuit, the current starts from
(a) the negative terminal of the battery
(b) the positive terminal of the battery
(c) either of the terminals of the battery
(d) none of the terminals of the battery.
4. The strength of an electromagnet does not depend upon
(a) the current flowing through the coil
(b) the number of turns of the coil
(c) the insulating material of the coil
(d) the length of the electromagnet.
5. In the symbol of an electric cell, the longer line represents the _____ terminal, and the thicker and shorter line represents the _____ terminal.
(a) negative, positive (b) neutral, positive
(c) neutral, negative (d) positive, negative
6. The device used to prevent the flow of excess current in the circuit is
(a) switch (b) fuse
(c) bulb (d) coil.
7. A current carrying coil of an insulated wire wrapped around a piece of soft iron becomes
(a) a filament (b) an electromagnet
(c) a fuse (d) a conductor.
8. The thin wire inside a bulb is
(a) coil (b) magnet
(c) filament (d) none of these
9. The bulb in an electric circuit glows because of
(a) magnetic effect of current
(b) heating effect of current
(c) chemical effect of current
(d) none of these
10. Which of the following is not a source of electric current?
(a) Car battery (b) Dry cell
(c) Cell (d) Electromagnet
11. A battery is a group of
(a) only two cells (b) two or more cells
(c) only single cell (d) all of these
12. Key or switch in circuit is placed
(a) left side of the battery
(b) right side of the battery
(c) anywhere in the circuit
(d) near the positive terminal of the bulb
13. The coil of wire contained in heater is known as
(a) component (b) circuit
(c) element (d) spring
14. Which mark is necessary on electric appliances?
(a) ISI (b) FICC
(c) AGMARK (d) KSK
15. Which of the following is/are true about CFLs?
(a) Reduce power wastage
(b) Fix in ordinary bulb holders
(c) Both (a) and (b)
(d) Neither (a) nor (b).
16. Which of the following is not a circuit element?
(a) Potential difference (b) Voltmeter
(c) Resistor (d) Battery
17. The necessary requirement for a fuse wire is
(a) conductor with low melting point
(b) conductor with high melting point
(c) insulator with low melting point
(d) insulator with high melting point
18. Mark out the correct statement.
(a) Fuses and MCBs are safety device.
(b) Fuses are safety device but MCBs are not.

- (c) MCBs are safety device but fuses are not.
(d) Neither fuses nor MCBs are safety device.
19. Which of these appliances does not use an electromagnet?
(a) Washing machine (b) Refrigerator
(c) Room heater (d) Electric bell
20. The shorter, thicker vertical line in the symbol of a cell represents
(a) the positive terminal
(b) the negative terminal
(c) the direction of current
(d) none of these
21. The longer, thinner line in the symbol of a cell denotes
(a) the positive terminal
(b) the negative terminal
(c) the direction of current
(d) none of these
22. Which of the following is the symbol for a bulb?
(a)  (b) 
(c)  (d) 
23. Which of the following is an electrical conductor?
(a) Silver (b) Cork
(c) Silver-coloured plastic
(d) Wood
24. In which circuit will the bulb or bulbs glow the brightest?
(a) A simple circuit with one bulb and one cell.
(b) A simple circuit with one bulb and two cells
(c) A simple circuit with two bulbs and one cell
(d) A simple circuit with two bulbs and two cells
25. Why is electrical wiring usually covered with a layer of plastic?
(a) To make it strong
(b) To help electricity flow in it
(c) To make it safe
(d) To make it beautiful
26. Rizvi has connected two bulbs across two cells in a simple circuit. How can she make the bulbs dimmer?

- (a) Replace one of the cells with a cork
(b) Replace one of the cells with a wire
(c) Replace one of the bulbs with a cork
(d) Replace one of the bulbs with a wire

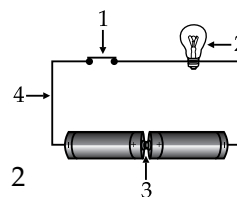
27. Pooja makes a simple circuit with one bulb and five cells. The bulb lights for an instant and then goes out. It happened because
(a) electricity could not flow through the circuit
(b) too much electricity passed through the bulb filament
(c) the wires melted in the heat
(d) all of these
28. Why is electrical wiring usually made from copper and not silver?
(a) Copper is a better conductor
(b) Copper is a better insulator
(c) Copper is less expensive
(d) Copper is non magnetic

29. Study the circuit shown here. Which switch if opened will cause the light bulb to stop glowing?



- (a) P (b) Q
(c) R (d) S

30. The bulb in the circuit given here does not glow. Which labelled part is responsible for this?



- (a) 1 (b) 2
(c) 3 (d) 4

31. An electric heater is used by us to convert electrical energy to
(a) heat energy (b) light energy
(c) chemical energy (d) both a and b
32. If you place a compass near a current carrying wire, it will
(a) get deflected (b) get charged
(c) get hot (d) glow brightly
33. When the two terminals of a cell are connected directly with a wire, then
(a) more electrical energy is stored in the cell
(b) the chemicals get used up very fast
(c) no current flows
(d) the cell explodes

34. Which of the following statements regarding an electromagnet is NOT true?
 (a) Insulated wire is wound around it.
 (b) It works only in the presence of electricity.
 (c) It is used in fans and radio.
 (d) It is a permanent magnet.
35. Electricians wear rubber gloves because it is
 (a) soft (b) water proof
 (c) an insulator (d) inexpensive
36. Which of the following does not belong to the group formed by the others?
 (a) Copper coin (b) Steel spoon
 (c) Wooden ruler (d) Iron nail
37. Iron is used for making electromagnet; not steel, nickel, cobalt because
 (a) iron is cheap and easily available
 (b) iron is a good conductor of electricity
 (c) when current is switched off in the coil of an electromagnet made of iron, iron loses all its magnetism
 (d) none of these
38. Which one of the following phenomenon occurs when two naked wires of electricity supply line touch each other?
 (a) Overloading (b) Shortcircuiting
 (c) Lightening (d) None of these
39. The electric fuse work on which one of the following phenomenon?
 (a) Chemical effect of current
 (b) Magnetic effect of current
 (c) Heating effect of current
 (d) None of these
40. On which of the following the resistance of wire depends?
 (a) Length of the wire
 (b) Thickness of the wire
 (c) Material of the wire
 (d) All of these
41. In which of the following conditions, amount of heat produced in a current carrying wire, will increase?
 (a) When amount of current passing in the wire is increased
 (b) When amount of current passing in the wire is decreased
 (c) When terminals of the wire are changed
 (d) None of these
42. Which one of the following is the best conductor of electricity?
 (a) Silver (b) Copper
 (c) Aluminium (d) Iron
43. Magnetic effect of current was discovered by
 (a) Thomas Jefferson
 (b) Hans Christian Oersted
 (c) Flemming
 (d) Louis Pasteur
44. What is overloading?
 (a) Touching of live wire with the neutral wire.
 (b) Touching of live wire with the earth wire.
 (c) Touching of neutral wire with the earth wire.
 (d) Putting more current across a wire than it can handle.

Fill in the Blanks

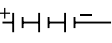



- In all the circuit diagrams, the direction of the current is shown by arrows, starting from the _____ of the cell or battery and ending in _____.
- A circuit may get _____ due to reasons like short-circuiting.
- When an electric current flows through a wire, it behaves like a _____.
- Doctors use very small but strong _____ to remove iron dust from a patient's eye.
- The magnetic effect of current was first observed by _____.
- If the amount of current passing through the coil of an electromagnet is decreased, the strength of the electromagnet will _____.
- A battery, made up of more than one cell is used to provide _____ current in the circuit.
- The heating coil of an electric geyser is made up of _____.
- The melting point of a fuse is _____ than the melting point of remaining circuit.
- Electric current flows where there is some difference in _____.

True or False

- Insulators do not carry electric current because they do not have free electrons.
- An MCB can be used instead of a fuse in an electrical circuit.
- The insulation on a wire prevents it from getting hot when carrying current.
- Electrical devices such as lamps and fans offer resistance to the flow of current.
- The potential difference in a circuit is shown by an arrow.
- An electric motor makes use of the magnetic effect of a current.
- To make a battery of two cells, the negative terminal of one cell is connected to the negative terminal of the other cell.
- When the electric current through the fuse exceeds a certain limit, the fuse wire melts and breaks.
- An electromagnet does not attract a piece of iron.
- An electric bell has an electromagnet.

Match the Following

In this section each question contains statements given in two columns which have to be matched. Statements (p, q, r, s, t) in Column-I have to be matched with statements (i), (ii), (iii), (iv), (v) in Column-II.

- | Column-I | Column-II |
|---|---|
| (p) Bulb | (i) _____ |
| (q) Cell | (ii)  |
| (r) Battery | (iii)  |
| (s) Wire | (iv)  |
| (t) Open switch | (v)  |
| (a) p-(ii), q-(iii), r-(v), s-(i), t-(iv) | |
| (b) p-(v), q-(iv), r-(ii), s-(i), t-(iii) | |
| (c) p-(v), q-(ii), r-(iv), s-(i), t-(iii) | |
| (d) p-(i), q-(ii), r-(iii), s-(iv), t-(v) | |

- | Column-I | Column-II |
|------------------------------------|--|
| (p) CFL | (i) A safety device to prevent short circuit |
| (q) ISI | (ii) The wire used in heater to get heat |
| (r) Fuse | (iii) Consume less energy than bulb |
| (s) Element | (iv) Appliances is safe to use |
| (a) p-(i), q-(ii), r-(iii), s-(iv) | |
| (b) p-(iii), q-(iv), r-(ii), s-(i) | |
| (c) p-(iii), q-(iv), r-(i), s-(ii) | |
| (d) p-(ii), q-(i), r-(iv), s-(iii) | |

Assertion and Reason Type

Directions : In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as

- If both assertion and reason are true and reason is the correct explanation of assertion
- If both assertion and reason are true but reason is not the correct explanation of assertion
- If assertion is true but reason is false
- If assertion is false but reason is true.

- Assertion :** Copper wires are used for making connections in a circuit as they are good conductors of electric current.

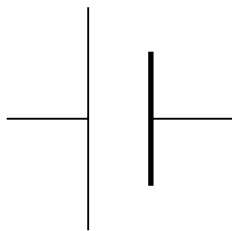
Reason : When current passes through the copper wire, it behaves like a magnet.
- Assertion :** The amount of heat produced in a wire does not depends on its material.

Reason : If a large current passes through filament of an electric bulb the filament may become so hot that it may even melt and break.
- Assertion :** The strength of an electromagnet can be increased by increasing the number of turns of the coil per unit length.

Reason : A soft iron piece, which is kept in a coil of wire, behaves as a magnet when electricity is passed through the wire.

Comprehension Type

Look at the given figure carefully and answer the following questions.



1. It is a symbol of
 - (a) switch
 - (b) fuse
 - (c) bulb
 - (d) cell
2. The figure is made up of two parallel lines. One is thin and long, while the other is thick and short. The thick and short line represents
 - (a) negative terminal of the cell
 - (b) positive terminal of the cell
 - (c) negative terminal of the bulb
 - (d) positive terminal of the bulb

Subjective Problems

Very Short Answer Type

1. What is the source of electric current in a torch?
2. Name any four appliances which work on the principle of heating effect of current.
3. Name any four devices where magnetic effect of electric current is used.
4. Name the element from which the filament of electric bulb is made.
5. What type of magnet is used in an electric bell?
6. What do you mean by an electric circuit?
7. In which position is key placed in a circuit?
8. How can we connect the cells to prepare battery?
9. What are the effects of electricity?
10. What is element in respect of heating effect?

11. What is resistance?
12. Name three sources of electricity.
13. What is the meaning of the term 'battery'?
14. What are MCBs?
15. What are the advantages of having electrical appliances connected in parallel?

Short Answer Type

1. Why does an electric bulb get hot if it is switched on for a while?
2. Why does a magnetic needle get deflected when it is placed near a current carrying wire?
3. What are the factors on which heating effect of electric current depends?
4. How are electromagnets prepared?
5. Write two applications of electromagnets.
6. Explain the construction of battery.
7. Why should we not touch the lighted bulb?
8. What are electric fuses? What is their importance?
9. What happens when a compass needle is brought near to a current carrying wire?
10. Draw diagram of electromagnet. On which effect of electricity does it work?

Long Answer Type

1. What do you mean by an electric circuit? What are the main components of an electric circuit? Draw diagram of an closed circuit?
2. How does an electric torch work?
3. How can you show that an electric current has magnetic field?
4. What is an electromagnet? Name some devices in which it is used.
5. Explain the working of electric bell.

Electric Current and its Effects

Multiple Choice Questions

1. (b): Fuse is used as a safety device in electric circuits.
2. (a): A U-shaped electromagnet is used in an electric bell. It is magnetised when the push button of the bell is pressed.
3. (b): The current starts from the positive terminal of the cell or battery and ends in negative terminal.
4. (c): The strength of electromagnet depends upon the amount of current flowing through the coil, number of turns in the coil, length of the electromagnet and the magnetic material used.
5. (d)
6. (b): Fuse blows off a little before any other part of the circuit could, so the flow of excess current stops and further heating of the circuit is prevented.
7. (b): An electromagnet utilizes the magnetic effect of current. It acts as a magnet as long as the current is flowing in the wire.
8. (c)
9. (b): When a bulb is connected in a circuit and switched on, its filament becomes so hot that it gives out light.
10. (d): An electromagnet is a temporary magnet. It is not a source of electric current.
11. (b): Two or more cells are combined together to provide more electric current, known as battery.
12. (c): A switch is a device which helps in breaking or completing a circuit so it can be placed anywhere in the circuit.
13. (c)
14. (a)
15. (c)
16. (a): Potential difference is a physical quantity.
17. (a): Fuse is made up of tin or alloy of tin and copper. It is a thin conducting wire with low melting point.
18. (a)
19. (c)
20. (b)
21. (a)
22. (d)
23. (a): Silver is a metal and a good conductor of electricity.
24. (b): The chemical energy stored in two cells is more than one. The electrical energy used by one bulb is less than the energy used by two bulbs. So the bulb in the circuit that has one bulb and two cells will glow the brightest.
25. (c): Plastic is a good insulator of electricity and makes it possible to work with wires without any harm/injury.
26. (b): Using a cork in the circuit will break it, since it is an insulator. Removing one of the cells will reduce the flow of electricity and make the bulbs dimmer.
27. (b): Because of too many cells, the electricity that was flowing through the filament of the bulb was more, causing it to melt and break contact.
28. (c): Silver is better conductor, non magnetic but expensive material.
29. (a): The other switches would not be able to break the circuit.
30. (c): Two similar terminals, if connected together does not allow electric current to flow.
31. (a): A heater is used to obtain heat energy. For light energy, a bulb or other sources are used.

32. (a): A current carrying wire behaves like a magnet and affects other magnets in its magnetic field.
33. (b)
34. (d): It is a temporary magnet, which works only in the presence of electricity.
35. (c): Rubber gloves, being an insulator, protects them from electric shock.
36. (c): Wooden ruler is an electrical insulator.
37. (c): Iron is called a soft magnetic material because it loses its magnetism easily.
38. (b): When two naked wires of electricity supply line touch each other, a large amount of current flows through the wires. This phenomenon is known as shortcircuiting.
39. (c)
40. (d): Resistance offered by a conductor depends on its length, thickness and the material of which it is made.
41. (a): The larger the current, the more is the heat produced in the wire. And how large the current is depends on the voltage of the source and the resistance of the conductor.
42. (a) 43. (b) 44. (d)

Fill in the Blanks

- positive terminal, negative terminal
- overheated
- magnet
- electromagnet
- Hans Christian Oersted
- decrease
- more
- element
- lower
- potential difference

True or False

- True
- True
- False
- True
- False
- True

- False
- True
- False
- True

Match the Following

- (b): p-(v), q-(iv), r-(ii), s-(i), t-(iii)
- (c): p-(iii), q-(iv), r-(i), s-(ii)

Assertion and Reason Type

- (b)
- (d)
- (b)

Comprehension Type

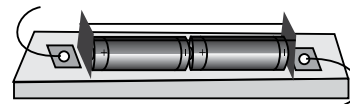
- (d)
- (a)

Subjective Problems

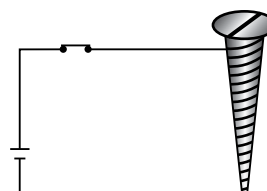
Very Short Answer Type

- Electric cells are the source of electric current in a torch.
- Electric geysers, room heaters, electric toasters, electric iron etc.
- Electric bells, loudspeakers, telephone receivers, cranes etc.
- The filament of electric bulb is made of tungsten which has a very high melting point.
- Electromagnets are used in electric bells.
- The path through which electric charges move from one point to other is called electric circuit.
- Key can be placed anywhere in the circuit.
- The positive terminal of one cell is connected to the negative terminal of the next cell to prepare a battery.
- There are three effects of electricity :
(i) Heating effect (ii) Chemical effect
(iii) Magnetic effect
- The coil of wire used in heating devices is known as heating element.

11. Resistance is a physical quantity that measures the opposition offered to the flow of current by a conductor.
12. The common sources of electricity are cells, batteries and the mains.
13. The meaning of 'battery' is an arrangement of a number of cells.
14. MCBs are switches which automatically turn off when current in a circuit exceeds the safe limit.
15. On connecting appliances in parallel to the mains, each appliance can be used independently of the others and each has the potential difference of the mains across it.
6. Battery is a combination of two or more cells. This can be constructed by placing cells properly on cell holder such that the positive terminal of one cell is connected to the negative terminal of the other. A piece of wire is connected to each of the two metal clips on the cell holder.

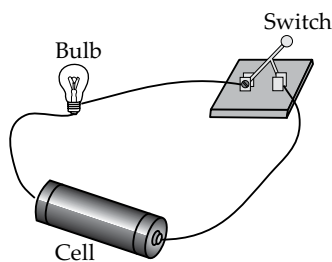


7. We should never touch a lighted electric bulb as it may be very hot and our hand may get burnt badly.
8. Fuse is a safety device which prevents our houses, appliances and electric circuits from electrical hazards at the time of the short circuiting or overloading. The fuse works on the basis of heating effects of the electric current. If by an accident the current exceeds a certain limit this device becomes overheated and melts which breaks the circuit and supply of electricity is stopped. In this way it helps in prevention of damage.
9. Compass needle is a tiny magnet which points in north-south direction. When it is brought close to a magnet then needle gets deflected. When compass needle is brought near to a current carrying wire then it is deflected and when direction of current is changed then direction of deflection of compass needle is also changed. This shows the magnetic effect of electricity.
10. The electromagnet works on the basis of magnetic effect of electricity.



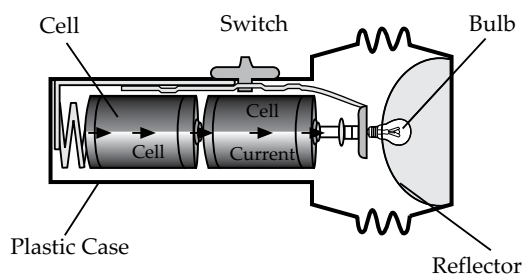
- Short Answer Type**
1. Electric bulbs have a filament made of tungsten. This filament gets so hot when an electric current flows through it that it glows. So, an electric bulb gets hot as well.
 2. Due to the magnetic effect of current, the current carrying wire behaves as a magnet. So a magnetic needle gets deflected when it is placed near a current carrying wire.
 3. The heat developed in a conductor due to the passage of electric current depends on the following factors :
 - (i) Current flowing through the conductor
 - (ii) Time of passage of current
 - (iii) Nature of conductor
 - (iv) Physical characteristics of conductor (e.g., length and thickness)
 4. Electromagnets can be prepared by using the magnetic effect of electric current. It consists of long, coiled copper wire wrapped around an iron rod. When current is passed through the wire, it behaves like a magnet, called electromagnet.
 5. Applications of electromagnets :
 - (i) Electromagnets are used in cranes for lifting heavy loads.
 - (ii) Electromagnets are used in electric bells, speakers, etc.

- Long Answer Type**
1. The closed path in which the electric current flows is called an electric circuit. An electric circuit generally consists of the following components:

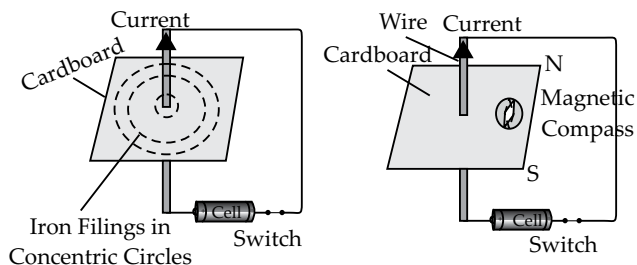


- (i) A source of electric current
- (ii) A conducting path or wires
- (iii) An electrical appliance
- (iv) A switch/key.

2. If we examine an electric torch, we will find a small bulb in the reflector and two or more cells in it. These cells are the source of electricity in a torch. When we press the switch of the torch, circuit gets completed and its bulb glows and gives light.



3. If we put some iron filings on the cardboard and pass current through the wire. We will notice that the iron filings arrange themselves in clusters near the wire in concentric circles. The direction of magnetic effect (i.e., magnetic field) can be found by using a magnetic compass.



When we place the magnetic compass on the cardboards, its needle points in a particular direction. The direction where the north pole of the needle points is the direction of magnetic field. Now we change the terminals of the cell. We will find that the pattern of concentric circles

remain the same but the direction of magnetic field changes.

From this experiment, we conclude that a current carrying wire also behaves like a magnet. Once the flow of current is stopped, the magnetic property also disappears.

4. When current is passed through a coil of wire wrapped around an iron rod, then the coil behaves like a magnet. One end of coil acts as north pole and other end acts as south pole. When the electric current is switched off, the coil generally loses its magnetism. Such coils are called electromagnets. The electromagnets are very strong and their power can be increased so they are very important.

Two important applications (uses) of electromagnets are :

- (i) They are used in electric bells, telegraphs, telephones and speakers etc.
- (ii) They are used in cranes to lift heavy loads of scrap iron or iron sheets.

5. Electric bell consists of an iron hammer around which is wound a wire. When current is passed by pressing button, the wire turns into a temporary magnet. The hammer is attracted towards gong to make sound. When this strikes, the current is disconnected automatically. It happens due to shift arrangement in it. The magnetic property of wire is lost and it comes back to its original position through a spring. In this way, we get separated hammering resulting in ringing of an electric bell.

