Ch-01 Electric Charges & Fields

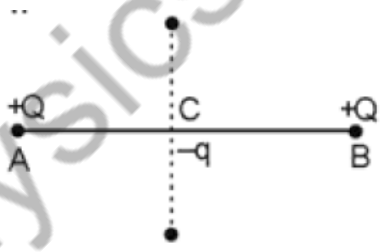
DAILY PRACTICE PROBLEMS -02

Q1) An electron at rest has a charge of 1.6 x 10^{-19} C. it starts moving with a velocity v = c/2, where c is the speed of light, then the new charge on it is

a. 1.6 x 10^{-19} C
b. 1.6 x 10^{-19} $\sqrt{1-\left(\frac{1}{2}\right)^2}$
c. 1.6 x 10^{-19} $\sqrt{\left(\frac{2}{1}\right)^2-1}$ C
d. $\frac{1.6\ x\ 10-19}{\sqrt{1-\left(\frac{1}{2}\right)^2}}$ C

Ans) a

Q2) Two similar charge of +Q, as shown in figure are placed at A and B. -q charge is placed at point C midway between A and B. -q charge will oscillate if



a. It is moved towards A.
b. It is moved towards B.
c. It is moved upwards AB.
d. Distance between A and B is reduced.

Ans) c

Q3) Two-point charges in air at a distance of 20 cm from each other interact with a certain force. At what distance from each other should these charges be placed in oil of relative permittivity 5 to obtain the same force of interaction –

a. 8.94 x 10^{-2} m

b. 0.894×10^{-2} m
c. 89.4×10^{-2} m
d. 8.94×10^{2} m

Ans) a

Q4) A certain charge Q is divided at first into two parts, (q) and (Q-q). Later on, the charges are placed at certain distance. If the force of interaction between the two charges is maximum then-

a. (Q/q) = (4/1)
b. (Q/q) = (2/1)
c. (Q/q) = (3/1)
d. (Q/q) = (5/1)

Ans) b

Q5) Two small balls having equal positive charge Q (Coulomb) on each are suspended by two insulating strings of equal length 'L' meter, from hook fixed to a stand. The whole set up is taken in a satellite in to space where there is no gravity (state of weightlessness) Then the angle (θ) between the two strings is-

a. 0^o
b. 90^o
c. 180^o
d. $0^o < \theta < 180^o$

Also find the tension in each string.

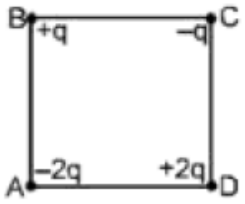
Ans) c, $(k_eQ^2)/4L^2$

Q6) Three equal charges {q) are placed at corners of a equilateral triangle. The force on any charge is-

a. Zero
b. $\sqrt{3}\ \frac{kq^2}{a^2}$
c. $\frac{kq^2}{\sqrt{3}a^2}$
d. $3\sqrt{3}\ \frac{kq^2}{a^2}$

Ans) b

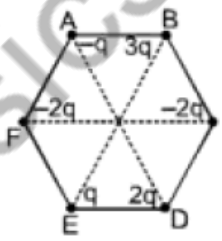
Q7) Four charges are arranged at the corners of a square ABCD, as shown. The force on +ve charge kept at the center pf the square is



a. Zero
b. Along diagonal AC
c. Along diagonal BD
d. Perpendicular to the side AB

Ans) d

Q8) Six charges are placed at the corner of regular hexagon as shown. If an electron is placed at its center O, force on it will be



a. Zero
b. Along OF
c. Along OC
d. None of these

Ans) d

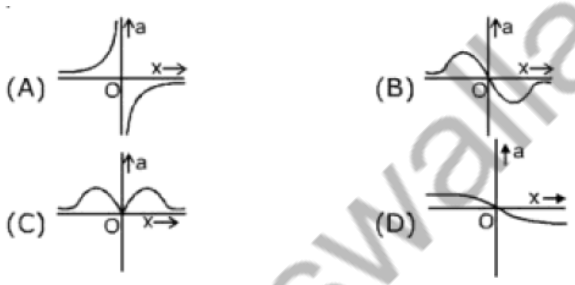
Q9) Two free positive charges 4q and q are a distance l apart. What charge Q is needed to achieve equilibrium for the entire system and where should it be placed form charge q?

a. Q= $\frac{4}{9}$q (negative) at $\frac{l}{3}$

b. Q= $\frac{4}{9}$ q (positive) at $\frac{l}{3}$
c. Q = q (positive) at $\frac{l}{3}$
d. Q= q (negative) at $\frac{l}{3}$

Ans) a

Q10) Two identical positive charges are fixed on the y-axis, at equal distances from the origin O. A particle with a negative charge starts on the x-axis at a large distance from O, moves along the +x-axis, passes through O and moves far away from O. Its acceleration a is taken as positive along its direction of motion. The particle's acceleration a is plotted against its x-coordinate =. Which of the following best represents the plot?



Ans) b

Q11) Suppose we have a large number of identical particles, very small in size. Any two of them at 10cm separation repel with a force of 3 x 10^{-10}N.

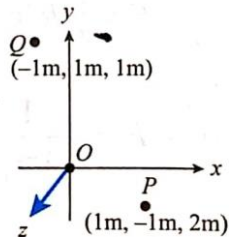
a) If one of them is at 10cm from a group of very small size of n others, how strongly do you expect it to be repelled?
b) Suppose you measure the repulsion and find it 6 x 10^{-6}N. how many particles were there I the group?

Ans) a) 3n x 10^{-10} N, b) 2 x 10^{4}

Q12) Two fixed point charges +4e and +e units are separated by a distance a. where should a third point charge be placed for it to be in equilibrium?

Ans) 2a/3 from +4e

Q13) Find the force on a charge q_1 (=20μC) due to the charge q_2 (= -10μC) if the positions of the charges are given as P_1 (1, -1, 2) and Q (-1, 1, 1) (see figure)



Q14) a particle of mass m carrying a charge $-q_1$ starts moving around a fixed charge $+q_2$ along a circular path of radius r. find the time period of revolution T of charge $-q_1$.

Ans) $\sqrt{\frac{16\pi^3\varepsilon_0 mr^3}{q_1 q_2}}$

Q15) Four equal point charges, each of magnitude +Q, are to be placed in equilibrium at the corners of a square. What should be the magnitude and sign of the point charge that should be the magnitude and sign of the point charge that should be placed at the center of the square to do this job.

Ans) $\frac{-Q(2\sqrt{2}+1)}{4}$

Q16) a copper atom consists of a copper nucleus surrounded by 29 electrons. The atomic weight of copper is 63.5 g mol^{-1}. Let us now take two pieces of copper each weighing 10g. Let one electron from one piece be transferred to another for every 1000 atoms in a piece.

a) Find the magnitude of charge appearing on each piece
b) What will be the coulomb force between the two pieces after the transfer of two electrons if they are 10cm apart? (Avogadro's number is 6 x 10^{23} mol^{-1}).

Ans) a) 15.12C b) 2.05 x 10^{14}N