Additional Conceptual Short Questions with Answers

Q1. The time constant of a series RC circuit is t = RC, verify that an Ohm times farad is equivalent to second.

Ans. Given data:

The time constant of a series circuit = t = RC

To prove:

1 Ohm x 1 farad = 1 second

Proof:

According to Ohm's law

$V = IR$

Putting $I = \frac{q}{t}$, we have

$V = \frac{q}{t} R$

or $R = \frac{Vt}{q}$ (1)

According to equation

$q = CV$

Or $C = \frac{q}{V}$ (2)

Multiplying equation (1) and (2), we get

$RC = \frac{Vt}{q} \times \frac{q}{V}$

Or $RC = t$

Hence, 1ohm x 1 farad = 1 second

where ohm is the unit of resistance R.

2. Show that $\frac{1\,Volt}{1\,meter} = \frac{1\,Newton}{1\,Coulomb}$

Ans. L.H.S = $\frac{Volt}{meter}$

$= \frac{joule}{Colomb-meter}$

$= \frac{Newton-meter}{Colomb-meter}$

$= \frac{Newton}{Coulomb}$

3. Do electrons tend to go to region of high potential of low potential?

Ans. Electrons tend to go the region of high potential.

Reason:

As the electrons are negatively charged particles when they are released in an electric field. They move from negative end (low potential) to positive end (high potential)

4. Vehicles carrying inflammable materials usually have metallic ropes touching the ground during motion. Why?

Ans. When vehicles move through air, they get charged due to air friction and charges develop on tyres also. If charges are sufficient, they will produce spark. The vapour which escape from the inflammable material carried by vehicle may catch fire. To prevent this metallic rope touching the ground are sus ended. Through this conducting metal the charges flow to the earth.

5. Force of attraction between two-point charges placed at a distance d in a medium is F. At what distance apart should these changes be kept in the some medium so that force between them become $\frac{F}{3}$?

Ans.

$F = k\frac{q_1q_2}{d^2}$ (1)

$F' = k\frac{q_1q_2}{x^2}$ (2)

$F' = \frac{F}{3}$

$k\frac{q_1q_2}{x^2} = \frac{1}{3}\left(k\frac{q_1q_2}{d^2}\right)$

$\frac{1}{x^2} = \frac{1}{3d^2}$

$x^2 = 3d^2$

Taking square root of both sides

$x = \sqrt{3d^2}$

$x = \sqrt{3}d$

6. Why is it safe to stay inside an automobile during a light storm?

Ans. Although many people believe that this is safe because of the insulating rubber tyre, this is not true. Lighting is able to travel through several kilometer of air, so it can certainly penetrate a few centimeters of rubber.

The interior of the car is safe because the charges on the car's metal shell reside on its outer surface. Thus, the occupant in the automobile touching the inner surface is not in danger.

7. The distance between the plates of a parallel plate capacitor is d. A metal plate of thickness $\frac{d}{2}$ is placed between the plates. What will be its effect on the capacitance?

Ans. When metal plate is introduced between two plates of a capacitor, it will act as two capacitors and the capacitance will increase.

8. A negatively charged balloon is set free, It first clings to the wall but eventually falls down. Why?

Ans. Due to phenomenon of electrostatic induction negatively charged balloon induces a positive charge on the wall, so it clings to the wall. It falls eventually because of leakage of charge through wall and surrounding.

Self-Assessment Paper 1

Q.No.2 Write Short Answers any SIX of the following questions.

1. Define potential gradient. Shot that volt/meter = newton / coulomb.

2. Water has a large dielectric constant, but is rarely used in capacitors. Why?

3. Suppose that you follow an electric field line due to a negative point charge. Do electric field and electric potential increase or decrease?

4. What are uniform and uniform electric field lines, explain with example.

5. Is E necessarily zero inside a charged rubber balloon if balloon is spherical? Assume that charge is distributed uniformly over the surface.

6. What is the relationship between electric potential difference and change in potential energy?

7. Define electron volt and show that $1eV = 1.6 \times 10^{-19} J$.

Q.No.3 Extensive Question.

Q. (a) State Gauss's law. Determine the electric intensity at a point due to an infinite sheet of charge.

(b) A 280 J of work is done in varying a charge of 2C from a place where the potential is -12 V to another place where potential is V, calculate the value of V?

Self-Assessment Paper 2

Q.No.2 Write Short Answers of the following questions.

1. Describe the application of Electrostatic in the function of photocopier machine.

2. Why the equi-potential surface and hence the line is at one same potential in an electric field?

3. Write down four dissimilarities between electric and gravitational forces.

4. Sketch the graphs for charging and discharging of a capacitor.

5. Sketch the graphs for charging and discharging of a capacitor.

6. Do the electrons tends to go to a region of high potential or low potential?

7. Write down some important properties of electric field lines?

Q. No 3 Extensive Questions.

Q. (a) Explain M Mikan 's oh drop method to determine the charge on an electron.

(b) What is the potential difference between two points in a electric field if it takes 600J of energy to move a charge between two points?