LAKSHYA JEE 2023

Electric Charges and Field

DPP-01

1. A soap bubble is given a negative charge, then its radius
(A) Decreases
(B) Increases
(C) Remains unchanged
(D) Nothing can be predicted as information is insufficient

2. A body can be negatively charged by
(A) Giving excess of electrons to it
(B) Removing some electrons from it
(C) Giving some protons to it
(D) Removing some neutrons from it

3. The minimum possible charge on an object is
(A) 1 coulomb
(B) 1 stat coulomb
(C) $1.6 \rightarrow 10^{-19}$ coulomb
(D) $3.2 \rightarrow 10^{-19}$ coulomb

4. An attractive force between two neutrons is due to
(A) Electrostatic and gravitational
(B) Electrostatic and nuclear
(C) Gravitational and nuclear
(D) Some other forces like Vander Waals

5. Two charges placed in air repel each other by a force of 10^{-4}. When oil is introduced between the charges, the force becomes 2.5×10^{-5} *N*. The dielectric constant of oil is
(A) 2.5 (B) 0.25
(C) 2.0 (D) 4.0

6. Two particle of equal mass *m* and charge *q* are placed at a distance of 16 cm. They do not experience any force. The value of $\frac{q}{m}$ is
(A) *l* (B) $\sqrt{\frac{\pi\varepsilon_0}{G}}$
(C) $\sqrt{\frac{G}{4\pi\varepsilon_0}}$ (D) $\sqrt{4\pi\varepsilon_0 G}$

7. The law, governing the force between electric charges is known as
(A) Ampere's law (B) Ohm's law
(C) Faraday's law (D) Coulomb's law

8. When the distance between the charged particles is halved, the force between them becomes
(A) One-fourth (B) Half
(C) Double (D) Four times

9. A total charge Q is broken in two parts Q_1 and Q_2 and they are placed at a distance R from each other. The maximum force of repulsion between them will occur, when
(A) $Q_2 = \frac{Q}{3}, Q_1 = \frac{2Q}{3}$
(B) $Q_2 = \frac{Q}{4}, Q_1 = \frac{3Q}{4}$
(C) $Q_2 = \frac{Q}{4}, Q_1 = \frac{2Q}{4}$
(D) $Q_1 = \frac{Q}{2}, Q_2 = \frac{Q}{2}$

10. Three charges 4 *q*, Q and *q* are in a straight line in the position of O, *l*/2 and *l* respectively. The resultant force on q will be zero, if Q is
(A) $-q$ (B) $-2q$
(C) $-\frac{q}{2}$ (D) $4q$

Answer Key

1. **(B)**
2. **(A)**
3. **(C)**
4. **(C)**
5. **(D)**
6. **(D)**
7. **(D)**
8. **(D)**
9. **(D)**
10. **(A)**

Hints and Solutions

1. **(B)**
Due to mutual repulsion of charges distributed on the surface of bubble.

2. **(A)**
Excess of electron gives the negative charge on body.

3. **(C)**
All other charges are its integral multiple.

4. **(C)**
Gravitational force and nuclear force both are attractive in nature.

5. **(D)**

By using $K = \frac{F_a}{F_m} \Rightarrow K = \frac{10^{-4}}{2.5\times10^{-5}} = 4$

6. **(D)**
They will not experience any force if $|\overrightarrow{F_G}| = |\overrightarrow{F_e}|$

$$\Rightarrow G\frac{m^2}{(16\times10^{-2})^2} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{q^2}{(16\times10^{-2})^2}$$

$$\Rightarrow \frac{q}{m} = \sqrt{4\pi\varepsilon_0 G}$$

7. **(D)**
Coulomb's law is used to calculate the force between charges.

8. **(D)**

$F \propto \frac{1}{r^2}$; so when r is halved the force becomes four times.

9. **(D)**

$Q_1 + Q_2 = Q$ ….(i) and $F = k\frac{Q_1Q_2}{r^2}$ …(ii)

From (i) and (ii) $F = \frac{kQ_1(Q-Q_1)}{r^2}$

For F to be maximum $\frac{dF}{dQ_1} = 0 \Rightarrow Q_1 = Q_2 = \frac{Q}{2}$

10. **(A)**

The force between $4q$ and q; $F_1 = \frac{1}{4\pi\varepsilon_0}\cdot\frac{4q\times q}{l^2}$

The force between Q and q; $F_2 = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Q\times q}{(l/2)^2}$

We want $F_1 + F_2 = 0$ or $\frac{4q^2}{l^2} = -\frac{4Qq}{l^2}$

$\Rightarrow Q = -q$