NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS
CLASS :- 12th **PAPER CODE :- CWT-1**
CHAPTER :- ELECTROSTATE

ANSWER KEY

1.	(D)	**2.**	(C)	**3.**	(B)	**4.**	(B)	**5.**	(C)	**6.**	(C)	**7.**	(C)
8.	(D)	**9.**	(D)	**10.**	(C)	**11.**	(B)	**12.**	(C)	**13.**	(D)	**14.**	(C)
15.	(A)	**16.**	(A)	**17.**	(C)	**18.**	(B)	**19.**	(C)	**20.**	(D)	**21.**	(C)
22.	(C)	**23.**	(B)	**24.**	(C)	**25.**	(B)	**26.**	(A)	**27.**	(A)	**28.**	(B)
29.	(B)	**30.**	(C)	**31.**	(C)	**32.**	(A)	**33.**	(A)	**34.**	(A)	**35.**	(B)
36.	(D)	**37.**	(B)	**38.**	(A)	**39.**	(B)	**40.**	(B)	**41.**	(A)	**42.**	(C)
43.	(D)	**44.**	(C)	**45.**	(D)	**46.**	(B)	**47.**	(B)	**48.**	(D)	**49.**	(D)
	50.	(B)											

SOLUTIONS

SECTION-A

1. (D)

Sol. In the presence of medium force becomes $\frac{1}{K}\, times$.

2. (C)

3. (B)

Sol. $F \propto \frac{1}{r^2} \Rightarrow \frac{F_1}{F_2} = \left(\frac{r_2}{r_1}\right)^2$ ®

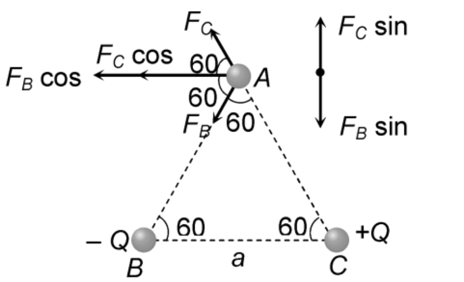
$\frac{5}{F_2} = \left(\frac{0.04}{0.06}\right)^2 = F_2 = 11.25\ N$

4. (B)

Sol. $n = \frac{Q}{e} = \frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18}$

5. (C)

Sol. $|\vec{F_B}| = |\vec{F_C}| = k.\frac{Q^2}{a^2}$



Hence force experienced by the charge at *A* in the direction normal to *BC* is zero.

6. (C)

Sol. By $Q = Ne$ or

$N = \frac{Q}{e} \therefore N = \frac{80 \times 10^{-6}}{1.6 \times 10^{-19}} = 5 \times 10^{14}$

7. (C)

Sol. Potential energy depends upon the charge at peaks of irregularities. Since every event in the universe leads to the minimisation of energy.

8. (D)

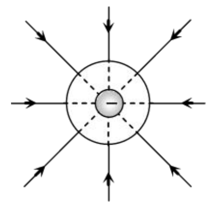
Sol. (D) $F = k.\frac{Q^2}{r^2}$. If *Q* is halved, *r* is doubled then $F \to \frac{1}{16}$ times

9. (D)

Sol. The force is perpendicular to the displacement.

10. (C)

Sol. Electric lines force due to negative charge are radially inward.



11. (B)

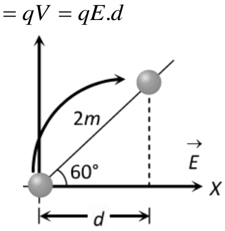
Sol. $E = \frac{V}{d} = \frac{10}{2 \times 10^{-2}} = 500\ N/C$

12. (C)

Sol. Electric lines of force never intersect the conductor. They are perpendicular and slightly curved near the surface of conductor.

13. (D)

Sol. $W = qV = qE.d$



® 4 = 0.2 · E · (2 cos 60°)
= 0.2 E · (2 · 0.5)

4 $E = \frac{4}{0.2} = 20\ NC^{-1}$

14. (C)

Sol. Lines of force is perpendicular to the equipotential surface. Hence angle = 90°

15. (A)

Sol. $E = \frac{F}{q_0} \longrightarrow Newton\ /\ Coulomb$

16. (A)

Sol. $V = \frac{kq}{R}$ *i.e.* $V \propto \frac{1}{R}$

4 Potential on smaller sphere will be more.

17. (C)

Sol. $\Delta KE = qV = eV = e \times 1 = 1eV$

18. (B)

Sol. $E = 9 \times 10^9 . \frac{Q}{r^2}$

$= 9 \times 10^9 \times \frac{5 \times 10^{-6}}{(0.8)^2} = 7 \times 10^4\ N/C$

19. (C)

Sol. $E = \frac{1}{4\pi\varepsilon_0} . \frac{Qr}{R^3}$ ® $E \propto \frac{1}{R^3}$

20. (D)

Sol. (-particles are charged particles, so they can deflect by electric field.

21. (C)

Sol. Because electric field applies the force on electron in the direction opposite to it's motion.

22. (C)

Sol. Potential $V \propto \frac{1}{r} \Rightarrow V' = \frac{V}{2} = 8V$

23. (B)

Sol. Given electric potential of spheres are same *i.e.* $V_A = V_B$

® $\frac{1}{4\pi\varepsilon_0} . \frac{Q_1}{a} = \frac{1}{4\pi\varepsilon_0} . \frac{Q_2}{b} \Rightarrow \frac{Q_1}{Q_2} = \frac{a}{b}$ ......(i)

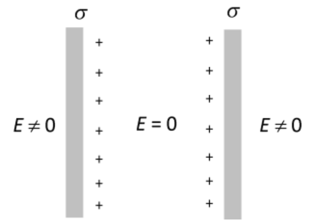
as surface charge density $\sigma = \frac{Q}{4\pi r^2}$

® $\frac{\sigma_1}{\sigma_2} = \frac{Q_1}{Q_2} \times \frac{b^2}{a^2} = \frac{a}{b} \times \frac{b^2}{a^2} = \frac{b}{a}$

24. (C)

Sol. Electric field between sheets

$E = \frac{1}{2\varepsilon_0}(\sigma - \sigma) = 0$



25. (B)

Sol. $\Delta E = 2e \times 5V = 10eV$ ® Final kinetic energy $= 10eV$

26. (A)

27. (A)

Sol. $V = Ed = \frac{3000}{3} \times 10^{-2} = 10\,V$

28. (B)

29. (B)

Sol. Electric potential due to dipole in it's general position is given by $V = \frac{k.p\cos\theta}{r^2}$ ® $V \propto \frac{1}{r^2}$

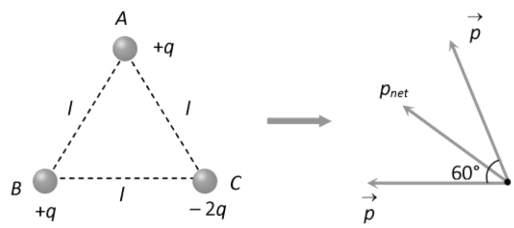
30. (C)

Sol. Dipole moment $p = q\ (2l)$

$= 3.2 \times 10^{-19} \times (2.4 \times 10^{-10}) = 7.68 \times 10^{-29}\ C\text{-}m$

31. (C)

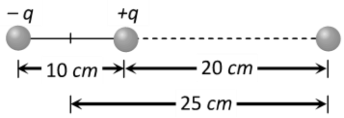
Sol.



$p_{net} = \sqrt{p^2 + p^2 + 2pp\cos 60°} = \sqrt{3}p = \sqrt{3}\ ql$ ($\because$ $p = ql$)

32. (A)

Sol.



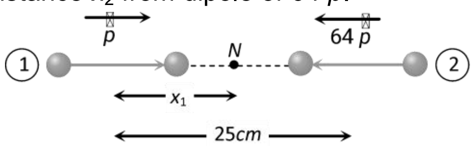
By using $E = 9\times10^9 . \frac{2pr}{(r^2 - l^2)^2}$; where
p = (500 · 10^{-6}) · (10 · 10^{-2}) = 5 · 10^{-5} $c\times m$,
r = 25 *cm* = 0.25 *m*, l = 5 *cm* = 0.05 *m*

$$E = \frac{9\times10^9 \times 2\times5\times10^{-5}\times0.25}{\{(0.25)^2 - (0.05)^2\}^2}$$

$= 6.25\times10^7\, N/C$

33. (A)

Sol. Suppose neutral point *N* lies at a distance *x* from dipole of moment *p* or at a distance x_2 from dipole of 64 *p*.



At *N* |E. F. due to dipole Ⅱ|= |E. F. due to dipole ♋|

® $\frac{1}{4\pi\varepsilon_0} . \frac{2p}{x^3} = \frac{1}{4\pi\varepsilon_0} . \frac{2(64\,p)}{(25-x)^3}$

® $\frac{1}{x^3} = \frac{64}{(25-x)^3}$ ® x = 5 *cm*.

34. (A)

Sol. By Gauss's theorem.

35. (B)

SECTION-B

36. (D)

Sol. $\phi = \frac{\Sigma q}{\varepsilon_0} = 0$ *i.e.* net charge on dipole is zero.

37. (B)

Sol. According to Gauss's applications.

38. (A)

Sol. Electron has negative charge, in electric field negative charge moves from lower potential to higher potential.

39. (B)

Sol. Electron and proton have same amount of charge so they have same coulomb force. They have different accelerations because they have different masses $(a = \frac{F}{m})$

Therefore, both assertion and reason are true and reason is the correct explanation of the assertion.

40. (B)

Sol. $V_{inside} = \frac{Q}{4\pi\varepsilon_0 R}$ for $r \le R$ ....(i)

and $V_{out} = \frac{Q}{4\pi\varepsilon_0 r}$ for $r \ge R$ ....(ii)

i.e. potential inside the hollow spherical shell is constant and outside varies according to $V \propto \frac{1}{r}$.

41. (A)

Sol. Because of the presence of positive test charge q_0 in front of positively charged ball, charge on the ball will be redistributed, less charge on the front half surface and more charge on the back half surface. As a result of this net force *F* between ball and point charge will decrease *i.e.* actual electric field will be greater than F/q_0.

42. (C)

Sol. Electric field at a distance *R* is only due to sphere because electric field due to shell inside it is always zero. Hence electric field = $\frac{1}{4\pi\varepsilon_0} . \frac{3Q}{R^2}$

43. (D)

Sol. $E_x = -\frac{dV}{dx} = -(6 - 8y^2)$,

$E_y = -\frac{dV}{dy} = -(-16xy - 8 + 6z)$

$E_z = -\frac{dV}{dz} = -(6y - 8z)$

At origin *x* = *y* = *z* = 0 so, $E_x = -6, E_y = 8$ and $E_z = 0$

® $E = \sqrt{E_x^2 + E_y^2} = 10\, N/C$.

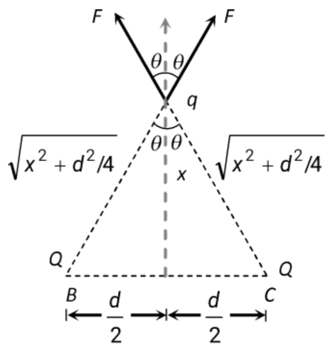
Hence force $F = QE = 2\times10 = 20\,N$

44. (C)

Sol. Suppose third charge is similar to *Q* and it is *q*

So net force on it

F_{net} = 2*F* cos(



Where $F = \frac{1}{4\pi\varepsilon_0}\cdot\frac{Qq}{\left(x^2+\frac{d^2}{4}\right)}$ and

$$\cos\theta = \frac{x}{\sqrt{x^2+\frac{d^2}{4}}}$$

$$F_{net} = 2\times\frac{1}{4\pi\varepsilon_0}\cdot\frac{Qq}{\left(x^2+\frac{d^2}{4}\right)}\times\frac{x}{\left(x^2+\frac{d^2}{4}\right)^{1/2}}$$

4

$$= \frac{2Qqx}{4\pi\varepsilon_0\left(x^2+\frac{d^2}{4}\right)^{3/2}}$$

For F_{net} to be maximum $\frac{dF_{net}}{dx} = 0$

i.e. $\frac{d}{dx}\left[\frac{2Qqx}{4\pi\varepsilon_0\left(x^2+\frac{d^2}{4}\right)^{3/2}}\right] = 0$

or $\left[\left(x^2+\frac{d^2}{4}\right)^{-3/2} - 3x^2\left(x^2+\frac{d^2}{4}\right)^{-5/2}\right] = 0$

i.e. $x = \pm\frac{d}{2\sqrt{2}}$

45. (D)

Sol. Negative charge means excess of electron which increases the mass of sphere *B*.

46. (B)

Sol. On rubbing glass rod with silk, excess electron transferred from glass to silk. So glass rod becomes positive and silk becomes negative.

47. (B)

Sol. $\frac{4}{3}\pi R^3 = 27\left(\frac{4}{3}\pi r^3\right) \Rightarrow R = 3r$ ...(1)

$$V = \frac{Kq}{r} \Rightarrow \frac{V_1}{V_2} = \left(\frac{q_1}{q_2}\right)\left(\frac{r_2}{r_1}\right)$$

$$\Rightarrow \frac{220}{V_2} = \left(\frac{q}{27q}\right)\left(\frac{3r}{r}\right)$$

$$\Rightarrow \frac{220}{V_2} = \frac{1}{9}$$

$$\Rightarrow V_2 = 220\times 9 = 1980\text{ Volt}$$

48. (D)

Sol. Electric lines of force are the electric field lines and electric field lines are perpendicular to equipotential surfaces

49. (D)

Sol. **A → r ; B→ r → C→ p**

Electric field due to metallic plates remains same and constant at near by points.

[A] For $\sigma_1 + \sigma_2 = 0 \Rightarrow \sigma_1 = -\sigma_2$

∴ Electric field at a point is equal & opposite in direction.

$\sigma_1 + \sigma_2 = 0 \Rightarrow \sigma_1 = -\sigma_2$

[B] $\sigma_1 + \sigma_2 > 0 \Rightarrow \sigma_1$ & σ_2 [densities] either both positive or opposite but positive has a greater magnitude. So the net electric field will be away from the plates in region I & III.

[C] Same explanation according to [B].

50. (B)

Sol. **A→ r; B→ r ; C → p**

(A) Electric field at a point is the vector sum of all individual fields at that point

(B) Electric flux $\oint \vec{E} \cdot d\vec{S} = \frac{q_{enc}}{\epsilon_0}$

(C) Electric flux $\oint \vec{E} \cdot d\vec{S} = \frac{q_{enclosed}}{\epsilon_0}$