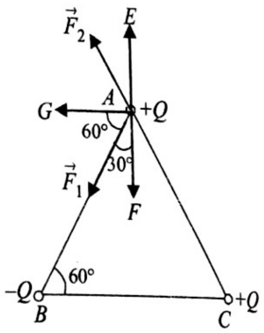
PHYSICS

71. (1)

If an electric dipole is placed in a non-uniform electric field, then the positive and the negative charges of the dipole will experience a net force and as one end of the dipole is experiencing a force in one direction and the other end in the opposite direction, so the dipole will have a net torque also.

72. (3)



The force experienced by A due to B is $F_1 = \frac{1}{4\pi\varepsilon_0}\frac{QQ}{a^2}$ along $\overrightarrow{AB}$ (attractive)

The force experienced by A due to C is $F_2 = \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{a^2}$ along $\overrightarrow{CA}$ produced (repulsive)

Now the force $\vec{F}_1$ is having a component $F_1 \cos 30°$ along $\overrightarrow{AF}$ and the force F_2 is having a component $F_2 \cos 30°$ along $\overrightarrow{AE}$

and $\overrightarrow{AF}$ are both normal to $\overrightarrow{BC}$ but they are mutually opposite to each other and as $|\vec{F}_1| = |\vec{F}_2|$. So the forces along $\overrightarrow{AE}$ and $\overrightarrow{AF}$ will both cancel each other. and so the force experienced by the charge at A in the direction normal to $\overrightarrow{BC}$ is zero.

73. (4)

The electrostatic force due to one Cs^+ ion is balanced by diagonally opposite other Cs^+. Thus, the net electrostatic force on Cl^- ion due to eight Cs^+ ions is zero.

74. (3)

Electric field between the sheets is

$$E = \frac{\sigma}{\varepsilon_0} = \frac{26.4\times10^{-12}}{8.85\times10^{-12}} = 3\ \text{N C}^{-1}$$

75. (1)

Since, $\vec{v} = v_0\hat{i}$, $\vec{E} = E_0\hat{j}$

The electron is moving in x-direction perpendicular to the electric field which is in y-direction. Thus, the path of electron moving perpendicular to field will be a parabola.

76. (4)

From Gauss's law, E is independent of r.

77. (1)

Consider an electric dipole with −q charge at A and +q charge at B, placed along z-axis, such that its dipole moment is in negative z direction. i.e., $p_z = -10^{-7}$ C m

The electric field is along positive direction of z-axis, such that

$$\frac{dE}{dz} = 10^5\ \text{N C}^{-1}\ \text{m}^{-1}$$

From, $F = qdE = (q\times dz)\times\frac{dE}{dz} = p\frac{dE}{dz}$

Force experienced by the system in the negative z-direction

$$F = -p\times\left(-\frac{dE}{dz}\right) = 10^{-7}\times(-10^5) = -10^{-2}\ \text{N}$$

78. (2)

Charge on electron = e

Mass of electron = m and intensity of uniform electric field = E.

Acceleration of the electron,

$$d = \frac{\text{Force on the electron}}{\text{Mass of electron}}$$

$$= \frac{\text{Electric charge} \times \text{Electric field}}{\text{Mass of electron}} = \frac{eE}{m}$$

79. (1)

In air, $F_{air} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$

In medium, $F_m = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{Kr^2}$

$\therefore \frac{F_m}{F_{air}} = \frac{1}{K} \Rightarrow F_m = \frac{F_{air}}{K}$ (decreases K-times)

80. (3)

Net force on each of the charge due to the other charges is zero. However, disturbance in any direction other than along the line on which the charges lie, will not make the charges return.