

EXERCISE 9(A)

PAGE NO: 218

Question: 1

At what voltage and frequency is the electric power generated at the power generating station?

Solution:

The electric power generated at the power generating station at 11 kV and 50 Hz respectively.

Question: 2

(a) At what voltage is the electric power from the generating station transmitted?

Give reasons to your answer.

(b) What is the nature of current transmitted from the power station?

Solution:

(a) Generation at voltage higher than 11 kV causes insulation difficulties, while generation at voltage lower than 11 kV involves a very high current. Hence, electric power from the generating station is transmitted at 11 kV.

(b) Alternating current (AC) is the nature of current transmitted from the power station

Question: 3

The voltage of power generated at the generating stations is first stepped up before its transmission. Give reason.

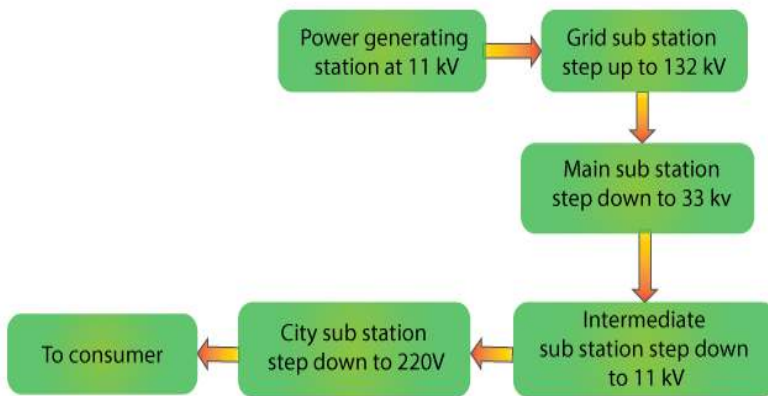
Solution:

Usually at 11 kV, power generated at generating stations which is very high. This power is to be transmitted across far away distances from the generating stations. A lot of energy is lost in the transmission line wires in the form of heat during transmitting the 11 kV power. Hence, using the step up transformer the voltage of power generated at the stations is stepped up from 11 kV to 132 kV. This process is applicable only for alternating current since direct current cannot be raised.

Question: 4

Explain with the aid of a simple diagram, the transmission of electric power from the generating station to your house.

Solution:



The electric power is generated at 11 kV at a power generating station. The alternating voltage is transmitted to the grid sub-station from here and stepped up to 132 kV using a step-up transformer. It is then transmitted to the main sub-station. At the main sub-station the voltage is stepped down to 33 kV using a step-down transformer and is then transmitted to the intermediate sub-station. The voltage is stepped down to 11 kV using a step-down transformer at the intermediate sub-station. From here it is transmitted to the city sub-station, where the voltage is further stepped down to 220 V and is supplied to our houses.

Question: 5

At what voltage and frequency is the a.c. supplied to our houses?

Solution:

The a.c. is supplied to our houses at 220 V of voltage and 50 Hz of frequency.

Question: 6

Name the device used to (a) Increase the voltage at the generating station (b) Decrease the voltage at the sub-station for its supply.

Solution:

- (a) Step-up transformer is used to increase the voltage at the generating station
- (b) Step-down transformer is used to decrease the voltage at the sub-station for its supply.

Question: 7

- (a) Name the three connecting wires used in a household circuit.
- (b) Which two wires mentioned in part (a) are at the same potential?
- (c) In which of the wire stated in part (a) the switch is connected?

Solution:

- (a) Live wire, neutral wire and earth wire are the three connecting wires used in household circuit

- (b) Neutral wire and earth wire are at the same potential
- (c) Live wire is the wire in which the switch is connected

Question: 8

What is the pole fuse? Write down its current rating.

Solution:

Before connecting the cable from pole to the meter in a house, first a fuse of high rating is connected in the live wire at the pole or just before the meter. This fuse is called the pole fuse. The current rating of pole fuse is ≈ 50 A.

Question: 9

State the function of each of the following in a house circuiting:

- (a) kWh meter, (b) main fuse, and (c) main switch**

Solution:

- (a) After the company fuse, the cable is connected to a kWh meter. From this meter, connections are made to a main switch and to a main fuse in the distribution box.
- (b) Main fuse is connected only in the live wire and in case of high current it gets burnt and the cut the connections to save appliances.
- (c) Main switch is connected in both the live and neutral wires. It is used to break the connections of the live as well as the neutral wires simultaneously from the main supply.

Question: 10

In what unit does the electric meter in a house measure the electrical energy consumed? What is its value in S.I. unit?

Solution:

The electric meter in a house measure the electrical energy consumed in kWh.
 $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$ is its value in S.I. unit.

Question: 11

Where is the main fuse connected in a house circuit?

Solution:

The main fuse is connected in series only in the live wire before the main switch in the distribution board of a house circuit

Question: 12

State one advantage of using the main switch in house wiring.

Solution:

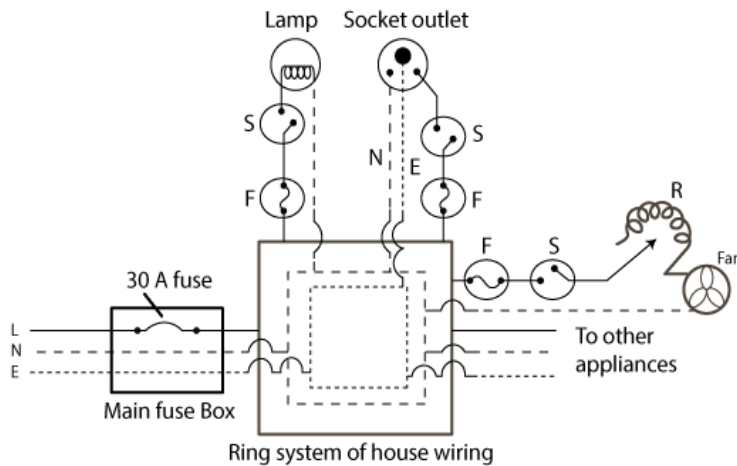
The main switch is a double pole switch and has an iron covering. The advantage of

using the main switch is that it can break both the connection of the live and the neutral wires at the same time. This protects the electrical appliances from accidental damage due to electrical faults.

Question: 13

Draw a circuit diagram to explain the ring system of house wiring. State two advantages of it.

Solution:



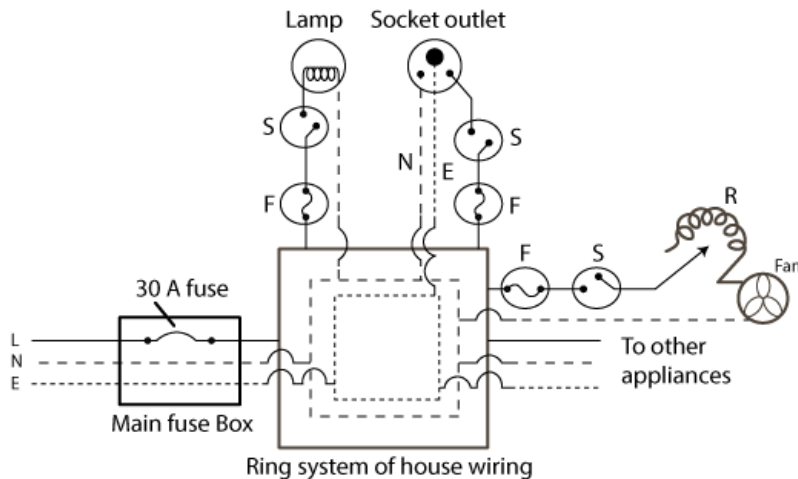
Advantages of a ring system over tree system

- (i) The wiring is cheaper in a ring system than in tree system
- (ii) The sockets and plugs of same size can be used in a ring system while sockets and plugs are of different size in a tree system
- (iii) Each appliance has a separate fuse in a ring system. Therefore if due to some fault, the fuse of one appliance burns, it does not affect the operation of the other appliances while in a tree system when fuse in one distribution line blows, it disconnects all the appliances connected to that distribution circuit.

Question: 14

Draw a labelled diagram with the necessary switch, regulator, etc. to connect a bulb and a fan with the mains. In what arrangement are they connected to the mains: series or parallel?

Solution:



The appliances are connected in a parallel arrangement to the mains

Question: 15

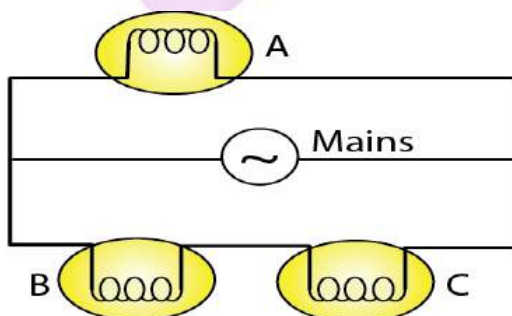
How should the several electric lamps be connected with the mains so that the switching on or off a lamp has no effect on the operation of other lamps?

Solution:

All the electrical appliances in a building should be connected in parallel with the mains. Each electrical appliances with a separate switch and a separate fuse connected in the live wire so that switching on or off in a room has no effect on other lamps in the same building.

Question: 16

Fig.9.12 shows three bulbs A, B and C each of rating 100 W, 220 V connected to the mains of 220 V. Answer the following:



- How is the bulb A connected with the mains? At what voltage does it glow?
- How are the bulbs B and C connected with the mains? At what voltage does the bulb B glow?
- How is the glow of bulbs A and C affected if bulb B gets fused?

(d) How is the glow of bulbs B and C affected if bulb A gets fused?

Solution:

- (a) Bulb A is connected with the mains in parallel. The bulb A glows when the voltage applied across the bulb is 220 V
- (b) Bulbs B and C are connected in series with the mains. The voltage at which they glow will be divided by two from the mains supply voltage due to the series connection with the mains. Thus bulb B will glow at 110 V
- (c) If bulb B gets fused, bulb C will not glow which is connected in series with the bulb B. This will not affect the glow of bulb A as it is connected in parallel with the mains.
- (d) The glow of bulbs B and C will not be affected if bulb A gets fused.

Question: 17

Two sets A and B each of four bulbs are glowing in two separate rooms. When one of the bulbs in set A is fused, the other three bulbs also cease to glow. But in set B, when one bulb fuses, the other bulbs continue to glow.

- (i) Explain the difference in the two sets,**
- (ii) Which set of arrangement is preferred in housing circuit and why?**

Solution:

(i) In set A, all the three bulbs are in series connection. The voltage of source gets divided connected in series in all the three bulbs and they operate at the same time. None of the bulb can be operated independently and thus when one bulb fuses the other two bulb also ceases to glow

In set B, all the three bulbs are in parallel connection. Therefore even when one of the bulbs ceases to glow, the others continues to glow. So, each bulb operates independently.

(ii) Set B arrangement that is all the bulbs connected in parallel is preferred in housing circuit because each appliances gets connected to 220 V supply for its normal working and each appliance operates independently without being affected whether the other appliance is switched on or off.

MULTIPLE CHOICE TYPE

Question: 1

The main fuse is connected in:

- (a) Live wire**
- (b) Neutral wire**
- (c) Both the live and earth wires**
- (d) Both earth and the neutral wire.**

Solution:

The main fuse is connected in live wire

Question: 2

The electrical appliances in a house are connected in:

- (a) Series
- (b) Parallel
- (c) Either in series or parallel
- (d) Both in series and parallel

Solution:

The electrical appliances in a house are connected in parallel

Question: 3

The electrical meter in a house records the consumption of:

- (a) Charge
- (b) Current
- (c) Energy
- (d) Power

Solution:

The electrical meter in a house records the consumption of energy.

EXERCISE 9(B)

PAGE NO: 227

Question: 1

What is a fuse? Name the material of fuse. State one characteristic of the material used for fuse.

Solution:

An electric fuse is defined as a safety device which is used to limit the current in an electric circuit. The use of a fuse safeguards the circuit and the appliances connected in that circuit from being damaged.

An alloy of lead and tin is used as the material of the fuse wire because its melting point is low and specific resistance is more than that of copper, aluminium, etc.

Question: 2

Name the device used to protect the electric circuits from overloading and short circuit. On what effect of current does it work?

Solution:

The device used to protect the electric circuits from overloading and short circuit is fuse. It works on heating effect of current.

Question: 3

Complete the following sentences:

- (a) A fuse is a short piece of wire of high _____ and of material low _____.
- (b) A fuse wire is made of an alloy of _____ and _____. If the current in a circuit exceeds the current rating of the fuse wire it _____.
- (c) A fuse is connected in _____ with the _____ wire.
- (d) Higher the current rating, _____ is the fuse wire.
- (e) Live wire is also called _____ wire.

Solution:

- (a) A fuse is a short piece of wire of high resistance and of material low melting point.
- (b) A fuse wire is made of an alloy of lead and tin. If the current in a circuit exceeds the current rating of the fuse wire it melts.
- (c) A fuse is connected in series with the live wire.
- (d) Higher the current rating, thicker is the fuse wire.
- (e) Live wire is also called phase wire.

Question: 4

Why is the fuse wire fitted in a porcelain casing?

Solution:

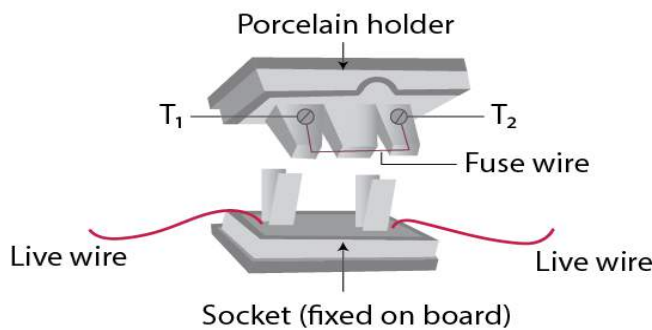
Porcelain is an insulator of electricity. Hence, the fuse wire is fitted in a porcelain casing

Question: 5

How is a fuse put in an electric circuit? State the purpose of using a fuse in a circuit.

Solution:

Since porcelain is an insulator of electricity, hence the fuse wire is stretched between the two metallic terminals T_1 and T_2 in a porcelain holder. This holder fits into a porcelain socket having two metallic terminals to each of which the live wire of the circuit is connected. Thus the fuse wire gets connected in the live wire. The diagram below showing the fuse arrangement

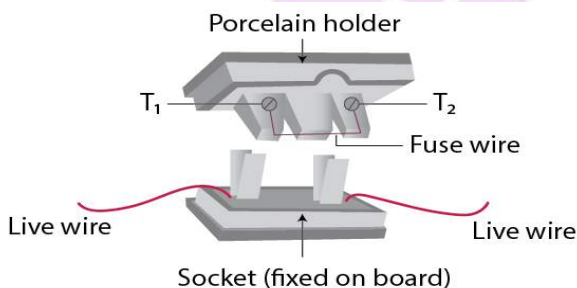


In order to safeguard the fuse from the flow of excessive current through it, a fuse is connected with each electrical appliance.

Question: 6

Describe with the aid of a diagram some form of a fuse, which is used in the electric lighting circuit of a house. Give two reasons why a fuse must not be replaced by an ordinary copper wire.

Solution:



The most common fuse arrangement is shown in the above figure. In this fuse arrangement the fuse wire is stretched between the two metallic terminals T_1 and T_2 in a porcelain holder (since porcelain is an insulator of electricity). This holder fits into a porcelain socket having two metallic terminals to each of which the live wire of the circuit is connected.

Copper has very low resistivity and high melting point. Thus fuse must not be replaced with a copper wire.

Question: 7

A fuse is always connected in the live wire of the circuit. Explain the reason.

Solution:

If the fuse is put in the neutral wire, then due to some defect in the appliance an excessive current flows in the circuit, the fuse blows off and current stops flowing in the circuit, but the appliance remains connected to the high potential point of the supply through the live wire. Now if a person touches the faulty appliance, he gets an electric shock because the person comes in direct contact of the mains through the live wire. Therefore the fuse is always connected in the live wire of the circuit.

Question: 8

How does the (i) thickness and (ii) length of a fuse wire depend on its current rating?

Solution:

- (i) The current rating of the fuse wire is directly proportional to the thickness of the fuse wire. Higher the thickness of fuse wire, higher will be the current rating.
- (ii) The current rating of the fuse wire is independent on its length.

Question: 9

Two fuse wires are rated 5 A and 20 A. Which of the two is (i) thicker, (ii) longer?

Solution:

- (i) More the thickness of wire, more will be the current and thus more electrons can pass through a greater area. Therefore 20 A wire will be more thicker than the 5 A wire.
- (ii) Both fuse wires may be of same length.

Question: 10

Explain the meaning of the statement ‘the current rating of a fuse is 5 A’

Solution:

The current rating of a fuse is 5 A means that the fuse wire will melt if current exceeds 5 A in the circuit.

Question: 11

‘A fuse is rated 8 A’. Can it be used with an electrical appliance of rating 5 kW, 200 V?

Solution:

The safe limit of current which can flow through the electrical appliance is $I = P / V$

Now,

Substituting 5 kW and 200 V in $I = P / V$, we get

$$I = P / V$$

$$I = 5000 / 200$$

$$I = 25 \text{ A}$$

25 A is greater than 8 A.

Hence, such fuse cannot be used

Question: 12

An electrical kettle is rated 3 kW, 250 V. Give reason whether this kettle can be used in a circuit which contains a fuse of current rating 13 A.

Solution:

The safe limit of current for kettle is $I = 3000 / 250 = 12 \text{ A}$

Yes, this kettle can be used in a circuit which contains a fuse of current rating 13 A as the safe limit of current for kettle is 12 A.

Question: 13

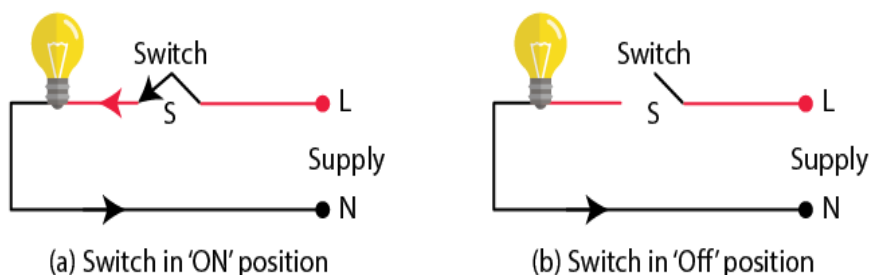
(a) What is the purpose of a switch in a circuit?

(b) Why is the switch put in the live wire?

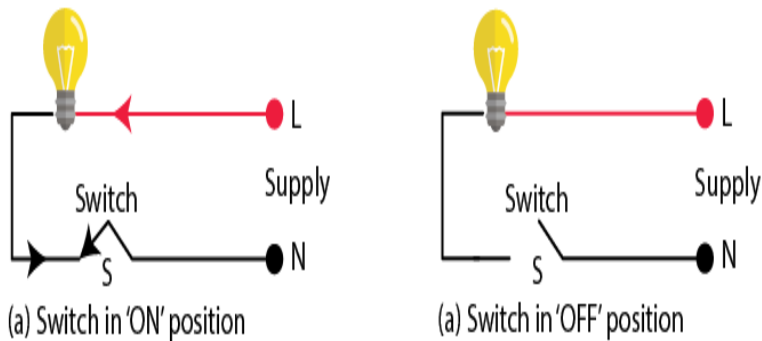
(c) What precaution do you take while handling a switch?

Solution:

A switch is an on-off device for current in a circuit (or in an appliance). It is connected in the live wire. The appliance gets connected to the high potential point through the live wire. The current flows in the appliance because the circuit is complete as the neutral wire provides the return path for the current. In the off position of the switch, the circuit is incomplete and no current reaches the appliance through the live wire.



If switch is connected in the neutral wire, then in off position, no current passes through the bulb. But in the off position of switch, the appliance remains connected to the high potential terminal through the live wire.



Therefore, it is deceptive and dangerous to connect a switch in the neutral wire. Safety precaution while using a switch: A switch should never be touched with wet hands.

Question: 14

(a) A switch is not touched with wet hands while putting it on or off. Give a reason for your answer.

(b) Name the wire to which a switch is connected.

Solution:

(a) If water reaches the live wire, it forms a conducting layer between the hand and the live wire of the switch due to which a current passes to the hand through it and the person may get a fatal shock. For this reason, the switch should never be touched with wet hands.

(b) The switch is connected to the live wire.

Question: 15

It is dangerous to connect the switch in the neutral wire. Explain your answer.

Solution:

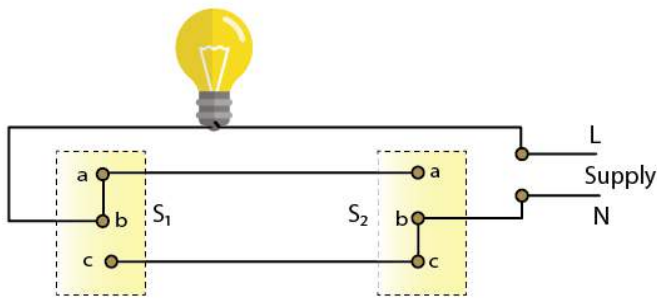
It is dangerous to connect the switch in the neutral wire in case of excessive current. The fuse blows off due to excessive current and the current stops flowing in the circuit. But the appliance still remains connected to the high potential point of the supply through the live wire. Now, if the person touches the body of that appliance, he gets an electric shock. Thus it is highly unsafe to use fuse in the neutral wire.

Question: 16

Draw a circuit diagram using the dual control switches to light a staircase electric light and explain its working.

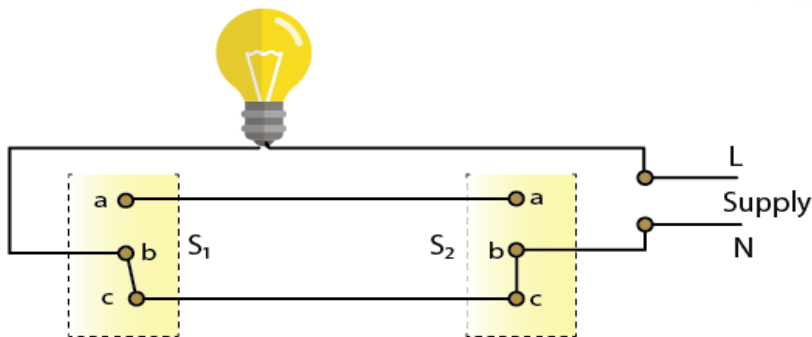
Solution:

Two switches S_1 and S_2 are used. Switch S_1 is fitted at the bottom and the switch S_2 at the top of the staircase. The off position of the bulb is shown in figure (a)



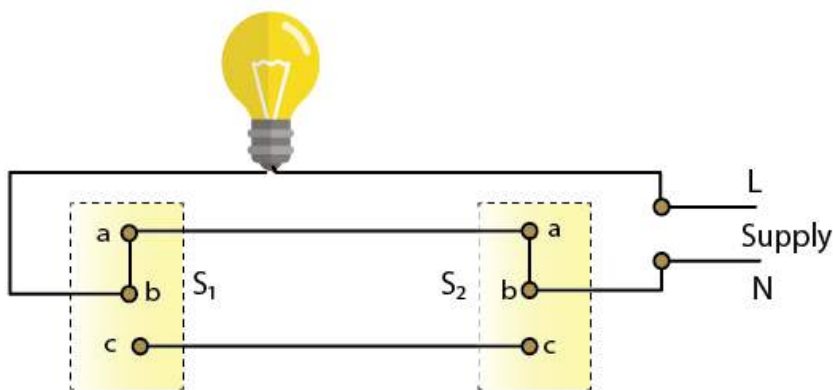
(a) Bulb off

The bulb can now be switched 'on' by either the switch S_1 or the switch S_2 independently. If the switch S_1 is operated, the connection 'ba' is changed to 'bc', which completes the circuit and the bulb lights up [as shown in figure (b) below]



(b) Bulb on through switch S_1

Similarly, the connection 'bc' changes to 'ba' on operating the switch S_2 , which again completes the circuit [as shown in figure (c) below]



(c) Bulb on through switch S_2

Similarly, one can switch off the bulb either from the switch S_1 or the switch S_2 if the

bulb is in on position as shown in figure (b) or (c).

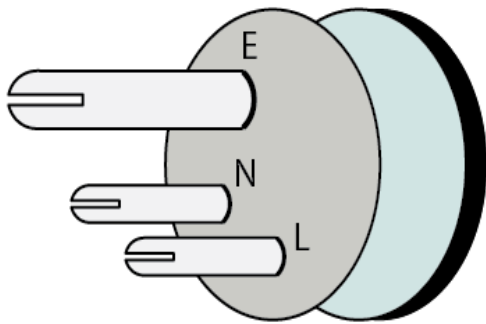
Question: 17

What purpose is served by the terminals of a three way pin plug? Draw a diagram and name the pins.

Solution:

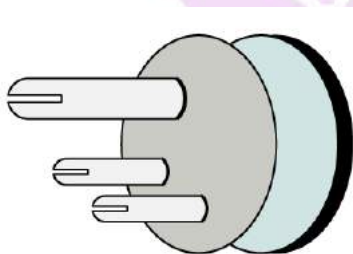
To connect the appliance to the electric supply, all electrical appliances are provided with a cable having a plug at one end.

In this three pin plug, the top pin is for earthing, the pin on the left is for live and the pin on the right is for neutral. In the good quality plugs, these are marked as E, L and N respectively.



Question: 18

The diagram in fig. shows a three pin plug. Label the three pins.

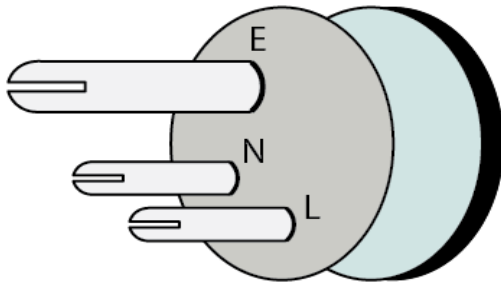


(a) Why is top pin thicker and longer than the other two?

(b) Why are the pins splitted at the ends?

Solution:

The three pins in the plug are labelled as E, L and N



Here E signifies the earth pin,
L is for live wire and
N is for neutral wire

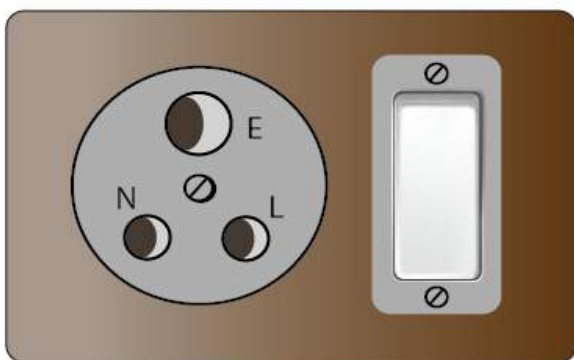
(a) The earth pin is made long so that the earth connection is made first. This ensures the safety of the user because if the appliance is defective, the current passes to the earth as soon as the live pin gets connected and the fuse blows off. The earth pin is made thicker because even by mistake it cannot be inserted into the hole of the live or neutral connection.

(b) The pins are splitted at the ends to provide a spring action so that they fit in the socket holes tightly.

Question: 19

Draw a labelled diagram of a three pin socket.

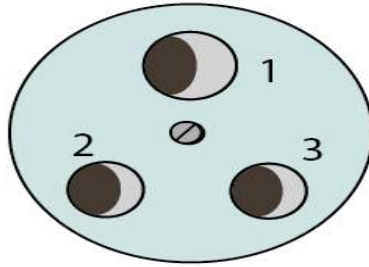
Solution:



Here E is for earth pin, N for neutral wire pin and L for live wire pin

Question: 20

The diagram in Fig. shows a three-pin socket marked as 1, 2 and 3.



- (a) Identify and write live (L), neutral (N) and earth (E) against the correct number.
(b) To which part of the appliance is the terminal 1 connected?
(c) To which wire joined to 2 or 3, is the fuse connected?

Solution:

- (a) 1 – Earth, 2 – Neutral and 3 - Live
(b) Terminal 1 is connected to the outer metallic case of the appliance
(c) The fuse is connected to live wire joined to 3 because in case of excessive flow of current fuse melts first and breaks down the circuit to protect appliances.

Question: 21

What do you mean by the term local earthing? Explain how it is done.

Solution:

Local earthing is done in the house near the kWh meter. For this purpose, a hole nearly 2 – 3 metre deep is dug in the ground. A copper rod covered by a hollow insulating pipe, is inserted in the hole. A thick copper plate of dimensions 50 cm × 50 cm is welded at the lower end of the copper rod and it is buried inside the ground. The plate is surrounded by a mixture of charcoal and salt to make a good contact between the plate and the earth. Water is poured through the pipe from time to time to keep the ground damp. This forms a conducting layer between the plate and the ground. The upper end of the copper rod is joined to the earth connection at the kWh meter.

Question: 22

To which wire is the metallic case of an electric appliance connected? Give the reason?

Solution:

When the live wire of a faulty appliance comes in direct contact with its metallic case due to some reason then the appliance acquires the high potential of the live wire. A person touching the appliance will get a fatal shock because current flows through his body to the earth. But if the appliance is properly earthed, then as soon as the live wire comes in contact with the metallic case, a heavy current flows to the earth through the case of the appliance. The fuse connected in the circuit of appliance blows off. Hence, the appliance gets disconnected from the mains supply.

Question: 23

(a) The earthing of an electric appliance is useful only if the fuse is in the live wire.

Given the reason.

(b) Name the part of the appliance which is earthed.

Solution:

(a) If the fuse is in the neutral wire, then although the fuse burns due to the flow of heavy current, but the appliance remains at the supply voltage so that on touching the appliance current flows through the appliance to the person touching it. Hence, the fuse must be connected in the live wire only.

(b) The part of the appliance which is earthed is the metallic case.

Question: 24

For earthing an electrical appliance, one has to remove the paint from the metal body of the appliance where the electrical contact is made. Explain the reason.

Solution:

The paint provides an insulating layer on the metal body of the appliance. Therefore the paint must be removed from the body part where connection is to be made to make earth connection.

Question: 25

What is the colour code for the insulation on (a) live, (b) neutral and (c) earth wire?

Solution:

According to the new international convention

(a) Brown for live wire

(b) Light blue for neutral wire and

(c) Green or yellow for earth wire

Question: 26

Name the colour code of the wire which is connected to (i) metallic body of an appliance, (ii) switch for the appliance.

Solution:

(i) The colour code of the wire which is connected to metallic body of an appliance is the green colour i.e., earthing wire.

(ii) The colour code of the wire which is connected to switch of the appliance is red colour i.e., live wire.

Question: 27

How does the colour code of wires in a cable help in house wiring?

Solution:

The colour coding of wires in the circuit of house wiring helps us to connect the switch, fuse, sockets, etc. through proper wire.

Question: 28

A power circuit uses a cable having three different wires.

(a) Name the three wires of the cable.

(b) Between which of the two wires should the heating element of an electric geyser be connected?

(c) To which wire should the metal case of the geyser be connected?

(d) To which wire should the switch and fuse be connected?

Solution:

(a) The three wires of the cable are live wire, earth wire and neutral wire

(b) The heating element of an electric geyser should be connected between live wire and neutral wire

(c) The metal case of the geyser should be connected to earth wire

(d) The switch and fuse should be connected to live wire

Question: 29

State two circumstances when one may get an electric shock from an electric gadget.

What preventive measures must be provided with the gadget to avoid it?

Solution:

An electric shock may be caused from an electrical gadget in the following cases

(i) If the fuse is put in neutral wire, due to some defect in the appliance an excessive current flows in the circuit, the fuse burns and the current stops flowing in the circuit. But the appliance still remains connected to the high potential point of the supply through the live wire. If a person touches the faulty appliance in this situation, he gets an electric shock because the person will come in contact of the mains through the live wire.

Preventive measure: The fuse must always be connected in the live wire.

(ii) When the live wire of a faulty appliance comes in direct contact with its metallic case due to break of insulation after its constant use, the appliance acquires the high potential of the live wire. A person touching the appliance will get a fatal shock because current flows through his body to the earth.

Preventive measure: Proper 'earthing' of the electric appliance should be done

Question: 30

Why is it necessary to have an earth wire installed in a power circuit, but not in a lighting circuit?

Solution:

It is necessary to have an earth wire installed in a power circuit because power circuit

carries high power and costly devices. It can damage the device if there is some unwanted power signal in the wire. To reduce this effect earth wire is necessary.

MULTIPLE CHOICE TYPE

Question: 1

The rating of a fuse connected in the lighting circuit is:

- (a) 15 A
- (b) 5 A
- (c) 10 A
- (d) Zero

Solution:

The rating of a fuse connected in the lighting circuit is 5 A

Question: 2

A switch must be connected in the:

- (a) live wire
- (b) neutral wire
- (c) earth wire
- (d) either earth or neutral wire

Solution:

A switch must be connected in the live wire