Chapter: 13

Electrostatics

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Objective

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1. An object gains excess negative charge after being rubbed against another object which is:
   - (A) Neutral
   - (B) Positively charged
   - **(C) Negatively charged**
   - (D) All of these

2. A positive charge OR A positive electric charge:
   - **(A) Repels other positive charge**
   - (B) Attracts other positive charge
   - (C) Repels other neutral bodies
   - (D) Attracts other neutral bodies

3. The electroscope is an instrument which is used for:
   - **(A) Detecting charge**
   - (B) Detecting current
   - (C) Detecting radiations
   - (D) None of these

4. An instrument is used for detecting charge is:
   - (A) Stroboscope
   - **(B) Electroscope**
   - (C) Spectroscope
   - (D) Microscope

5. The strength of an electric field at any point in space is called:
   - (A) Electric potential
   - **(B) Electric field intensity**
   - (C) Electrostatic induction
   - (D) Electric field lines

6. To protect the gold leaves from external disturbances in an electroscope a foil is grounded which is make of:
   - (A) Silver
   - (B) Copper
   - **(C) Aluminum**
   - (D) Brass

7. The SI unit of charge is:
   - **(A) Coulomb**
   - (B) Volt
   - (C) Ohm
   - (D) Ampere

8. According to coulomb's law what happens to force of attraction of two oppositely charged objects as their distance of separation increases?
   - **(A) Decreases**
   - (B) Increases
   - (C) Remains unchanged
   - (D) Cannot be determined

9. The coulomb's law is:
   - (A) $F = k\frac{q_1 q_2}{r^3}$
   - (B) $F = qE$
   - **(C) $F = k\frac{q_1 q_2}{r^2}$**
   - (D) $F = G\frac{m_1 m_2}{r}$

10. $1\ \mu C$ = ... C
    - (A) 10^{-3}
    - (B) 10^{6}
    - (C) 10^{3}
    - **(D) 10^{-6}**

11. The value of k in Coulomb's law is:
    - **(A) $9 \times 10^9\ Nm^2C^{-2}$**
    - (B) $9 \times 10^9\ m^2C^{-2}$
    - (C) $9 \times 10^9\ Nm^{-2}C^{-2}$
    - (D) $9 \times 10^9\ m^{-2}C^{-2}$

12. The SI unit of Coulomb's constant is:
    - (A) $Nm^{-2}C^2$
    - (B) Nm^2C^2
    - (C) $Nm^{-2}C^{-2}$
    - **(D) Nm^2C^{-2}**

13. Electric field lines always:
    - **(A) Never cross each other**
    - (B) Cross each other in the region of weak field
    - (C) Cross each other
    - (D) Cross each other in the region of strong field

14. The equation to calculate electric potential "V" is OR The electric potential "V" at a point be given by:
    - (A) $w = \frac{q}{v}$
    - **(B) $v = \frac{w}{q}$**
    - (C) $q = \frac{w}{v}$
    - (D) $q = \frac{v}{w}$

15. What will be the electric lines of force where the intensity of field is maximum?

Ⓐ Wider Ⓑ −ve to +ve **Ⓒ Narrow** Ⓓ +ve to −ve

16. SI unit of electric intensity is:

Ⓐ NC^{-2} Ⓑ NC **Ⓒ NC^{-1}** Ⓓ NC^{2}

17. The equation of electric intensity is:

Ⓐ $F = qE$ Ⓑ $E = \frac{q}{F}$ Ⓒ $F = \frac{F}{q_0}$ Ⓓ $q = EF$

18. The electric lines of forces were introduced by:

Ⓐ Faraday Ⓑ Coulomb Ⓒ Einstein Ⓓ Newton

19. The formula of Electric field intensity is:

Ⓐ Fq_0 **Ⓑ $\frac{F}{q_0}$** Ⓒ $\frac{1}{Fq_0}$ Ⓓ $\frac{q_0}{F}$

20. If 4 J of work is done on a 2C charge against the direction of electric field, the value of electric potential is:

Ⓐ 2 V Ⓑ 8 V Ⓒ 4 V Ⓓ 1 V

21. Three capacitors of capacitances 3 pF, 4pF and 5pF are connected in parallel combination, with battery of 6V. Calculate equivalent capacitance:

Ⓐ 17 pF Ⓑ 14 pF Ⓒ 6 pF **Ⓓ 12 pF**

22. The SI unit of electric potential is:

Ⓐ Ohm Ⓑ Ampere Ⓒ Joule **Ⓓ Volt**

23. One volt is equal to:

Ⓐ $1\ JC^{-1}$ Ⓑ $1\ C^{-1}$ Ⓒ 1 JC Ⓓ 1 J

24. Five joules of work is needed to shift 10 C of charge from one place to another. The potential difference between the places is:

Ⓐ 10 V Ⓑ 5 V Ⓒ 2 V **Ⓓ 0.5 V**

25. ..... Blocks DC current but allows AC current to pass through the circuit.

Ⓐ Thermometer **Ⓑ Capacitor** Ⓒ Resistor Ⓓ Specific resistance

26. The capacitance is defined as:

Ⓐ $\frac{V}{Q}$ **Ⓑ $\frac{Q}{V}$** Ⓒ QV Ⓓ VC

27. Each bolt of lightning contain the energy:

Ⓐ 4000 million joules of energy **Ⓑ 1000 million joules of energy**
Ⓒ 3000 million joules of energy Ⓓ 2000 million joules of energy

28. SI unit of capacitance is:

Ⓐ Coulomb Ⓑ Newton Ⓒ Volt **Ⓓ Farad**

29. Capacitors are used to differentiate between high frequency and low frequency signals. Such circuit is called:

Ⓐ Filter circuit Ⓑ Parallel circuit Ⓒ Series circuit Ⓓ None of these

30. The ability of capacitor to store charge is called:

Ⓐ Electric energy Ⓑ Electric potential Ⓒ Resistance **Ⓓ Capacitance**

31. One nano Farad is equal to:

Ⓐ $1 \times 10^{-18} F$ **Ⓑ $1 \times 10^{-9}\ F$** Ⓒ $1 \times 10^{-12} F$ Ⓓ $1 \times 10^{-6}\ F$

32. If 4C charge is given to the plates of capacitor and potential between the plates is 2V then its capacitance is:

Ⓐ 8F Ⓑ 6f Ⓒ 4F **Ⓓ 2F**

33. Give the number of factors which affect the ability of a capacitor to store charge:

Ⓐ 4 **Ⓑ 3** Ⓒ 2 Ⓓ 1

34. In parallel combination of capacitors, each capacitor will have the same:

Ⓐ Voltage Ⓑ Charge Ⓒ A and B **Ⓓ Capacitance**

35. Combinations of capacitors are:

Ⓐ 4 **Ⓑ 2** Ⓒ 3 Ⓓ 1

36. 1 micro F is equal to:

Ⓐ 1×10^{-5} F **Ⓑ 1×10^{-6} F** Ⓒ 1×10^{-3} F Ⓓ 1×10^{-4} F

37. If the medium between the two charges is air, then the value of "k" will be:

Ⓐ $9 \times 10^{9}\ m^{-2}C^{-2}$ Ⓑ $9 \times 10^{9}\ Nm^{-2}C^{-2}$ Ⓒ $9 \times 10^{9}\ m^{2}C^{-2}$ **Ⓓ $9 \times 10^{9}\ Nm^{2}C^{-2}$**

38. In mica capacitor the dielectric is:

Ⓐ Paper **Ⓑ Mica** Ⓒ Aluminum Ⓓ Plastic

Chapter : 13 Electrostatics

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Subjective

Q1: ***How can you show by simple experiments that there are two types of electric charges?***

Ans: *We can produce charge by rubbing a neutral body with another neutral body. The following experiment shows that we can produce two types of electric charges by the process of rubbing.*

Experiment:

Take a plastic rod. Rub it with fur and suspend it horizontally by a silk thread. Now take another plastic rod and rub it with fur and bring near to the suspended rod. We will observe that both the rods will repel each other. It means during the rubbing both the rods were charged.

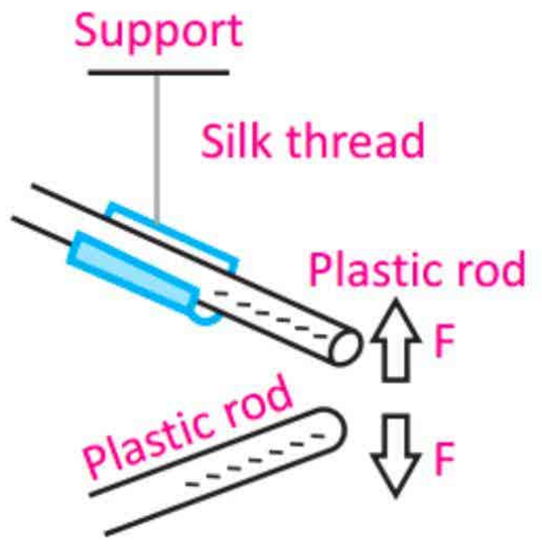


Fig. Two plastic rods rubbed with fur repel each other

Q2: ***Describe the method of charging bodies by electrostatic induction.***

Ans: *Take two metal spheres A and B and bring positively charged rod near A. The rod will attract negative charges and repel positive charges. In this way negative charges develop on the left surface of A and positive charges develop on the right surface of B.*

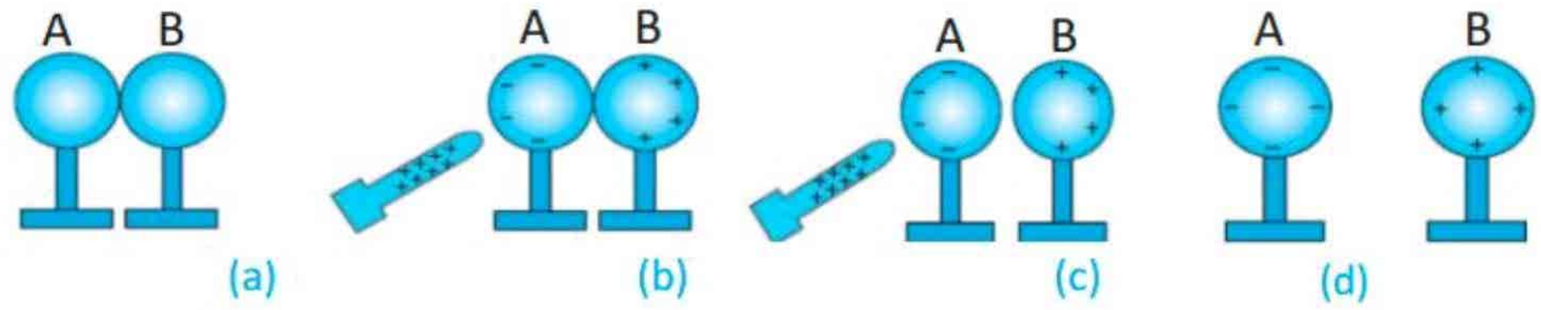


Fig. Charging two spheres by electrostatic induction

If both the spheres are kept at small distance in the presence of rod they will attract each other. If the rod is removed the charges are uniformly distributed on the surface of spheres. This is the process of charging by electrostatic induction.

Q3: ***How does charging by friction differ from charging by electrostatic induction?***

Ans: ***Charging by Friction:***

- *Bodies acquire the charges during rubbing process. When a neutral body is rubbed with another neutral body transfer of charge take place.*
- *During the process of charging by friction, we rub a neutral body with another neutral body.*

Charging by Electrostatic Induction:

- *In electrostatic induction a charged body is brought near a neutral body opposite charges appear at one end and same charges appear at the other end.*
- *In the process of electrostatic induction, we charge a conductor without making any contact with the charged body.*

Q4: ***What is gold leaf electroscope? Discuss its working principle.***

Ans: ***Gold leaf Electroscope:***

The gold leaf electroscope is sensitive instrument used for detecting and testing the nature of charge on a body.

Working Principle:

Working principle of electroscope is electrostatic induction. When a metal disk of electroscope is brought near charged body then due to electrostatic induction like charges comes at one end unlike charges at the other end of the rod.

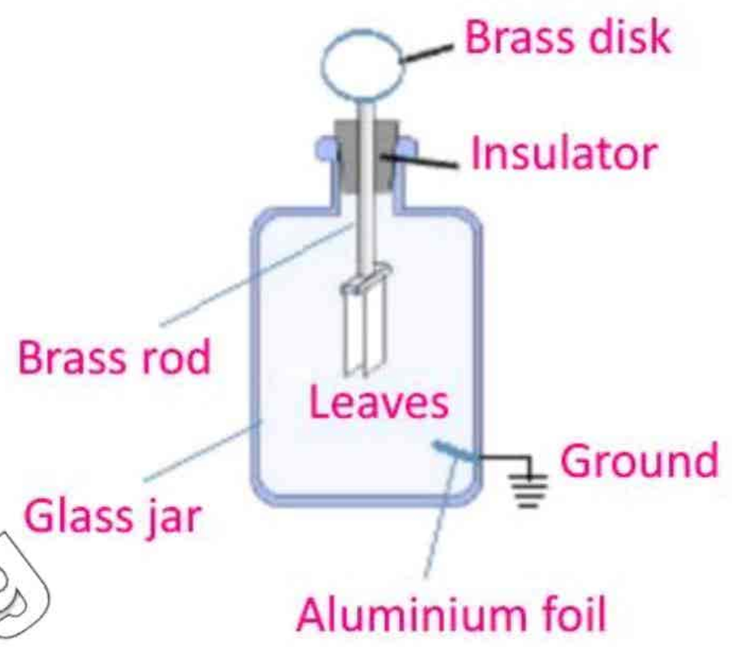


Fig. Uncharged electroscope

Q5: ***How electroscope is charged positively and negatively?***

Ans: ***Positively Charging Electroscope:***

In order to produce positive charge on the electroscope, bring a negatively charged body near the disk of the electroscope. Positive charge will appear on the disk of the electroscope while negative charge will shift to the leaves. Now connect the disk of electroscope to the earthed aluminum foil by a conducting wire. Charge of the leaves will flow the earth through the wire. The electroscope is positively charged now.

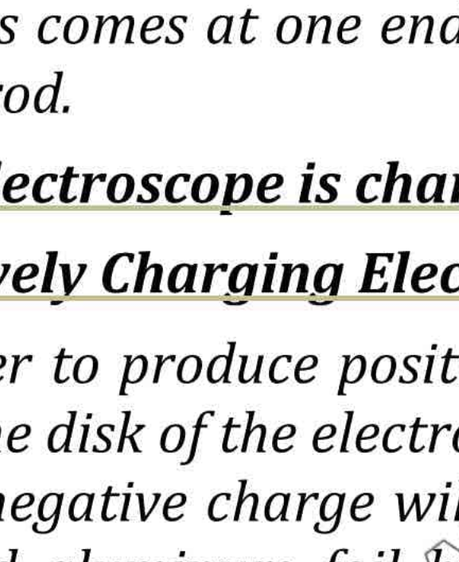


Fig. (a) Charging the electroscope positively

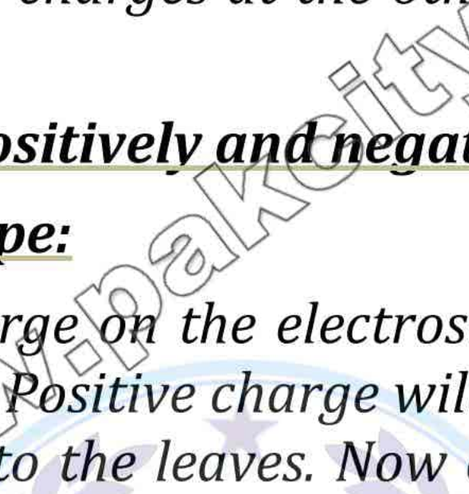


Fig (b) Charging the electroscope positively

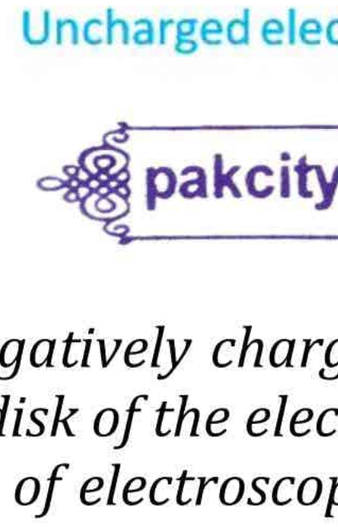
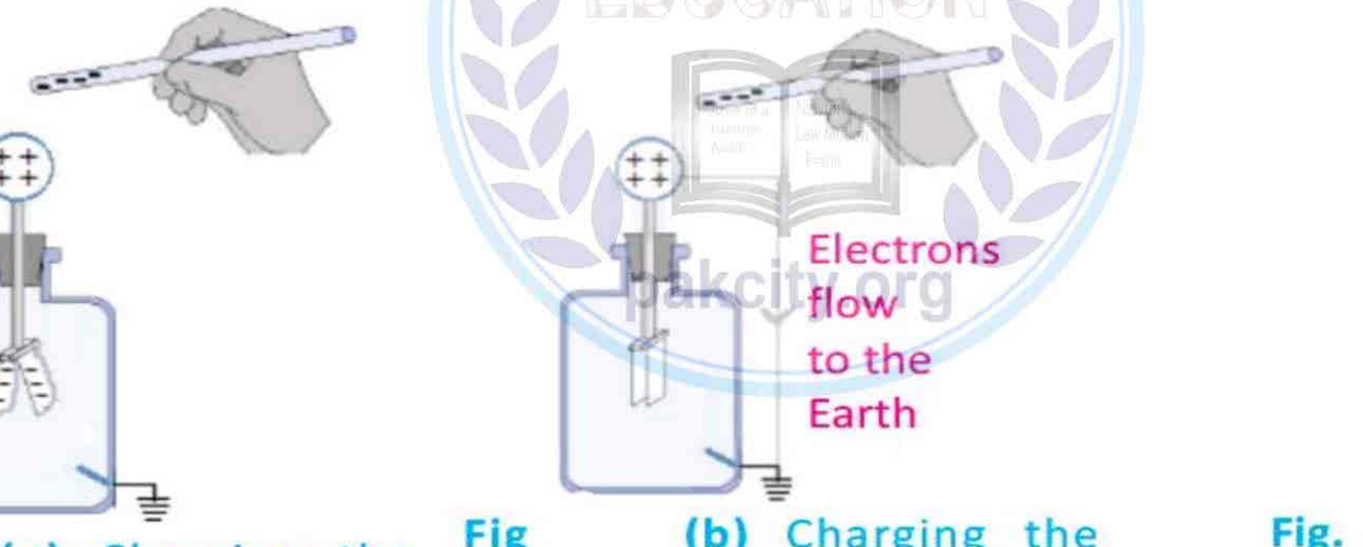


Fig. (c) Positively charged electroscope

Negatively Charging Electroscope:



In order to produce negative charge on the electroscope, bring a positively charged body near the disk of the electroscope. Negative will appear on the disk of the electroscope while positive charge will shift to the leaves. Now connect the disk of electroscope to the earthed aluminum foil by a conducting wire. Charge of the leaves will flow the earth through the wire. The electroscope is negatively charged now.

Q6: ***With the help of electroscope how will you find the presence of charge on the body?***

Ans: ***Detection of types of Charges:***

For detection of charge on a body electroscope is first charged either positively or negatively. Suppose electroscope is positively charged. Now for detection of type of charge bring the charged body near the disk of positively charged electroscope.
The body carries positive charge if the divergence of the leaves increases on the other hand, body carries negative charge if the divergence decreases.

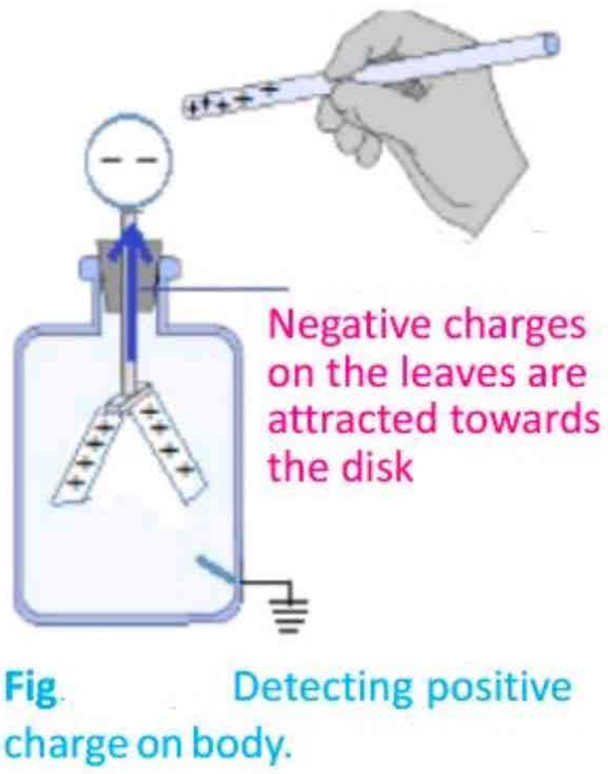


Fig. Detecting positive charge on body.

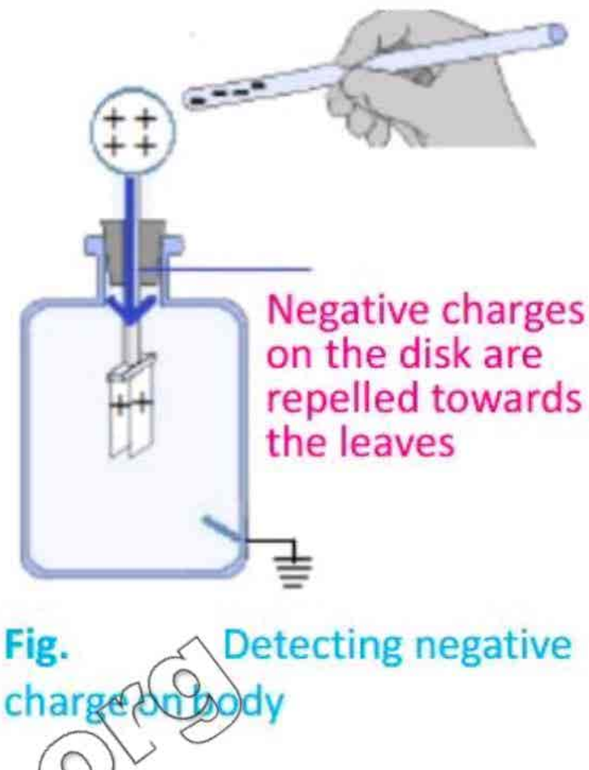


Fig. Detecting negative charge on body

Q7: ***What is meant by point charge?***

Ans: *Coulomb's law is true only for point charges whose sizes are very small as compared to the distance between them. The coulomb's law is applied for point charges.*

Q8: ***Define Coulomb's law. OR Define coulomb's law and write its mathematical form. OR Define coulomb's law and write formula for finding force.***

Ans: ***Coulomb's law:***

"The force of attraction or repulsion between two point charges is directly proportional to the product of the magnitude of charges and inversely proportional to the square of the distance between them"

Mathematical form:

$$F \propto q_1 q_2 \longrightarrow (1)$$

$$F \propto \frac{1}{r^2} \longrightarrow (2)$$

Combine equation (1) and (2):

$$F \propto q_1 q_2 \frac{1}{r^2} \longrightarrow (3)$$

$$F = k\, q_1 q_2 \frac{1}{r^2} \longrightarrow (4)$$

or

$$F = k \frac{q_1 q_2}{r^2} \longrightarrow (5)$$

Here K is the coulomb's constant.

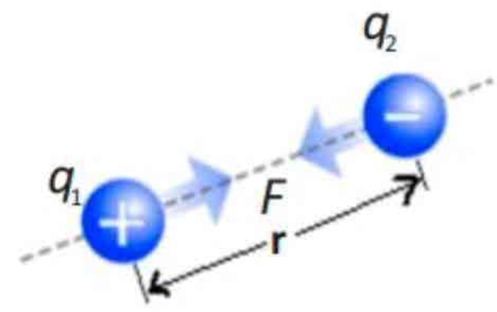


Fig. (a) Attraction between opposite charges

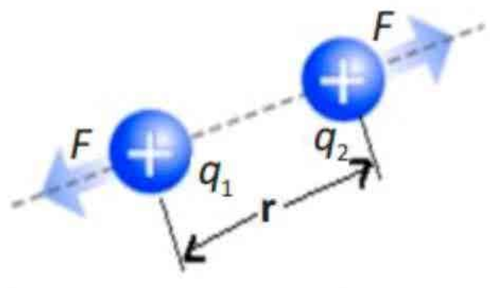


Fig. (b) Repulsion between similar charges

Q9: ***Write the equation of Coulomb's law and what is the value of constant in it?***

Ans: *The equation of coulomb's law is:*

$$F = k \frac{q_1 q_2}{r^2}$$

The value of constant is:

$$K = 9 \times 10^9\ Nm^2C^{-2}$$

For your information

In SI, the unit of charge is coulomb (C). It is equal to the charge of 6.25×10^{18} electrons. This is very big unit. Usually, charge is measured in micro coulomb. One micro coulomb is equal to 10^{-6}C.

Q10: ***What is the numerical value of 'k' in coulomb's law?***

Ans: *K is constant of proportionality. The value of k depends upon the medium between the two charges. If the medium between charges is air, then the value of k in SI units will be*

$$K = 9 \times 10^9\ Nm^2C^{-2}$$

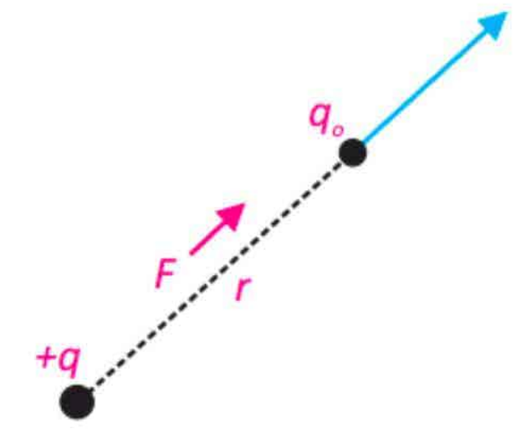


Fig. A charge q_o is placed at a distance '*r*' from charge +*q*

Q11: ***What is meant by electric field and electric field intensity?***

Ans: ***Electric field:***

"The electric field is a region around a charge in which it exerts electrostatic force on another charge."

Electric field Intensity:

"The strength of electric field at any point in space is called electric field intensity."

Formula:

$$E = \frac{F}{q_o}$$

S.I Unit:

The S.I unit of Electric Intensity is NC^{-1}

Q12: ***Is electric intensity a vector quantity? What will be its direction?***

Ans: *Being a force, electric intensity is a vector quantity. The direction of electric intensity is along the direction of force which acts on test charge. If a test charges get free in the electric field it will move in the direction of electric intensity.*

Q13: ***How would you define potential difference between two points? Define its unit.***

Ans: ***Potential Difference:***

"The energy supplied by a unit charge as it moves from one point to the other in the direction of field".

Potential difference is a scalar quantity.

S.I Unit of Potential Difference is:

S.I Unit of Potential Difference is volt which is equal to JC^{-1}

Volt:

"If one joule of work is done against the electric field in bringing one coulomb positive charge from infinity to a point in the electric field then the potential at that point is one volt."

Higher Potential Lower Potential

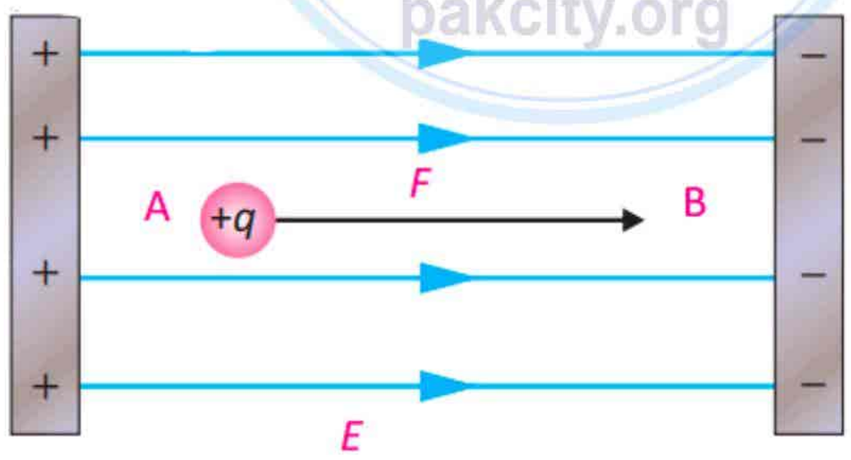


Fig Potential difference between two points

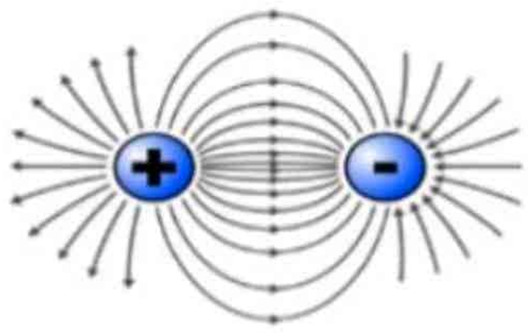
Q14: ***Show that potential difference can be described as energy transfer per unit charge between two points.***

Ans: ***Potential Difference as Energy Transfer:***

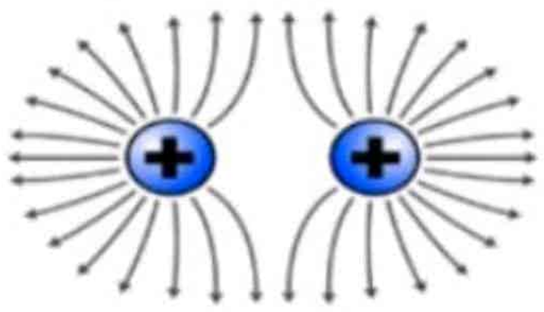
In gravitational field, a body always tends to move from a point of higher potential energy to a point of lower potential energy. If the potential of point 'a' is V_a *and that of point 'b' is* V_b*, the potential energy of charge will be* qV_a *and* qV_b *respectively. The change in potential energy would be* $qV_a - qV_b$*. The energy is used in doing some useful work. Therefore,*

$$E = qV_a - qV_b$$

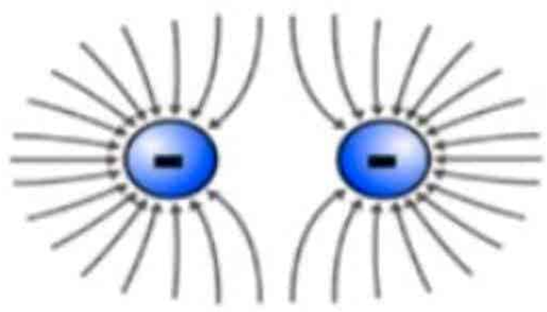
For your information



Electric field lines for two opposite and equal point charges.



Electric field lines for two positive point charges.



Electric field lines for two negative point charges.

Q15: ***What do you mean by capacitance of a capacitor? Define its unit.***

Ans: ***Capacitance:***

"The ability of a capacitor to store charge is called capacitance."

Formula:

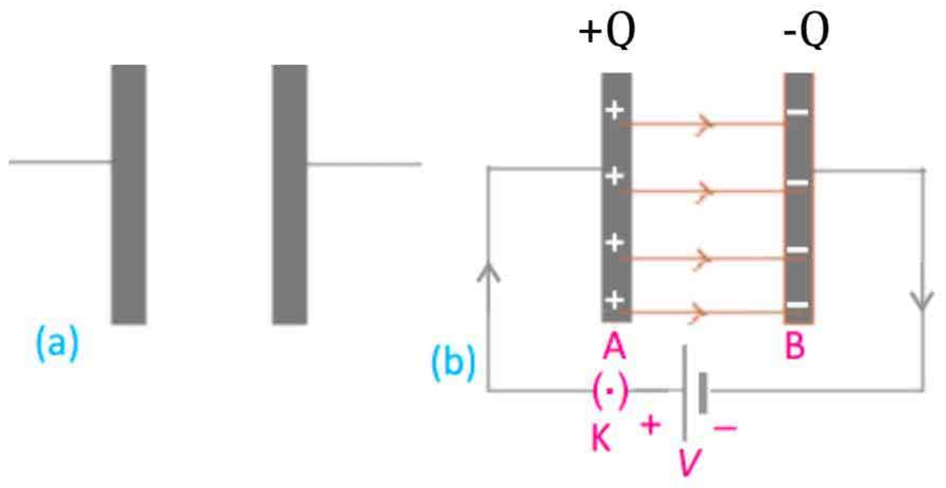
$$C = \frac{Q}{V}$$

S.I Unit of Capacitance is:

The S.I unit of capacitance is farad.

Farad:

"If one coulomb of charge is given to the plates of a capacitor to produce potential difference of one volt between the plates of the capacitor then its capacitance would be one farad."



(a) Parallel plate capacitor (b) Plates of capacitor connected with battery

Q16: ***What is difference between fixed capacitor and variable capacitor?***

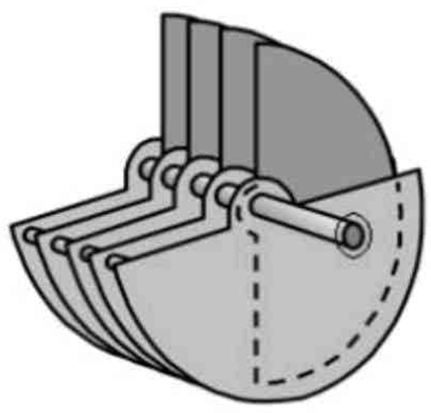


Fig. Variable capacitor

Ans: Difference between fixed capacitor and variable capacitor:

Fixed Capacitor	***Variable Capacitor***
❖ *If plates of the capacitor are immovable then this capacitor is called fixed capacitor.* ❖ *The capacitance of such capacitor cannot be changed.*	❖ *In variable capacitor the plates of capacitors are movable. It is generally a combination of many capacitors with air as dielectric.* ❖ *The value of capacitance can be changed by changing the area of plates facing each other.*

Q17: ***What is dielectric in capacitor? OR What is meant by Dielectric?***

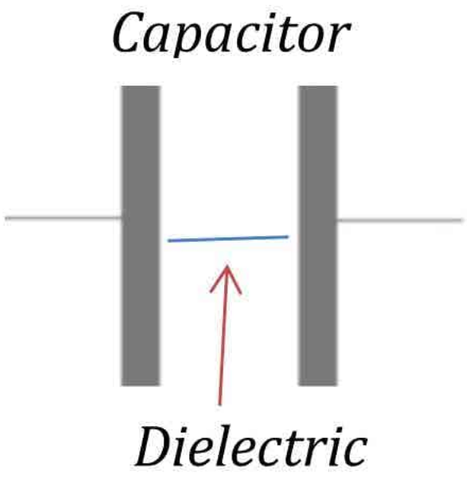
Ans: "The medium between the two plates of capacitor is air or a sheet of some insulator. This medium is known as dielectric."

Q18: ***How a capacitor stores a charge. Explain.***

Dielectric:*Ans: If a capacitor is connected to a battery of V volts, then the battery transfers a charge +Q from plate B to plate A, so that –Q charge appears on plate B and +Q charge appears on plate A. The charge on each plate attracts each other and thus remained bound within the plates. In this way, Charge is stored in a capacitor for a long time.*

Q19: ***Describe the construction of capacitor.***

Ans: A capacitor consists of two thin metal plates, parallel to each other separated by a very small distance. The medium between the two plates is air or a sheet of some insulator. This medium is known as dielectric.



Q20: ***What is the difference between capacitor and dielectric?***

Ans: Difference between capacitor and dielectric:

Capacitor	***Dielectric***
❖ *A device which is used to store electric charge is called capacitor.*	❖ *In capacitors, the medium between the two plates is air or a sheet of some insulator. This medium is known as dielectric.*

Q21: ***In which form a capacitor stores energy?***

Ans: Capacitor stores energy in an electric field between two plates in the form of electrostatic potential energy.

Q22: ***Why electric bulbs and electric heaters are not connected in series?***

Ans: It is impracticable to connect an electric bulb and an electric heater in series because it will divide voltage.

Q23: ***How many methods are there of combination of capacitors?***

Ans: There are two methods of combination of capacitors:

- *Parallel combination.*
- *Series combination.*

Q24: ***Write the formula of Parallel combination of capacitors.***

Ans: In case of 'n' capacitors connected in parallel, the equivalent capacitance is given by:

$$C_{eq} = C_1 + C_{2+} C_3 + \ldots\ldots\ldots + C_n$$

Q25: ***On which factors do the ability of a capacitor to store charge depends?***

Ans: Three factors affect the ability of a capacitor to store charge.

- *Types of insulator used between the plates.*
- *Distance between the plates.*
- *Area of the plates.*

Q26: ***Describe any two characteristics of series combination of capacitors.***

Ans: Two characteristics are given below:

- *The potential difference across each capacitor is different due to different values of capacitances.*
- *Each capacitor has the same charge across it. If the battery supplies +Q charge to the left plate of the capacitor C_1, due to the induction –Q charge is induced on its right plate and +Q charge on the left plate of the capacitor C_2 i.e.,*

$$Q_1 = Q_2 = Q_3 = Q$$

Q27: ***Describe any two characteristics of parallel combination of capacitors.***

Ans: Two characteristics are given below:

- *The charge developed across the plates of each capacitor will be different due to different value of capacitances.*
- *Each capacitor connected to a battery of voltage V has the same potential difference V across it. i.e.,*

$$V_1 = V_2 = V_3 = V$$

Q28: ***What do you know about Electrolyte capacitor?***

Ans: Electrolytic capacitors are consists of a metal foil in contact with an electrolyte. A solution that conducts charge by virtue of the motion of the ions contained in it. When a voltage is applied between the foil and the electrolyte, a thin layer of metal oxide is formed on the foil, and this layer serves as the dielectric, very large capacitance can be attained because the dielectric layer is very thin.

Q29: ***What do you mean by Variable capacitor? Give its one use.***

Ans: In variable capacitors, some arrangements are made to change the area of the plates facing each other.

Uses:

Variable capacitors are usually utilize or tuning in radio sets.

Q30: ***Give two examples of fixed capacitors.***

Ans: These are the examples of fixed capacitors with some explanation:

Mica capacitors:

It is example of fixed capacitors in which mica is used as dielectric material. For safety packed into plastic hole.

Paper capacitors:

It is also an example of fixed capacitors where oil or grease or thin plastic sheet is used as a dielectric between two aluminum foils in papers capacitors.

Q31: ***Differentiate between mica capacitor and paper capacitor.***

Ans: The differentiate between mica capacitor and paper capacitor is:

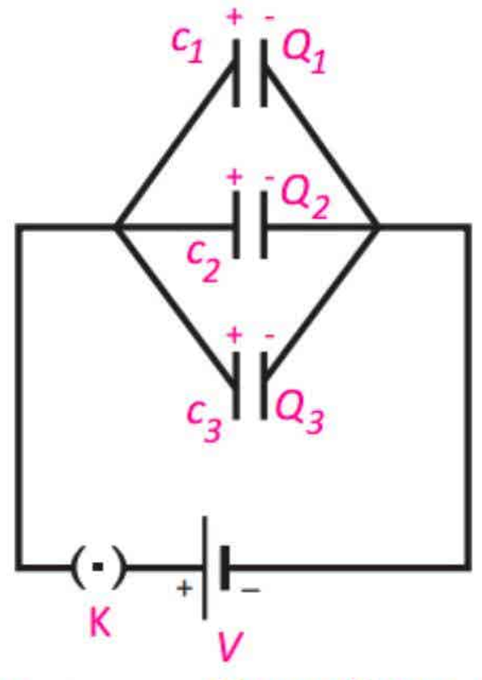


Fig. Capacitors in parallel combination

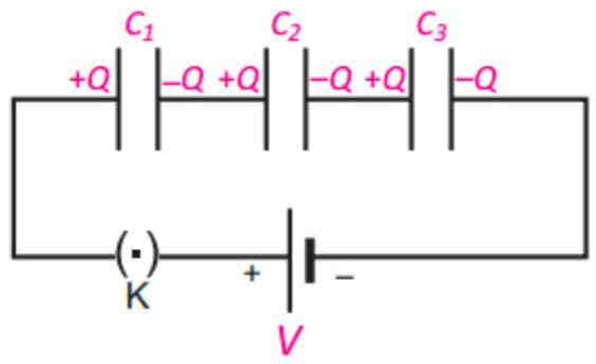


Fig. capacitors in series combination.

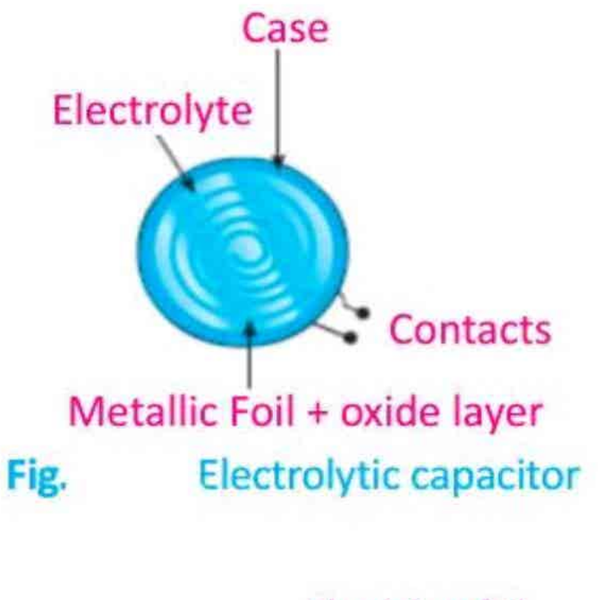


Fig. Electrolytic capacitor

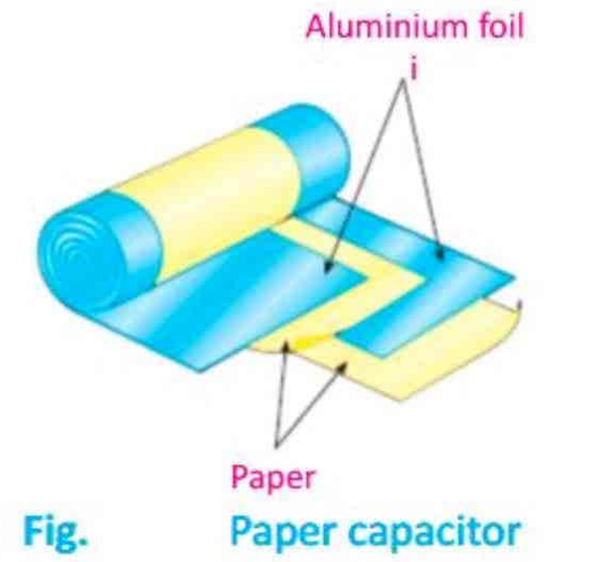


Fig. Paper capacitor

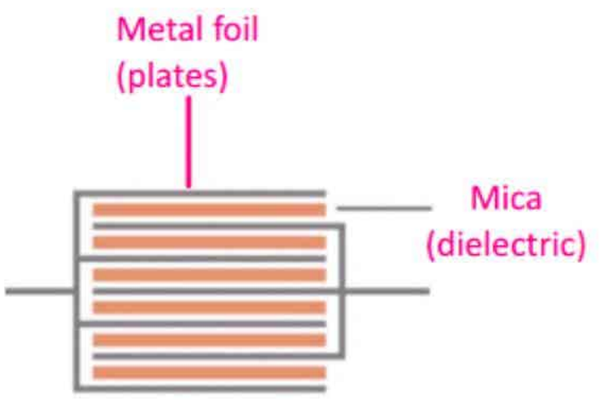


Fig. Mica capacitor

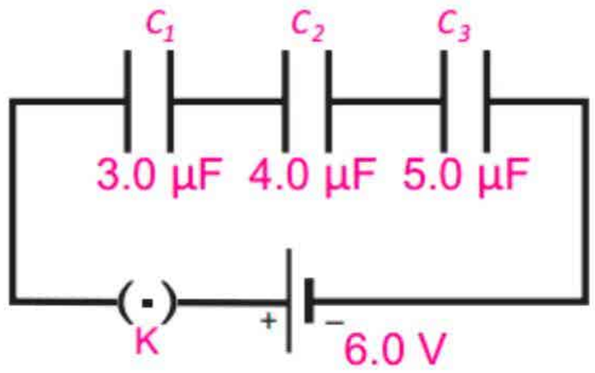
Mica capacitors	Paper capacitors
❖ *It is example of fixed capacitors in which mica is used as dielectric material. For safety packed into plastic hole.*	❖ *It is also an example of fixed capacitors where oil or grease or thin plastic sheet is used as a dielectric between two aluminum foils in papers capacitors.*

Q32: ***What is used as dielectric in paper capacitors?***

Ans: *Usually, an oiled or grease or thin plastic sheet is used as a dielectric between two aluminum foils in papers capacitors.*

Q33: ***Draw circuit diagram for three capacitors circuit connected in series combination.***

Ans: *Circuit diagram for three capacitors circuit connected in series combination:*



It's formula is:

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

Q34: ***Write the uses of capacitors.***

Ans: *The uses of capacitors are:*

- *Capacitors can be used to differentiate between high frequency and low frequency signals.*
- *Capacitors are also used in electronic circuits of computers.*
- *They are also used for table fanes, ceiling fans, exhaust fans, fan motors in air conditioners.*
- *They are used for tuning transmitters, receivers and transistor radios.*

Q35: ***Define fixed capacitor. Also give an example.***

Ans: *A capacitor in which the area between two plates cannot change.*

Example:

Paper capacitor is the example of fixed capacitors.

Q36: ***What is meant by filter circuit?***

Ans: *Capacitors can be used to differentiate between high frequency and low frequency signals which make them useful in electronic circuits. Capacitors used in the resonant circuits that tune radios to particular frequencies. Such circuits are called filter circuits.*

Q37: ***Describe two uses of electrostatics.***

Ans: *Two uses of electrostatic are given by:*

- *Electrostatic air cleaner.*
- *Electrostatic powder painting.*

Q38: ***Write a brief note on electrostatic air cleaner.***

Ans: *An electrostatic air cleaner is used in homes to relieve the discomfort of allergy sufferers. Air mixed with dust and pollen enters the device across a positively charged mesh. The airborne particles become positively charged when they make contact with the mesh. Then they pass through a second, negatively charged mesh.*

The electrostatic force of attraction between the positively charged particles in the air and the negatively charged mesh causes the particles to precipitate out on the surface of the mesh. Through this process we can remove a very high percentage of contaminants from the air stream.

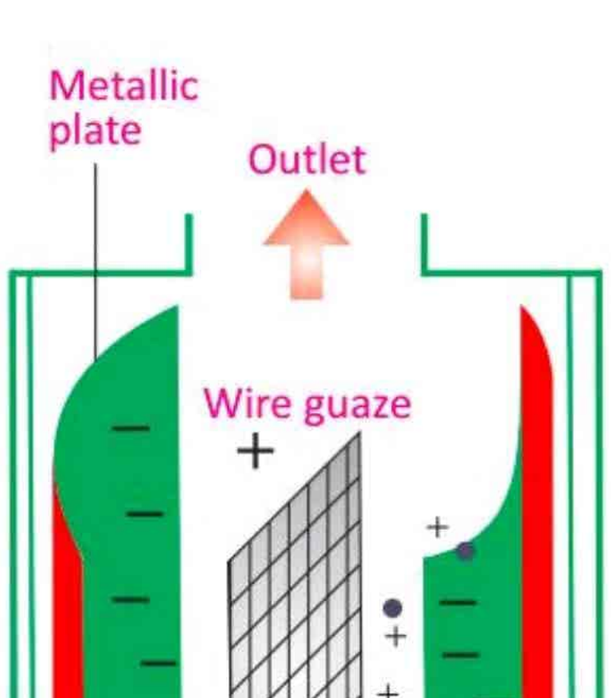


Fig.

Electrostatic air cleaner

Q39: ***Write down a brief note on application of electrostatic in spray painting. OR explain one application of electrostatics.***

Ans: *Automobile manufacturers use static electricity to paint new cars. The body of a car is charged and then the paint is given the opposite charge by charging the nozzle of the sprayer. Due to mutual repulsion, charge particles coming out of nozzle from a fine mist and are evenly distributed on the surface of the object.*

The charged paint particles are attracted to the car and stick to the body, just like a charged balloon stick to a wall. Once the paint dries, it sticks much better to the car and is smoother, because it is uniformly distributed. This is very effective, efficient and economical way of painting automobiles on large scale.

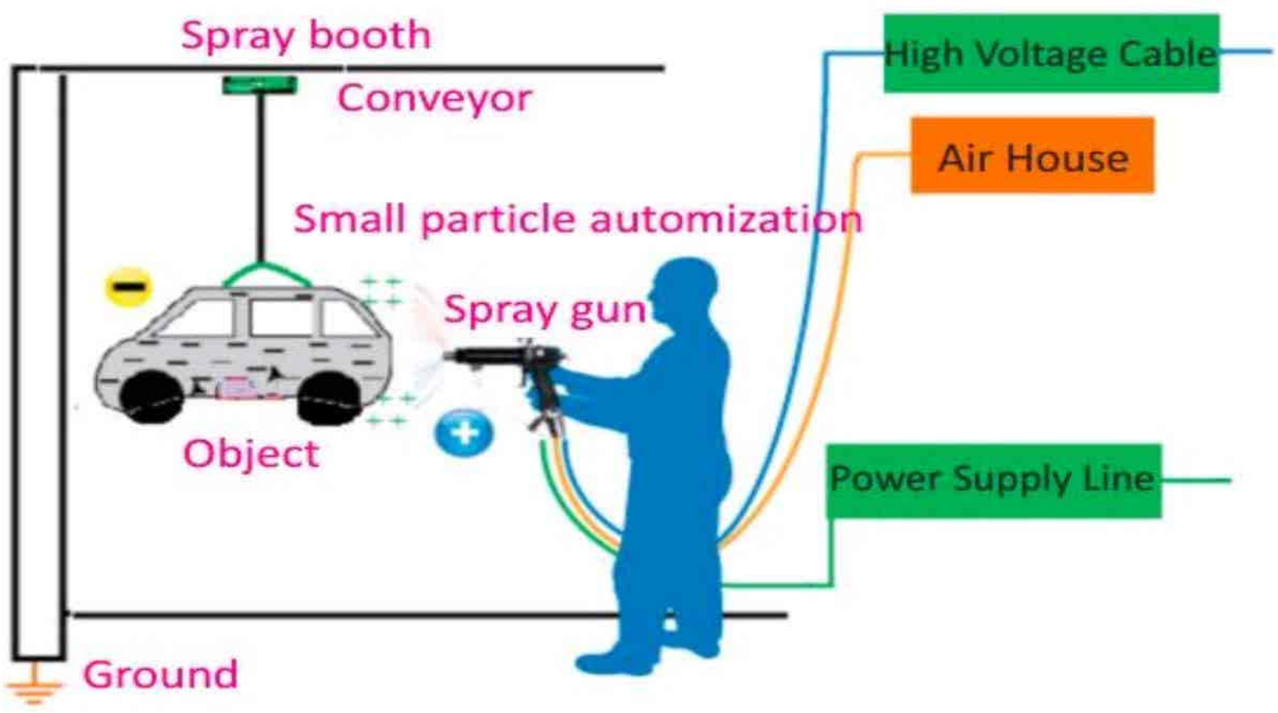


Fig. Schematic diagram of electrostatic spray painting system. Car is negatively charged and spray gun is positively charged. As drops have

Q40: ***Write the name of any two applications of electrostatics.***

Ans: *The applications of electrostatic are given by:*

- *Electrostatic powder painting.*
- *Electrostatic air cleaner.*

Q41: ***Describe the applications of electrostatics.***

Ans: *The two hazards of static electricity are given below:*

- *Fires or explosions.*
- *Lightning.*

Q42: ***What are the hazards of static electricity? OR Write two hazards of static electricity.***

Ans: *The two hazards of static electricity are given below:*

- *Fires or explosions.*
- *Lightning*

Q43: ***What is the cause of lightening?***

Ans: *The phenomenon of lightening occurs due to a large quantity of electric charge which builds up in the heavy thunderclouds. The thunderclouds are charged by friction between the water molecules in the thunderclouds and the air molecules.*

Q44: ***Write the characteristics of charges.***

Ans: *The characteristics of charges are:*

- *Repulsion is the sure test of charge on a body.*
- *Unlike charges attracts each other.*
- *Like charges always repel each other.*
- *Friction produces two different types of charges on different material.*
- *Charge is a basic property of a material body due to which it attracts or repels another objects.*

Conceptual Question

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Q1: ***An electrified rod attracts pieces of paper. After a while these pieces fly away. Why?***

Ans: *When rod is brought near the pieces they attract each other due to opposite charge. But when rod touches the pieces of paper charge is transferred from rod to paper so they repel each other due to repulsive force.*

Fig. : Comb rubbed with hair attracts small pieces of paper

Q2: ***How much negative charge has been removed from a positively charged electroscope, if it has a charge of 7.5 x 10^{-11} C?***

Ans: *Charge* $= 7.5 \times 10^{-11}\text{C}$

Charge on one electron $= 1.6 \times 10^{-19}\text{C}$

No. of electrons removed $= n = ?$

$q = ne$ or $n = q/e$

$$n = \frac{7.5 \times 10^{-11}\text{C}}{1.6 \times 10^{-19}\text{C}}$$

$$n = 4.7 \times 10^{8}$$

Q3: ***In what direction will a positively charged particle move in an electric field?***

Ans: *The positively charged particle will move from high potential terminal to low potential terminal in an electric field.*

Q4: ***Each capacitor in parallel combination has equal potential difference between its two plates. Justify the statement.***

Ans: *Each capacitor in parallel combination has equal potential difference because each capacitor is individually connected to the same battery.*

Q5: ***Perhaps you have seen a gasoline truck trailing a metal chain beneath it. What purpose does the chain serve?***

Ans: *The metal chain is trailing under the truck to transfer extra charge on the body of truck to ground. This charge on the body is produced due to air resistance. This may avoid the chance of explosion.*

Q6: ***If a high voltage power line fell across your car while you were in the car, why should you not come out of the car?***

Ans: *When high voltage power line fell across the car, then this car acts like a Faraday Cage. If we come out of the car there may arise high potential difference which may result in sever electric shock.*

Q7: ***Explain why a glass rod can be charged by rubbing when held by hand but an iron rod cannot be charged by rubbing if held by hand?***

Ans: *Since the bonds in glass rod are weaker than iron so electrons from glass rod are easily transferred to our hands. That's why glass rod becomes charged body by rubbing.*

Additional Question

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Q1: ***On what factors do the capacitance of a capacitor depends?***

Ans: *Capacitance of capacitor depends on following factors:*

- *Type of medium used between the plates.*
- *Distance between the plates.*
- *Size of plates of the capacitor.*

Q2: ***Define electrostatic induction.***

Ans: *In the presence of a charged body an insulated conductor develops positive charge at one end and negative charge at the other end this process is called the electrostatic induction.*

Q3: ***Define electroscope. Describe its construction.***

Ans: ***Electroscope:***

The devise which is used to detect charge on the body is called electroscope.

Construction:

It consists of a brass rod with brass disk on the top and two thin leaves of gold foil hanging at bottom. The rod passes through an insulator that keeps the rod in place and also retains the charges. A thin aluminum foil is attached on the lower part inside the jar. Aluminum foil is grounded with the help of

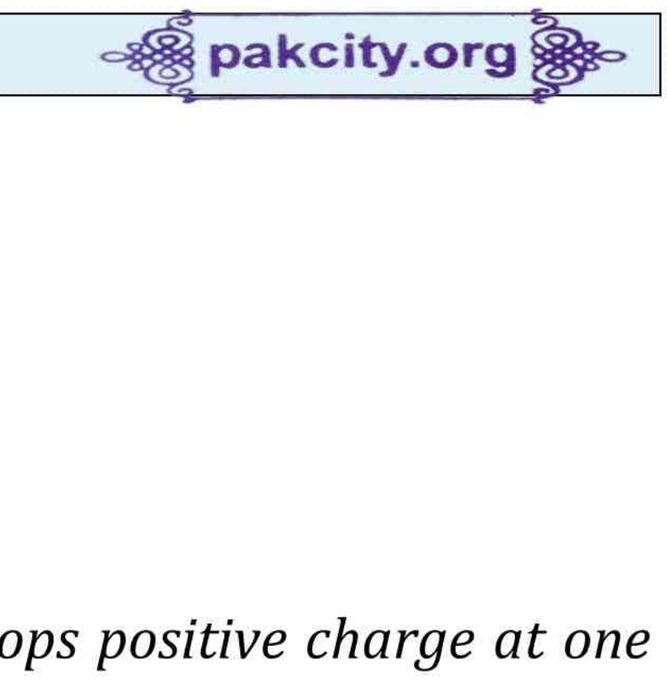
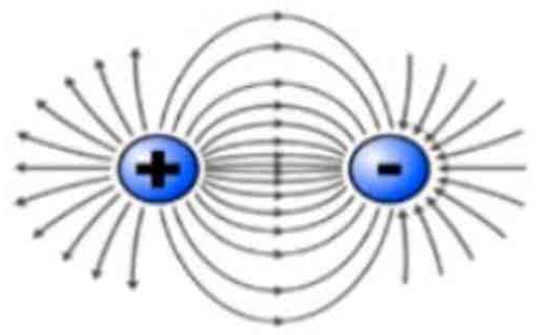


Fig. Uncharged electroscope

copper wire.



Electric field lines for two opposite and equal point charges.

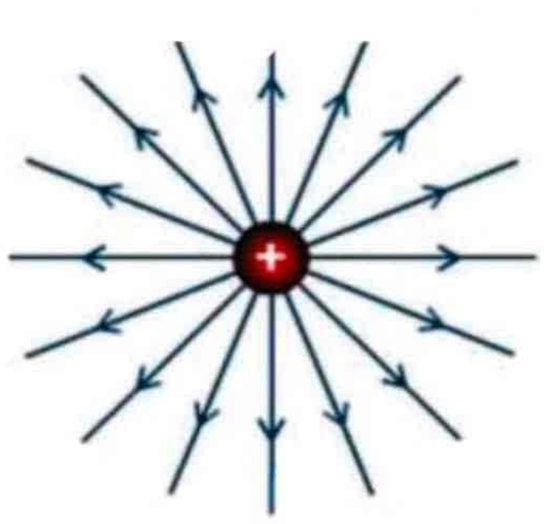
Q4: ***Define electric field.***

Ans: ***Electric field:***

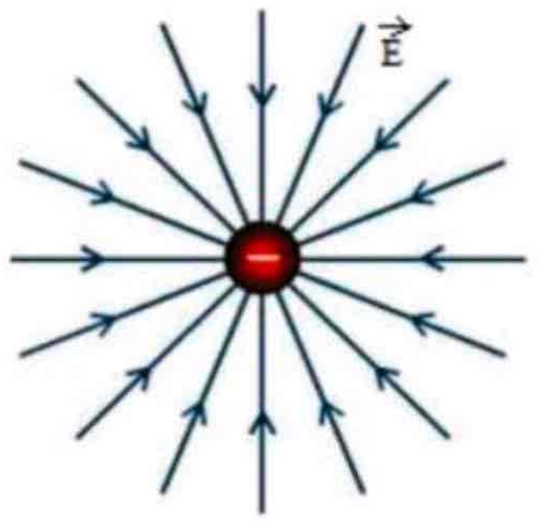
The electric field is a region around a charge in which it exerts electrostatic force on another charges.

Q5: ***Define electric lines of force. Who introduced them?***

Ans: The direction of electric field intensity in an electric field can also be represented by drawing lines. These lines are known as electric lines of force.
These lines are introduced by Michael Faraday.



Electric field lines for an isolated positive point charge.



Electric field lines for an isolated negative point charge.

Q6: ***State Coulomb's law.***

Ans: The force of attraction or repulsion between two point charges is directly proportional to the product of the quantity of charges and inversely proportional to the square of the distance between them.

Q7: ***Write the names of different types of capacitors.***

Ans: These are the names of the different types of capacitors:

- *Parallel Plate capacitor*
- *Electrolytic capacitor*
- *Paper capacitor*
- *Mica capacitor*

Q8: ***What do you mean by electrolytic capacitor?***

Ans: ***Electrolytic Capacitor:***

Electrolytic capacitor is used to store large amount of charge at relatively low voltages.

Construction:

It consists of a metal foil in contact with an electrolyte. When voltage is applied between the foil and the electrolyte a thin layer of metal oxide is formed on the foil and this layer serves as a dielectric very large capacitance is attained because the dielectric layer is very thin.

Chapter : 13	*Electrostatics*

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Imp.Long Questions

Q.1: ***How are capacitors connected in parallel? Derive relation for equivalent capacitance and write down characteristic features for this combination.***

Q.2: ***How are capacitors connected in series? Derive relation for equivalent capacitance and write down characteristic features for this combination.***

Q.3: ***State and explain Coulomb's law.***

Q.4: ***Give any two applications of electrostatics.***

Q.5: ***Two capacitors of capacitances 6 μF and 12 μF are connected in series with 12 V battery. Find the equivalent capacitance of the combination. Find the charge and the potential difference across each capacitor.***

Q.6: ***A capacitor holds 0.03 coulombs of charge when fully charged by a 6 volt battery. How much voltage would be required for it to hold 2 coulombs of charge?***

Q.7: ***What are hazards of electricity?***

Q.8: ***The charge of how many negatively charged particles would be equal to 100 μC. Assume charge on one negative particle is 1.6×10^{-19} C ?***

Q.9: ***The electric potential at a point in an electric field is 10^4 V. If a charge of +100 μC is brought from infinity to this point. What would be the amount of work done on it?***