NeetPreparation

Electrostatics Important Questions With Answers

NEET Physics 2023

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1. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
   Assertion: In the absence of an external electric field, the dipole moment per unit volume of a polardielectric is zero.
   Reason : The dipoles of a polar dielectric are randomly oriented.
   a) If both assertion and reason are true and reason is the correct explanation of assertion
   b) If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false   d) If both assertion and reason are false

   Solution : -
   There are polar and non polar dielectric materials. The molecules of a polar dielectric have a permanent dipole moment. However due to random orientations net dipole moment is zero. If there is no external electric field, there is no polarisation
2. An electric dipole is kept in non - uniform electric field. It experiences
   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

   Solution : -
   An electric dipole if kept in non-uniform electric field will experiences two forces that are opposite and not equal. In this, a net force will exists and the forces will act at different points of a body along with a torque.
3. If dielectric constant and dielectric strength be denoted by K and X respectively, then a material suitable for use as a dielectric in a capacitor must have
   a) high K and high X   b) high K and low X   c) low K and high X   d) low K and low X

   Solution : -
   The material suitable for using as a dielectric must have high dielectric strength X and large dielectric constant K.
4. In the question number 4, work done in bringing a charge of 4 x 10^{-9} C from infinity to that point is
   a) 2.4 x 10^{-4} J   **b) 1.8 x 10^{-4} J**   c) 3.2 x 10^{-5} J   d) 4.1 x 10^{-5} J

   Solution : -
   Work done, W = q$(V_f - V_i) = 4 \times 10^{-9} \times 4.5 \times 10^4$
   = 1.8 x 10^{-4} J
5. Metallic sphere of radius R is charged to potential V. Then charge q is proportional to
   a) V   b) R   **c) both V and R**   d) none of these

   Solution : -
   As charge, q = CV =$(4\pi\varepsilon_o R)V$
   $\therefore$ q depends on both V and R

6. Two metallic spheres of radii 1 cm and 3 em are given charges of -1×10^{-2} C and 5×10^{-2} C, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is:
   a) 3 X 10^{-2} C b) 4 X 10^{-2} C c) 1 X 10^{-2} C d) 2 X 10^{-2} C

   Solution : -
   After connecting with the wire, they have equal potential
   So, $V_1 = V_2$
   $\frac{KQ_1}{3} = \frac{KQ_2}{1}$, Hence, Q_1 is the charge of sphere having radius 3 cm.
   So, $Q_1 = 3Q_2$
   When they are connected, $Q_1 + Q_2 = 4 \times 10^{-2}$ C
   So, $Q_2 = 1 \times 10^{-2}$ C and $Q_1 = 3 \times 10^{-2}$ C

7. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a uniform electric field E. If its dipole moment is along the direction of the field, the force on it and its potential energy are respectively:
   a) 2q·E and minimum b) q·E and p·E **c) Zero and minimum** d) q·E and maximum

   Solution : -
   From the question, as dipole moment is along direction of field, in such case angle between p and E zero, so the potential energy will be
   U = - pE cos θ
   = - pE = minimum
   It is observed thath in uniform electric field, net force
   $F_{net} = 0$

8. The capacity of a parallel plate condenser is C. Its capacity when the separation between the plates is halved will be:
   a) 4C **b) 2C** c) C/2 d) C/4

   Solution : -
   The capacity of a parallel plate condenser
   $C = \varepsilon_0 A/d$
   If the separation between the plates is halved, then
   C' = $\frac{\varepsilon_1 A}{d/2} = 2 \times \frac{\varepsilon_0 A}{d} = 2c$

9. A capacitor has some dielectric between its plates, and the capacitor is connected to a de source. The battery is now disconnected and then the dielectric is removed, then
   a) capacitance will increase b) energy stored will decrease **c) electric field will increase.**
   d) voltage will decrease

   Solution : -
   When the capacitor is connected to de source, it gets charged. The battery is then disconnected, so no more charge can flow in. On removing dielectric, capacitance decreases.
   Energy stored $\left(u = \frac{q^2}{2c}\right)$will increase
   Potentia$\left(V = \frac{Q}{C}\right)$ will also increase
   Electric field $\left(E = \frac{V}{D}\right)$ will increase

10. Four equal charges q each are placed at four corners of a square of side a each. Work done in carrying a charge -q from its centre to infinity is

a) zero **b) $\frac{\sqrt{2}q^2}{\pi\varepsilon_o a}$** c) $\frac{\sqrt{2}q}{\pi\varepsilon_o a}$ d) $\frac{q^2}{\pi\varepsilon_o a}$

Solution : -

Potential at the centre O of the square due to four equal charges q at four corners

$$V = \frac{4q}{4\pi\varepsilon_0(a\sqrt{2}/2)} = \frac{\sqrt{2}q}{\pi\varepsilon_o a}$$

$$W_{0\to\infty} = -W_{\infty\to 0} = -(-q)V = \frac{\sqrt{2}q^2}{\pi\varepsilon_o a}$$

11. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: For a point charge, concentric spheres centered at a location of the charge are equipotential surfaces.

Reason: An equipotential surface is a surface over which potential has zero value.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

Solution : -

An equipotential surface is a surface over which potential is constant.

12. Two charged spheres of radii 10 cm and 15 cm are connected by a thin wire. No current will flow, if they have:

a) The same charge on each **b) The same potential** c) The same energy

d) The same field on their surfaces

Solution : -

When two charged spheres are connected by a thin wire, there will be no current when having similar potential.

13. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: If distance between the parallel plates of a capacitor is halved, then its capacitance is doubled.

Reason: The capacitance depends on the introduced dielectric.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

Solution : -

The capacitance of a parallel plates capacitor is gi.ven by $C = \dfrac{\varepsilon_0 A}{d}$

where A is area of each plate,d is the distancebetween plates.

$$\therefore \quad \frac{C_1}{C_2} = \frac{\dfrac{\varepsilon_0 A}{d}}{\dfrac{\varepsilon_0 A}{d/2}} = \frac{1}{2} \quad \therefore \quad C_2 = 2C_1$$

When dielectric of dielectric constant k is introduced in

between the plates then the capacitance $C = \dfrac{k\varepsilon_0 A}{d}$

i.e. $C \propto k$

Capacitance C depends on introduced dielectric

14. An electron and a proton are in a uniform electric field, the ratio of their accelerations will be:

a) Zero b) Unity c) The ratio of the masses of proton and electron

d) The ratio of the masses of electron and proton

Solution : -
Ratio of acceleration will be qE/m
Ratios of electron and a proton $a_e/a_p = m_p/m_e$
It shows ratio of the masses of proton and electron

15. A 16 pF capacitor is connected to 70 V supply. The amount of electric energy stored in the capacitor is
a) 4.5×10^{-12} J **b) 5.1×10^{-8} J** c) 2.5×10^{-12} J d) 3.2×10^{-8} J

Solution : -
Here, C = 16 pF = 16×10^{-12} F V=80V
As V= $\frac{1}{2}CV^2 = \frac{1}{2} \times 16 \times 10^{-12} \times (80)^2 = 5.1 \times 10^{-8}$ J

16. The distance between H^+ and Cl^- ions in HCl molecules is 1.38 $\mathring{A}$. The potential due to this dipole at a distance of 10 $\mathring{A}$ on the axis of dipole is
a) 2.1 V b) 1.8 V **c) 0.2 V** d) 1.2 V

Solution : -
Here, $2a = 1.38 \times 10^{-10}$ m, $r = 10 \times 10^{-10}$ m charge, $q = 1.6 \times 10^{-19}$ C
As potential, V = $\frac{P}{4\pi\varepsilon_o r^2} = \frac{q(2a)}{4\pi\varepsilon_o r^2}$
$= \frac{9\times10^9\times1.6\times10^{-19}\times1.38\times10^{-10}}{(10\times10^{-10})^2} = 0.2V$

17. The energy stored in a condenser of capacity C which has been raised to a potential V is given by:
a) (1/2) CV **b) (1/2) CV^2** c) CV d) (1/2)VC

Solution : -
Energy stored U = ∫CV dV = (1/2)CV^2

18. Two spherical conductors each of capacity Care charged to potential Y and - Y. These are then connected by means of a fine wire. The loss of energy is
a) zero b) $\frac{1}{2}CV^2$ **c) CV^2** d) 2 CV^2

Solution : -
Here, loss of energy
$$= \frac{C_1C_2\left(V_1+V_2\right)}{2\left(C_1+C_2\right)} = \frac{CC(V+V)^2}{2\left(C+C\right)} = CV^2$$

19. The magnitude of electric field E in the annular region of a charged cylindrical capacitor
a) is the same throughout b) is higher near the outer cylinder than near the inner cylinder
c) varies as $\frac{1}{r^2}$ where r is the distance from the axis
d) varies as $\frac{1}{r^3}$ where r is the distance from the axis

20. The electric field in a certain region is acting radially outward and is given by E = Ar. A charge contained in a sphere of radius '*a*' centred at the origin of the field, will be given by:
a) $4\pi\varepsilon_0 Aa^3$ b) $\varepsilon_0 Aa^3$ c) $4\pi\varepsilon_0 Aa$ d) $\varepsilon_0 a^2$

Solution : -
Net flux = Q/ε_0
(Aa) x $4\pi a^2$ = Q/ε_0
or, Q = $4\pi\varepsilon_0 Aa^3$

21. In a regular polygon of n sides, each corner is at a distance r from the centre. Identical charges are placed at (n - 1) corners. At the centre, the magnitude of intensity is E and the potential is V. The ratio VIE is:

a) rn **b) r(n - 1)** c) (n - 1)/r d) r(n - 1)/n

Solution : -

At the centre, the intensity is effectively due to one charge and the potential is due to (n - 1) charges.

$\therefore \quad E = \frac{kQ}{r^2}$ and $V = \frac{k(n-1)Q}{r}$

Hence, $\frac{V}{E} = \frac{k(n-1)Q}{r} \times \frac{r^2}{kQ} = (n-1)r$

22. The acceleration of an electron in an electric field of magnitude 50 V/cm, if e/m value of the electron is 1.76 x 10^{11} C/kg, is:

a) 8.8 x 10^{14} m/sec^2 b) 6.2 x $l0^{13}$ m/sec^2 c) 5.4 x 10^{12} m/sec^2 d) Zero

Solution : -

E = 50 V/cm= 50/10-zVim

Now elm = 1.76 x 1011C/kg

As, eE = ma

or a = eE/m

= 1.76 x 10^{11} x 5 x 10^3

= 88 x 10^{13} = 8.8 x 10^{14} m/s^2

23. An electric dipole is placed at an angle of 30^0 with an electric field intensity 2.0 X 10^5 N/C. It experiences a torque equal to 4 N m. The charge on the dipole, if the dipole length is 2 cm, is:

a) 8 mC **b) 2 mC** c) 5 mC d) 7 μC

Solution : -

Torque is given by τ = pE sin θ

τ = pE sin θ = qlE sin θ

or, q = τ/lE sin θ

= 4/(2 x 10^{-2} x 0.5 x 2 x 10^5) = 2 mC

24. Consider a parallel plate capacitor with plates 20 cm by 20 cm and separated by 2 mm. The dielectric constant of the material between the plates is 5. The plates are connected to a voltage source of 500 V. The energy density of the field between the plates will be close to:

a) 2.65 J/m^3 b) 1.95 J/m^3 **c) 1.38 J/m^3** d) 0.69 J/m$^{3.}$

Solution : -

Electric field density or energy per unit volume

is $u = \frac{K\varepsilon_0}{2}\left(\frac{V}{d}\right)^2$

K = 5, V = 500 volts, d = 2 x 10^{-3} m

u = 2. 2 x 1 x (500) = 1.38 J/m^{-3}.

25. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: Dielectric polarisation means formation of positive and negative charges inside the dielectric.

Reason: Free electrons are formed in this process

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

Solution : -

When an electric field is applied to the dielectric, each molecule of dielectric gets polarised, centres of gravity of positive and negative charges get displaced from each other. Electric dipoles are produced inside.

26. A simple pendulum of period T has a metal bob which is negatively charged. If it is allowed to oscillate above a positively charged metal plate, its period will:

a) Remains equal to T **b) Less than T** c) Greater than T d) Infinite

Solution : -

When negative charged pendulum oscillates over a positively charged plate then effective value of acceleration g increases, so the time period: T = $2\pi\sqrt{l/g}$,

27. Van de Graaff generator is used to

a) store electrical energy **b) build up high voltages of few million volts**

c) decelerate charged particle like electrons d) both (a) and (b) are correct

28. A parallel plate capacitor of capacitance 5 μF and plate separation 6 cm is connected to a 1 V battery and charged. A dielectric of dielectric constant 4 and thickness 4 cm is introduced between the plates of the capacitor. The additional charge that flows into the capacitor from the battery is

a) 2μC b) 3μC **c) 5μC** d) 10μC

Solution : -

Charge on capacitor plates without the dielectric is

Q = CV= (5 X 10^{-6} F) x 1 V = 5 X 10^{-6} C = 5μC

The capacitance after the dielectric is introduced is

$$C' = \frac{\varepsilon_o A}{d-(t-\frac{t}{k})} = \frac{\varepsilon_o A/d}{1-\left(\frac{t-\frac{t}{K}}{d}\right)}$$

$$= \frac{C}{1-\left(\frac{t-\frac{t}{K}}{d}\right)} = \frac{5\mu F}{1-\left(\frac{4cm-\frac{4cm}{4}}{6cm}\right)}$$

$$= \frac{5\mu F}{1-\left(\frac{4-1}{6}\right)} = 10\mu F$$

$\therefore$ Charge on capacitor plates now will be

Q' = C'V = 10 μFx 1 V = 10 μC

Additional charge transferred = Q' - Q = 10 μC- 5 μC

=5μC

29. Two charged conducting spheres of radii a and b are connected to each other by a wire. The ratio of electric fields at the surfaces of two spheres is

a) $\frac{a}{b}$ **b)** $\frac{b}{a}$ c) $\frac{a^2}{b^2}$ d) $\frac{b^2}{a^2}$

Solution : -

Let q_1 and q_2 be the charges and C_1 and C_2 be the capacitance of two spheres. The charge flows from the sphere at higher potential to the other at lower potential, till their potentials becomes equal.

After sharing, the charges on two spheres would be

$\frac{q_1}{q_2} = \frac{C_1 V}{C_2 V}$ ....(i)

Also $\frac{C_1}{C_2} = \frac{a}{b}$ ....(ii)

From (i) $\frac{q_1}{q_2} = \frac{a}{b}$

Ratio of surface charge on the two spheres

$\frac{\sigma_1}{\sigma_2} = \frac{q_1}{4\pi a^2} . \frac{4\pi b^2}{q_2} = \frac{q_1}{q_1} . \frac{b^2}{a^2} = \frac{b}{a}$ (using (ii))

$\therefore$ The ratio of electric fields at the surfaces of two spheres $\frac{E_1}{E_2} = \frac{\sigma_1}{\sigma_2} = \frac{b}{a}$

30. The energy of a charged capacitor is given by the expression (q = charge on the conductor and C = its capacity):

a) $q^2/2C$ b) q^2/C c) 2qC d) $q/2C^2$

Solution : -

Now q = CV

So, $U = (1/2)CV^2 = q^2/2C$

31. If two conducting spheres are separately charged and then brought in contact:

a) The total energy of the two spheres is conserved **b) The total charge on the two spheres is conserved**

c) Both the total energy and charge are conserved

d) The final potential is always the mean of the original potentials of the two spheres

Solution : -

As per the law of conservation of charge, if two conducting spheres are separately charged and then brought in contact, then the total charge on the two spheres gets conserved.

32. The electric potential at the surface of an atomic nucleus (Z = 50) of radius 9.0×10^{-13} cm is

a) 80 volts **b) 8×10^6 volts** c) 9 volts d) 9×10^5 volts

Solution : -

The electric potential at the surface of an atomic nucleus will be:

$V = \frac{1}{4\pi\varepsilon_0} \times \frac{q}{r}$

$V = 9 \times 10^9 \times 50 \times 1.6 \times 10^{-19}/9 \times 10^{-15} = 8 \times 10^6 V$

33. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is:

a) Proportional to the square root of the distance between the plates

b) Linearly proportional to the distance between the plates

c) Independent of the distance between the plates

d) Inversely proportional to the distance between the plates

Solution : -

In an isolated capacitor Q is constant, so an electrostatic force between metal plates is given as:

$F = QE = Q \times \sigma/2\varepsilon_0 = O^2/2A\varepsilon_0$

Which is independent of the distance between the plates.

34. 2μF capacitance has potential difference across its two terminals 200 volts. It is disconnected from battery and then another uncharged capacitance is connected in parallel to it, then P.D. becomes 20 volts. Then the capacity of another capacitance will be:

a) 2 μF b) 4 μF **c) 18 μF** d) 10 μF

Solution : -

On applying common potential:

$V = (C_1V_1 + C_2V_2) / C_1 + C_2$

Now $20 = (2 \times 200 + C_2 \times 0) / (2 + C_2)$

Capacity of second capacitance will be C_2 = 18μF

35. A system consists of two charges 4 μC and -3 μC with no external field placed at (-5 cm, 0, 0) and (5 cm, 0, 0) respectively. The amount of work required to separate the two charges infinitely away from each other is

a) -1.1 J b) 2 J c) 2.5 J d) 3 J

Solution : -

Here, $q_1 = 4\mu$C, q2 = - 3μC, r= 10 cm = 0.1 m Electrostatic potential energy,

$$U = \frac{1}{4\pi\varepsilon_o}\frac{q_1 q_2}{r} = 9 \times 10^9 \times \frac{4\times10^{-6}\times(-3)\times10^{-6}}{0.1}$$

= -1.1 J

36. The condensers of capacity C_1 and C_2 are connected in parallel, then the equivalent capacitance is:

a) $C_1 + C_2$ b) $C_1C_2/C_1 + C_2$ c) C_1/C_2 d) C_2/C_1

Solution : -

In parallel combination, the equivalent capacitance

$C_{equ} = C_1 + C_2$

37. A charge of 40μC is given to a capacitor having capacitance C = 10μF. The stored energy in ergs is:

a) 80×10^{-6} **b) 800** c) 80 d) 8000

Solution : -

Energy stored

$U = O^2/2C$

$= (40 \times 10^{-6})^2 / (2 \times 10^{-6} \times 10)$

$= 16 \times 10^{-10} / (2 \times 10^{-5}) = 8 \times 10^{-5}$ J

Now converting to erg,

$= 8 \times 10^{-5} \times 10^7 = 800$ erg

38. An electric dipole when placed in a uniform electric field E will have minimum potential energy, if the positive direction of dipole moment makes the following angle with E:

a) π b) $\pi/2$ **c) Zero** d) $3\pi/2$

Solution : -

In an electric dipole, when angle θ = 0, then potential energy = - pE cos θ

39. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: The potential difference between the two conductors of a capacitor is small.

Reason: A **c**apacitor is so configured that it confines the electric field lines within a small region of space

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

Solution : -

Even though field may have considerable strength, the potential difference between the two conductors of a capacitor is small because the field lines are confined within a small region of space.

40. In a Van de Graaff type generator, a spherical metal shell is to be 15×10^6 V electrode. The dielectric strength of the gas surrounding the electrode is 5×10^7 V m^{-1}. The minimum radius of the spherical shell required is:

a) 1 m b) 2 m c) 1.5 m **d) 3 m**

Solution : -

Here, $V = 15 \times 10^6$V, dielectric strength

$= 5 \times 10^7$ Vm^{-1}

Maximum electric field, E = 10% of dielectric strength

$$\therefore \quad E = \frac{10}{100} \times 5 \times 10^7 = 5 \times 10^6 Vm^{-1} \quad As \quad E = \frac{V}{r}$$

$$\therefore \quad r = \frac{V}{E} = \frac{15 \times 10^6}{5 \times 10^6} = 3m$$

41. Minimum number of capacitors each of 8μF and 250 V used to make a composite capacitor of 16 μF and 1000 V are

a) 8 **b) 32** c) 16 d) 24

Solution : -

Minimum number of capacitors in each row $= \frac{1000}{250} = 4$
Therefore, 4 capacitors connected in series.
If there are m such rows, then total capacity
= m x 2 = 16 $\therefore\ m = 16/2 = 8$
$\therefore$ minimum number of capacitors = 4 x 8 = 32

42. The electric intensity due to a dipole of length 10 em and having a charge of 500 μC, at a point on the axis at a distance 20 cm from one of the charges in air, is:
a) 6.25 x 10^7 N/C b) 9.28 x 10^7 N/C c) 13.1 x 11^{11} N/C d) 20.5 x 10^7 N/C

Solution : -
Considering electric field intensity
E = 9 X 10^9 x 2pr/(r^2 - l^2)^2
Here, p = (500 X 10^{-6}) x (10 x $l0^{-2}$) = 5 x 10^{-5}
Now r = 25 cm = 0.25 m
l = 5 cm = 0.05 m
Using the above expression and putting the values:
E = 9 X 10^9 X 2 X 5 X 10^{-5} X 0.25/[$(0.25)^2$ -$(0.05)^2$]^2
= 6.25 x 10^7 N/C

43. On rotating a point charge having a charge q around a charge Q in a circle of radius r. The work done will be:
a) q x 2πr b) q x 2πQr **c) Zero** d) Q/2ε_0r

Solution : -
On rotating a point charge q around a charge Q in a circle of radius Y, work done will be zero as charge Q moves on equipotential surface where work done is zero.

44. Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron):
a) $4\pi\varepsilon_0 Fd^2/e^2$ b) $\sqrt{4\pi\varepsilon_0 Fe^2/d^2}$ **c)** $\sqrt{4\pi\varepsilon_0 Fd^2/e^2}$ d) $4\pi\varepsilon_0 Fd^2/q^2$

Solution : -
According to Coulomb's law, the force of repulsion between the two positive ions each of charge q, separated by a distance d is given by
$$F = (1/4\pi\varepsilon_0) \times (q)(q)/d^2$$
$$F = q^2/4\pi\varepsilon_0 d^2$$
$$q^2 = 4\pi\varepsilon_0 Fd^2$$
$$q = \sqrt{4\pi\varepsilon_0 Fd^2}$$
$$Since, \quad q = ne \quad or \quad n = q/e$$
$$n = \sqrt{4\pi\varepsilon_0 Fd^2}/e = \sqrt{4\pi\varepsilon_0 Fd^2/e)} is$$

45. In a charged capacitor, the energy resides:
a) The positive charges b) Both the positive and negative charges **c) The field between the plates**
d) Around the edge of the capacitor plates

Solution : -
In a charged capacitor, the energy resides in between the plates

46. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will:
a) increase four times b) be reduced to half **c) remain the same** d) be doubled

Solution : -

Total flux = Net Charge enclosed/ε_0

It depends only on net charge enclosed by the surface.

47. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as

Assertion: The electric field inside a cavity is always zero.

Reason: Charges reside only on the outer surface of a conductor with cavity.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If both assertion and reason are true but reason is not the correct explanation of assertion

d) If both assertion and reason are false

48. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: Work done in moving a charge between any two points in an electric field is independent of the path followed by the charge, between these points.

Reason : Electrostatic force is a non conservative force.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

Solution : -

Electrostatic force is conservative force

49. A parallel plate capacitor is filled by a dielectric whose relative permittivity varies with the applied voltage (V) as $\varepsilon = \alpha V$ where $\alpha = 2\ V^{-l}$. A similar capacitor with no dielectric is charged to V_o = 78 V. It is then connected to the uncharged capacitor with the dielectric. Final voltage on the capacitor is

a) 2 V b) 3 V c) 5 V **d) 6 V**

Solution : -

On connecting the two given capacitors, let the final voltage be V. If capacity of capacitor without the dielectric is C, then the charge on this capacitor is q_l = CV

The other capacitor with dielectric has capacityεC.

Therefore, charge on it is $q_2 = \varepsilon CV$

As $\varepsilon = \alpha V$, therefore, $q_2 = \alpha CV2$

The initial charge on the capacitor (without dielectric) that was charged is $q_o = CV_o$

From the conservation of charge, $q_o = q_1 + q_2$

$CV_o = CV + \alpha CV_2$ or $\alpha V_2 + V - V_o = 0$

$$V = \frac{-1 \pm \sqrt{1 + 4\alpha V_0}}{2\alpha}$$

As V is positive,therefore,$V = \frac{\sqrt{625 - 1}}{4} = \frac{24}{4} = 6V$

50. Which of the following statements is false for a perfect conductor?

a) The surface of the conductor is an equipotential surface.

b) The electric field just outside the surface of a conductor is perpendicular to the surface.

c) The charge carried by a conductor is always uniformly distributed over the surface of the conductor.

d) None of these