Daily Practice Problems

Q1) If mass of the electron = 9.1 x 10^{-31}Kg. Charge on the electron = 1.6 x 10^{-19} coulomb and g= $9.8\ m/s^2$. Then the intensity of the electric field required to balance the weight of an electron is

a. 5.6 x $10^{-9} N/C$
b. 5.6 x $10^{-11} N/C$
c. 5.6 x $10^{-8} N/C$
d. 5.6 x $10^{-7}\ N/C$

Ans) b

Q2) A point charge 50μC is located in the XY plane at point of position vector $\vec{r_0} = 2\hat{\imath} + 3\hat{\jmath}$. What is the electric field at the point of position vector $\vec{r} = 8\hat{\imath} - 5\hat{\jmath}$

a. 1200 V/m
b. 0.04 V/m
c. 900 V/m
d. 4500 V/m

Ans) d

Q3) A point charge q is placed at origin. Let $\vec{E_A}, \vec{E_B}\ and\ \vec{E_C}$ be the electric field at three points A (1, 2, 3), B(1, 1, -1) and C(2, 2 2) due to charge q. then $[i] E_{\vec{A}} \perp \vec{E_B}\ [ii] |\vec{E_B}| - 4\ |\vec{E_C}|$

Select the correct alternative

a. Only [i] is correct
b. Only [ii] is correct
c. Both are correct
d. Both are wrong

Ans) c

Q4) A particle of mass m and charge Q is placed in an electric field E which varies with time as $E = E_0 sin\omega t$. It will undergo simple harmonic motion of amplitude

a. $\frac{QE_0^2}{m\omega^2}$
b. $\frac{QE_0}{m\omega^2}$
c. $\sqrt{\frac{QE_0}{m\omega^2}}$
d. $\frac{QE_0}{m\omega^2}$

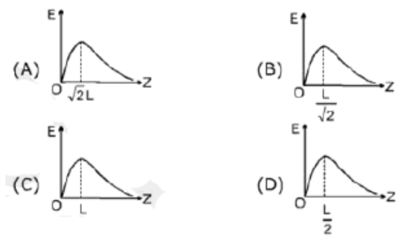
Ans) b

Q5) A charged particle of charge q and mass m is released from rest in an uniform electric field E. neglecting the effect of gravity, the kinetic energy of the charged particle after time 't' seconds is

a. $\frac{Eqm}{t}$
b. $\frac{E^2q^2t^2}{2m}$
c. $\frac{2E^2t^2}{mq}$
d. $\frac{Eq^2m}{2t^2}$

Ans) b

Q6) Four equal positive charges are fixed at the vertices of square of side L. Z-axis is perpendicular to the plane of square. The point z=0 is the point where the diagonals of the square intersect each other. The plot of electric field due to the four charges, as one moves on the z axis,



Ans) d

Q7) A simple pendulum has a length l, mass of bob m. the bob is given a charge q coulomb. The pendulum is suspended in a uniform electric horizontal field of strength E, then calculate the time period of oscillation when the bob is slightly displaced from its mean position

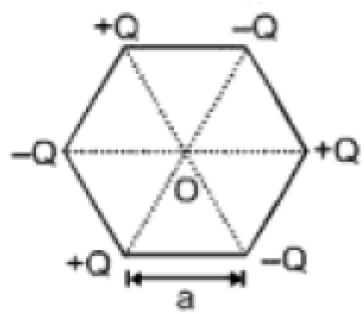
a. $2\pi\sqrt{\frac{l}{g}}$
b. $2\pi\sqrt{\frac{l}{g+\frac{qE}{m}}}$
c. $2\pi\sqrt{\frac{l}{g-\frac{qE}{m}}}$
d. $2\pi\sqrt{\frac{l}{\sqrt{g^2+\left(\frac{qE}{m}\right)^2}}}$

Ans)

Q8) A charge $+10^{-9}C$ is located at the origin in free space & another charge Q at (2, 0, 0). If the X- component of the electric field at (3, 1,1) is zero, calculate the value of Q. Is the Y component zero at (3, 1, 1)?

Ans) $Q = -\left(\frac{3}{11}\right)^{\frac{3}{2}} 3 \times 10^{-9}C, \overrightarrow{E_y} = -2K \times \frac{10^{-9}}{\sqrt{11^3}}$

Q9) Six charges are placed at the vertices of a regular hexagon as shown in the figure. Find the electric field on the line passing through O and perpendicular to plane of the figure as a function of distance x from point O.



Ans) $E_{net} = 0$

Q10) A clock face has a negative charge -q, -2q, -3q, ……-12q fixed at the position of the corresponding numerals on the dial. The clock hands do not disturb the net field due o the point charges at what time does the hour hand points in the same direction as the electric field at the center of the dial and the magnitude of electric field in that direction.

Ans) at 9, $\vec{E} = \frac{6kq}{r^2} + \left(1 + \sqrt{3} + 1\right)(-\hat{\imath})$

Q11) Tiny spherical oil drop carrying a net charge q is balanced in still air with a vertical uniform electric field strength $\frac{81\pi}{7} x10^{5} N/C$. When the field is switched off, the drop is observed to fall with terminal velocity $2 \times 10^{-3}\ m/s$ .Given g = 9.8 ms^{-2}, viscosity $1.8 \times 10^{-5} Nsm^{-2}$ and the density of oil = 900 kg m^{-5}, the magnitude of q is:

a. $1.6 \times 10^{-19} C$
b. $3.2 \times 10^{-19} C$
c. $4.8 \times 10^{-19} C$
d. $8.0 \times 10^{-19} C$

Ans) d

Q12) How many electrons should be removed from a coin of mass 1.6 g, so that it may just float in an electric field of intensity $10^{9}\ NC^{-1}$, directed upward?

Ans) $9.8 \times 10^{-3} kg$

Q13) A wheel having mass m has charges +q and -q on diametrically opposite points. It remains in equilibrium on a rough inclined plane in the presence of uniform vertical electric field =

a. Mg/q
b. Mg/2q
c. Mg tanθ/2q
d. None

Ans) b