Prachand NEET 2025

Physics

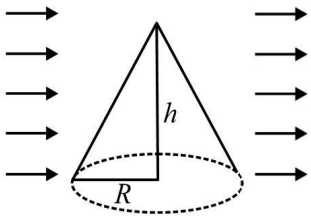
Electric Charges and Fields

DPP 01

Q1 An electric dipole is kept in non-uniform electric field. It may experience
(A) A force and a torque
(B) A force but not a torque
(C) A torque but not a force
(D) Neither a force nor a torque

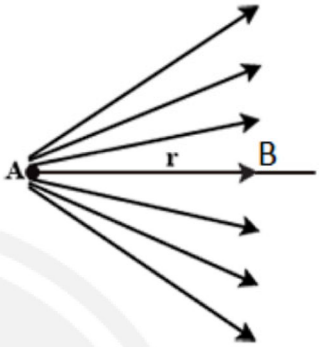
Q2 A region surrounding a stationary electric dipole has
(A) Magnetic field only
(B) Electric field only
(C) Both electric and magnetic fields
(D) No electric and magnetic fields

Q3 In figure, a cone lies in a uniform electric field *E*. Determine the electric flux entering the cone.



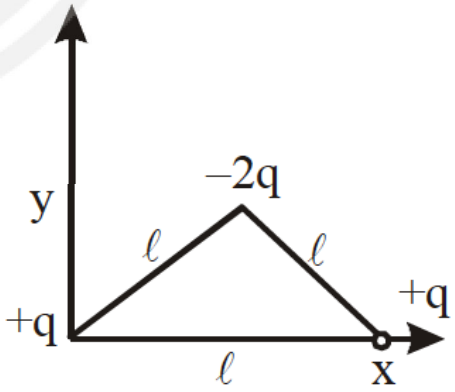
(A) $E\pi R^2$ (B) ERh
(C) $E\pi h^2$ (D) ER^2

Q4 In figure shown, the electric lines of force emerging from a charged body. If the electric fields at A and B are E_A and E_B respectively and the distance between A and B is r then



(A) $E_{\mathrm{A}} > E_{\mathrm{B}}$
(B) $E_{\mathrm{A}} < E_{\mathrm{B}}$
(C) $E_{\mathrm{A}} = E_{\mathrm{B}}$
(D) $E_{\mathrm{A}} = (E_{\mathrm{B}})/r^2$

Q5 Determine the electric dipole moment of the system of three charges, placed on the vertices of an equilateral triangle, as shown in the figure.



(A) $2ql\hat{j}$
(B) $(ql)\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
(C) $\sqrt{3}ql\frac{\hat{j}-\hat{i}}{\sqrt{2}}$
(D) $-\sqrt{3}ql\hat{j}$

Q6

A proton of mass ' m ' and charge ' e ' is released from rest in a uniform electric field of strength ' E '. The time taken by it to travel a distance ' d ' in the field is

(A) $\sqrt{\frac{2de}{mE}}$

(B) $\sqrt{\frac{2dm}{Ee}}$

(C) $\sqrt{\frac{2dE}{me}}$

(D) $\sqrt{\frac{2Ee}{dm}}$

Q7 In nature, the electric charge of any system is always equal to:

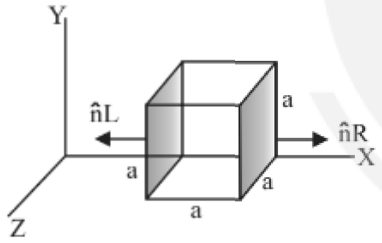
(A) half integral multiple of the charge on electron

(B) zero

(C) square of the charge on electron

(D) integral multiple of the charge on electron

Q8 The electric field components in the given figures are $\mathrm{E_x} = \alpha \mathrm{x}^{1/2}, \mathrm{E_y} = \mathrm{E_z} = 0$ in which $\alpha = 800\ \mathrm{NC}^{-1}\ \mathrm{m}^{-1/2}$. If net flux through the cube is $1.05\ \mathrm{Nm^2C^{-1}}$ (assume $\mathrm{a} = 0.1\ \mathrm{m}$), The charge within the cube is



(A) $9.27 \times 10^{-12}\mathrm{C}$

(B) $9.27 \times 10^{12}\mathrm{C}$

(C) $6.67 \times 10^{-12}\ C$

(D) $6.97 \times 10^{12}\mathrm{C}$

Q9 A circular wire loop of radius *r* carries a total charge *Q* distributed uniformly over its length. A small length dl of the wire is cut off. The electric field at the centre due to the remaining wire :-

(A) $\frac{\mathrm{Qd}\ell}{8\pi^2\in_0 \mathrm{r}^3}$

(B) $\frac{\mathrm{Qd}\ell}{2\pi^2\in_0 \mathrm{r}^3}$

(C) $\frac{\mathrm{Qd}\ell}{8\pi\epsilon_0 \mathrm{r}^3}$

(D) $\frac{\mathrm{Qd}\ell}{4\pi^2\in_0 \mathrm{r}^3}$

Q10 Two parallel infinite line charges with linear charge densities $+\lambda \mathrm{C/m}$ and $-\lambda \mathrm{C/m}$ are placed at a distance of $2\mathrm{R}$ in free space. What is the electric field mid-way between the two line charges?

(A) zero

(B) $\frac{2\lambda}{\pi\epsilon_0 \mathrm{R}}\mathrm{N/C}$

(C) $\frac{\lambda}{\pi\epsilon_0 R}\ \mathrm{N/C}$

(D) $\frac{\lambda}{2\pi\epsilon_0 \mathrm{R}}\mathrm{N/C}$

Q11 An infinite line charge produces a field of $9 \times 10^4\ \mathrm{N/C}$ at a perpendicular distance of 0.02 m . The linear charge density is;

(A) $10^{-10}\mathrm{C/m}$ (B) $10^{-9}\mathrm{C/m}$

(C) $10^{-8}\mathrm{C/m}$ (D) $10^{-7}\mathrm{C/m}$

Q12 The distance between the two charges $25\ \mu\mathrm{C}$ and $36\ \mu\mathrm{C}$ is $11\ \mathrm{cm}$. At what point on the line joining the two, the electric field intensity will be zero ?

(A) At a distance of $5\ \mathrm{cm}$ from $25\mu\mathrm{C}$

(B) At a distance of $5\ \mathrm{cm}$ from $36\mu\mathrm{C}$

(C) At a distance of $10\ \mathrm{cm}$ from $25\mu\mathrm{C}$

(D) At a distance of $11\ \mathrm{cm}$ from $36\mu\mathrm{C}$

Q13 Two charges $4\ \mu\mathrm{C}$ and $-100\ \mu\mathrm{C}$ are placed 90 cm apart. The distance of a point from $4\ \mu C$ charge where the electric field intensity is zero is;

(A) 22.5 cm (B) 20.5 cm

(C) 18.65 cm (D) 2.95 cm

Q14 An electric dipole is put in north-south direction in a sphere filled with water. Which statement is correct?

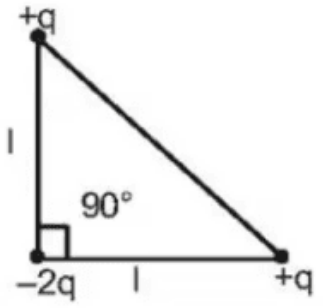
(A) Electric flux is coming towards the sphere.

(B) Electric flux is coming out of the spheré.

(C) Electric flux entering into and leaving the sphere are same.

(D) Water does not permit elettric flux to enter into sphere.

Q15 What is the magnitude of dipole moment of the system shown in figure?



(A) ql
(B) $\sqrt{3}(\mathrm{ql})$
(C) $\sqrt{2}(\mathrm{ql})$
(D) $\frac{ql}{\sqrt{2}}$

Q16 A cube of side l is placed in a uniform field $\overrightarrow{E} = E\hat{i}$. The net electric flux through the cube is

(A) Zero
(B) $l^2\mathrm{E}$
(C) $4l^2\mathrm{E}$
(D) $6l^2\mathrm{E}$

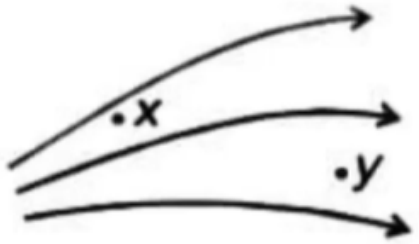
Q17 The unit of electric permittivity is

(A) Volt $/\mathrm{m}^2$
(B) $Joule/C$
(C) $\mathrm{Farad}/\mathrm{m}$
(D) $Henry/m$

Q18 Statement-I: An electric dipole placed in the electric field of a point charge can never experience zero resultant force.
Statement-II: Electric field of a point charge is non uniform.

(A) Both Statement-I and Statement-II are correct
(B) Both Statement-I and Statement-II are incorrect.
(C) Statement-I is correct and Statement-II incorrect.
(D) Statement-I is incorrect and Statement-II is correct.

Q19 Figure shows electric lines of force. If E_x and E_y are the magnitudes of electric field at points x and y respectively, then



(A) $E_x > E_y$
(B) $E_x = E_y$
(C) $E_x < E_y$
(D) Any of these

Q20 An electric dipole is placed at an angle of 30° with an electric field intensity $2 \times 10^5\ \mathrm{N/C}$. It experiences a torque equal to 4 N-m. The charge on the dipole, if the dipole length is $2\ \mathrm{cm}$, is

(A) $7\mu\mathrm{C}$
(B) $8mC$
(C) $2mC$
(D) $5mC$

Q21 Assertion (A): Total number of positive ions in nature is constant.
Reason (R): In an isolated system, charge remains conserved.

(A) Assertion (A) is True, Reason (R) is True; Reason (R) is a correct explanation for Assertion (A).
(B) Assertion (A) is True, Reason (R) is True; Reason (R) is not a correct explanation for Assertion (A).
(C) Assertion (A) is True, Reason (R) is False.
(D) Assertion (A) is False, Reason (R) is True.

Q22 Match Column I and Column II :

Column I	Column II
(a) unit of electric charge	(p) $N\ m^2\ C^{-1}$
(b) unit of electric intensity	(q) coulumb
(c) unit of electric flux	(r) stat coulomb
(d) c.g.s. unit of electric charge	(s) NC^{-1}

(A) $a \to q,\ b \to s,\ c \to p,\ d \to r$

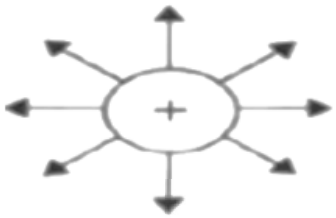
(B) $a \to q,\ b \to r,\ c \to p,\ d \to r$

(C) $a \to q,\ b \to r,\ c \to p,\ d \to s$

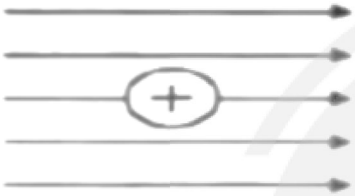
(D) $a \to q,\ b \to s,\ c \to r,\ d \to p$

Q23 Which of the following figure represents the electric field lines due to a single positive charge?

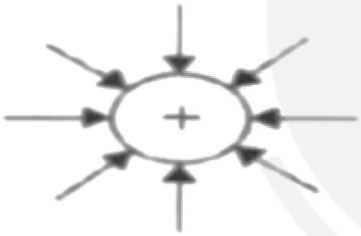
(A)



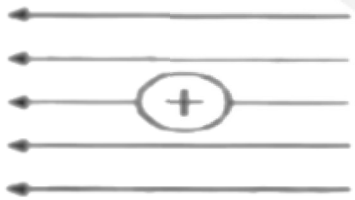
(B)



(C)



(D)



Q24 As per Gauss' law, which of the following is true about this $\int \vec{E} \cdot \vec{ds} = \frac{q_{\text{int}}}{\epsilon_0}$?

(A) This is valid for symmetrical surface only

(B) E is the electric field due to the charge inside the surface

(C) Electric flux through the closed surface due to outside charge is always zero

(D) none of the above

Q25 The dimensional formula of electric flux is

(A) $\left[\mathrm{M}^1\ \mathrm{L}^1\ \mathrm{T}^{-2}\right]$

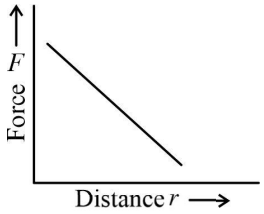
(B) $\left[M^1 L^3\ \mathrm{T}^{-3}\ \mathrm{A}^{-1}\right]$

(C) $\left[\mathrm{M}^2\ \mathrm{L}^2\ \mathrm{T}^{-2}\ \mathrm{A}^{-2}\right]$

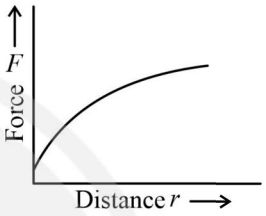
(D) $\left[\mathrm{M}^1\ \mathrm{L}^{-3}\ \mathrm{T}^3\ \mathrm{A}^1\right]$

Q26 Which of the following graphs shows the correct variation of force when the distance r between two charges varies ?

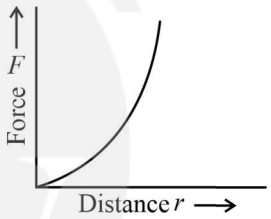
(A)



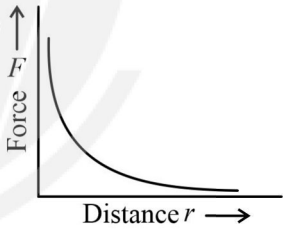
(B)



(C)



(D)

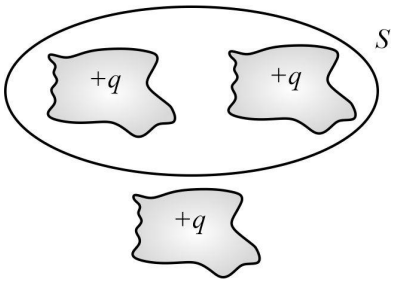


Q27 Two unlike charges attract each other with a force of 10 N. If the distance between them is doubled, the force between them is;

(A) 40 N (B) 20 N

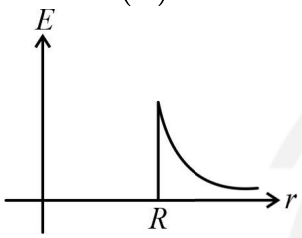
(C) 5 N (D) 2.5 N

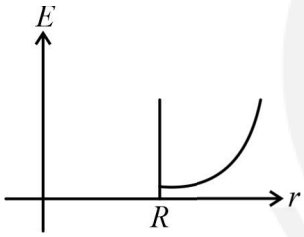
Q28 Shown below is a distribution of charges. The flux of electric field due to these charges through the surface S is:-

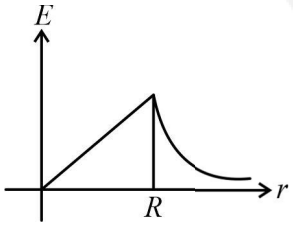


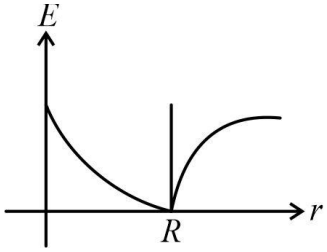
(A) $3q/\varepsilon_0$
(B) $2q/\varepsilon_0$
(C) q/ε_0
(D) Zero

Q29 If r is distance measured from centre of a charged shell and R is its radius, then the graph which may correctly represent variation of electric field (E) is

(A)


(B)


(C)


(D)


Q30 The dimensional formula of linear charge density λ is

(A) $\left[\mathrm{M}^{-1}\,\mathrm{L}^{-1}\,\mathrm{T}^{+1}\,\mathrm{A}\right]$
(B) $\left[M^0 L^{-1} T^{+1} A\right]$
(C) $\left[\mathrm{M}^{-1}\,\mathrm{L}^{-1}\,\mathrm{T}^{+1}\,\mathrm{A}^{-1}\right]$
(D) $\left[\mathrm{M}^{0}\,\mathrm{L}^{-1}\,\mathrm{T}^{+1}\,\mathrm{A}^{-1}\right]$

Answer Key

Q1	(A)	Q16	(A)
Q2	(B)	Q17	(C)
Q3	(B)	Q18	(A)
Q4	(A)	Q19	(A)
Q5	(D)	Q20	(C)
Q6	(B)	Q21	(D)
Q7	(D)	Q22	(A)
Q8	(A)	Q23	(A)
Q9	(A)	Q24	(C)
Q10	(C)	Q25	(B)
Q11	(D)	Q26	(D)
Q12	(A)	Q27	(D)
Q13	(A)	Q28	(B)
Q14	(C)	Q29	(A)
Q15	(C)	Q30	(B)

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

(A)

As the dipole will feel two forces which are although opposite but not equal.

Therefore, a net force will be there and as these forces act at different points of a body, a torque is also there.

Video Solution:

Q2 Text Solution:

(B)

Region around stationary charge has electric field only

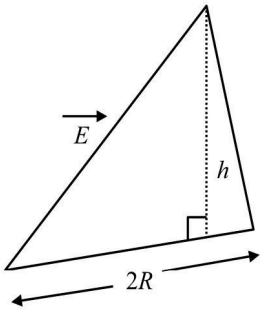
Video Solution:

Q3 Text Solution:

(B)

The cross section of the cone is a triangle

$\phi = E \times \frac{1}{2} \times 2R \times h = ERh$



Video Solution:

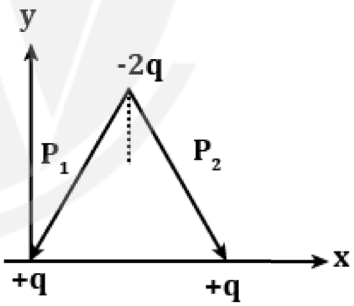
Q4 Text Solution:

(A)

Electric field intensity is proportional to the density of electric field lines. The crowder lines means strong electric field and rarer lines means weak electric field.

Video Solution:

Q5 Text Solution:



Dipole moment is given by,

P=charge × distance between two charges.

So for two pairs of dipoles, we can write,

$|P_1| = q(l)$

$|P_2| = q(l)$

|Resultant| = $2P\cos 30°$

$2ql\left(\frac{\sqrt{3}}{2}\right) = \sqrt{3}ql$

So, $\overrightarrow{P}_{\text{Resultant}} = -\sqrt{3}ql\hat{j}$

As the resultant is along negative y-axis direction.

Video Solution:

Q6 Text Solution:

(B)

F = eE

$a = \frac{eE}{m}$

$S = ut + \frac{1}{2}at^2$

$d = \frac{1}{2}\left(\frac{eE}{m}\right)t^2$

$t = \sqrt{\frac{2md}{eE}}$

Video Solution:

Q7 Text Solution:

(D)

By quantization of charge

Q = ±*ne*

Where,

N = number of transferred electrons.

e = 1.6 × 10^{-19}C

Video Solution:

Q8 Text Solution:

(A)

By Gauss's law

$\phi = \frac{q}{\in_0}$

or $q = \phi \in_0$

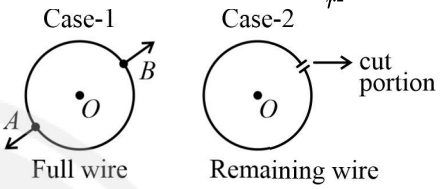
$= 1.05 \times 8.854 \times 10^{-12} C = 9.27 \times 10^{-12} C$

Video Solution:

Q9 Text Solution:

(A)

E due to point charge $= \frac{Kq}{r^2}$



Let charge is positive

Assume two dimetrically opposite sections on ring, suppose point A and B in case-1, so electric live of force due to small charge (dq) on it will be as directed in figure. Hence they will cancel each other.

Now, in case-2, dl is cut, hence at centre, E is produced due to point charge (dq) at A only.

Hence, $dq = \frac{Q}{2\pi r}.dl$

$dE = \frac{Kdq}{r^2} = \frac{KQ}{2\pi r^3}.dl$

$dE = \frac{Qdl}{8\pi^2 r^3 \varepsilon_o}$ where $\left(K = \frac{1}{4\pi\varepsilon_o}\text{S. I.}\right)$

Video Solution:

Q10 Text Solution:

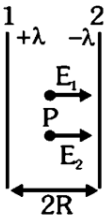
(C)

The correct option is $C\frac{\lambda}{\pi\varepsilon_0 R}N/C$

$\overrightarrow{E} = \overrightarrow{E_1} + \overrightarrow{E_2}$

$= \frac{\lambda}{2\pi\varepsilon_0 R} + \frac{\lambda}{2\pi\varepsilon_0 R}$

$= \frac{\lambda}{\pi\varepsilon_0 R}N/C$



Video Solution:

Q11 Text Solution:

(D)

Use, $E = \frac{\lambda}{2\pi\varepsilon_0 r} = \frac{2\lambda}{4\pi\varepsilon_0 r}$ or,

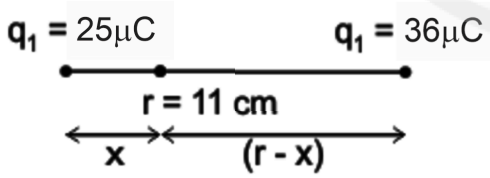
$9 \times 10^4 \left(\mathrm{N/C}\right) = \frac{9\times10^9\times2\lambda}{0.02}$

$\therefore \lambda = 10^{-7}$ coulomb per meter

Video Solution:

Q12 Text Solution:

(A)



Let at point P, E = 0

$E_{q_1} = E_{q_2}$

$\frac{Kq_1}{x^2} = \frac{Kq_2}{(r-x)^2}$

$\frac{25}{x^2} = \frac{36}{(r-x)^2}$

$\frac{5}{x} = \frac{6}{(r-x)}$

5(r - x) = 6x

5r - 5x = 6x

11x = 5r

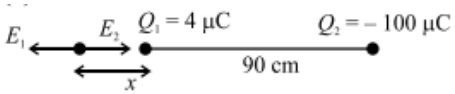
$x = \frac{5}{11} \times r = \frac{5}{11} \times 11 \text{ cm} = 5\ cm$

Video Solution:

Q13 Text Solution:

(A)

According to question;



$\left|\vec{E}_1\right| = \left|\vec{E}_2\right|$

$\Rightarrow \frac{kQ_1}{x^2} = \frac{kQ_2}{(90+x)^2}$

$\Rightarrow \frac{4}{x^2} = \frac{100}{(90+x)^2}$

$\Rightarrow \frac{90+x}{x} = 5$

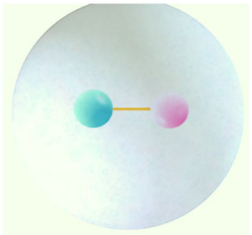
$\Rightarrow 90 = 4x$

$\text{Or } x = 22.5 \text{ cm}$

Video Solution:

Q14 Text Solution:

(C)



According to the Gauss' law, net flux through the surface

$\phi = \frac{Q_{inside}}{\varepsilon_0}$

Net charge inside the sphere

For a diploe, both charges are equal in magnitude and opposite in sign.

Q_{inside} = (+q) + (-q)

Q_{inside} = zero

So, net flux

$\Rightarrow \phi = \frac{0}{\varepsilon_0} = 0 \ NC^{-1}m^2$

Video Solution:

Q15 **Text Solution:**

(C)

Angle between the two vectors is 90° and Length of the diploe is a. Diploe Moment will be aq.

Resultant Diploe Moment will be:

$$P = \sqrt{(aq)^2 + (aq)^2 + \left(aq\right)\left(aq\right)\cos 90^\circ}$$

$$\Rightarrow P = \sqrt{2(aq)^2}$$

$$\Rightarrow P = aq\sqrt{2}$$

Video Solution:

Q16 **Text Solution:**

(A)

Given – side of cube = L

- According to **Gauss law,**

$$\Rightarrow \phi = \oint \overline{E}.\ ds = \frac{q_{in}}{\varepsilon_0}$$

- As there is **no charge residing inside the cube,**

$$\Rightarrow \phi = \frac{0}{\varepsilon_0} = 0$$

- Hence net flux is zero.

Video Solution:

Q17 **Text Solution:**

(C)

$C = \frac{A\varepsilon_0}{d}$(C is capacity in air)

$\varepsilon_0 = \frac{Cd}{A}$

S.I. unit of C is farad

S.I. unit of d is meter

S.I. unit of A is meter^2

$\therefore$ S.I. unit of ε_0 is farad/metre

Video Solution:

Q18 **Text Solution:**

(A)

As E is not uniform, therefore magnitude of forces are not equal. Hence net force is not zero. Electric field of a point charge either starts from it or enters into it, hence it is not uniform.

Video Solution:

Q19 **Text Solution:**

(A)

Near point *x*, Electric lines of force are crowded and near point y Electric Lines Of Force are $E_x > E_y$.

Video Solution:

Q20 **Text Solution:**

(C)

$\tau = pE.\sin\theta$

$\therefore p = \frac{\tau}{E.\sin\theta}$

q×2l = $\frac{4}{2\times10^5\times0.5}$ ..... $\left(p = q \times 2I \right)$

$\therefore\ q = \frac{4}{2\times10^5\times0.5\times0.02}$ ...

$.\left(2I = 0.02m\ \ given \right)$

= 2×10^{-3}C

q = 2 mC

Video Solution:

Q21 **Text Solution:**

(D)

Statement I is false because the total number of positive ions is not constant and can vary with situations and system.

Statement II is true by conservation of charge.

Video Solution:

Q22 **Text Solution:**

(A)

(a) S,I, unit of charge is coulomb (C)

(b) $E = \frac{F}{q}$ $\therefore$ S.I. unit of E is N/C

(c) ϕ =E.ds , S.I. unit of ϕ is N-m^2-C^{-1}

(d) CGS unit of charge is stat coulomb

Video Solution:

Q23 **Text Solution:**

(A)

Electric lines of force due to an isolated positive charge are radially outwards.

Video Solution:

Q24 **Text Solution:**

(C)

Since the electric field at a point is equal to electric flux passing per unit area, therefore,

$\oint \overrightarrow{E}.\overrightarrow{ds}$ is the net flux emanating from a closed surface.

Though net flux through the closed surface depends upon the charges enclosed in that surface only.

Electric field E at a point depends not only upon charges enclosed but it depends on charges lying outside the surface also.

Hence (A) is wrong.

Gauss' law is applicable to a closed surface. The surface may have any shape. It means, it is a general law. Hence (B) is wrong.

Gauss' law is $\oint \overrightarrow{E}.\overrightarrow{ds} = \frac{\sum q}{\varepsilon_0}$ It means, that net flux through a closed surface depends upon $\sum q$. But it is equal to the net charge enclosed within the surface only. Hence (C) is correct.

Video Solution:

Q25 **Text Solution:**

(B)

$\phi = E.\ ds$

$= \frac{F}{q}.A$

$= \frac{M^1L^1T^{-2}.L^2}{AT}$

$[\phi] =$ $= [M^1L^3T^{-3}A^{-1}]$

Video Solution:

Q26 **Text Solution:**

(D)

$F \propto \frac{1}{r^2}$

Force according to Coulomb's law obeys inverse square law.

Video Solution:

Q27 **Text Solution:**

(D)

$$F \propto \frac{1}{r^2}$$

$$\frac{F_1}{F_2} = \left(\frac{r_2}{r_1}\right)^2 \qquad \{r_2 = 2r_1\}$$

$$F_2 = \frac{F_1}{4} = \frac{10}{4} = 2.5\ \text{N}$$

Video Solution:

Q28 **Text Solution:**

(B)

Using Gauss' law

$\phi = \sum q_{enclosed}/\varepsilon_0$

Video Solution:

Q29 **Text Solution:**

(A)

Electric field inside shell is zero.

Outside shell. $E \propto \frac{1}{r^2}$

Video Solution:

Q30 **Text Solution:**

(B)

$\lambda = \frac{q}{L} = \frac{It}{L}$

$[\lambda] = [M^0L^{-1}T^{+1}A]$

Video Solution: