

divided among the various capacitors. Hence

$$V = V_1 + V_2 + V_3$$

As $Q = CV$

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

$$V = \frac{Q}{C_1} + \frac{Q}{C_2} + \frac{Q}{C_3}$$

$$V = Q \left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \right)$$

As $Q = CV$

Hence $\frac{V}{Q} = \frac{1}{C}$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

4. Series combination of capacitors can be replaced with one equivalent capacitor having capacitance C_{eq} .

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

If 'n' capacitors are connected in series then

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

5- Equivalent capacitance of a series combination of capacitors is smaller than any individual capacitance. Capacitors connected in series decrease the value of capacitance.

Question : 7(b)

Given Data :-

$$q_1 = 500 \mu C \\ = 500 \times 10^{-6} C$$

$$q_2 = 100 \mu C \\ = 100 \times 10^{-6} C$$

$$r = 0.5 m$$

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

$$F = ?$$

Calculations :-

According to Coulomb's Law

$$F = K \frac{q_1 q_2}{r}$$

Putting values we get

$$F = \frac{9 \times 10^9 \times 500 \times 10^{-6} \times 100 \times 10^{-6}}{(0.5)^2}$$

$$= \frac{9 \times 5 \times 10^9 \times 10^2 \times 10^{-6} \times 10^2 \times 10^{-6}}{(0.5)(0.5)}$$

$$= \frac{45 \times 10^{9+2-6+2-6}}{0.25}$$

$$= \frac{45 \times 10}{0.25}$$

$$\boxed{F = 1800 \text{ N}} \quad \underline{\underline{\text{Ans.}}}$$

TEST-4
CH - 13

PHYSICS

Time Allowed: 15 Minutes

-019(10TH CLASS)

Paper: (Objective Type)

Maximum Marks : 12

Note : You have four choices for each objective type question as A,B,C and D. The choice which you think is correct fill that circle in front of that question number. Use marker or pen in fills this circle. Cutting or filling two or more circles will result in zero mark in that question.

Q.1	QUESTIONS	(A)	(B)	(C)	(D)
1.	S.I unit of capacitance is	Coulomb	Electric volt	Farad	Volt
2.	Capacitance is defined as	VC	Q/V	QV	V/Q
3.	The unit of electric intensity.	ms ⁻¹	NS	dNC ⁻¹	Ne ⁻¹
4.	Electroscope is used to detect:	Charge	Current	Voltage	Resistance
5.	In series combination of capacitors each capacitor will have same.	Voltage	Charge	Capacitance	Charge and voltage
6.	The value of k in coulomb's law is.	$9 \times 10^9 \text{ Nm}^{-2}\text{C}^{-2}$	$9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$	$9 \times 10^8 \text{ Nm}^{-2}\text{C}^{-2}$	$9 \times 10^{-9} \text{ Nm}^{-2}\text{C}^{-2}$
7.	The SI Unit of charge is.	Volt	Coulomb	Ampere	Ohm
8.	How many factors are which effect the ability of capacitor to store charge?	2	3	4	5
9.	The coulomb's law is.	$F = k \frac{q_1 q_2}{r^3}$	$F = k \frac{q_1 q_2}{r^2}$	$F = qE$	$F = G \frac{m_1 m_2}{r}$
10.	Positive Electric charge is	Repels other positive charge	Attract other positive charge	Attract a neutral charge	Repels a neutral object
11.	To protect the gold leaves of electroscope from the external electric disturbances, the aluminum foil is grounded by a thin wire, which is made up of.	Aluminium	Silver	Copper	Brass
12.	Which device is used to store charge?	Resistor	Capacitor	Dielectric	Fuse

A B C D

A B C D

A B C D

A B C D

A B C D

1	☐ A ☐ B ☒ C ☐ D	4	☒ A ☐ B ☐ C ☐ D	7	☐ A ☒ B ☐ C ☐ D	10	☒ A ☐ B ☐ C ☐ D	13	☐ A ☐ B ☐ C ☐ D
2	☐ A ☒ B ☐ C ☐ D	5	☐ A ☒ B ☐ C ☐ D	8	☐ A ☒ B ☐ C ☐ D	11	☐ A ☐ B ☒ C ☐ D	14	☐ A ☐ B ☐ C ☐ D
3	☐ A ☐ B ☒ C ☐ D	6	☐ A ☒ B ☐ C ☐ D	9	☐ A ☐ B ☒ C ☐ D	12	☐ A ☒ B ☐ C ☐ D	15	☐ A ☐ B ☐ C ☐ D

نوٹ: معروضی سوال نامے کو توجہ سے پڑھیں اور ہر MCQ کی درست آپشن A,B,C,D کو پین کی سیاہی یا مار کر اس طرح پُر کریں کہ سیاہی دائرے سے باہر نہ نکلے۔ ایک سے زیادہ دائروں کو پُر کرنے یا کاٹ کر پُر کرنے کی صورت میں مذکورہ جواب غلط تصور ہوگا۔

TEST NO. 4
CH NO. 13

PHYSICS

Time Allowed: 1:45 Hours

-019 (10th CLASS)

Paper: (Essay Type)
Maximum Marks: 48

(PART – I)

2. Write short answers to any Five (5) questions: 10

- (i) Define electrostatic Induction.
- (ii) What is electroscope?
- (iii) What is the difference between capacitor and dielectric.
- (iv) Define charge and types of charge.
- (v) Define Coulomb's law. Write mathematical form.
- (vi) Define electric field and electric field intensity. Write its unit.
- (vii) What is meant by point charge?
- (viii) Write the names of different types of capacitors.

3. Write short answers to any five (5) questions: 10

- (i) What is electric field lines.
- (ii) What is potential difference and write its name of unit?
- (iii) What is electric potential? Write its Unit.
- (iv) Describe the construction of variable capacitor?
- (v) Does each capacitor carry equal charge in series combination? Explain.
- (vi) Two uses of Capacitors.
- (vii) What is gold leaf electroscope?
- (viii) Difference between variable and fixed type capacitor?

4. Write short answers to any Five (5) questions: 10

- (i) What do you mean by the capacitance of a capacitor?
- (ii) Define capacitance state its SI unit.
- (iii) What are hazards of static electricity?
- (iv) Draw circuit diagram for three capacitors circuit connected in series combination.
- (v) How energy stored in a capacitor?
- (vi) Write the formula of parallel combination of capacitor?
- (vii) What is mica capacitor?
- (viii) How electric potential and potential energy relate with electric field?

(PART – II)

Note: Attempt any TWO questions.

- 5. (a) What is meant by electric field and electric field intensity with help of example. 4
(b) Two-point charges $q_1 = 10 \mu C$ and $q_2 = 5 \mu C$ and placed at a distance of 150 cm. 5
Find the Coulomb's force between them. Also find the direction of this force?
- 6. (a) Explain briefly electrostatic Induction. 4
(b) Two capacitors of capacitance $6 \mu F$ and $12 \mu F$ are connected in series with 12 V battery. Find the equivalent capacitance of the combination. Find the charge and the potential across each capacitor. 5
- 7. (a) How are capacitors connected in series? Describe the characters features of the combination. 4
(b) Two bodies are oppositely charged with $500 \mu C$ and $100 \mu C$. Find the force 5
between the two charges if the distance between them in air is 0.5 m.

PHYSICS

(PART - I)

Question: 2

Write short answers of any five questions:

(i) Define Electrostatic induction.

Electrostatic Induction :-

In the presence of a charged body an insulated conductor develops positive charges at one end and negative charges at the other end. This process is called electrostatic induction.

(ii) What is electroscope?

Electroscope :-

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

(iii) What is the difference between capacitor and dielectric.

A device used for storing electric charge is called a capacitor. The air or insulator placed between the plates of a capacitor is called dielectric.

(iv) Define charge and types of charge.

Charge :-

Charge is the basic property of the material body due to which it attracts or repels another body and there are two types of the charges one is positive and second is negative.

(v) Define Coulomb's law. Write mathematical form.

Coulomb's Law :-

"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.

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

(Vi) Define electric field and electric field intensity. Write its unit.

Electric Field :-

A region around a charge in which it exerts electrostatic force on another charge.

Electric Field Intensity :-

The force acting on a unit positive charge placed at a point. Its SI unit is NC^{-1} .

(Vii) What is meant by point charge?

Point Charge :-

If the distance between two charges is much greater as compared to their size

then these bodies are considered as point charge.

(VIII) Write the names of different types of capacitors?

- 1- Paper capacitor
- 2- Mica capacitor
- 3- Parallel plate capacitor
- 4- Electrolytic capacitor

Question : 3

Write short answers of any five questions:

(i) What is electric field lines?

Electric Field Lines :-

The direction of electric field intensity in an electric field can also be represented by drawing lines. These lines are known as electric field lines.

(ii) What is potential difference and write its name of unit?

Potential Difference :-

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

- (iii) What is electric potential? Write its unit.

Electric Potential :-

"Electric potential at a point in an electric field is equal to the amount of work done in bringing a unit positive charge from infinity to that point." Its unit is volt or JC^{-1}

- (iv) Describe the construction of capacitor?

Construction of Capacitor :-

It consist 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.

(N) Does each capacitor carry equal charge in series combination? Explain.

Each capacitor has the same charge across each capacitor in series combination if battery supplies $+Q$ charge to the left plate of the capacitor C_1 , due to induction $-Q$ charge is induced on its right plate and $+Q$ charge on the left plate of the capacitor i.e. on each plate of capacitor charge ^{is} same.

(Vii) Write two uses of capacitors.

Uses of Capacitors :-

1- They are used for table fans, ceiling fans, coolers motors and washing machines.

2- They are used in electronic circuits of computers.

(Vii) What is gold leaf electroscope?

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

(Viii) What is difference between fixed and variable capacitor?

Fixed Capacitor

Variable Capacitor

If the plates of the capacitor are immovable then such capacitors are called fixed capacitors. The capacitance of the such capacitor can not be changed.

In variable capacitors the value of capacitance can be increased or decreased. In these capacitors some arrangements are made to change the area of the plates facing each other.

Question : 4

Write short answers to any five questions:

(i) What do you mean by the capacitance of a capacitor?
Capacitance :-

It is the ability of the capacitor to store charge when one coulomb of charge given to the plates of the capacitor produces a potential difference of one volt between the plates of the capacitor.

(ii) Define the unit of capacitance.

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

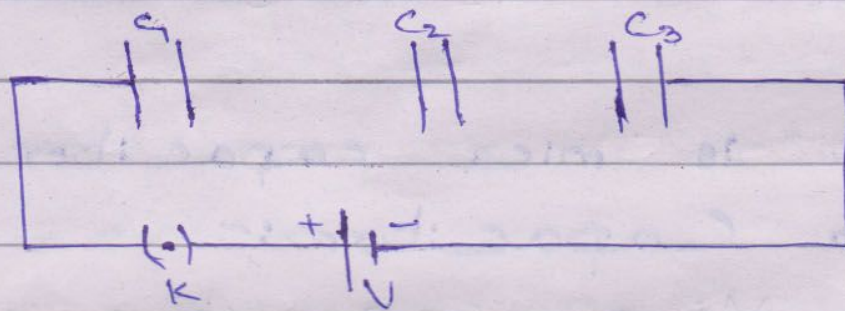
(iii) What are hazards of static electricity?

The phenomenon of lightning occurs due to a large

quantity of electric charge which build up in the heavy thunderclouds. The thunderclouds are charged by friction between the water molecules in the thunderclouds and the air molecules.

(iv) Draw circuit diagram for three capacitors circuit connected in series combination.

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



(v) How energy stored in a capacitor?

If a capacitor is connected to a battery of V , then the battery transfers a charge $+Q$ from plate A to plate B so that $-Q$ charge appears on

plate B and +Q charge appears on plate A. The charge on each plate attract each other and thus remained bound with in the plate, in this way charge is stored in a capacitor for long time.

(Vi) Write the formula of parallel combination of capacitor.

The formula of parallel combination of capacitor is

$$C_{eq} = C_1 + C_2 + C_3 + \dots + C_n$$

(Vii) What is mica capacitor?

Mica Capacitor :-

Mica capacitor is an example of fixed capacitor.

In mica capacitor, mica is used as dielectric between the two metal plates.

Mica is enclosed in a plastic case.

(Viii) How electric potential and potential energy relate

with electric field?

The relation between electric potential and potential energy is given by $V = \frac{W}{q}$

(PART- II)

Question : 5(a)

Electrostatic Induction :-

"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."

Experiment :-

Consider a metallic sphere placed on an insulated stand. The sphere is neutral as it carries equal number of positive and negative charges. Now bring a ⁺sep⁺ negatively charged rubber rod near the conducting sphere. Left part of the sphere that is

close to the rod becomes positively charged while the right part that is away from the rod becomes negatively charged. Negative charge in the rod repels the negative charge of the sphere and shifts it to the opposite "sign" region of the sphere that is away from the rod. Thus there is excess of positive charge in the region of sphere close to the rod while there is excess of negative charge in the region of the sphere away from the rod. But as a whole the sphere is still neutral, since no charge has been added or subtracted.

Now if we remove the rod away from the sphere the charges again will spread uniformly on the whole surface of "sub" the sphere.

Question : 5(b)

Given Data :-

$$q_1 = 10 \mu C$$
$$= 10 \times 10^{-6} C$$

$$q_2 = 5 \mu C$$
$$= 5 \times 10^{-6} C$$

$$r = 150 \text{ cm} = 1.5 \text{ m}$$

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

$$F = ?$$

Calculation :-

As we know that

$$F = K \frac{q_1 q_2}{r}$$

Putting values we get

$$F = \frac{(9 \times 10^9) \times 5 \times 10^{-6} \times 10 \times 10^{-6}}{(1.5)^2}$$

$$= \frac{9 \times 5 \times 10^{9-6+1-6}}{2.25}$$

$$= \frac{45 \times 10^{-2}}{2.25}$$

$$F = 0.2 \text{ N}$$

Ans.

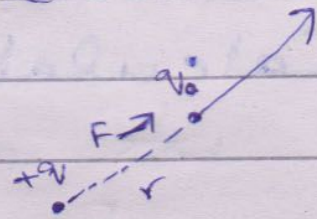
Question: 6(a)

Electric Field:-

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

Explanation:-

Consider a positive charge q and bring a test charge q_0 at a distance r . The q_0 will experience a force. According to Coulomb's law, the value of this force will depend upon the distance between two charges.



If charge q_0 is moved away from q this force will decrease till a certain distance, the force would practically reduce to zero.

Electric Field Intensity:-

"The strength of electric field at any point in space

is called electric field intensity."

Explanation :-

If F is the force acting on test charge q_0 the electric field intensity would be

$$E = \frac{F}{q_0}$$

If the electric field due to a given arrangement of charge is known at some point, the force on any particle with charge q placed at that point can be calculated by using the formula

$$F = qE$$

This is force acting on a unit positive charge placed at that point.

Unit :-

SI unit of electric field intensity is NC^{-1}

Quantity :-

Electric intensity being a force is a vector

Quantity:

Question: 6(b)

Given Data :-

$$C_1 = 6 \mu F$$

$$= 6 \times 10^{-6} F$$

$$C_2 = 12 \mu F$$

$$= 12 \times 10^{-6} F$$

$$V = 12 \text{ volt}$$

$$C_e = ?$$

$$V_1 = ?$$

$$V_2 = ?$$

$$Q_1 = ?$$

$$Q_2 = ?$$

Calculation :-

We know that

$$\frac{1}{C_e} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$\frac{1}{C_e} = \frac{1}{6} + \frac{1}{12}$$

$$= \frac{2+1}{12}$$

$$= \frac{3}{12}$$

$$\frac{1}{C_e} = \frac{1}{4}$$

$$C_e = 4 \mu F$$

$$C_e = 4 \times 10^{-6} F$$

$$Q = C_e V$$

$$= 4 \times 10^{-6} \times 12$$

$$= 48 \times 10^{-6}$$

$$Q = 48 \mu C$$

In series combination,
charge across each capacitor
is same so

$$Q = Q_1 = Q_2$$

$$V_1 = \frac{Q_1}{C_1}$$

$$= \frac{48 \times 10^{-6}}{6 \times 10^{-6}}$$

$$V_1 = 8 \text{ volts}$$

$$V_2 = \frac{Q_2}{C_2}$$

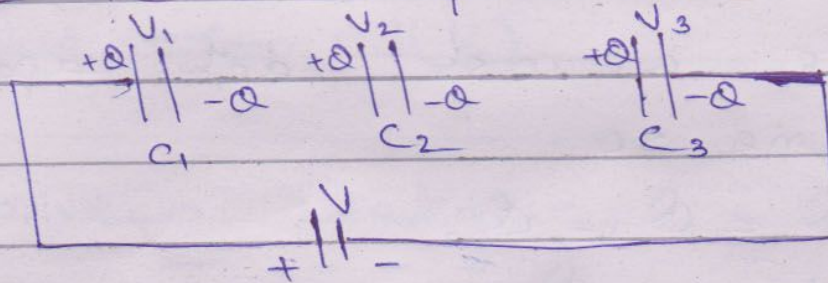
$$= \frac{48 \times 10^{-6}}{12 \times 10^{-6}}$$

$$V_2 = 4 \text{ volts}$$

Ans

Question : 7(a)

In this combination capacitors are connected side by side i.e., the right plate of one capacitor is connected to left plate of the next capacitor.



Characteristics :-

- 1- Each capacitor has the same charge. If battery supplies $+Q$ charge to the left plate of the capacitor C_1 , due to induction $-Q$ charge is induced on its right plate i.e.,

$$Q_1 = Q_2 = Q_3 = Q$$

- 2- The potential difference across each capacitor is different due to different value of capacitances.

- 3- The battery voltage has been