8. Electricity

- ELECTRICITY: “Is the rate of flow of electrons”. $i = \frac{q}{t}$
- To keep electrons move, potential difference is needed. This is done by a cell or battery.
- Potential difference “is the amount of work done in moving a unit positive charge from one point to other.”
  Potential difference V = Work done (W) / charge moved (Q)
  Or W = QV but charge = it
  Hence, W = VIt or Electrical energy = VIt
- Power is “Rate of doing work”
  P = W/t = VIt/t = VI
  Power is measured in watt or J S^{-1}
  1 Watt = 1 Volt × 1 Ampere
- S.I. unit of charge is coulomb (C).
  S.I. unit of current is Ampere (A).
  S.I. unit of P.D. is volt.
  S.I. unit of electrical energy is Joule (J) and of power is watt (W)
  1 kWh-3600000J = 3.6 x 10^6 J
- ELECTRIC power is generated at the GENERATING STATION at 11000 volt, or 11 kV as these stations are at very far off place from areas where it is to be used. The voltage (A.C.) is of 50 HZ frequency.
- AT GRID SUB-STATION this alternating current (A.C) voltage is stepped up from 11 kV to 132 kV to minise the loss of energy in transmission line wires.
- At MAIN-SUB-STATION this voltage is stepped down from 132 kV to 33 kV and transmitted to city SUB-STATION.
- At CITY SUB STATION, it is further stepped down from 33 kV to 220 V for supply to hourses for consumers.
- Colour coding: Live wire — Red or Brown
  Neutral—Black or light blue
  Earth wire — Green or yellow
- 1 kWh = 1 unit: Power Rating on an appliance 100 W – 220 V means the appliance when worked on a 220 V will consume 100 W electricity power
- OVER LOADING: is the condition of Electric circuit, when it draws more current than it is designed for i. e. when a number of appliances are switched on at a time i.e. geyser, A.C. Electric motor etc. or a large number of plugs are put in the same socket.
- EARTHING: is done in a house near the kWh meter. Earthing is a safety device which puts the appliance at zero potential.
- SHORT CIRCUITING: If the insulation on the wire of cable used f in the wiring (or used with an appliance) breaks. The LIVE WIRE
  COMES IN CONTACT WITH THE NEUTRAL WIRE, this result in SHORT CIRCUITING
- FUSE: “Is a device used to limit the current in an electric circuit”. The use of fuse protects the appliance in circuit from being damaged Fuse is always connected in live wire. A fuse wire should have
  (i) High resistance
  (ii) Low melting point.
  These days miniature circuit breakers (MCB) are used. It is AUTOMATIC breaker, when current flowing excess.
- Appliances in a house are connected in parallel.

Test yourself

A. Objective Questions

1. Write true or false for each statement:

(a) A fuse wire has a high melting point.
Answer. False.

(b) Flow of protons constitutes electric current.
Answer. False.

(c) Silver is an insulator of electricity.
Answer. False.

(d) S.I. unit and commercial unit of electrical energy are same.
Answer. False.

(e) Overloading of electric current in circuits can lead to short circuiting.
Answer. True.

(f) Our body can pass electricity through it.
Answer. True.

(g) All metals are insulators of electricity.
Answer. False.

(h) The earth wire protects us from an electric shock.
Answer. True.

(i) A switch should not be touched with wet hands.
Answer. True.

(j) AH electrical appliances in a household circuit work at the same voltage.
Answer. True.

(k) In a cable, the green wire is the live wire.
Answer. False.

(l) A fuse is connected to the live wire.
Answer. True.

(m) A switch is connected to the neutral wire.
Answer. False.

2. Fill in the blanks

(a) The unit in which we pay the cost of electricity is **kWh.**
(b) The electrical energy consumed in a house is measured by **kWh meter.**
(c) In a household electrical circuit, the appliance are connected in **parallel** with the mains.
(d) A switch is connected to the **live** wire.
(e) The red colour insulated wire in a cable is the **live** wire.
(f) One kilowatt hour is equal to **3.6 x 106** joule.
(g) A fuse wire should have low **melting point.**

3. Match the following

Column A	**Column B**
(a) Electric power	**(i) volt**
(b) kWh	**(ii) joule**
(c) Electric current	**(iii) volt × ampere**
(d) Electric energy	**(iv) watt**
(e) watt	**(v) ampere**
(f) potential difference	**(vi) electrical energy**

Ans.

Column A	**Column B**
(a) Electric power	(iv) watt
(b) kWh	(vi) electrical energy
(c) Electric current	(v) ampere
(d) Electric energy	(ii) joule
(e) watt	(iii) volt × ampere
(f) potential difference	(i) volt

4. Select the correct alternative

(a) All wires used in electric circuits should be covered with

1. colouring material
2. conducting material
3. **an insulating material**
4. none of the above

(b) Electric work done per unit time is

1. electrical energy
2. electric current
3. electric voltage
4. **electrical power**

(c) One kilowatt ¡s equal to

1. 100 watt
2. **1000 watt**
3. 10 watt
4. none of these

(d) Fuse wire is an alloy of

1. **tin-lead**
2. copper-lead
3. tin-copper
4. lead-silver

(e) A fuse wire should have

1. **a low melting point**
2. high melting point
3. very high melting point
4. none of the above

(f) When switch of an electric appliance is put off, it disconnects

1. **the live wire**
2. the neutral wire
3. the earth wire
4. the live and the neutral wire

(g) The purpose of an electric meter in a house is

1. to give the cost of electricity directly
2. **to give the consumption of electrical energy**

3. to safeguard the circuit from short circuiting
4. to put on or off the mains.

(h) If out of the two lighted bulbs in a room, one bulb suddenly fuses, then

1. other bulb will glow more
2. other bulb will glow less
3. other bulb will also fuse
4. **other bulb will remain lighted unaffected.**

B. Short/Long Answer Questions

Question 1.
From where does the electricity come to our home ?
Answer:
In our homes electricity comes from the CITY SUBSTATION.

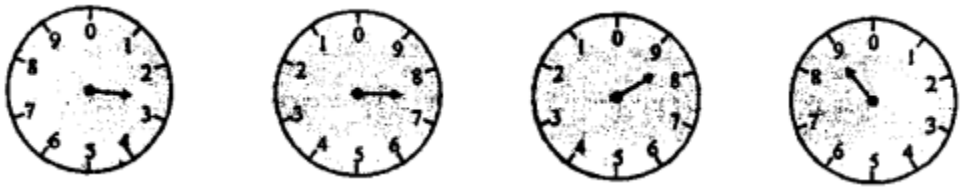
Question 2.
What is an electric meter ? Where is it fixed in our house ?
Answer:
ELECTRIC METER : Is ENERGY meter or kWh meter and measures the amount of electric energy consumed in kWh for which electricity bill is paid.
It is connected through a cable after company fuse on the front or outside wall of the house.

Question 3.
State the purpose of kWh meter.
Answer:
Purpose of kWh meter is to measure the electric energy consumed in kWh for which the electricity bill is to be paid. i.e. units of energy consumed.

Question 4.
For which unit do we pay our electricity bill ?
Answer:
UNIT — is boad of trade unit i. e. kWh = 1000 W used in 1 hour.

Question 5.
How can you check just by seeing the meter whether the electricity is in use or not ?
Answer:
If the electricity is in use, the counter fixed on the armature ofthe meter rotates and reads the number of rotations
(A red mark is seen rotating).

Question 6.
The diagram below in figure shows the reading on the dials of a meter. State what is its reading.



Answer:
The reading 2 7 8 9
is 2 7 8 9

Question 7.
One day the meter reading is found to be 7643 units while next day, it was 7657 units. What is the consumption of electricity in a day ?
Answer:
Final reading 7657 units
Initial reading 7643 units
Consumption of electricity in a day
=Final reading-initial reading
= 7657 – 7643
= 14 units.

Question 8.
A source of potential difference V volt sends current I ampere in a circuit for time t second. Write expressions for
(a) electrical energy supplied by the source, and
(b) electrical power spent by the source.
Answer:
Potential difference V is the work done in moving a unit charge
∴ Work done in moving a charge Q through pot. diff. V = QV
i.e. W = QV
but = Q / t = I Or Q = It
∴ W = VIt
Work done = Electrical energy
(a) :. Electrical energy = VIt is the expression
(b) Power ¡s the rate of doing W

$$P = \frac{W}{t} = \frac{VIt}{t} = VI$$

P = VI is the expression.

Question 9.
Name the unit in which you pay the cost of your electricity bill. How is it related to joule ?

Answer:
UNIT in which the electricity bill is charged is board of TRADE
UNIT = kWh
1 Unit = kWh=3600000 J = 3.6×10^6 J
1 kWh= 3.6×10^6 J

Question 10.
If an appliance of power P watt is used for time t hour. How much electrical energy is consumed in kWh.
Answer:
Power P = $\frac{W}{t}$ = Electrical energy / t
.'. Electrical energy = P × t

Question 11.
What is an electric fuse ? State its purpose in the household electrical circuit.
Answer:
FUSE: "Is a safety device which is used to limit the current in an electric circuit.
PURPOSE OF FUSE IN HOUSE HOLD CIRCUIT : It safe guards the circuit and the appliancesrconnected in the circuit from being damaged if the current in the circuit exceeds the specified value due to voltage fluctuation or short circuiting.

Question 12.
State one property of the material of a fuse wire.
Answer:
Two CHARACTERISTICS OF FUSE WIRE are:
(i) Has LOW MELTING POINT.
(ii) Has HIGH RESISTANCE.

Question 13.
Name the material of a fuse wire.
Answer:
MATERIAL used is an ALLOY of LEAD (50%) and TIN 50% having low M.P. of200°C

Question 14.
Can we use copper wire as a fuse wire ? Give reason.
Answer:
Copper wire cannot be used as a fuse wire since meting point of Cu is higher and resistance is very low and current can flow through it without melting it and without breaking the circuit.

Question 15.
How does a fuse protect the electric wiring (or an appliance) from being damaged ?
Answer:

Due to voltage fluctuations or insulation on the wire of cable gets worn and tom (breaks), the live wire comes in contact with neutral wire and results in SHORT CIRCUIT. To prevent this damage, a fuse is used in the LIVE WIRE. The fuse wire gets heated up to the extent that it melts, a gap is produced in the live wire and the circuit becomes incomplete, no current flows and the appliance is saved.

Question 16.
Which fuse wire is thick : 5 A or 15 A ?
Answer:
∴ R α l/a
More the area, lesser is the resistance and more is the current flowing.
∴ 15 A fuse wire is thick.

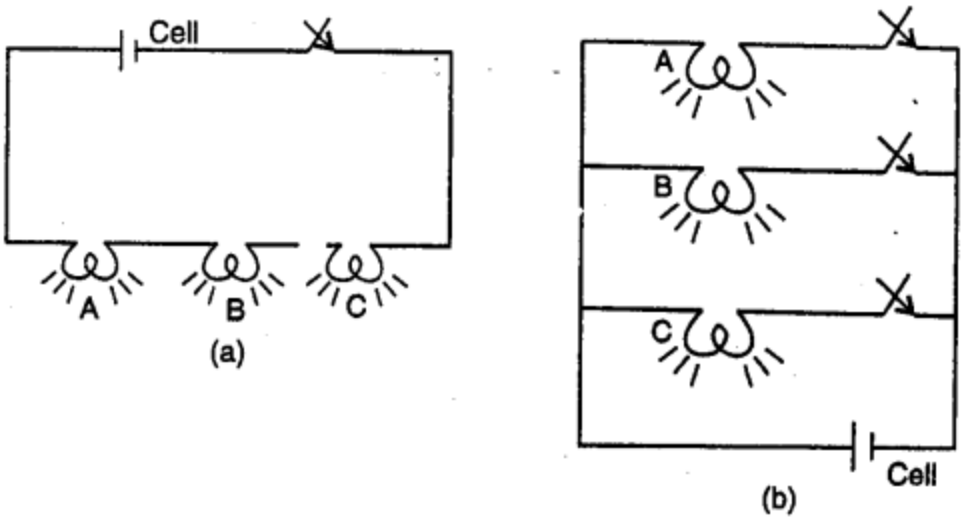
Question 17.
Write the full form of M.C.B.
Answer:
Miniature Circuit Breaker.

Question 18.
How is M.C.B. superior to the fuse wire ?
Answer:
M.C.B.automaticallyfalldownandswitchoffthecircuitinvery short time, when excessive flow of electric current in a circuit. It is raised up after the fault is rectified.

Question 19.
With which wire: live or neutral is the fuse wire connected?
Answer:
Fuse is connected with LIVE WIRE.

Question 20.
What do you mean by short circuiting of a circuit ?
Answer:
SHORTCIRCUIT: Iftheinsulation on the wire of cable used in
the wiring (or used with an appliance) breaks, THE LIVE WIRE COMES IN CONTACT WITH THE NEUTRAL WIRE, This results in a SHORT CIRCUIT.

Question 21.
Figure shows two ways of connecting the three bulbs A, B and C to a battery. Name the two arrangements. Which of them do you prefer to use in a household circuit ? Give a reason to support your answer.



Answer:
(a) is SERIES arrangement .
(b) is parallel arrangement.
A PARALLEL arrangement of bulbs is preferred as if one ofthe bulbs gets fused, the other two will keep glowing.

Question 22.
How are the electrical appliances connected in a house circuit: in series or in parallel ? Give reason.
Answer:
ELECTRICAL appliances in a house are connected in PARALLEL as :
(i) Each appliance gets full voltage as resistance in parallel becomes low.
(ii) If fuse of one appliance is fails it does not effect the working of other appliances.
(iii) We can light one bulb without lighting the other bulbs.

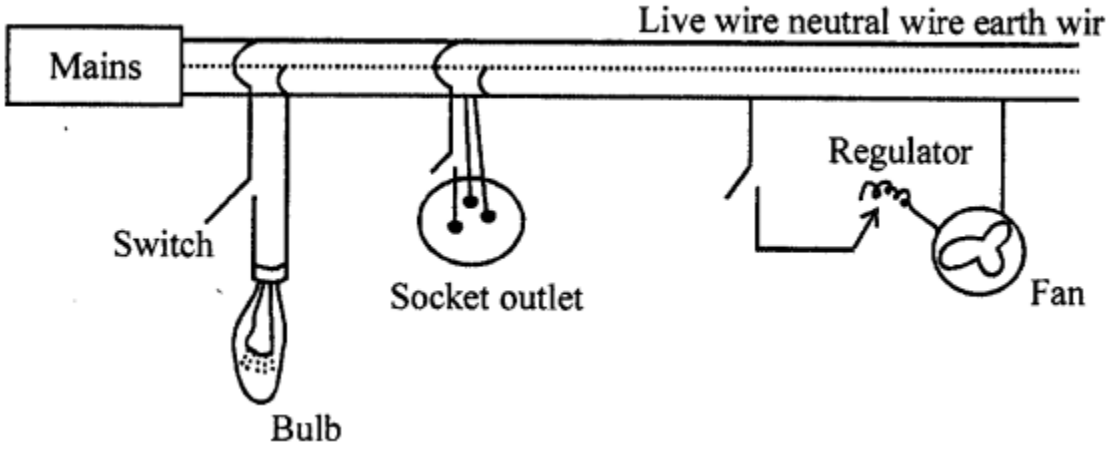
Question 23.
In the household electric circuit, if one bulb is fused in a room, the other bulbs keep glowing. Explain the reason.
Answer:
In the house hold electric circuit the appliances are connected in parallel and each appliance has an independent path for current and work at the same voltage. Hence, if one bulb in a room is fused, the other bulbs keep glowing.

Question 24.
State the voltage at which electricity is supplied to our houses.
Answer:
Electricity voltage is supplied to our houses at 220 volt.

Question 25.
Draw a labelled diagram with the necessary switches to connect a bulb, a fan and a

plug socket in a room with the mains. In what arrangement will you connect them to the mains ?

Answer:

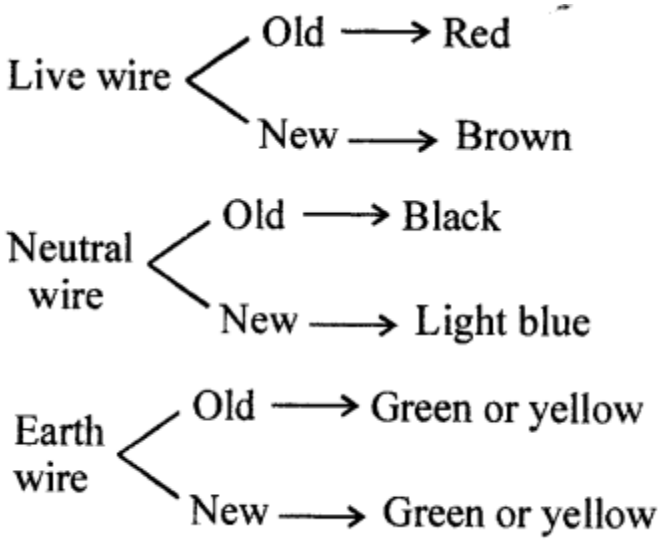


Question 26.

State the colour coding of the three wires in a cable used for

Answer:

COLOUR CODING OF THREE WIRES :



Question 27.

Why is the metal covering of an electrical appliance earthed?

Answer:

EARTHING OF THE APPLIANCE : To protect from the electric shock electric appliance is earthed. Sometimes due to break of insulation of wires, live wire comes in contact with the body of appliance and we get a fatal shock when the appliance is touched. If the appliance is earthed, the current will pass to the earth and we remain protected from the electric shock.

C. Numericals

Question 1.
An electrical appliance is rated as 60 W – 150 V.
(a) What do you understand by this statement ?
(b) How much current will flow through the appliance when in use ?
Answer:
(a) 60 W -150 V power rating of appliance means, “If appliance is put in circuit on 15 0 volt, it will consume 60 w electrical power i.e. electric energy consumed by it in 1 sec. is 60 J.
(b) P = VI
∴ Current will through the appliance

$$I = \frac{P}{V} = \frac{60\ w}{150\ v} = 0.4\ A$$

Question 2.
An electric iron of power 1.5 kW is used for 30 minute to press the clothes. Calculate the electrical energy consumed in (a) kilowatt hour (b) joule.
Answer:

$P = \frac{w}{t}$ ∴ Eelectrical energy W = P × t

P = 1.5 kW t = 30 minute = $\frac{30}{60} = \frac{1}{2}$ hr

$1.5 \times \frac{1}{2}$ = 0.75 kwh
(b) 1 kWh = 3.6×10^6 J
∴ 75 kWh =$0.75 \times 3.6 \times 10^6$
= 2.700×10^6
= 2.7×10^6 J

Question 3.
Assuming the electric consumption per day to be 12 kWh and the rate of electricity to be ?6.25 per unit, find how much money is to be paid in a month of 30 days ?
Answer:
Electric energy consumed per day = 12 kWh = 12 units
Electric energy consumed in 30 days = 12 × 30 = 360
units Cost to be paid in 1 month = 360 × 6.25 = ₹ 2250

Question 4.
In a premise 5 bulbs each of 100 W, 2 fans each of 60 W, 2 A.Cs each of 1.5 kW are used for 5 h per day. Find :
(a) total power consumed per day,
(b) total power consumed in 30 days,

(c) totoal electrical energy consumed in 30 days.
(d) the cost of electricity at the rate of ₹ 6.25 per unit.

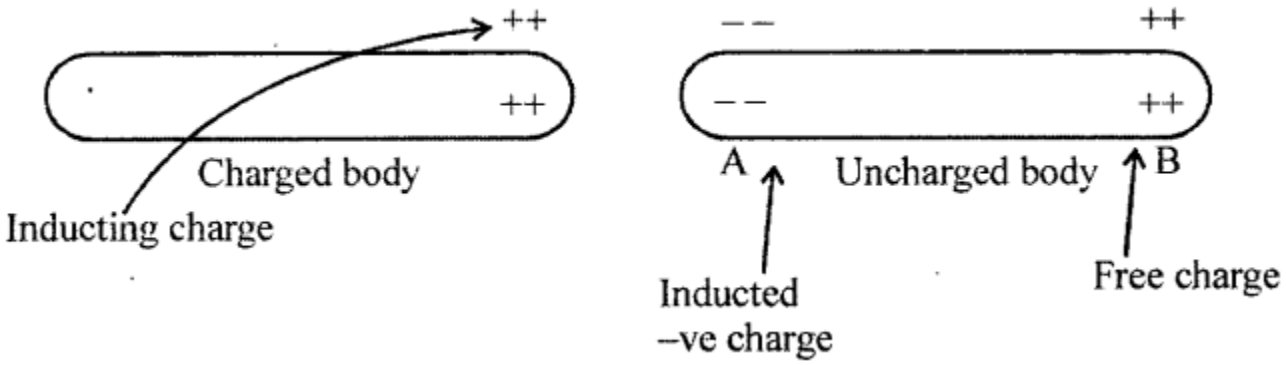
Answer:

Power consumed by
5 bulbs = 5 × 100 = 500 W
2 fans = 2 × 60= 120 W
2 A.C = 2 × 1.5 x 1000 = 3000 W
(a) Total power consumed per day = 3620 W
(b) Total power consumed in 30 days = $\frac{3620}{1000}$ × 30 = 108.6 kw
(c) Electric energy is used for 5 h per day.
Total electrical energy consumed in 30 days.
(d) Cost of electricity = P × t = 108.6 × 5 = 543 kWh
= 543 × 6.25 = ₹ 3393.75

Exercise 8 B

- **STATIC ELECTRICITY:** "The substances like glass, plastic, ebonite, amber, nylon etc. when rubbed with wool, fur or silk produces electric charge or static charge called static electricity."
- Glass rod when rubbed with silk, glass is charge positively and silk is negatively charged.
- Ebonite rubbed with fur, ebonite is charged negatively and fur is charged positively.
- Plastic comb rubber with dryhair is -vely charged. Rubber balloon rubbed with woollen cloth is negatively charged.
- Charged bodies (+ve or -ve) attract small pieces of paper, glass dust etc.
- Like charged REPEL each other and unlike charges ATTRACT each other i.e. +ve and negative attract and +ve repels +ve.
- Two rubber balloons rubbed with woollen cloth (each -vely charged) REPEL each other. A balloon charged -vely moves twoards wall (uncharged body) i.e. a charged body attracts uncharged body.
- CONDUCTORS : "Substances which allow electricity to flow through them are conductors, e.g. silver, copper, iron, aluminium — all metals human body, impure water, wet cloth, wet wood.
- INSULATORS or BAD CONDUCTOS or poor conductors : "Substances which do not allow the electricity to flow through them." e.g. Rubber, glass, mica, dry cloth or dry wood, polythene, wax, wool, pure water etc.
- Conductors can be charged by
  (i) Conduction
  (b) Induction
- CONDUCTION: A charged body when touches (or in contact with) uncharged body. Charge of the same kind is produced on uncharged body i.e. charge is shared.
- INDUCTION : When a charged body is brought near uncharged body the uncharged body is charged and charge remains on body so long as the charged body remains near the uncharged body. Nearer end gets oppositely charged called bound charge and farther

end has similar charge called free charge.



- ELECTROSCOPE: is a device which is used to detect the presence and nature (kind) of charge on a body,
  (i) pith ball pendulum and
  (ii) Gold leaf electroscope (GL.E.S.) are two devices.
- During thunder storm when a charged cloud passes over earth or other cloud, due to induction opposite charge is induced and a spark may occur between two oppositely charge clouds (as two nacked electric wires are brought near each other. As they come closer, a spark is produced with crackling sounds). This spark is called LIGHTNING
- LIGHTNING CONDUCTOR: is a device to save the high buildings from LIGHTNING

Test yourself

A. Short Answerwer Questions

1. Write true or false for each statement:

(a) The number of electrons and protons in an atom are same.
Answer. True.

(b) If the charge is not in motion, we call it static electricity.
Answer. True.

(c) Human body is a conductor of electricity.
Answer. True.

(d) When an ebonite rod is rubbed with fur, the electrons move from ebonite to fur.
Answer. False.
Correct: When an ebonite rod is rubbed with fur, the electrons move from fur to ebonite.

(e) When, glass rod is rubbed with dry silk cloth, the electrons move from glass to silk.
Answer. True.

(f) The cap of gold leaf electroscope is made of copper.
Answer. False.
Correct: The cap of gold leaf electroscope is of brass.

(g) If a glass rod rubbed with silk is brought near the cap of a negatively charged electroscope, the divergence of leaves will decrease.
Answer. True.

(h) In induction, a positively charged body can make an uncharged ‘ body positively charged.
Answer. False
Correct: In induction, a positively charged body can make an uncharged body negatively charged.

(i) A lightning conductor saves the building from lighting.
Answer. True.

(j) When a comb is rubbed with dry hair both comb and paper ‘ get similarly charged.
Answer. False.
Correct: A comb rubbed with hair and brought near pieces of r paper attracts them, because both have dissimilar charges.

(k) A glass rod rubbed with silk repels an ebonite rod rubbed with fur.
Answer. False.
Correct: A glass rod rubbed with silk attract an ebonite rod rubbed with fur.

(l) When a ebonite rod is rubbed with fur, the protons move from the ebonite rod to the fur.
Answer. False.
Correct: When a ebonite rod is rubbed with fur, the free electrons move from the fur to the ebonite rod.

(m) A conductor has a large number of free electrons.
Answer. True.

(n) An ebonite rod can be charged by touching it with a charged copper rod.
Answer. False.
Correct: An ebonite rod can be charged by not touching it with a charged copper rod, will be charged by induction method.

(o) To find whether a body is charged or not, an uncharged electroscope is used.
Answer. True.

(p) To find whether the charge on a body is positive or negative, an uncharged electroscope is used.
Answer. False.
Correct : To find whether the charge on a body is positive or negative, an charged electroscope is used.

(q) If a negatively charged rod is brought near a negatively charged pith ball electroscope, the pith ball will be stuck with the rod.
Answer. False.
Correct: If a negatively charged rod is brought near a positevely charged pith ball electroscope, the pith ball will be stuck with the rod.

2. Fill in the blanks

(a) Like charges **repel** while unlike charges attract.
(b) Mercury is a **conductor** of electricity while pure water is **insulator** of electricity.
(c) An ebonite rod when rubbed with fur acquires the **negative** charge.
(d) When an uncharged conductor is brought in contact with the disc of a gold leaf electroscope, its leaves **will remain un changed.**
(e) Charge is shared in charging a conductor by the method of **conduction.**

3. Match the following

Column A	Column B
(a) Two like charges	(i) negative charge
(b) Two unlike charges	(ii) repel
(c) Silver is a	(iii) insulator
(d) Silk is an	(iv) attract
(e) Ebonite rod rubbed with fur acquires	(v) conductor

Ans.

Column A	Column B
(a) Two like charges	(ii) repel
(b) Two unlike charges	(iv) attract
(c) Silver is a	(v) conductor
(d) Silk is an	(iii) insulator
(e) Ebonite rod rubbed with fur acquires	(i) negative charge

4. Select the correct alternative

(a) When a glass rod is rubbed with dry silk cloth, the charge acquired by the silk cloth is

1. positive
2. **negative**
3. both positive and negative
4. none of the above

(b) When an ebonite rod is rubbed with fur, the rod acquires

1. positive charge
2. **negative charge**
3. no charge
4. none of the above

(c) When a negatively charged body is brought closer to another negatively charged body, then they will show

1. attraction

2. no effect
3. **repulsion**
4. none of the above

(d) Charging a conductor by bringing another charged conductor close to it without touching is called

1. **induction**
2. conduction
3. convection
4. radiation

(e) The factor responsible for charging a conductor is

1. transfer of protons
2. transfer of neutrons
3. **transfer of electrons**
4. transfer of both protons and electrons

(f) Two objects when rubbed together get charged. The charges on them are

1. **equal and opposite**
2. equal and similar
3. unequal and similar
4. unequal and opposite

(g) When a glass rod is rubbed with silk, the glass rod and the silk get charged because

electrons are transferred from the silk to the glass rod

1. **electrons are transferred from the glass rod to the silk**
2. protons are transferred from the silk to the glass rod
3. protons are transferred from the glass rod to the silk

(h) The conductor of electricity is

1. wood
2. glass
3. ebonite
4. **human body**

(i) A gold leaf electroscope is to be charged positively by conduction. For this

1. a positively charged rod is held close to near the disc of electroscope
2. **a positively charged rod is placed in contact with the disc of electroscope**
3. a negatively charged rod is held near the disc of electroscope

4. a negatively charged rod is touched with the disc of electroscope

(j) A glass rod rubbed with silk is touched with the disc of a negatively charged gold leaf electroscope. The divergence of leaves will

1. **decrease**
2. increase
3. remain unchanged
4. first decrease and then increase.

(k) The rod in a gold leaf electroscope is made up of

1. wood
2. **brass**
3. glass
4. ebonite

(l) Lightning conductor is made up of:

1. **copper**
2. glass
3. ebonite
4. wood

B. Short/Long Answer Questions

Question 1.
What do you understand by electricity at rest ?
Answer:
When the charges are not allowed to flow are termed as static electricity, i.e., the electricity at rest.

Question 2.
Why does a plastic comb rubbed with dry hair attract bits of paper ?
Answer:
Plastic comb rubber with dry hair gets charged and attracts the bits of paper.

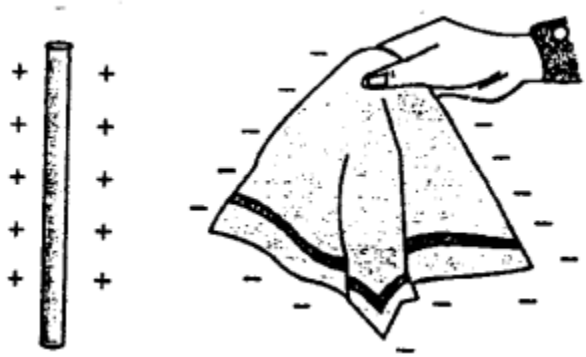
Question 3.
Who discovered the way of producing electricity by friction?
Answer:
Philospher Thales discovered it but it was satisfactorily explained by Dr Gilbert.

Question 4.
Name two substances which canbe charged by friction.
Answer:

(i) Glass.
(ii) Ebonite.

Question 5.
What are the two kinds of charges ?
Answer:
(i) Negative charge.
(ii) Positive charge.

Question 6.
A glass rod is rubbed with silk. State the kind of charge acquired by each.
Answer:
When a glass rod is rubbed with silk, the glass rod loses electrons to the silk piece. The glass rod has free electrons which are less tightly bound so get transferred to the silk cloth. The glass rod has defeciency of electrons and acquired apositive charge while the silk cloth acquires a negative charge.

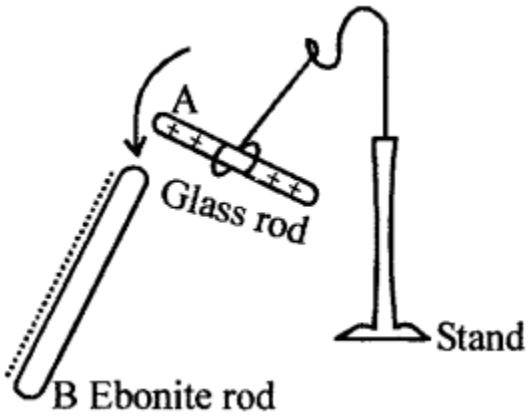


On rubbing, electrons wove from glass rod to silk

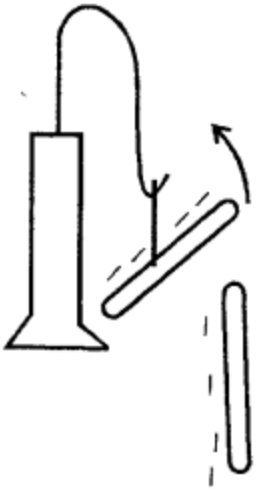
Question 7.
An ebonite rod is rubbed with fur. State the kind of-charge acquired by each.
Answer:
EXPERIMENT : TO DEMONSTRATE CHARGES ARE OF TWO KINDS:
EXPERIMENT: Take two glass rods A and B and charge each by rubbing them with silk.
Take two Ebonite rods C and D and charge each by rubbing with Fur or (flanel) suspend charged rod A by a thread in stand. Bring charged rod B near A.
A gets deflected (moves away) This show that A is repelled by B.
Now suspend charged rod C in a stand and bring charged rod D ‘ near C. Again repulsion is seen.
Now bring charged rod C near the suspended charged rod A. This time attraction is there between the two rods.
This prove that charges are of two kinds A and B have same kind of r charge called +ve charge and similar charge repels eachother where as rods C and D also have similar charge (-ve charge) and repel each other.
Rod A attracts rod C prove that opposite charges attract each other.

Question 8.
Describe an experiment to demonstrate that there are two r kinds of charges.
Answer:
Aim— To show that there are two kinds of charges.
Apparatus— gold leaf electroscope,
glass rod rubbed with silk cloth.
any two non-identical bodies say A and B.
Procedure—
(i) Charge the gold leaf electroscope positively by touching it with glass rod rubbed with silk cloth.
(ii) The gold leaf electroscope shows its charging by showing its leaves diverging.
(iii) Touch the brass cap of this electroscope with body A-Note the divergence of the gold leaves.
(iv) Now touch the brass cap with body Band note the divergence.
Observation— In case of body A—Leaves further diverge.
In case of body B — leaves converge.
Inference— Body A (positively charged)
Body B (negatively charged)
So there are two types of charges.

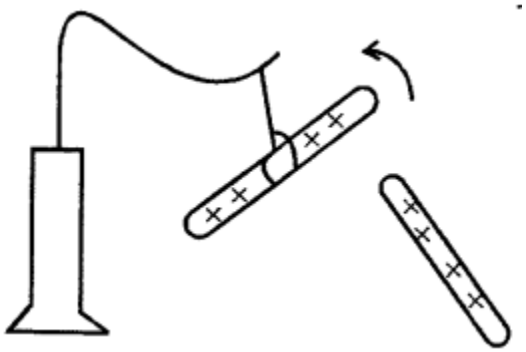
Question 9.
How will you show that like charges repel and unlike charges attract each other ?
Answer:
Experiment: Take a glass rod rubbed with silk piece (+vely charged) Suspend it in a stand with the help of a thread.
Bring a-vely charged Ebonite rod (rubbed with fur) near the glass rod.



Attraction is seen between the two rods. Now inter change them i.e. suspend B and bring A near it, again attraction is there. This show that unlike charges attract each other.



vely charged ebonite rods
Now take two glass rods (+vely charged) and bring them near each other, repulsion takes place. Similarly, if we take two -vely charged ebonite rods and suspend one of them and bring second rod near it again the suspended rod moves away showing repulsion between like charges.



+vely charged glass rods

Question 10.
A glass rod rubbed with silk is suspended near an ebonite r rod rubbed with fur. What will be your observation ? Give a reason to your answer.
Answer:
A glass rod rubbed with silk i.e. +vely charged is brought near ebonite rod rubbed with fur i.e. negatively charged ATTRACTION is seen f as they have opposite charge.

Question 11.
An ebonite rod rubbed with fur is suspended near another ebonite rod rubbed with fur. State your observation and give a reason to support your answer.
Answer:
Both ebonite rods are rubbed fur with have similar charge (-ve charge). We know like chafes repel each other.

∴ Rods repel each other.
Reason: Like charges REPEL each other.

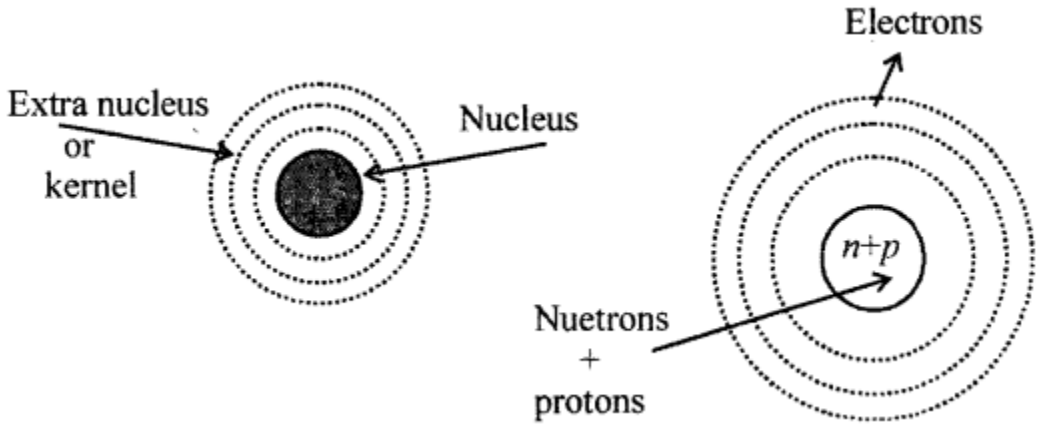
Question 12.
What do you mean by conservation of charges ?
Answer:
According to the Law of conservation of charge
"When two different bodies are rubbed together, both bodies get charged equally but with charges of opposite kind." Thus, the total charge of two bodies before and after rubbing remains the same.
Example : When an ebonite rod is-rubbed with fur, the electrons from the fur are transferred to the ebonite rod and therefore the ebonite rod becomes negatively charged (due to gain of eletrons), while the fur becomes equally positively charged (due to deficit of
same number of electrons). As the same no. of electrons are , exchanged by the ebonite rod and fur, the magnitude of charges main same but with opposite sign.

Question 13.
An ebonite rod is rubbed with fur. Compare the charges acquired by them.
Answer:
An ebonite rod is rubbed with fiir the electrons are transferred from fur to ebonite rod. Ebonite has excess of electrons is negatively charged and fur due to deficit of same number of electrons gets positive charge.

Question 14.
Name three constituents of an atom and state the kind of charge on each of them.
Answer:
The three constituents of an atom are:
(i) Protons — These carry positive charge.
(ii) Electrons — These carry negative charge.
(iii) Neutrons — They have no charge or are electrically neutral.

Question 15.
What is the net charge on an atom ?
Answer:
Net charge on atom is zero i.e. atom is neutral.

Question 16.
Briefly describe the structure of an atom.
Answer:
STRUCTURE OF ATOM:

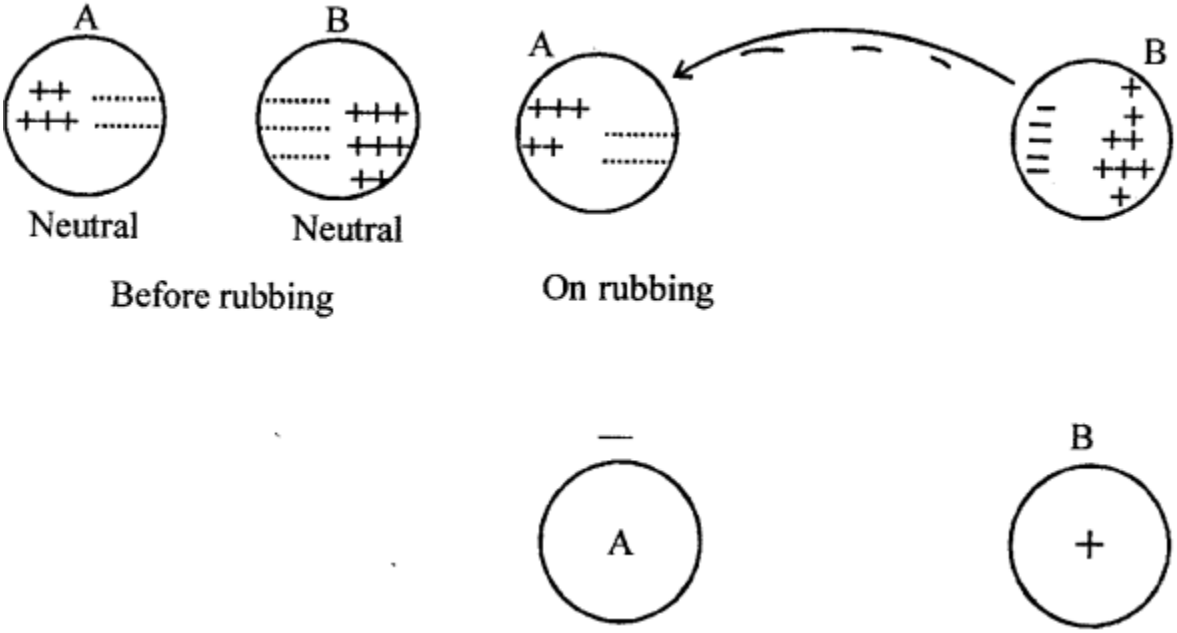


Atom : has equal number of +ve charge (protons) and -ve charge electrons and hence atom has no charge.
Neutrons (having no charge) and protons are present in nucleus. Electrons keep revolving around the nucleus in different shells.

Question 17.
What are free electrons ?
Answer:
FREE ELECTRONS. Electrons of the outermost orbit of a solid,
which can easily leave the atom and become free to move inside the solid are called FREE ELECTRONS.

Question 18.
What causes the charging of two objects when they are rubbed together ?
Answer:
CAUSE OF CHARGING OF TWO OBJECTS WHEN RUBBED:
Both objects before rubbing are neutral.
On Rubbing transfer of electrons from one object to other object takes place.
The body from which electrons are transferred gets DEFICIENT in ELECTRONS and becomes POSITIVELY charged.
The body to which electrons are transferred has EXCESS ELECTRONS and becomes

NEGATIVELY charged.



Question 19.
In each of the following cases, state which body loses electrons:
(a) A glass rod when rubbed with silk.
(b) An ebonite rod when rubbed with fur.
Answer:
A glass rod is rubbed with silk. Glass rod loses electrons and becomes positively charged.
Silk gains electrons and becomes negatively charged.
An Ebonite rod is rubbed with fur.
Fur loses electrons and acquires positive charge.

Question 20.
A glass rod is rubbed with silk. Explain the charging of the glass rod and the silk on the basis of electron movement.
Answer:
A glass rod is rubbed with silk. Glass rod loses electrons and becomes positively charged.
Silk gains electrons and becomes negatively charged.
Explanation: Suppose glass rod in neutral form has 10 protons and 10 electrons
i.e. 10 units of positive charge
and 10 units of negative charge.
While silk has (in neutral state) 7 electrons and 7 protons (suppose) i.e. 7 units of negative charge and 7 units of positive charge.
Suppose on rubbing together glass rod loses 2 electrons and silk gains 2 electrons.
Now glass rod has 8 electrons and 10 protons on it.
i.e. 8 units of negative charge and 10 units of positive charge i.e. glass rod has net 2

units of positive charge. Thus, glass rod has acquired positive charge.
Silk has now 9 units of negative charge and 7 units of positive charge i.e. silk has net 2 units of negative charge. Thus, silk has acquired negative charge.

Question 21.
An ebonite rod is rubbed with fur. Explain the charging of the ebonite rod and the fur on the basis of electron movement.
Answer:
An Ebonite rod is rubbed with fur.
Ebonite rod gains electrons and acquires negative charge while fur loses electrons and acquires positive charge.
Explanation. Same as in the above question.

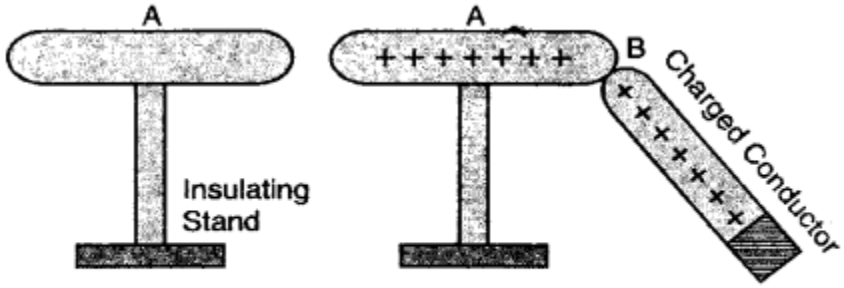
Question 22.
Distinguish between conductors and insulators of electricity.
Answer:
DISTINCTIONS BETWEEN CONDUCTORS AND INSULATORS OF ELECTRICITY:

CONDUCTORS	INSULATORS
(i) They allow the current electricity to flow through them.	Do not allow the current electricity to flow through them.
(ii) They have large number of free electrons.	They have small number of free electrons.
(iii) All metals like Ag,Cu, iron, gold, wet wood etc.	Cotton, dry wood, rubber, glass distilled water etc.
(iv) Conductors cannot be charged by rubbing.	Can be charged by rubbing.

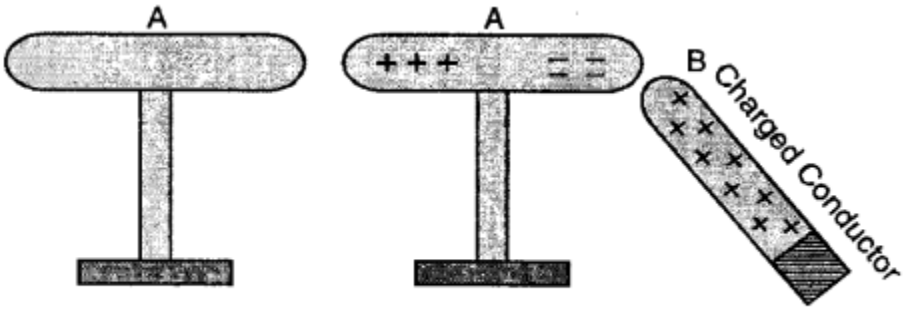
Question 23.
Give one example each of a conductor and an insulator of electricity.
Answer:

EXAMPLE of
CONDUCTOR: Hydrochloric acid INSULATOR: Mica.

Question 24.
State two ways of charging a conductor.
Answer:
The two methods of charging a conductor are:
(a) Conduction— The process of charging an uncharged conductor by touching with a charged conductor, the uncharged conductor shares the charge of the charged conductor.
(b) Induction— The process of charging an uncharged conductor with a charged conductor, without actually touching it is called induction. Here the nearer end of the uncharged conductor acquires a charge of Opposite nature as compared to the charge on a charged conductor.



Charging by conduction

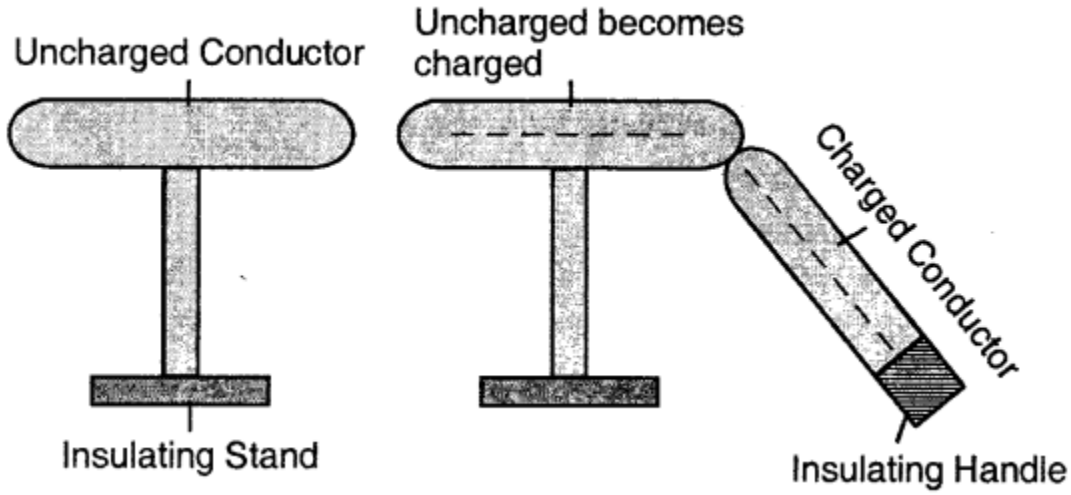


Charging by induction

Question 25.
Name the way of charging a conductor in which the charge is shared.
Answer:
By conduction.

Question 26.
Describe the method of charging a conductor by conduction.
Answer:
Conduction— The process of charging an uncharged conductor with a charged

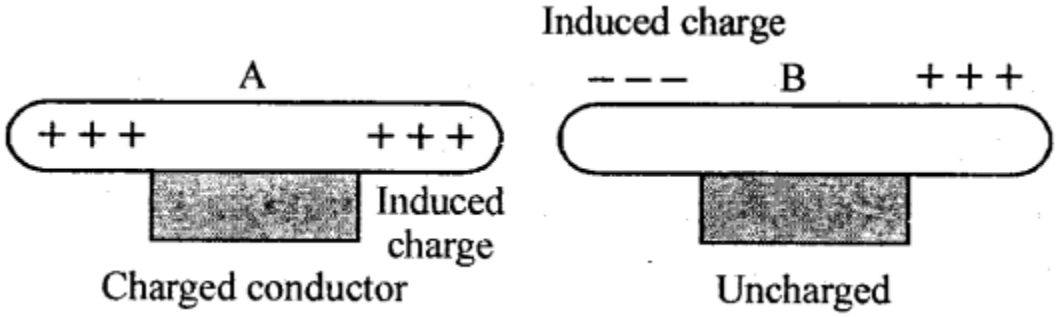
conductor by touching the uncharged one. Here the uncharged conductor shares the charge of the charged conductor.



Method of charging— Mount the uncharged conductor on an insulating stand take the charged conductor with an insulating handle to the uncharged conductor. If the charged conductor is positively charged then the uncharged will b^ charged positive and if the charged is negatively charged then the uncharged will be negatively charged.

Question 27.
A metal rod A is to be charged positively by using another charged rod B. What should be the kind of charge on the rod B if charging is to be done by conduction ?
Answer:
Road A is uncharged and Rod B is charged body.
A is to be charged positively by touching i.e. by conduction. So rod / B should have similar charge as is required by A i. e. +vely.
So rod B should be positively charged,
∴ By conduction same kind of charge is produced and shared by uncharged body.

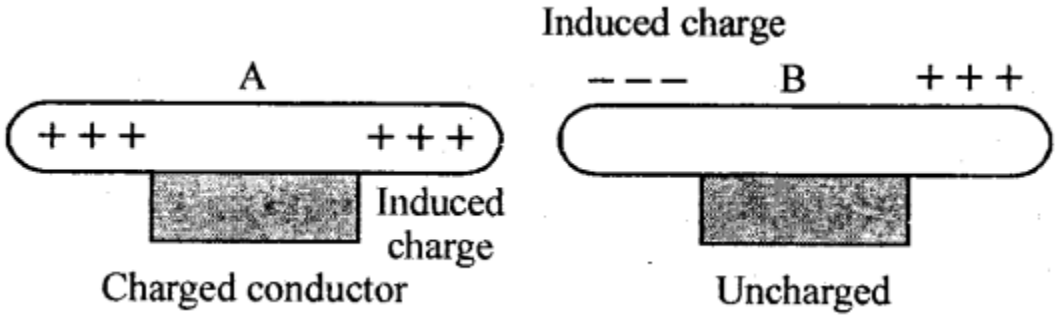
Question 28.
Explain the charging by conduction in terms of movement of electrons.
Answer:
CHARGING A CONDUCTOR BY CONDUCTION:



Place rod Aon an insulating stand and bring a +vely charged conductor B near A and touch it.

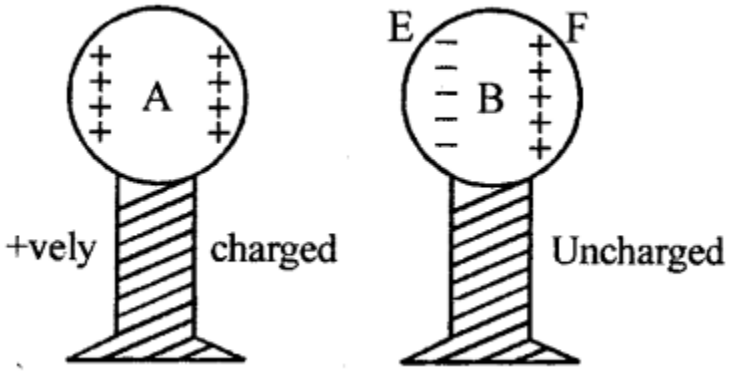
Charge from B is transferred on A till charge on both of them is same. Remove conductor B. A gets charged positively.
Explaination on the bases of electrons : Suppose body A (neutral rod) has 10 protons and 10 electrons. Body B is positively charged is deficient in electrons has 20 electrons and 30 protons. On touching B with A, 5 protons are transferred to A.
Now B is +vely charged as B has 25 P and 20 electrons.
A is also +vely charged as A has 15 protons and 10 electrons.
∴ A and B each has, 5 protons in excess and have +5 charge.

Question 29.
Describe the method of charging a conductor by induction.
Answer:
INDUCTION: "Charging an uncharged conductor by bringing a charged conductor near it without touching is called INDUCTION



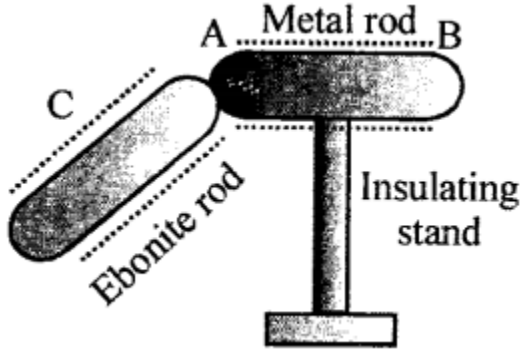
Place uncharged conductor B near +vely charged conductor A nearer end of B has -vely charged electrons attracted towards +vely protons remain on farther end of B.
Hence, nearer end of B is charged oppositely i.e. negative. We can test it by pith ball electroscope. On removing charged body A away from B, The body B becomes neutral due to protons and electron in B are equal and have opposite charge.

Question 30.
Explain the charging by induction in terms of movement of electrons.
Answer:
Let uncharged conductor B mounted on insulated stand is placed near +vely charged conductor Amounted on insulated stand without touching.

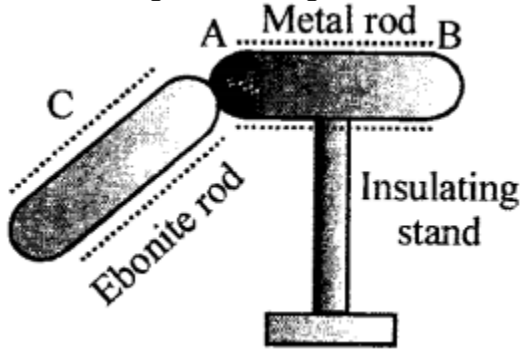


Electrons which are equal in number of protons in uncharged B, are attracted towards +vely charged A. Hence end E is charged negatively called BOUND CHARGE and protons remain at end F of B and is positively charged called FREE charge:
This induced charge remains on B so long as body A remains near B.

Question 31.
Figure below shows a metal rod AB placed on an insulating stand. In figure (a) a negatively charged ebonite rod C is touched w ith the metal rod AB, while in figure (b), the negatively charged ebonite rod C is held near the rod AB. State the kind of charges at the ends A and B of the rod, in each case.

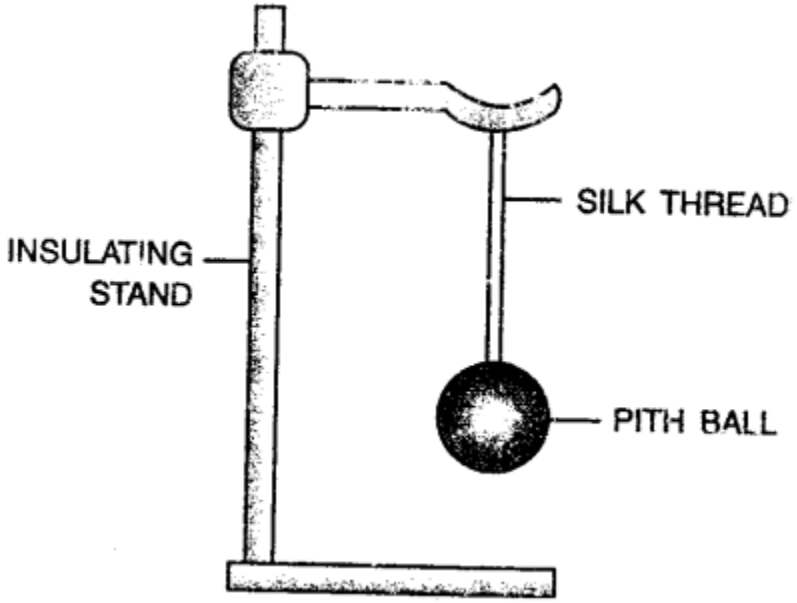


Answer:
In figure (a) conduction takes place.
There is negative charge at both ends A and B



In figure (b) Induction takes place.

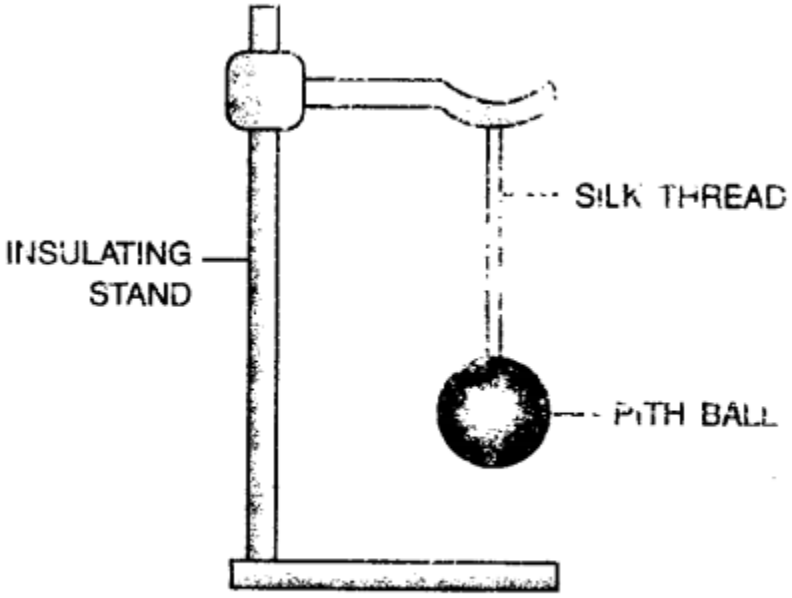
End A has oppositely positive charge called Bound charge and End B is similarly charged i.e. negative free charge.



Question 32.
Can you charge an insulator by thg method of conduction ?
Answer:
No, we cannot charge an insulator by method of conduction.

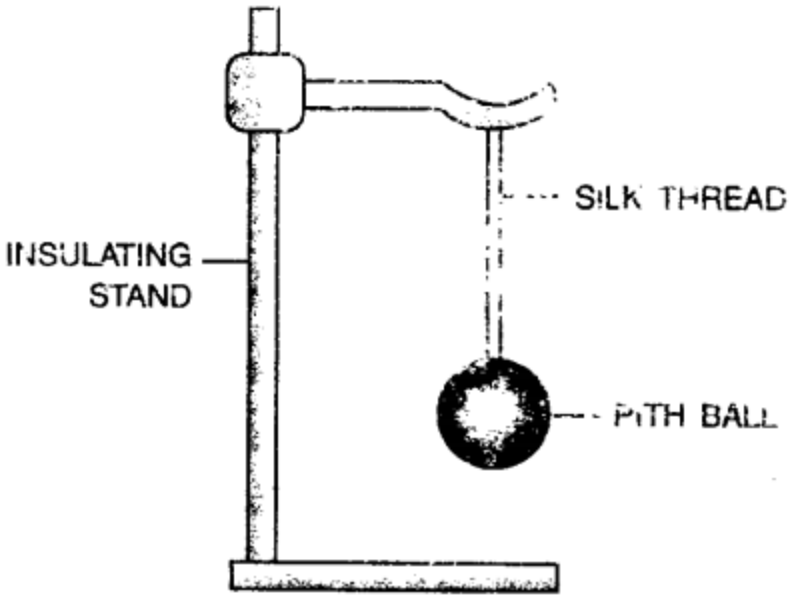
Question 33.
What is an electroscope ? Name the two types of electroscopes.
Answer:
An electroscope is a device with the help of which we detect whether the body is charged or uncharged and in the charged body detects the type of charge it carries. ie hether positive or negative.
The electroscope are of two types.
(i) Pith ball electroscope.

(ii) Gold leaf electroscope.



Pith ball electroscope

Question 34.
Describe a pith ball electroscope. how can you use it to test whether a body is charged or uncharged ?
Answer:
PITH BALL ELECTROSCOPE It consists of a smail pith ball suspended by a dry silk thread from an insutating stand.



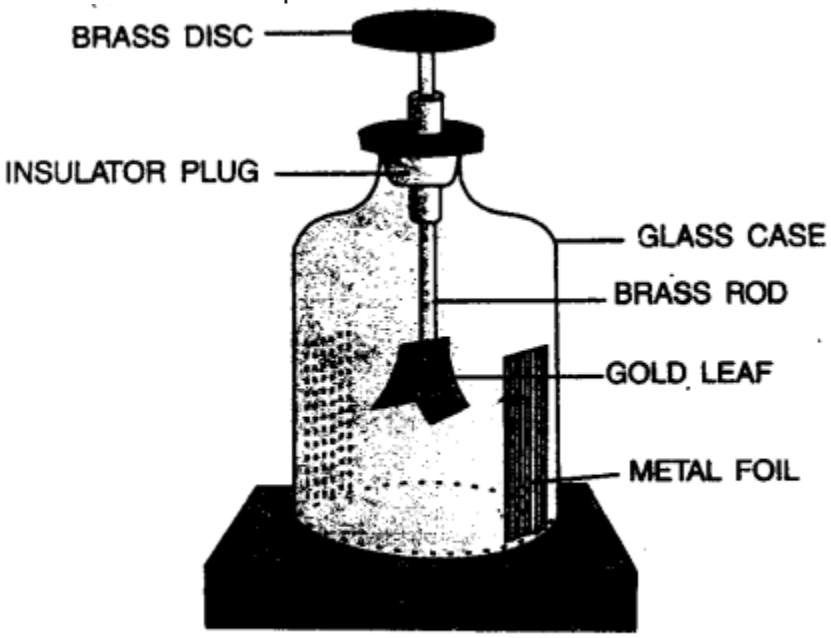
Pith ball electroscope

TO TEST A BODY IS CHARGED OR NOT: Bring the body to be tested near the pith ball (without touching it). If the pith ball moves towards the body, the body is charged. But if the body does not move, the body is uncharged.

Question 35.
How will you use a pith ball electroscope to find out whether the charge on a charged body is positive or negative ?
Answer:
Take a positively charged pith ball electroscope. Bring the charged body near the pith ball (without touching it). If the pith ball moves away, the body has similar charge (positive charge) and if the pith ball moves towards the body, the body has negative charge.

Question 36.
Draw a labelled diagram of a gold leaf electroscope and describe its construction.
Answer:
Construction
(i) Brass rod which passes through an insulator stopper in a glass case.
(ii) Brass disc is at the top end of brass rod.
(iii) Gold leaves Lower end carries two gold (or aluminium) leave held parallel when uncharged.
(iv) Glass case protects the gold leaves from the outside air current.
(v) Metal foil present at the lower part of the glass case. This is connected to the earth

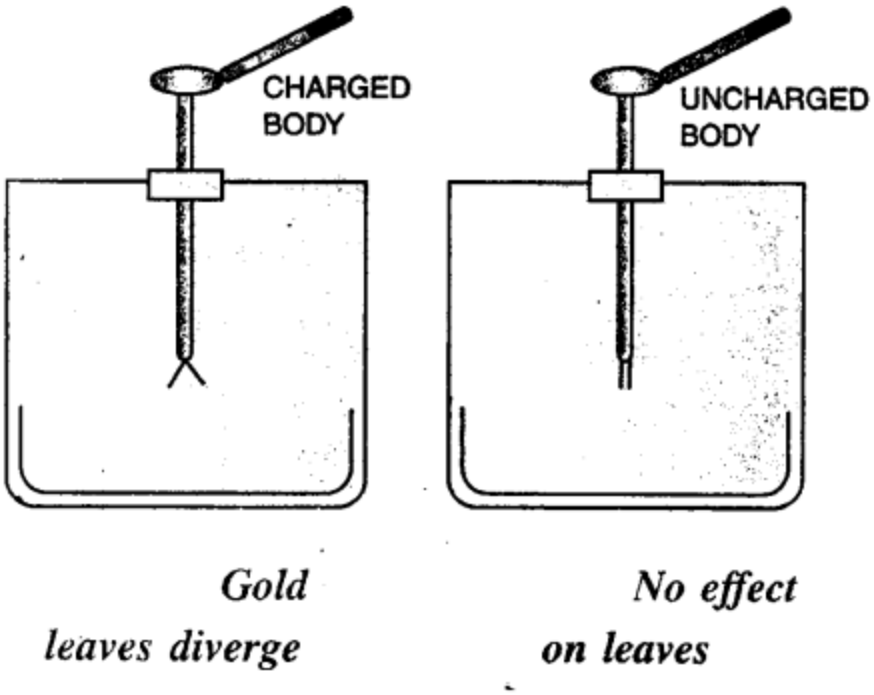
when the electroscope is used.



Gold leaf electroscope

Question 37.
A positively charged glass rod is touched with the disc of an uncharged gold leaf electroscope. What will be your observation?
Answer:
Leaves will DIVERGE as both leaves have positive charge due to conduction and diverge as like charges REPEL EACH other.

Question 38.
How will you use a gold leaf electroscope to find out whether a body is charged or uncharged ?
Answer:
TO TEST IF THE BODY is CHARGED OR UNCHARGED with GOLD LEAF ELECTROSCOPE:



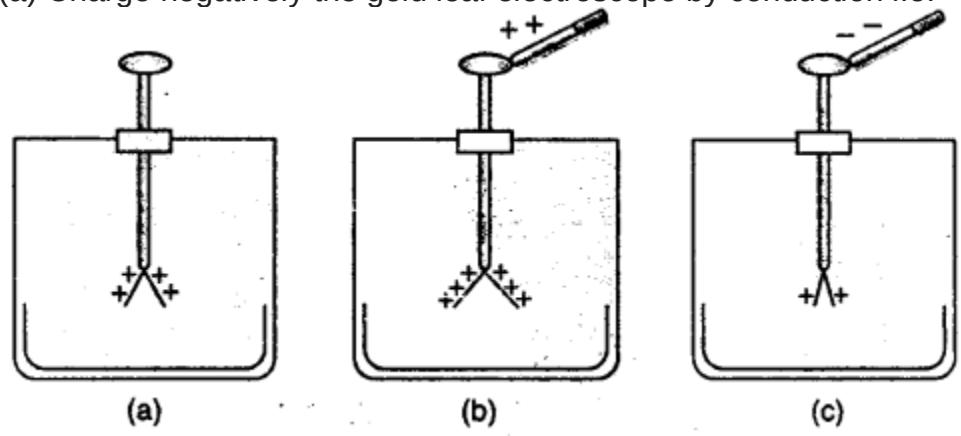
The body to be tested for charged or not is brought near the disc of GL.E. and touched with disc. If the leaves diverge, the body is charged and if leaves are not diverged, it is uncharged.

Question 39.

How will you use a gold leaf electroscope to find out whether the charge on a charged body is positive or negative ?

Answer:

(a) Charge negatively the gold leaf electroscope by conduction i.e.



To detect the kind of charge by a positively charged gold leaf electroscope touching the disc of GL.E. with – vely charged ebonite rod. The leaves diverge (because of repulsion)Note the divergence as show in figure (a).

(b) Bringa charged body to be tested in contact with disc. If divergence in leaves increase, it has similar charge i.e. negative as shown in figure (b)

(c) If divergence decrease, the body has opposite charge i.e. positive charge as shown in figure (c).

Question 40.
A negatively charged ebonite rod is touched with the disc of a negatively charged gold leaf electroscope. What will be your
observation ?
Answer:
Divergence of leaves will increase because similar charge will increase.

Question 41.
When a charged rod is touched with the disc of a positively charged gold leaf electroscope, it is observed that the divergence of leaves decreases. What is the kind of charge on the rod ?
Answer:
As on touching the disc with charged rod, divergence in the leaves decreases, this means the rod has opposite kind of charge than leaves i.e. rod has negative charge.

Question 42.
Describe Franklin's experiment. What did he conclude from his experiment ?
Answer:
FRANKLIN'S EXPERIMENT: Franklin flew a kite made of silk in a thunder-storm. At the top comer of the kite, he fixed a metal wire about 30 cm long. The other end of the wire was joined to the string.
At the lower end of the string he tied a metal key.
When the string got wet, he obtained a number of sparks between his Knuckle and the key.
He concluded from his experiment that in a thunder storm, the clouds acquire an electric charge due to friction.

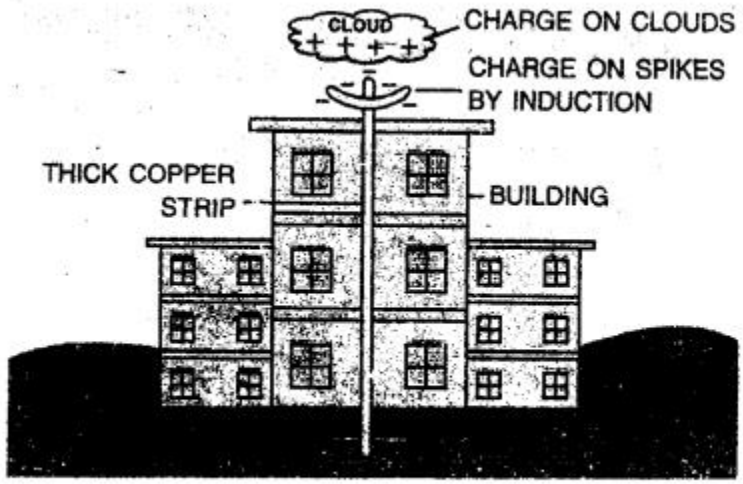
Question 43.
What causes lightning ?
Answer:
Due to friction from winds, clouds mb each other and get electrically charged during thunder storm (bundles of small water droplets and ice particles form thunder storm).
The upper part of cloud is usually positive while the lower part of cloud gets usually negatively charged.
Sudden movement in cloud causes this electrical charge to discharge in the form of

LIGHTNING (DAZZLING LIGHT).

Cloud

Question 44.
What are the effects of lightning ?
Answer:
EFFECTS OF LIGHTINING: Lightning can kill the men, animals and shatter the buildings.

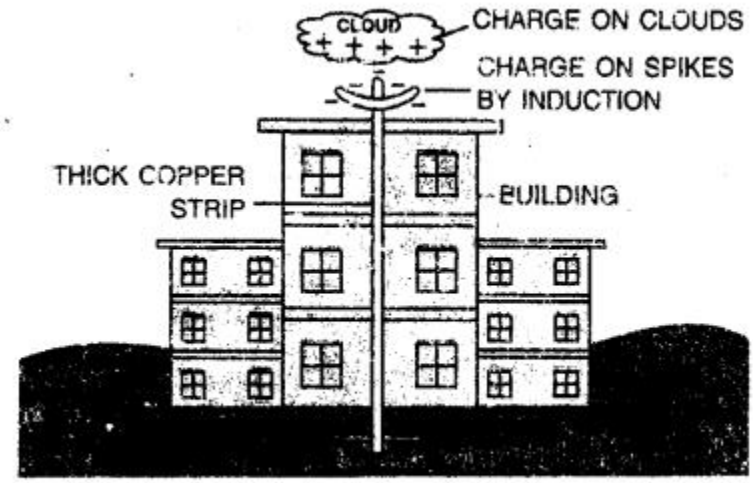
Question 45.
What is a lightning conductor ? How does it work ?
Answer:
The conductor which is fixed on the top of the building to protect the buildings from the damage by lightning. The conductor consists of several sharp metal spikes connected to a thick copper strip. The other end of the copper strip is fixed to a metal plate buried inside the ground. The process is called earthing. The conductor hoe works on the principle of induction. Whenever a charged cloud pass by the building, the conductor gets charge x opposite to that of the cloud
through the process of induction. Now this acquired charge moves to the earth through the earthing system.



Lightning conductor

Question 46.
Mow is a tall building protected from damage due to lightning?
Answer:

We can protect a tall building from lightning by the use of LIGH TNING CONDUCTOR.



Lightning conductor

WORKING : When a charged cloud passes over the building induction takes place and opposite charge (-ve) is induced on spikes of conductor. Spikes being pointed (having very small area) cannot hold the charge and charge leaks into air ai d opposite charge in air
and cloud can cell each other. Even if some charge remains on spikes passes to earth from copper rod. And building is saved.

Question 47.
State three safety measures that you will observe in thunder storm.
Answer:
THREE SAFETY MEASURES DURING THUNDER STORM:
(i) Do not lie on the ground, but squat low on the ground with your hands on you knees and head in between.
(ii) Take out the plugs of the T.V. sets, computers, etc. Do not use the wired phone.
(iii) Do not take bath during the thunder storms and avoid contact with running water or metallic tap.
(iv) Do not carry an umbrella over your head particularly if walking in an open ground. If there are tree around, take shelter under a shorter tree.