PHYSICS

BOOKS - MTG PHYSICS (ENGLISH)

ELECTROSTATIC POTENTIAL AND CAPACITANCE

Mcqs

1. Which of the following statement is true?

A. Electrostatic force is a conservative force.

B. Potential at a point is the work done per unit charge in bringing a charge from any point to infinity.

C. Electrostatic force is non-conservative.

D. Potential is the product of charge and work.

Answer: A

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2. 1 volt is equivalent to

A. $\frac{\text{netwon}}{\text{second}}$

B. $\frac{\text{newton}}{\text{coulomb}}$

C. $\frac{\text{joule}}{\text{coulomb}}$

D. $\frac{\text{joule}}{\text{second}}$

Answer: C

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3. The work done in bringing a unit positive charge from infinite distance to a point at distance x from a positive charge Q is W. Then the potential ϕ at that point is

A. $\frac{WQ}{x}$

B. W

C. $\frac{W}{x}$

D. WQ

Answer: B

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4. The potential at a point due to charge of $5 \times 10^{-7} C$ located 10 cm away is

A. $3.5 \times 10^{5} V$

B. $3.5 \times 10^{4} V$

C. $4.5 \times 10^{4} V$

D. $4.5 \times 10^{5} V$

Answer: C

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5. In the question number 4, work done in bringing a charge of 4×10^{-9} C form infinity to that point is

A. $2.4 \times 10^{-4} J$

B. $1.8 \times 10^{-4} J$

C. $3.2 \times 10^{-5} J$

D. $4.1 \times 10^{-5} J$

Answer: B

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6. Electric field intensity at a point B due to a point charge Q kept at point A is $24NC^{-1}$, and electric potential at B due to the same charge is $12JC^{-1}$. Calculate the distance AB and magnitude of charge.

A. $10^{-6}C$

B. $10^{-7}C$

C. $10^{-10}C$

D. $10^{-9}C$

Answer: D

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7. The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at that point is

A. $12\pi\varepsilon_0 Q \times 10^{22} Vm^{-1}$

B. $4\pi\varepsilon_0 Q \times 10^{22} Vm^{-1}$

C. $12\pi\varepsilon_0 Q \times 10^{20} Vm^{-1}$

D. $4\pi\varepsilon_0 Q \times 10^{20} Vm^{-1}$

Answer: B

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8. Two points A and B located in diametrically opposite directions of a point charge of +2μC at distances 2.0 m and 1.0 m respectively from it. Determine the potential difference $V_A - V_B$

A. $3 \times 10^3 V$

B. $6 \times 10^4 V$

C. $-9 \times 10^3 V$

D. $-3 \times 10^3 V$

Answer: C

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9. Electric field intensity (E) due to an electric dipole varies with distance (r) from the point of the center of dipole as :

A. $\frac{1}{r}$ and $\frac{1}{r^2}$

B. $\frac{1}{r^2}$ and $\frac{1}{r}$

C. $\frac{1}{r^3}$ and $\frac{1}{r^3}$

D. $\frac{1}{r^3}$ and $\frac{1}{r^2}$

Answer: D

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10. An electric dipole is placed at the centre of a sphere. Mark the correct options:

A. Electric field is zero at every point of the sphere

B. Electic field is zero anywhere on the sphere

C. The flux of electric field is not zero through the sphere

D. All of these

Answer: B

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11. Which of the following is not true ?

A. For a point charge, electrostatic potential varies as 1/r.

B. For a dipole, the potential depends on the magnitude of potition vector and dipole moment vector.

C. The electric dipole potential varties as 1/r at large distance.

D. For a point charge, the electrostatic field varies as $1/r^2$.

Answer: C

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12. The distance between H^{+} and Cl^{-} ions in HCl molecules is 1.38Å. The potential due to this dipole at a sistance of 10Å on the axis of dipole is

A. 2.1 V

B. 1.8 V

C. 0.2 V

D. 1.2 V

Answer: C

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13. Two tiny spheres carrying charges $1.8\mu C$ and $2.8\mu C$ are located at 40 cm apart. The potential at the mid-point of the line joining the two charges is

A. $3.8 \times 10^4 V$

B. $2.1 \times 10^5 V$

C. $4.3 \times 10^4 V$

D. $6.3 \times 10^5 V$

Answer: B

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14. In the question number 18, the potential at a point 20 cm from the mid-point of the line joining the two charges in a plance normal to the line and passing through the mid-point is

A. $1.4 \times 10^5 V$

B. $4.2 \times 10^3 V$

C. $2.9 \times 10^4 V$

D. $3.7 \times 10^5 V$

Answer: A

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15. Four equal charges Q are placed at the four corners of a square of each side is 'a'. Work done in removing a charge $-Q$ from its centre to infinity is

A. zero

B. $\frac{\sqrt{2}q^2}{\pi\varepsilon_0 a}$

C. $\frac{\sqrt{2}q}{\pi\varepsilon_0 a}$

D. $\frac{q^2}{\pi \varepsilon_0 a}$

Answer: B

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16. A cube of side x has a charge q at each of its vertices. Determine the potential due to this charge array at the center of the cube.

A. $\frac{4q}{3\pi \varepsilon_0 x}$

B. $\frac{4q}{\sqrt{3}\pi \varepsilon_0 x}$

C. $\dfrac{3q}{4\pi\varepsilon_0 x}$

D. $\dfrac{2q}{\sqrt{3}\pi\varepsilon_0 x}$

Answer: B

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17. A hexagon of side 8 cm has a charge $4\mu C$ at each of its vertices. The potential at the centre of the hexagon is

A. $2.7 \times 10^6 V$

B. $7.2 \times 10^{11} V$

C. $2.5 \times 10^{12} V$

D. $3.4 \times 10^{4} V$

Answer: A

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18. Consider a uniform electric field in the $\hat{z}$ direction. The potential is a constant.

A. for any x for a given z

B. for any y for a given z

C. on the x-y plane for a given z

D. All of these

Answer: D

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19. Equipotential surfaces

A. are closer in regions of large electric fields compared to regions of lower electric fields

B. will be more crowded near sharp edges of a conductor

C. will always be equally spaced

D. both (a) and (b) are correct

Answer: D

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20. In a region of constant potential

A. the electric field is uniform.

B. the electric field is zero.

C. there can be no charge inside the region.

D. both (b) and (c) are correct.

Answer: D

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21. What do you understand by potential gradient ?

Establish a relation between electric field and potential gradient.

A. Electric field is in the direction in which the potential decreases steepest

B. Magnitude of electric field is given by the charge in the magnitude of potential per unit displacement jnormal to the equipotential surface at the point.

C. In the region of strong electrric field, equipotential surfaces are far apart.

D. Both the statements (a) and (b) are correct.

Answer: D

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22. The angle between the equipotential surface and the electric field (or line of force) at any point on the equipotential surface is

A. 90° always

B. 0° always

C. 0° to 90°

D. 0° to 180°

Answer: A

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23. The work done to move a unit charge along an equipotential from P to Q

A. must be defined as $-\int_P^Q \vec{E} \cdot \vec{dl}$

B. is zero

C. can have a non-zero value

D. both (a) and (b)are correct

Answer: D

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24. The top of the atomosphere is about 400 kV with respect to the surface of earth, corresponding to an electric field that decreases with altitude. Near the surface of earth the field is about 100 V m^{-1}, but still don't get an electric shock, as we set out of out houses in to open because (assume the house is free from electric field)

A. our body is a perfect insulator

B. our body and ground form an equipotential surface

C. the original equipotential surfaces of open air remain same

D. none of these

Answer: B

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25. The work done in carrying a charge q once round a circle of radius r with a charge Q at the centre is

A. $\frac{qQ}{4\pi\varepsilon_0 a}$

B. $\frac{qQ}{4\pi\varepsilon_0 a^2}$

C. $\dfrac{q}{4\pi\varepsilon_0 a}$

D. zero

Answer: D

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26. When a positive q charge is taken from lower potential to a higher potential point, then its potential energy will

A. remin the same

B. increase

C. decrease

D. become zero

Answer: C

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27. A system consists of two charges $4\mu C$ and $-3\mu C$ with no external field placed at $(-5cm, 0, 0)$ and $(+5cm, 0, 0)$ respectively. The amount of work required to separated the two charges infinitely away from each other is

A. $-1.1J$

B. $2J$

C. $2.5J$

D. $3J$

Answer: A

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28. Two charges of magnitude $5nC$ and $-2nC$ are placed at points (2cm,0,0) and (x cm,0,0) in a region of space. Where there is no other external field. If the electrostatic potential energy of the system is $-0.5\mu J$. What is the value of x ?

A. 20 cm

B. 80 cm

C. 4 cm

D. 16 cm

Answer: A

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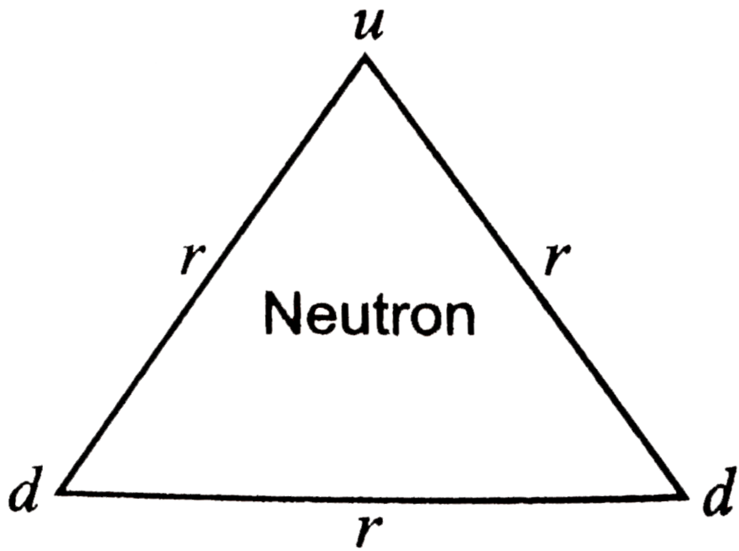
29. (a) In a quark model of elementary particles, a neutron is made of one up quarks [charge $(2/3)$e] and two down quarks [charges - $(1/3)e$]. Assume that they have a triangle configuration with side length of the order of $10^{-15}m$. Calculate electrostatic potential energy of neutron and compare it with its mass 939 MeV.

(b) Repeat above exercise for a proton which is made of two up and one down quark.



A. 7.68

B. -5.21

C. -0.48

D. 9.34

Answer: C

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30. A dipole of moment $\overrightarrow{p}$ is placed in a uniform electric field $\overrightarrow{E}$. The force on the dipole is $\overrightarrow{F}$ and the torque is $\overrightarrow{\tau}$

A. (i), (ii) and (iii) are correct

B. (i) and (ii) are correct and (ii) is wrong

C. only (i) is correct

D. (i) and (ii) are correct and (iii) is wrong

Answer: B

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31. A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-29}C m. A mole of this substance is polarized at low temperature by appling a strong elecrostatic field of magnitude $10^6 Vm^{-1}$. The direction of the field is suddenly changed by an angle of 60°. Estimate the heat released by the substance in aligning its dipole along the new direction of the field. For simplicity, assume 100% polarisation of sample.

A. $-6J$

B. $-3J$

C. $3J$

D. $6J$

Answer: B

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32. An electric dipole of length 20 cm having $\pm 3 \times 10^{-3}$ C charge placed at 60° with respect to a uniform electric field experiences a torque of magnitude 6 Nm. The potential energy of the dipole is

A. $-2\sqrt{3}J$

B. $5\sqrt{3}J$

C. $-3\sqrt{2}J$

D. $3\sqrt{5}J$

Answer: A

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33. If a conductor has a potential $V \neq 0$ and there are no charges anywhere else outside, then

A. there must be charges on the surface or inside itself.

B. there cannot be any charge in the body of the conductor.

C. there must be charges only on the surface.

D. both (a) and (b) are correct.

Answer: C

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34. 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 uniformaly distributed over the surface of the conductor.

D. none of these

Answer: D

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35. Consider two conductinbg spheres of radill R_1 and R_2 with $R_1 > R_2$. If the two are at the same potential, and the larger sphere has more charge than the smaller sphere, then

A. the charge density of smaller sphere is less then that of larger sphere,

B. the charge density of smaller sphere is more than that of larger sphere.

C. both spheres may have same charge density.

D. none of these

Answer: B

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36. Two metal spheres, one fo radius R and the other of radius 2R, both have same surface charge density s. They are brought in contact and seprated. What will be new surface charge densitites on them ?

A. $\frac{5}{2}\sigma, \frac{5}{4}\sigma$

B. $\frac{5}{3}\sigma, \frac{5}{6}\sigma$

C. $\frac{3}{5}\sigma, \frac{6}{5}\sigma$

D. $\frac{2}{3}\sigma, \frac{1}{2}\sigma$

Answer: B

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37. Two spheres of radius a and b respectively are charged and joined by a wire. The ratio of electric field of the spheres is

A. $\frac{a}{b}$

B. $\frac{b}{a}$

C. $\frac{a^2}{b^2}$

D. $\frac{b^2}{a^2}$

Answer: B

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38. Which among the following is an example of polar molecule ?

A. O_2

B. H_2

C. N_2

D. HCl

Answer: D

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39. Choose the correct statement.

A. Polar molecules have permanent electric dipole moment.

B. CO_2 molecule is a polar molecule.

C. H_2O is non-polar molecule.

D. The dipole field at large distances falls of as $\frac{1}{r^2}$.

Answer: A

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40. For metals the value of dielectric constant (K) is

A. zero

B. infinite

C. 1

D. 10

Answer: B

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41. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance

A. increases K times

B. remains unchanged

C. decreases K times

D. increases K^{-1} times

Answer: C

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42. 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

Answer: C

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43. The magnitude of electric field $\vec{E}$ 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.

Answer: C

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44. A cylindrical capacitor has two co-axial cylinders of length 20 cm and radii 1.5 cm and 1.6 cm. The outer cylinder is earthed and inner cylinder is given a charge $4\mu C$. The capacitance of the system is (neglect end effect)

A. $2.8 \times 10^{-8} F$

B. $4.2 \times 10^{-14} F$

C. $1.7 \times 10^{-10} F$

D. $3.4 \times 10^{-12} F$

Answer: C

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45. In a parallel plate capacitor , the capacity increases if

A. area of the plate is decreased

B. distance between the plates increases

C. area of the plate is increased

D. dielectric constant decreases.

Answer: C

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46. Two large parallel conducting plates are placed close to each other ,the inner surface of the two plates have surface charge densities $+\sigma$ and $-\sigma$ .The outer surfaces are without charge.The electric field has a magnitude of

A. (sigma)/(epsi_(0))` in the region between the plates

B. "$\frac{\sigma}{\varepsilon_0}$ in the region between the plates

C. 0

D. none of these

Answer: B

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47. A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an isulating handle. As a result the potential difference between the plates

A. increases

B. decrease

C. does not charge

D. becomes zero

Answer: A

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48. A parallel plate capacitor is charged and then isolated. The effect of increasing the plate separation on charge, potential and capacitance respectively are

A. constant, decrease, decrease

B. increase, decreases, decreases

C. constant, decreases, increases

D. constant, increases, decreases.

Answer: D

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49. If the dielectric constant and dielectirc strength be denoted by K and x respectively, then a meterial suitable for use as a dielectric in a capacitor must have

A. high K and high X

B. high K and low K

C. low K and high K

D. low K and low X

Answer: A

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50. A parallel plate capacitor with air between the plates has a capacitance of 10 pF. The capacitance, if the distance bgetween the plates is reduced by half and the space between tehm is filled with a substance of dielectric constant 4 is

A. $80pF$

B. $96pF$

C. $100pF$

D. $120pF$

Answer: A

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51. The capacitance of a parallel plate capacitor with air as medium is $3 \mu F$. with the introduction of a dielectric medium between the plates, the capacitance becomes $15 \mu F$. The permittivity of the medium is

A. $5 C^2 N^{-1} M^{-2}$

B. $15 C^2 N^{-1} m^{-2}$

C. $0.44 \times 10^{-10} C^2 N^{-1} m^{-2}$

D. $8.854 \times 10^{-11} C^2 N^{-1} m^{-2}$

Answer: C

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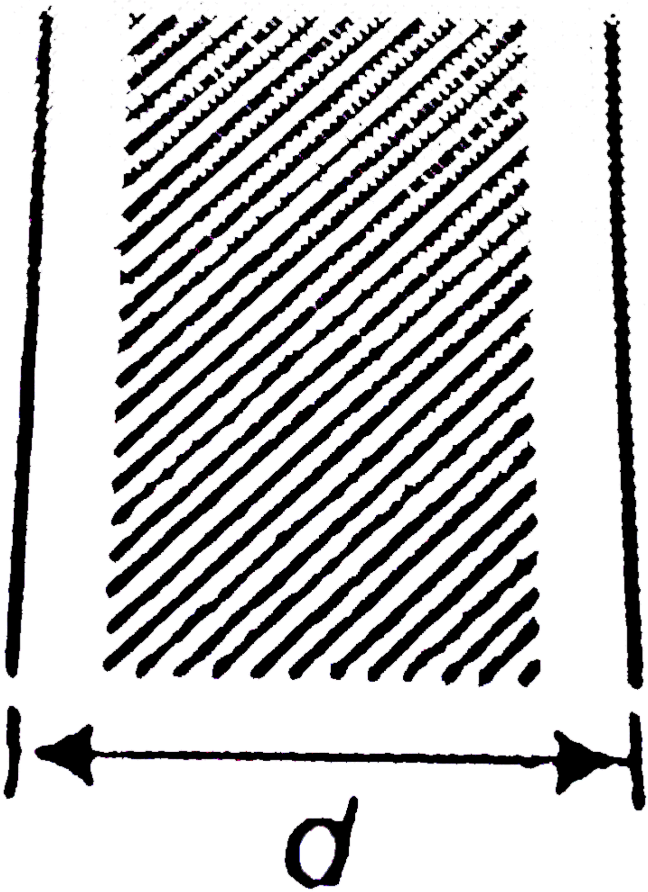
52. A copper plate of thickness b is placed inside a parallel plate capacitor of plate distance d and area A as shown in figure. The capacitance of capacitor is



A. $\dfrac{\varepsilon_0 A}{d + \frac{b}{2}}$

B. $\dfrac{\varepsilon_0 A}{2d}$

C. $\frac{\varepsilon_0 A}{d - b}$

D. $\frac{2\varepsilon_0 A}{d + \frac{b}{2}}$

Answer: C

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53. A parallel plate capacitor of capacity $5\mu F$ and plate separation $6cm$ is connected to a $1V$ battery and is charged. A dielectric of dielectric constant 4 and thickness $4cm$ is introduced into the capacitor. The additional charge that flows into the capacitor from the battery is.

A. $2\mu C$

B. $3\mu C$

C. $5\mu C$

D. $10\mu C$

Answer: C

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54. A slab of material of dielectric constant K has the same area as the plates of a parallel capacitor, but has a thickness $\left(\frac{3}{4}d\right)$, where d is the separation of the plates. How is the capacitance changed when the slab is inserted between the plates

A. $C = \frac{\varepsilon_0 A}{d}\left(\frac{K+3}{4K}\right)$

B. $C = \frac{\varepsilon_0 A}{d}\left(\frac{2K}{K+3}\right)$

C. $C = \frac{\varepsilon_0 A}{d}\left(\frac{K}{K+3}\right)$

D. $C = \frac{\varepsilon_0 A}{d}\left(\frac{4K}{K+3}\right)$

Answer: D

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55. Three capacitors each of capacity $4\mu F$ are to be connected in such a way that the effective capacitance is $6\mu F$. This can be done by

A. connecting them in series

B. connecting them is parallel

C. connecting two in series and one in parallel

D. connecting two in parallel and one is series

Answer: C

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56. In the question number 66, the charge on capacitors C_1 and C_4 are

A. $4 \times 10^{-3}C, 12 \times 10^{-3}C$

B. $6 \times 10^{-3}C, 12 \times 10^{-3}C$

C. $2 \times 10^{-3}C, 4 \times 10^{-3}C$

D. $3 \times 10^{-3}C, 2 \times 10^{-3}C$

Answer: A

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57. Minimum number of capacitors each of $8\mu F$ and 250 V used to make a composite capacitor of $16\mu F$ and 1000 V are

A. 8

B. 32

C. 16

D. 24

Answer: B

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58. A capacitor or capacitance C_1 is charge to a potential V and then connected in parallel to an uncharged capacitor of capacitance C_2. The fianl potential difference across each capacitor will be

A. $\frac{C_1 V}{C_1 + C_2}$

B. $\frac{C_2 V}{C_1 + C_2}$

C. $1 + \frac{C_2}{C_1}$

D. $1 - \frac{C_2}{C_1}$

Answer: A

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59. Two capacitrors of $2 \mu F$ and $4 \mu F$ are connected in parallel. A third capacitor of $6 \mu F$ is connected in series. The combaination is connected across a 12 V battery. The voltage across $2 \mu F$ capacitor is

A. 2 V

B. 8 V

C. 6 V

D. 1 V

Answer: C

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60. Two idential capacitors are joined in parallel, charged to a potential V and then separated and then connected in series i.e. the positive plate of one is connected to negative of the other

A. The charges on the free plated connected together are destoyed.

B. The energy stored in the system increases.

C. The potential difference between the free plates is 2V.

D. The potential difference remains constant.

Answer: C

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61. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is 'C' then the resultant capacitance is

A. nC

B. $\frac{C}{n}$

C. $(n+1)C$

D. $(n-1)C$

Answer: D

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62. A parallel plate air capacitor has a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increase in the capacitance will be

A. $400\ \%$

B. $66.6\ \%$

C. $33.3\ \%$

D. $200\ \%$

Answer: B

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63. A capacitor is made of two circular plates of radius R each, separated by a distance $d < < R$. The capacitor is connected to a constant voltage. A thin conducting disc of radius $r < < R$ and thickness $t < < r$ is placed at a center of the bottom plate. Find the minimum voltage required to lift the disc if the mass of the disc is m.

A. $\dfrac{\sqrt{mgd}}{\pi\varepsilon_0 r^2}$

B. $\sqrt{\dfrac{mgd}{\pi\varepsilon_0 r}}$

C. $\sqrt{\dfrac{mgd^2}{\pi\varepsilon_0 r^2}}$

D. $\sqrt{\dfrac{mgd}{\pi\varepsilon_0 r^2}}$

Answer: C

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64. A parallel plate condenser is charged by connected it to a battery. The battery is disconnected and a glass slab is introduced between the plates. Then

A. potential increases

B. electric intensity increases

C. energy decreases.

D. capacity decreases

Answer: B

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65. A capacitor has some dielectric between its plates, and the capacitor is connected to a DC source. The battery is now disconnected and then the dielectric is removed. State whether the capacitance, the energy stored in it, electric field, charge stored and the voltage will increase ro remain constant.

A. capacitance will increase.

B. energy stored will decrease.

C. electric field will increase.

D. voltage will decrease.

Answer: C

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66. A capacitor of capacitance 700 pF is charged by 100 V battery. The electrostatic energy stored by the capacitor is

A. $2.5 \times 10^{-8} J$

B. $3.5 \times 10^{-6} J$

C. $2.5 \times 10^{-4} J$

D. $3.5 \times 10^{-4} J$

Answer: B

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67. A 16 pF capacitor is connected to 70 V supply. The amount of electric energy stored in the capacitor is

A. $4.5 \times 10^{-12} J$

B. $5.1 \times 10^{-8} J$

C. $2.5 \times 10^{-12} J$

D. $3.92 \times 10^{-8} J$

Answer: D

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68. A capacitor is charged through a potential difference of 200 V, when 0.1C charge is stored in it. The amount of energy released by it, when it is discharged is

A. 5 J

B. 10 J

C. 20 J

D. 2.5 J

Answer: B

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69. A parallel plate capacitor has a uniform electric field E in the space between the the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is

A. $\frac{1}{2}\varepsilon_0 E^2$

B. $\frac{E^2 Ad}{\varepsilon_0}$

C. $\frac{1}{2}\varepsilon_0 E^2 Ad$

D. $eisi_0 E^2 Ad$

Answer: C

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70. A metallic sphere of radius 18 cm has been given a charge of $5 \times 10^{-6} C$. The energy of the charged conductor is

A. $0.2J$

B. $0.6J$

C. $1.2J$

D. $2.4J$

Answer: B

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71. Two spherical conductors each of capacity C are charged to potetnial V and $-V$. These are then conneted by means of a fine wire. The loss of energy will be

A. zero

B. $\frac{1}{2}CV^2$

C. CV^2

D. $2CV^2$

Answer: C

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72. A parallel plate condenser with a dielectric of dielectric constant K between the plates has a capacity C and is charged to a potential V volt. The dielectric slab is slowly removed from between the plates and then reinserted. The net work done by the system in this process is

A. zero

B. $\frac{1}{2}(K-1)CV^2$

C. $\frac{CV^2(K-1)}{K}$

D. $(K-1)CV^2$

Answer: A

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73. Two identical capacitors, have the same capacitance C. One of them is charged to potential V_1 and the other V_2. The negative ends of the capacitors are connected together. When the poistive ends are also connected, the decrease in energy of the combined system is

A. $\frac{C}{4}\left(V_1^2 - V_2^2\right)$

B. $\frac{C}{4}\left(V_1^2 + V_2^2\right)$

C. $\frac{C}{4}(V_1 - V_2)^2$

D. $\frac{C}{4}(V_1 + V_2)^2$

Answer: C

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74. Energies stored in capacitor and dissipated during charging a capacitor bear a ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:3$

Answer: C

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75. Two capcitors, 3 μF and $4 \mu F$, are individually charged across a 6 V battery. After being disconnected from the battery, they are connected together with the negative plate of one attached to the positive plate of the other. What is the final total energy stored ?

A. $1.26 \times 10^{-4} J$

B. $2.57 \times 10^{-4} J$

C. $1.25 \times 10^{-6} J$

D. $2.57 \times 10^{-6} J$

Answer: D

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76. A parallel plate capacitor without any dielectric within its plates, has a capacitance C, and is connected to a battery of emf V. The battery is disconnected and the plates of the capacitor are pulled apart until the separation between the plates is doubled. What is the work done by the agent pulling the plates apart, in this process ?

A. $\frac{1}{2}CV^2$

B. $\frac{3}{2}CV^2$

C. $-\frac{3}{2}CV^2$

D. CV^2

Answer: A

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77. A series combination of n_1 capacitors, each of value C_1, is charged by a source of potential difference $4V$. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has same (total) energy stored in it, as the first combination has. the value of C_2, in terms of C_1, is then

A. $\frac{2C_1}{n_1 n_2}$

B. $16\frac{n_2}{n_1}C_1$

C. $2\frac{n_2}{n_1}C_1$

D. $\frac{16C_1}{n_1 n_2}$

Answer: D

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78. Consider a parallel plate capcaitor 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. $2.65J/m^3$

B. $1.95J/m^3$

C. $1.38J/m^3$

D. $0.69J/m^3$

Answer: C

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79. Van de Graaff generator is used for

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

Answer: B

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80. Which of the following statements is/are true about the principle of Van de Graaff generator ?

A. The action of sharp points.

B. The charge given to a hollow conductor is transfered to outer surface and it distributed uniformly over it.

C. It is used for accelerating uncharged particle.

D. Both (a) and (b) are true.

Answer: D

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81. Who established the fact of animal electricity ?

A. Van de Graaff

B. Count Alessandro Volta

C. Gustav Robert Kirchhoff

D. Hans Christing Oersted

Answer: B

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82. In case of a Van Graaff generator, the breakdown field of air is

A. $2 \times 10^8 Vm^{-1}$

B. $3 \times 10^6 Vm^{-1}$

C. $2 \times 10^{-8} Vm^{-1}$

D. $3 \times 10^4 Vm^{-1}$

Answer: B

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

A. 0.1 m

B. 0.2 m

C. 0.5 m

D. 0.3 m

Answer: D

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Hots

1. 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 intensity is E and the potential is V. The ratio V/E has magnitude

A. rn

B. $r(n-1)$

C. $(n-1)/r$

D. $r(n-1)/n$

Answer: B

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2. The potential at a point distant x (mesured in μm) due to some charges situated on the x-axis is given by $V(x) = \frac{20}{x^2 - 4}$ V. The electric field at $x = 4\mu m$ is given by

A. $\frac{5}{3} V \mu m^{-1}$ and in positive x direction

B. $\frac{10}{9} V \mu m^{-1}$ and in negative x direction

C. $\frac{10}{9} V \mu m^{-1}$ and in positive x direction

D. $\frac{5}{3} V \mu m^{-1}$ and in negative x direction.

Answer: C

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3. An infinite cylinder of radius r_o, carrying linear charge density λ. The equation of the equipotential surface for the cylinder is

A. $r = r_0 e^{\pi\varepsilon_0 [V(r) + V(r_0)]\lambda}$

B. $r = r_0 e^{2\pi\varepsilon_0 [V(r) - V(r_0)]\lambda^2}$

C. $r = r_0 e^{-2\pi\varepsilon_0 [V(r) = V(r_0)]\lambda}$

D. $r = r_0 e^{-2\pi\varepsilon_0 [V(r) - V(r_0)]\lambda}$

Answer: C

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4. Three concentric spherical shells have radii a, b and $c(a < b < c)$ and have surface charge densities $\sigma, -sigam$ and σ respectively. If V_A, V_B and V_C denote the potentials of the three shells, then for $c = a + b$, we have

A. $V_C = V_B = V_A$

B. $V_C = V_A \neq V_B$

C. $V_C = V_B \neq V_A$

D. $V_C \neq V_B \neq V_A$

Answer: B

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5. A parallel plate capacitor is filled by a dielectric whose relative permittivity varies with the applied voltage (U) as $\varepsilon = \alpha U$ where $\alpha = 2V^{-1}$. A similar capacitor with no dielectric is charged to $U_0 = 78V$. It is then is connected to the uncharged capacitor with the dielectric. Find the final voltage on the capacitors.

A. 2 V

B. 3 V

C. 5 V

D. 6 V

Answer: D

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Exemplar Problems

1. A positively charged particle is released from rest in a uniform electric field. The electric potential energy of the charge.

A. remains a constant because the electric field is uniform.

B. increases because the charge moves along the electric field.

C. decreases because the charge moves along the electric field.

D. decreases because the charge moves opposite to the electric field.

Answer: C

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2. The electrostatic potential on the surface of a charged concducting sphere is $100V$. Two statements are made in this regard

S_1 : at any inside the sphere, electric intensity is zero.

S_2 : at any point inside the sphere, the electrostatic potential is $100V$.

A. S_1 is true but S_2 is false

B. Both S_1 and S_2 are false

C. S_1 is true, S_2 is also true and S_1 is the cause of S_2

D. S_1 is true, S_2 is also true but the statements are independent.

Answer: C

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3. Equipotentials at a great distance from a collection of charges whose total sum is not zero are approximately

A. spheres

B. planes

C. paraboloids

D. ellipsoids.

Answer: A

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Assertion Reason

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

Reason: Electrostatic forces are non-conservative.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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2. Electric field inside a conductor can be zero only, if potential inside the conductor is

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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3. Assertion: In case of charged spherical shells, E-r graph is discontinuous while V-r graph is continuous

Reason: According to Gauss's theorem only the charge inside a closed surface ca produce electric field at some point.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: B

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4. 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 ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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5. Assertion: Polar mlecules have permanent dipole moment.

Reason : In polar molecule, the centres of positive and negative charges coincide evcen wehen there is no external field.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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6. Assertion. Dielectric polarization 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 ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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7. Assertion: In the absence of an external electric field, the dipole moment per unit volume of a polar dicletric is zero.

Reason : The dipoles of a polar diclectric are randomaly oriented.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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8. Can there be a potential difference between two adjacent conductors that carry same amount of positive charge ?

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: B

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

Reason : A capacitor is so configured that it cofines the electric field lines within a small region of space.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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10. Assertion: Increasing the charge on the plates of a capacitor means increasing the capacitance.

Resion : Capacitance is directly proportinal to charge.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: D

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11. As the distance between the plates of a parallel plate capacitor decreased

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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12. Assertion: The 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 ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: B

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13. Assertion. Capacity of a parallel plate condenser remains unaffected on introduced a conducting or insulating slab between the plates.

Reason. In both the cases, electric field intensity between the plates increases.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: D

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14. Assertion: Charge on all the condensers connected is series in the same.

Reason : Capacitance of capacitor is directly proportional to charge on it.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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15. Assertion- In a series combination of capacitors, charge on each capacitor is same.

Reason- In such a combination, charge cannot move only along one route.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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Electric Potential

1. Which of the following statement is true?

A. Electrostatic force is a conservative force.

B. Potential at a point is the work done per unit charge in bringing a charge from any point to infinity.

C. Electrostatic force is non-conservative.

D. Potential is the product of charge and work.

Answer: A

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2. 1 volt is equivalent to

A. $\frac{\text{netwon}}{\text{second}}$

B. $\frac{\text{newton}}{\text{coulomb}}$

C. $\frac{\text{joule}}{\text{coulomb}}$

D. $\frac{\text{joule}}{\text{second}}$

Answer: C

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3. The work done in bringing a unit positive charge from infinite distance to a point at distance x from a positive charge Q is W. Then the potential ϕ at that point is

A. $\frac{WQ}{x}$

B. W

C. $\frac{W}{x}$

D. WQ

Answer: B

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Potential Due To A Point Charge

1. The potential at a point due to charge of $5 \times 10^{-7} C$ located 10 cm away is

A. $3.5 \times 10^5 V$

B. $3.5 \times 10^4 V$

C. $4.5 \times 10^4 V$

D. $4.5 \times 10^5 V$

Answer: C

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2. In the question number 4, work done in bringing a charge of 4×10^{-9} C form infinity to that point is

A. $2.4 \times 10^{-4} J$

B. $1.8 \times 10^{-4} J$

C. $3.2 \times 10^{-5} J$

D. $4.1 \times 10^{-5} J$

Answer: B

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3. Electric field intensity at a point B due to a point charge Q kept at point A is $24 NC^{-1}$, and electric potential at B due to the same charge is $12JC^{-1}$. Calculate the distance AB and magnitude of charge.

A. $10^{-6}C$

B. $10^{-7}C$

C. $10^{-10}C$

D. $10^{-9}C$

Answer: D

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4. The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at that point is

A. $12\pi\varepsilon_0 Q \times 10^{22} Vm^{-1}$

B. $4\pi\varepsilon_0 Q \times 10^{22} Vm^{-1}$

C. $12\pi\varepsilon_0 Q \times 10^{20} Vm^{-1}$

D. $4\pi\varepsilon_0 Q \times 10^{20} Vm^{-1}$

Answer: B

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5. Two points A and B located in diametrically opposite directions of a point charge of +2μC at distances 2.0 m and 1.0 m respectively from it. Determine the potential difference $V_A - V_B$

A. $3 \times 10^3 V$

B. $6 \times 10^4 V$

C. $-9 \times 10^3 V$

D. $-3 \times 10^3 V$

Answer: C

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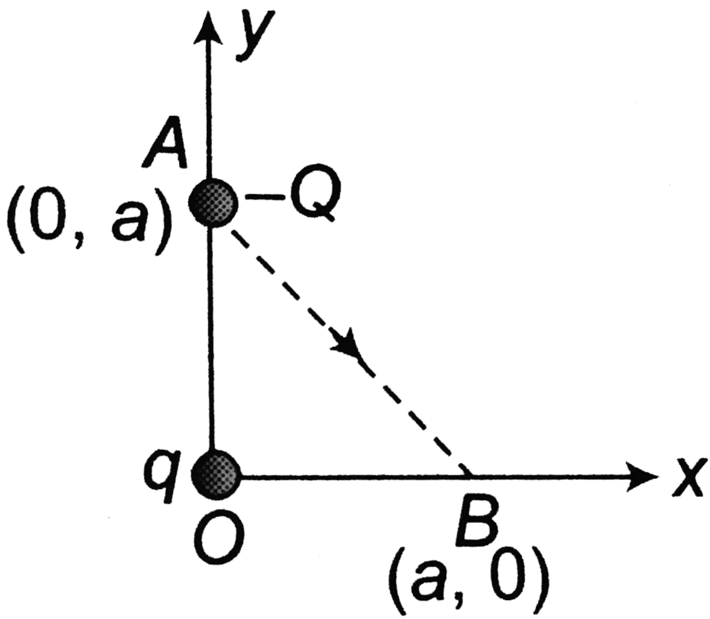
6. As per this diagram a point charge $+q$ is placed at the origin O. Work done in taking another point charge $-Q$ from the point $A(0, a)$ to another point $B(a, 0)$ along the staight path AB is:



A. $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{a-b}{ab}\right)$

B. $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{b-a}{ab}\right)$

C. $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{b}{a^2}-\frac{1}{b}\right)$

D. $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{a}{b^2}-\frac{1}{b}\right)$

Answer: A

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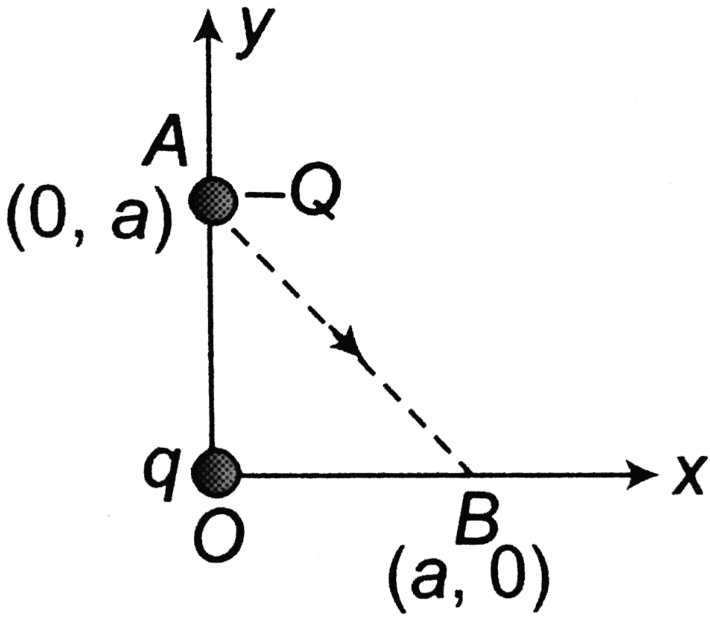
7. As per this diagram a point charge $+q$ is placed at the origin O. Work done in taking another point charge $-Q$ from the point

$A(0, a)$ to another point $B(a, 0)$ along the staight path AB is:



A. zero

B. $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2a}$

C. $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\frac{a}{\sqrt{2}}$

D. $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\frac{a}{\sqrt{2}}$

Answer: A

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Potential Due To An Electric Dipole

1. Electric field intensity (E) due to an electric dipole varies with distance (r) from the point of the center of dipole as :

A. $\frac{1}{r}$ and $\frac{1}{r^2}$

B. $\frac{1}{r^2}$ and $\frac{1}{r}$

C. $\frac{1}{r^3}$ and $\frac{1}{r^3}$

D. $\frac{1}{r^3}$ and $\frac{1}{r^2}$

Answer: D

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2. An electric dipole is placed at the centre of a sphere. Mark the correct options:

A. Electric field is zero at every point of the sphere

B. Electic field is zero anywhere on the sphere

C. The flux of electric field is not zero through the sphere

D. All of these

Answer: B

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3. Which of the following is not true ?

A. For a point charge, electrostatic potential varies as 1/r.

B. For a dipole, the potential depends on the magnitude of potition vector and dipole moment vector.

C. The electric dipole potential varties as 1/r at large distance.

D. For a point charge, the electrostatic field

varies as $1/r^2$.

Answer: C

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4. The distance between H^+ and Cl^- ions in HCl molecules is 1.38Å. The potential due to this dipole at a sistance of 10Å on the axis of dipole is

A. 2.1 V

B. 1.8 V

C. 0.2 V

D. 1.2 V

Answer: C

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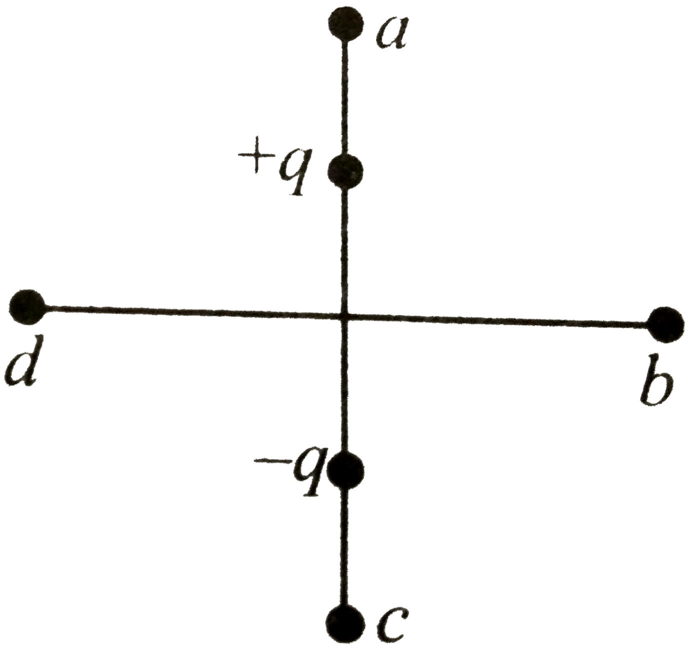
5. For points a, b, c and d ar set at equall distance from the centre of a dipole as shown in the figure. The magnitudes of electrostatic potential V_a, V_b, V_c and V_d would satisfy the following relation



A. $V_a > V_b > V_c > V_d$

B. $V_a > V_b > \ = V_d > V_c$

C. $V_a = V_c > V_b = V_d$

D. $V_b = V_d > V_a > V_c$

Answer: C

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Potential Due To A System Of Charges

1. Work done by an electrostatic field in moving a given charge from one point to another ...... upon the chosen closed path.

A. zero

B. positive

C. negative

D. data insufficient

Answer: C

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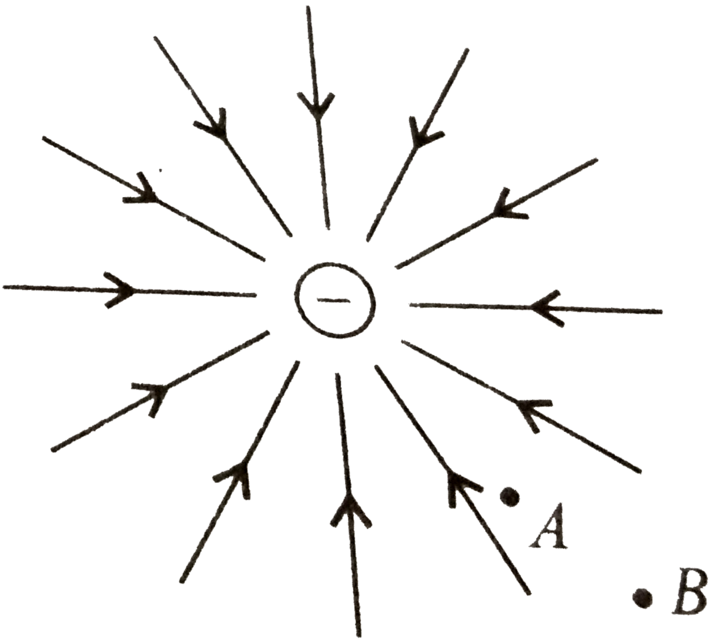
2. Figure shows the field lines of a point negative charge. In going from B to A, the kinetic energy of a small negative charge will



A. increase

B. decrease

C. remain constant

D. data insufficient

Answer: B

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3. Two tiny spheres carrying charges $1.8\mu C$ and $2.8\mu C$ are located at 40 cm apart. The potential at the mid-point of the line joining the two charges is

A. $3.8 \times 10^4 V$

B. $2.1 \times 10^5 V$

C. $4.3 \times 10^4 V$

D. $6.3 \times 10^5 V$

Answer: B

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4. In the question number 18, the potential at a point 20 cm from the mid-point of the line joining the two charges in a plance normal to the line and passing through the mid-point is

A. $1.4 \times 10^5 V$

B. $4.2 \times 10^3 V$

C. $2.9 \times 10^4 V$

D. $3.7 \times 10^5 V$

Answer: A

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5. Four equal charges Q are placed at the four corners of a square of each side is 'a'. Work done in removing a charge $-Q$ from its centre to infinity is

A. zero

B. $\dfrac{\sqrt{2}q^2}{\pi\varepsilon_0 a}$

C. $\dfrac{\sqrt{2}q}{\pi\varepsilon_0 a}$

D. $\dfrac{q^2}{\pi\varepsilon_0 a}$

Answer: B

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6. A cube of side x has a charge q at each of its vertices. Determine the potential due to this charge array at the center of the cube.

A. $\frac{4q}{3\pi\varepsilon_0 x}$

B. $\frac{4q}{\sqrt{3}\pi\varepsilon_0 x}$

C. $\frac{3q}{4\pi\varepsilon_0 x}$

D. $\frac{2q}{\sqrt{3}\pi\varepsilon_0 x}$

Answer: B

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7. A hexagon of side 8 cm has a charge $4\mu C$ at each of its vertices. The potential at the centre of the hexagon is

A. $2.7 \times 10^6 V$

B. $7.2 \times 10^{11} V$

C. $2.5 \times 10^{12} V$

D. $3.4 \times 10^4 V$

Answer: A

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Equipotential Surfaces

1. Consider a uniform electric field in the $\hat{z}$ direction. The potential is a constant.

A. for any x for a given z

B. for any y for a given z

C. on the x-y plane for a given z

D. All of these

Answer: D

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2. Equipotential surfaces

A. are closer in regions of large electric fields compared to regions of lower electric fields

B. will be more crowded near sharp edges of a conductor

C. will always be equally spaced

D. both (a) and (b) are correct

Answer: D

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3. In a region of constant potential

A. the electric field is uniform.

B. the electric field is zero.

C. there can be no charge inside the region.

D. both (b) and (c) are correct.

Answer: D

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4. What do you understand by potential gradient ?

Establish a relation between electric field and potential gradient.

A. Electric field is in the direction in which the potential decreases steepest

B. Magnitude of electric field is given by the charge in the magnitude of potential per unit displacement jnormal to the equipotential surface at the point.

C. In the region of strong electrric field, equipotential surfaces are far apart.

D. Both the statements (a) and (b) are correct.

Answer: D

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5. The angle between the equipotential surface and the electric field (or line of force) at any point on the equipotential surface is

A. 90° always

B. 0° always

C. 0° to 90°

D. 0° to 180°

Answer: A

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6. The work done to move a unit charge along an equipotential from P to Q

A. must be defined as $-\int_{P}^{Q} \overrightarrow{E} \, . \, \overrightarrow{dl}$

B. is zero

C. can have a non-zero value

D. both (a) and (b)are correct

Answer: D

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7. The top of the atomosphere is about 400 kV with respect to the surface of earth, corresponding to an electric field that decreases with altitude. Near the surface of earth the field is about 100 V m^{-1}, but still don't get an electric shock, as we set out of out houses in to open because (assume the house is free from electric field)

A. our body is a perfect insulator

B. our body and ground form an equipotential surface

C. the original equipotential surfaces of open air remain same

D. none of these

Answer: B

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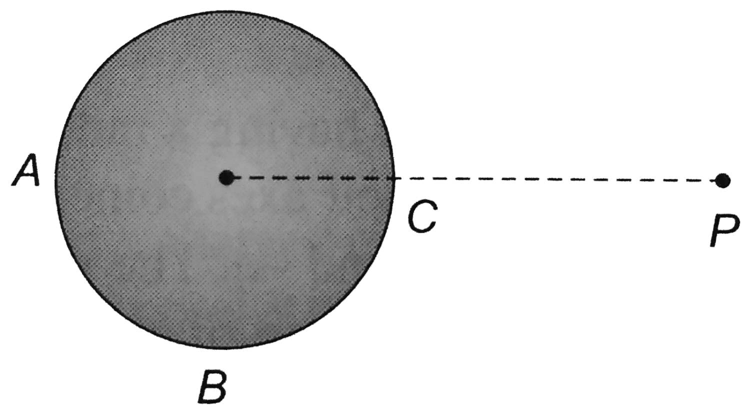
8. A hollow conducting sphere is placed in an electric field produced by a point charge placed at P as shown in figure.

Let V_A, V_B, V_C be the potentials at points A, B and C respectively. Then



A. $V_C > V_B$

B. $V_A > V_B$

C. $V_B > V_C$

D. $V_A = V_C$

Answer: D

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9. The work done in carrying a charge q once round a circle of radius r with a charge Q at the centre is

A. $\frac{qQ}{4\pi\varepsilon_0 a}$

B. $\dfrac{qQ}{4\pi\varepsilon_0 a^2}$

C. $\dfrac{q}{4\pi\varepsilon_0 a}$

D. zero

Answer: D

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Potential Energy As A System Of Charges

1. When a positive q charge is taken from lower potential to a higher potential point, then its potential energy will

A. remin the same

B. increase

C. decrease

D. become zero

Answer: C

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2. A system consists of two charges $4\mu C$ and $-3\mu C$ with no external field placed at $(-5cm, 0, 0)$ and $(+5cm, 0, 0)$ respectively. The amount of work required to separated the two charges infinitely away from each other is

A. $-1.1J$

B. $2J$

C. $2.5J$

D. $3J$

Answer: A

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3. Two charges of magnitude $5nC$ and $-2nC$ are placed at points (2cm,0,0) and (x cm,0,0) in a region of space. Where there is no other external field. If the electrostatic potential energy of the system is $-0.5\mu J$. What is the value of x ?

A. 20 cm

B. 80 cm

C. 4 cm

D. 16 cm

Answer: A

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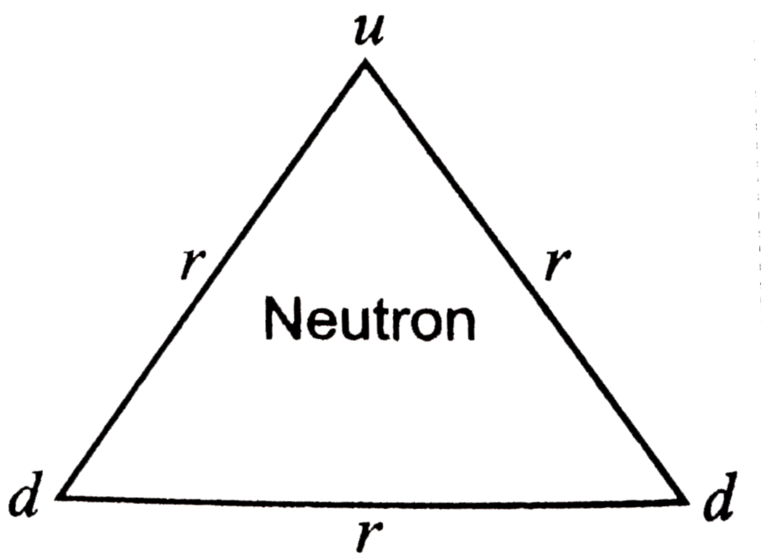
4. (a) In a quark model of elementary particles, a neutron is made of one up quarks [charge $(2/3)$e] and two down quarks [charges -$(1/3)e$]. Assume that they have a triangle configuration with side length of the order of $10^{-15}m$. Calculate electrostatic potential energy of neutron and compare it with its mass 939 MeV.

(b) Repeat above exercise for a proton which is made of two up and one down quark.



A. 7.68

B. -5.21

C. -0.48

D. 9.34

Answer: C

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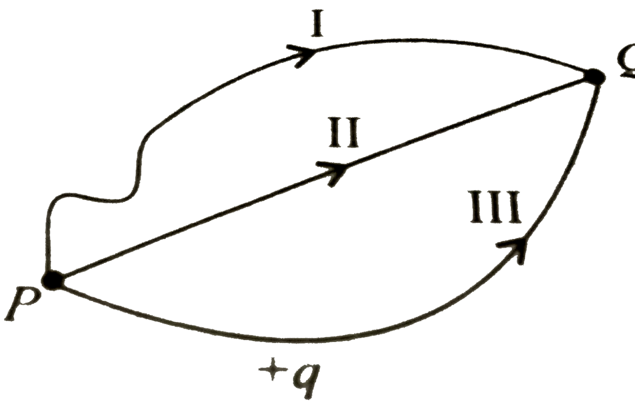
Potential Energy In An External Field

1. Which among the following statements is true about the work done in bringing a unit positive charge from point P to Q in an electrostatic field ?



A. Minimum work is done in case of path II.

B. Maximum work is done in case of path I.

C. Work done is same in all the three paths.

D. Work done is zero in case of path II.

Answer: C

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2. A dipole of moment $\overrightarrow{p}$ is placed in a uniform electric field $\overrightarrow{E}$. The force on the dipole is $\overrightarrow{F}$ and the torque is $\overrightarrow{\tau}$

A. (i), (ii) and (iii) are correct

B. (i) and (ii) are correct and (ii) is wrong

C. only (i) is correct

D. (i) and (ii) are correct and (iii) is wrong

Answer: B

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3. A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-29}C m. A mole of this substance is polarized at low temperature by appling a strong elecrostatic field of magnitude $10^{6}Vm^{-1}$. The direction of the field is suddenly changed by an angle of 60°. Estimate the heat released by the substance in aligning its dipole along the new direction of the field. For simplicity, assume $100\ \%$ polarisation of sample.

A. $-6J$

B. $-3J$

C. $3J$

D. $6J$

Answer: B

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4. An electric dipole of length 20 cm having $\pm 3 \times 10^{-3}$ C charge placed at 60° with respect to a uniform electric field experiences a torque of magnitude 6 Nm. The potential energy of the dipole is

A. $-2\sqrt{3}J$

B. $5\sqrt{3}J$

C. $-3\sqrt{2}J$

D. $3\sqrt{5}J$

Answer: A

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Electrostatics Of Conductors

1. If a conductor has a potential $V \neq 0$ and there are no charges anywhere else outside, then

A. there must be charges on the surface or inside itself.

B. there cannot be any charge in the body of the conductor.

C. there must be charges only on the surface.

D. both (a) and (b) are correct.

Answer: C

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2. 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 uniformaly distributed over the surface of the conductor.

D. none of these

Answer: D

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3. Consider two conductinbg spheres of radill R_1 and R_2 with $R_1 > R_2$. If the two are at the same potential, and the larger sphere has more charge than the smaller sphere, then

A. the charge density of smaller sphere is less then that of larger sphere,

B. the charge density of smaller sphere is more than that of larger sphere.

C. both spheres may have same charge density.

D. none of these

Answer: B

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4. Two metal spheres, one fo radius R and the other of radius 2R, both have same surface charge density s. They are brought in contact and seprated. What will be new surface charge densitites on them ?

A. $\frac{5}{2}\sigma, \frac{5}{4}\sigma$

B. $\frac{5}{3}\sigma, \frac{5}{6}\sigma$

C. $\frac{3}{5}\sigma, \frac{6}{5}\sigma$

D. $\frac{2}{3}\sigma, \frac{1}{2}\sigma$

Answer: B

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5. Two spheres of radius a and b respectively are charged and joined by a wire. The ratio of electric field of the spheres is

A. $\frac{a}{b}$

B. $\frac{b}{a}$

C. $\frac{a^2}{b^2}$

D. $\frac{b^2}{a^2}$

Answer: B

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Dielectrics And Polarisation

1. Which among the following is an example of polar molecule ?

A. O_2

B. H_2

C. N_2

D. HCl

Answer: D

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2. Choose the correct statement.

A. Polar molecules have permanent electric dipole moment.

B. CO_2 molecule is a polar molecule.

C. H_2O is non-polar molecule.

D. The dipole field at large distances falls of as $\frac{1}{r^2}$.

Answer: A

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3. For metals the value of dielectric constant (K) is

A. zero

B. infinite

C. 1

D. 10

Answer: B

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4. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance

A. increases K times

B. remains unchanged

C. decreases K times

D. increases K^{-1} times

Answer: C

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Capacitors And Capacitance

1. 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

Answer: C

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2. A spherical capacitor consists of two concentric spherical shells of outer radius r1 and inner radius r2, held in position by suitable insulating supports. calculate the capacitance of this spherical capacitor.

A. $\frac{4\pi\varepsilon_0 r_1 r_2}{r_1 - r_2}$

B. $\frac{4\pi\varepsilon_0 - (r_2 - r_1)}{r_1 r_2}$

C. $\frac{r_1 r_2}{4\pi\varepsilon_0 (r_2 - r_1)}$

D. $\frac{(r_1 - r_2)}{4\pi\varepsilon_0 r_1 r_2}$

Answer: A

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3. The magnitude of electric field $\vec{E}$ 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.

Answer: C

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4. A cylindrical capacitor has two co-axial cylinders of length 20 cm and radii 1.5 cm and 1.6 cm. The outer cylinder is earthed and inner cylinder is given a charge $4\mu C$. The capacitance of the system is (neglect end effect)

A. $2.8 \times 10^{-8} F$

B. $4.2 \times 10^{-14} F$

C. $1.7 \times 10^{-10} F$

D. $3.4 \times 10^{-12} F$

Answer: C

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The Parallel Plate Capacitor

1. In a parallel plate capacitor , the capacity increases if

A. area of the plate is decreased

B. distance between the plates increases

C. area of the plate is increased

D. dielectric constant decreases.

Answer: C

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2. Two large parallel conducting plates are placed close to each other ,the inner surface of the two plates have surface charge densities $+\sigma$ and $-\sigma$ .The outer surfaces are without charge.The electric field has a magnitude of

A. (sigma)/(epsi_(0))` in the region between the plates

B. "$\frac{\sigma}{\varepsilon_0}$ in the region between the plates

C. 0

D. none of these

Answer: B

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3. A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an isulating handle. As a result the potential difference between the plates

A. increases

B. decrease

C. does not charge

D. becomes zero

Answer: A

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4. A parallel plate capacitor is charged and then isolated. The effect of increasing the plate separation on charge, potential and capacitance respectively are

A. constant, decrease, decrease

B. increase, decreases, decreases

C. constant, decreases, increases

D. constant, increases, decreases.

Answer: D

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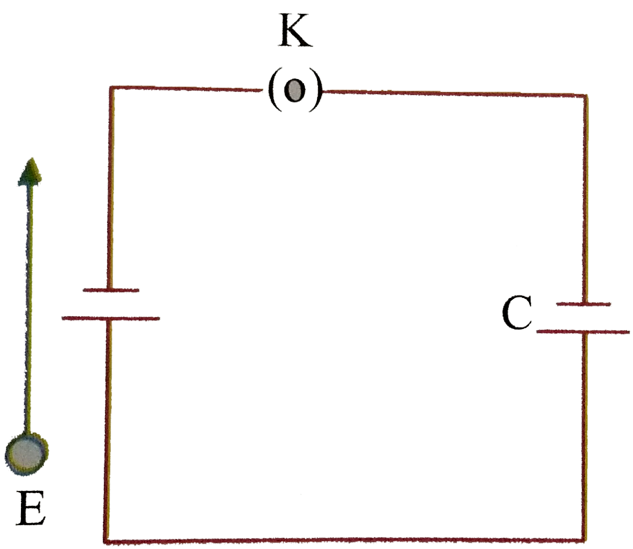
5. A parallel plate capacitor is connected to a battery as shown in figure. Consider two situations :



.

A : Key K is kept closed and plates of capacitors are moved apart using insulting handle.

B : Key K is opened and plates of capacitors are moved apart using insulting handle.

Choose the correct options (s).

A. In (i), Q remains same but C charges.

B. In (ii) V remains same but C charges.

C. In (i) V remains same and hence Q changes.

D. In (ii) both Q and V changes.

Answer: C

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Effect Of Dielectric On Capacitance

1. If the dielectric constant and dielectirc strength be denoted by K and x respectively, then a meterial suitable for use as a dielectric in a capacitor must have

A. high K and high X

B. high K and low K

C. low K and high K

D. low K and low X

Answer: A

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2. A parallel plate capacitor with air between the plates has a capacitance of 10 pF. The capacitance, if the distance bgetween the plates is reduced by half and the space between tehm is filled with a substance of dielectric constant 4 is

A. $80pF$

B. $96pF$

C. $100pF$

D. $120pF$

Answer: A

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3. The capacitance of a parallel plate capacitor with air as medium is $3\mu F$. with the introduction of a dielectric medium between the plates, the capacitance becomes $15\mu F$.

The permittivity of the medium is

A. $5C^2N^{-1}M^{-2}$

B. $15C^2N^{-1}m^{-2}$

C. $0.44 \times 10^{-10}C^2N^{-1}m^{-2}$

D. $8.854 \times 10^{-11}C^2N^{-1}m^{-2}$

Answer: C

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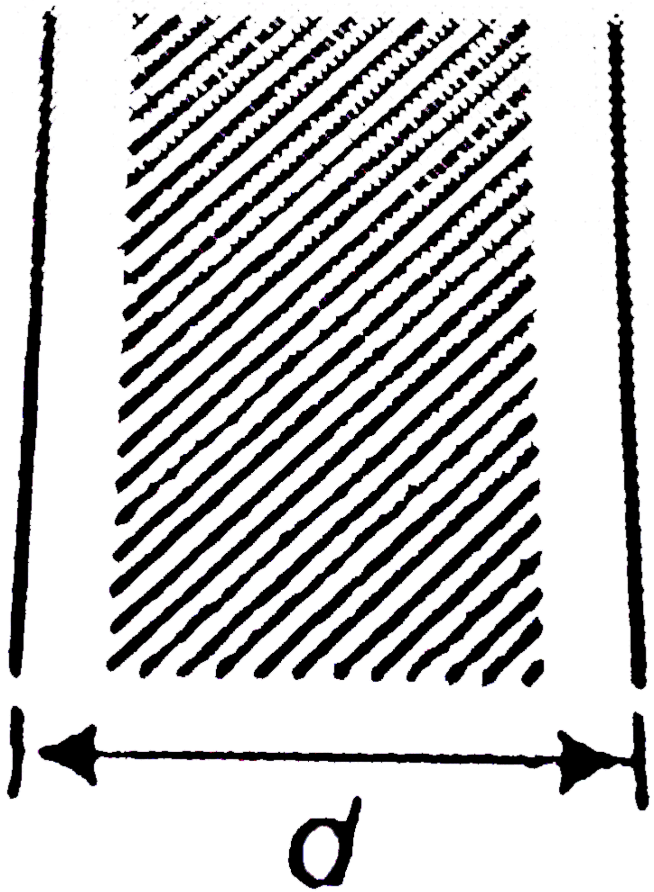
4. A copper plate of thickness b is placed inside a parallel plate capacitor of plate distance d and area A as shown in figure. The capacitance of capacitor is



A. $\dfrac{\varepsilon_0 A}{d+\frac{b}{2}}$

B. $\dfrac{\varepsilon_0 A}{2d}$

C. $\dfrac{\varepsilon_0 A}{d-b}$

D. $\dfrac{2\varepsilon_0 A}{d+\frac{b}{2}}$

Answer: C

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5. A parallel plate capacitor of capacity $5\mu F$ and plate separation $6cm$ is connected to a $1V$ battery and is charged. A dielectric of dielectric constant 4 and thickness $4cm$ is introduced into the capacitor. The additional charge that flows into the capacitor from the battery is.

A. $2\mu C$

B. $3\mu C$

C. $5\mu C$

D. $10\mu C$

Answer: C

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6. A slab of material of dielectric constant K has the same area as the plates of a parallel capacitor, but has a thickness $\left(\frac{3}{4}d\right)$, where d is the separation of the plates. How is the capacitance changed when the slab is inserted between the plates

A. $C = \frac{\varepsilon_0 A}{d}\left(\frac{K+3}{4K}\right)$

B. $C = \frac{\varepsilon_0 A}{d}\left(\frac{2K}{K+3}\right)$

C. $C = \frac{\varepsilon_0 A}{d}\left(\frac{K}{K+3}\right)$

D. $C = \frac{\varepsilon_0 A}{d}\left(\frac{4K}{K+3}\right)$

Answer: D

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Combination Of Capacitors

1. Three capacitors each of capacity $4\mu F$ are to be connected in such a way that the effective capacitance is $6\mu F$. This can be done by

A. connecting them in series

B. connecting them is parallel

C. connecting two in series and one in parallel

D. connecting two in parallel and one is series

Answer: C

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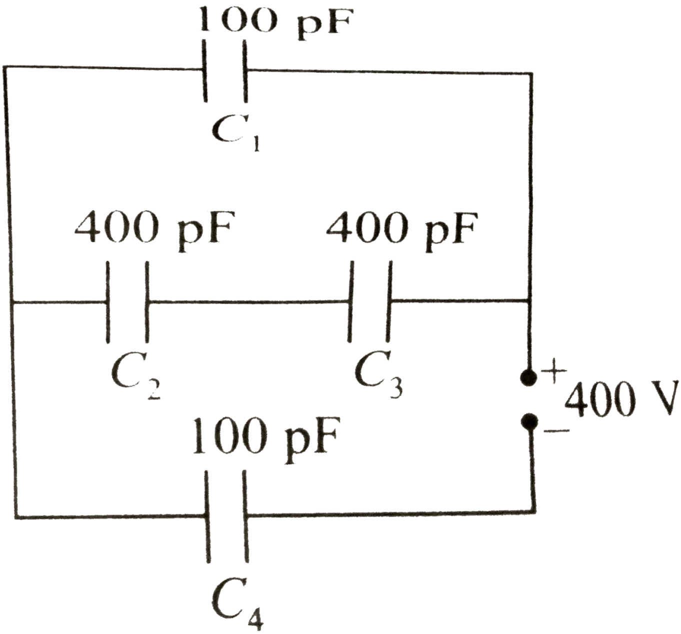
2. The equivalent capacitance for the network shown in the figure is



A. $\frac{1200}{7}pF$

B. $\frac{1000}{4}pF$

C. $\frac{1800}{7}pF$

D. $\frac{1300}{3}pF$

Answer: A

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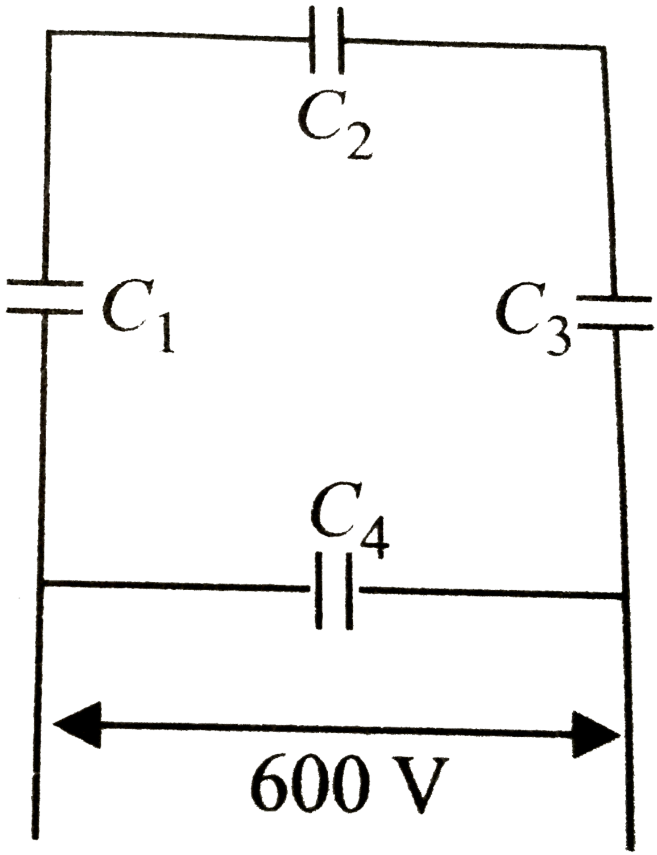
3. A network of four 20 μF capacitors is connected to a 600 V supply as shoen in the figure.

The equivalent capacitance of the network is



A. $30.26 \mu F$

B. $20 \mu F$

C. $26.67\mu F$

D. $10\mu F$

Answer: C

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4. In the question number 66, the charge on capacitors C_1 and C_4 are

A. $4 \times 10^{-3}C, 12 \times 10^{-3}C$

B. $6 \times 10^{-3}C, 12 \times 10^{-3}C$

C. $2 \times 10^{-3}C, 4 \times 10^{-3}C$

D. $3 \times 10^{-3}C, 2 \times 10^{-3}C$

Answer: A

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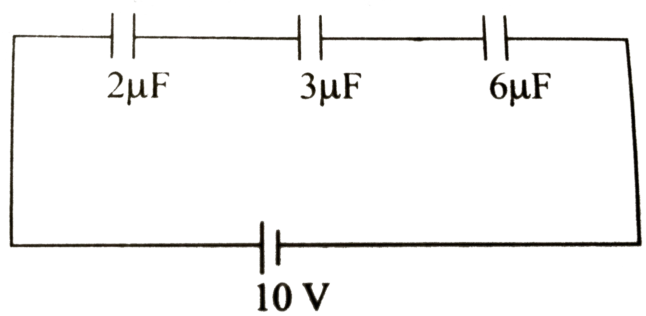
5. The charge on $3\mu F$ capacitor shown in the figure is



A. $2\mu C$

B. $10\mu C$

C. $6\mu C$

D. $8\mu C$

Answer: B

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6. Minimum number of capacitors each of $8\mu F$ and 250 V used to make a composite capacitor of $16\mu F$ and 1000 V are

A. 8

B. 32

C. 16

D. 24

Answer: B

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7. A capacitor or capacitance C_1 is charge to a potential V and then connected in parallel to an uncharged capacitor of capacitance C_2. The fianl potential difference across each capacitor

will be

A. $\dfrac{C_1V}{C_1 + C_2}$

B. $\dfrac{C_2V}{C_1 + C_2}$

C. $1 + \dfrac{C_2}{C_1}$

D. $1 - \dfrac{C_2}{C_1}$

Answer: A

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8. Two capacitrors of $2 \mu F$ and $4 \mu F$ are connected in parallel. A third capacitor of $6 \mu F$ is connected in series. The combaination is connected across a 12 V battery. The voltage across $2 \mu F$ capacitor is

A. 2 V

B. 8 V

C. 6 V

D. 1 V

Answer: C

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9. Two idential capacitors are joined in parallel, charged to a potential V and then separated and then connected in series i.e. the positive plate of one is connected to negative of the other

A. The charges on the free plated connected together are destoyed.

B. The energy stored in the system increases.

C. The potential difference between the free plates is 2V.

D. The potential difference remains constant.

Answer: C

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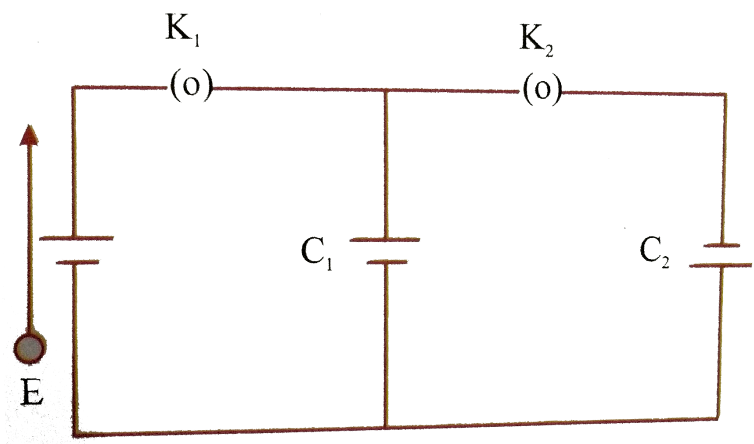
10. In the circuit shown in figure , initially key K_1 is closed and key K_2 is open. Then K_1 is opened and K_2 is closed (order is important). [Take Q_1' and Q_2' as charges on C_1 and C_2 and V_1 and V_2 as voltage respectively].



Then

A. charge on C_1 get redistributed such that $V_1 = V_2$

B. charge on C_1 gas redistributed such that $q_1{}' = q_2{}'$

C. charge on C_1 gets redisributed such that $C_1V_1 = C_2V_2 = C_1V$

D. charge on C_1 gets redistributed such that $q_1{}' + q_2{}' = 2q$

Answer: A

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11. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is 'C' then the resultant capacitance is

A. nC

B. $\frac{C}{n}$

C. $(n+1)C$

D. $(n-1)C$

Answer: D

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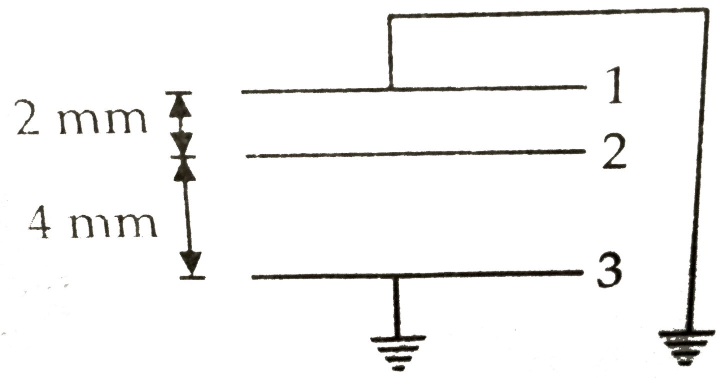
12. Two parallel conducting plates of area $A = 2.5m^2$ each are placed 6 mm apart and are both earthed. A third plate, identical with the first two, is placed at a distance of 2 mm from one of the earthed plates and is given a charge of 1 C. The potential of the central plate is



A. $6 \times 10^7 V$

B. $3 \times 10^7 V$

C. $4 \times 10^7 V$

D. $2 \times 10^7 V$

Answer: A

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13. A parallel plate air capacitor has a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increase in the capacitance will be

A. $400\ \%$

B. $66.6\ \%$

C. $33.3\ \%$

D. $200\ \%$

Answer: B

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14. A capacitor is made of two circular plates of radius R each, separated by a distance $d << R$. The capacitor is connected to a constant voltage. A thin conducting disc of radius $r << R$ and thickness $t << r$ is placed at a center of the bottom plate. Find the minimum voltage required to lift the disc if the mass of the disc is m.

A. $\dfrac{\sqrt{mgd}}{\pi\varepsilon_0 r^2}$

B. $\sqrt{\dfrac{mgd}{\pi\varepsilon_0 r}}$

C. $\sqrt{\dfrac{mgd^2}{\pi\varepsilon_0 r^2}}$

D. $\sqrt{\dfrac{mgd}{\pi\varepsilon_0 r^2}}$

Answer: C

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Energy Stored In Capacitor

1. A parallel plate condenser is charged by connected it to a battery. The battery is disconnected and a glass slab is introduced between the plates. Then

A. potential increases

B. electric intensity increases

C. energy decreases.

D. capacity decreases

Answer: B

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2. A capacitor has some dielectric between its plates, and the capacitor is connected to a DC source. The battery is now disconnected and then the dielectric is removed. State whether the capacitance, the energy stored in it, electric field, charge stored and the voltage will increase ro remain constant.

A. capacitance will increase.

B. energy stored will decrease.

C. electric field will increase.

D. voltage will decrease.

Answer: C

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3. A capacitor of capacitance 700 pF is charged by 100 V battery. The electrostatic energy stored by the capacitor is

A. $2.5 \times 10^{-8} J$

B. $3.5 \times 10^{-6} J$

C. $2.5 \times 10^{-4} J$

D. $3.5 \times 10^{-4} J$

Answer: B

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4. A 16 pF capacitor is connected to 70 V supply. The amount of electric energy stored in the capacitor is

A. $4.5 \times 10^{-12} J$

B. $5.1 \times 10^{-8} J$

C. $2.5 \times 10^{-12} J$

D. $3.92 \times 10^{-8} J$

Answer: D

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5. A capacitor is charged through a potential difference of 200 V, when 0.1C charge is stored in it. The amount of energy released by it, when it is discharged is

A. 5 J

B. 10 J

C. 20 J

D. 2.5 J

Answer: B

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6. A parallel plate capacitor has a uniform electric field E in the space between the the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is

A. $\frac{1}{2}\varepsilon_0 E^2$

B. $\frac{E^2 Ad}{\varepsilon_0}$

C. $\frac{1}{2}\varepsilon_0 E^2 Ad$

D. $eisi_0 E^2 Ad$

Answer: C

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7. A metallic sphere of radius 18 cm has been given a charge of $5 \times 10^{-6} C$. The energy of the charged conductor is

A. $0.2J$

B. $0.6J$

C. $1.2J$

D. $2.4J$

Answer: B

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8. Two spherical conductors each of capacity C are charged to potetnial V and $-V$. These are then conneted by means of a fine wire. The loss of energy will be

A. zero

B. $\frac{1}{2}CV^2$

C. CV^2

D. $2CV^2$

Answer: C

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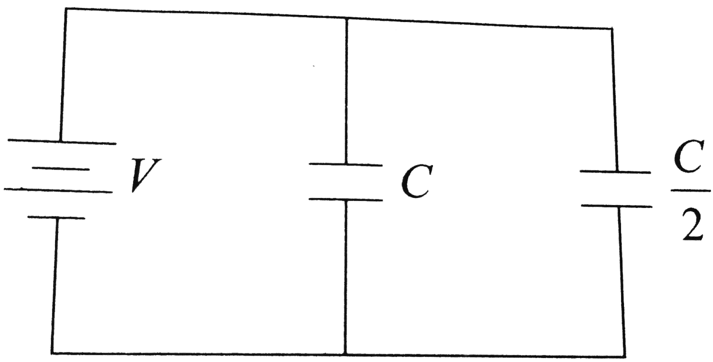
9. Two condensers, one of capacity C and the other of capacity $C/2$ are connected to a V volt battery, as shown.



The work done in charging fully both the condensers is

A. $\frac{1}{4}CV^2$

B. $\frac{3}{4}CV^2$

C. $\frac{1}{2}CV^2$

D. $2CV^2$

Answer: B

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10. A parallel plate condenser with a dielectric of dielectric constant K between the plates has a capacity C and is charged to a potential V volt. The dielectric slab is slowly removed from between the plates and then reinserted. The net work done by the system in this process is

A. zero

B. $\frac{1}{2}(K-1)CV^2$

C. $\frac{CV^2(K-1)}{K}$

D. $(K-1)CV^2$

Answer: A

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11. Two identical capacitors, have the same capacitance C. One of them is charged to potential V_1 and the other V_2. The negative ends of the capacitors are connected together. When the poistive ends are also connected, the decrease in energy of the combined system is

A. $\frac{C}{4}\left(V_1^2 - V_2^2\right)$

B. $\frac{C}{4}\left(V_1^2 + V_2^2\right)$

C. $\frac{C}{4}(V_1 - V_2)^2$

D. $\frac{C}{4}(V_1 + V_2)^2$

Answer: C

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12. Energies stored in capacitor and dissipated during charging a capacitor bear a ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:3$

Answer: C

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13. Two capcitors, 3 μF and $4 \mu F$, are individually charged across a 6 V battery. After being disconnected from the battery, they are connected together with the negative plate of one attached to the positive plate of the other. What is the final total energy stored ?

A. $1.26 \times 10^{-4} J$

B. $2.57 \times 10^{-4} J$

C. $1.25 \times 10^{-6} J$

D. $2.57 \times 10^{-6} J$

Answer: D

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14. A parallel plate capacitor without any dielectric within its plates, has a capacitance C, and is connected to a battery of emf V. The battery is disconnected and the plates of the capacitor are pulled apart until the separation between the plates is doubled. What is the work done by the agent pulling the plates apart, in this process ?

A. $\frac{1}{2}CV^2$

B. $\frac{3}{2}CV^2$

C. $-\frac{3}{2}CV^2$

D. CV^2

Answer: A

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15. A series combination of n_1 capacitors, each of value C_1, is charged by a source of potential difference $4V$. When another parallel combination of n_2 capacitors, each of value C_2 , is charged by a source of potential difference V, it has same (total) energy stored in it, as the first combination has. the value of C_2, in terms of C_1, is then

A. $\dfrac{2C_1}{n_1 n_2}$

B. $16\dfrac{n_2}{n_1}C_1$

C. $2\dfrac{n_2}{n_1}C_1$

D. $\dfrac{16C_1}{n_1 n_2}$

Answer: D

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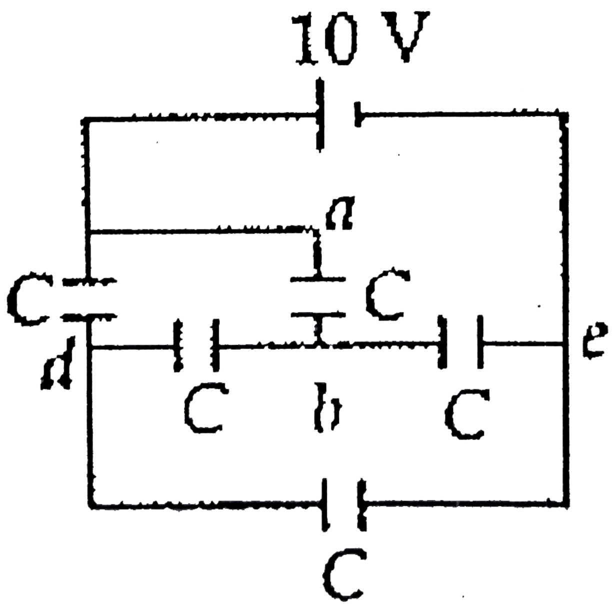
16. What is the energy stored in the capacitor between terminals a and b of the network shown in the figure ? (Capacitance of each capacitance $C = 1 \mu F$)



A. $12.5\mu J$

B. Zero

C. $25\mu J$

D. $52\mu J$

Answer: A

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17. Consider a parallel plate capcaitor 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. $0.69 J / m^3$

Answer: C

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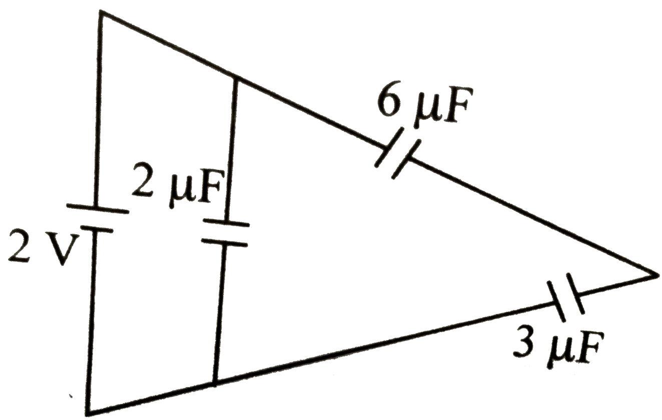
18. The total energy stored in the condensery system shown in the figure wili be



A. $8 \mu J$

B. $16 \mu J$

C. $2 \mu J$

D. $4 \mu J$

Answer: A

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Van De Graaff Generator

1. Van de Graaff generator is used for

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

Answer: B

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2. Which of the following statements is/are true about the principle of Van de Graaff generator ?

A. The action of sharp points.

B. The charge given to a hollow conductor is transfered to outer surface and it distributed uniformly over it.

C. It is used for accelerating uncharged particle.

D. Both (a) and (b) are true.

Answer: D

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3. Who established the fact of animal electricity ?

A. Van de Graaff

B. Count Alessandro Volta

C. Gustav Robert Kirchhoff

D. Hans Christing Oersted

Answer: B

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4. In case of a Van Graaff generator, the breakdown field of air is

A. $2 \times 10^8 Vm^{-1}$

B. $3 \times 10^6 Vm^{-1}$

C. $2 \times 10^{-8} Vm^{-1}$

D. $3 \times 10^4 Vm^{-1}$

Answer: B

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

A. 0.1 m

B. 0.2 m

C. 0.5 m

D. 0.3 m

Answer: D

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Higher Order Thinking Skills

1. 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 intensity is E and the potential is V. The ratio V/E has magnitude

A. rn

B. $r(n-1)$

C. $(n-1)/r$

D. $r(n-1)/n$

Answer: B

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2. The potential at a point distant x (mesured in μm) due to some charges situated on the x-axis is given by $V(x) = \frac{20}{x^2 - 4}$ V. The electric field at $x = 4 \mu m$ is given by

A. $\frac{5}{3} V \mu m^{-1}$ and in positive x direction

B. $\frac{10}{9} V \mu m^{-1}$ and in negative x direction

C. $\frac{10}{9} V \mu m^{-1}$ and in positive x direction

D. $\frac{5}{3} V \mu m^{-1}$ and in negative x direction.

Answer: C

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3. An infinite cylinder of radius r_o, carrying linear charge density λ. The equation of the equipotential surface for the cylinder is

A. $r = r_0 e^{\pi\varepsilon_0 [V(r) + V(r_0)]\lambda}$

B. $r = r_0 e^{2\pi\varepsilon_0 [V(r) - V(r_0)]\lambda^2}$

C. $r = r_0 e^{-2\pi\varepsilon_0 [V(r) = V(r_0)]\lambda}$

D. $r = r_0 e^{-2\pi\varepsilon_0 [V(r) - V(r_0)]\lambda}$

Answer: C

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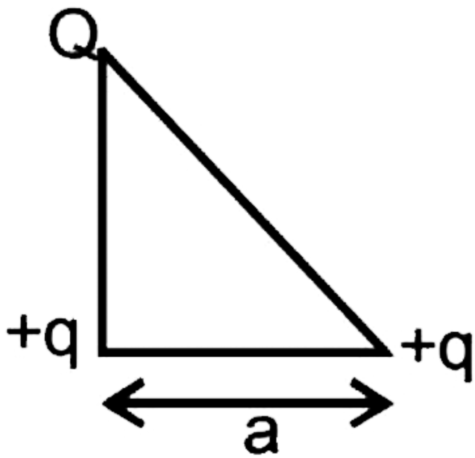
4. Three charges Q, $+q$ and $+q$ are placed at the vertices of a right-angled isosceles triangle as shown. The net electrostatic energy of the configuration is zero if Q is equal to



A. $\frac{-q}{1+\sqrt{2}}$

B. $\frac{-2q}{2+\sqrt{2}}$

C. $-2q$

D. $+q$

Answer: B

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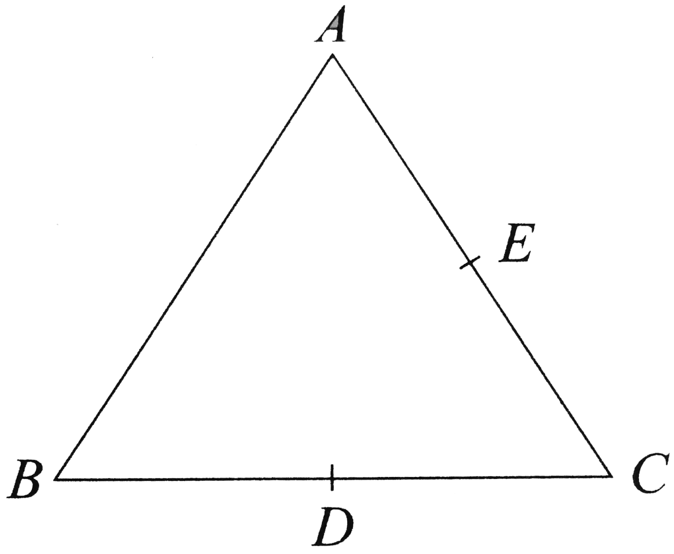
5. Three cahrges each $+q$, are placed at the corners of an isosceles trinagle ABC of sides BC and AC, $2a$, D and E are the mid-points of BC and CA. The work done in taking a charge Q from D to E is



A. $\dfrac{qQ}{8\pi\varepsilon_0 a}$

B. $\dfrac{qQ}{4\pi\varepsilon_0 a}$

C. zero

D. $\dfrac{3qQ}{4\pi\varepsilon_0 a}$

Answer: C

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6. Three concentric spherical shells have radii a, b and $c(a < b < c)$ and have surface charge densities $\sigma, -sigam$ and σ respectively. If V_A, V_B and V_C denote the potentials of the three shells, then for $c = a + b$, we have

A. $V_C = V_B = V_A$

B. $V_C = V_A \neq V_B$

C. $V_C = V_B \neq V_A$

D. $V_C \neq V_B \neq V_A$

Answer: B

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7. A parallel plate capacitor is filled by a dielectric whose relative permittivity varies with the applied voltage (U) as $\varepsilon = \alpha U$ where $\alpha = 2V^{-1}$. A similar capacitor with no dielectric is charged to $U_0 = 78V$. It is then is connected to the uncharged capacitor with the dielectric. Find the final voltage on the capacitors.

A. 2 V

B. 3 V

C. 5 V

D. 6 V

Answer: D

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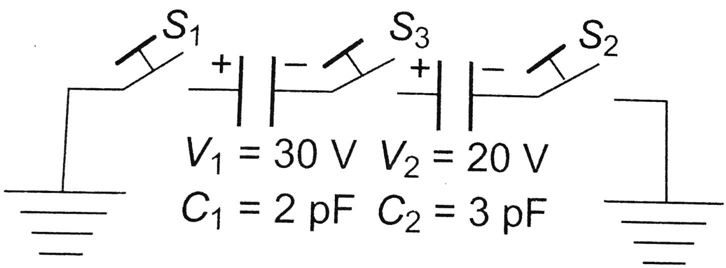
8. For the circuit shown in figure, which of the following statements is true ?



A. With S_1 closed, $V_1 = 15V, V_2 = 20V$

B. With S_3 closed, $V_1 = V_2 = 25V$

C. With S_1 and S_2 closed, $V_1 = V_2 = 0$

D. With S_1 and S_3 closed, $V_1 = 30V, V_2 = 20V$.

Answer: D

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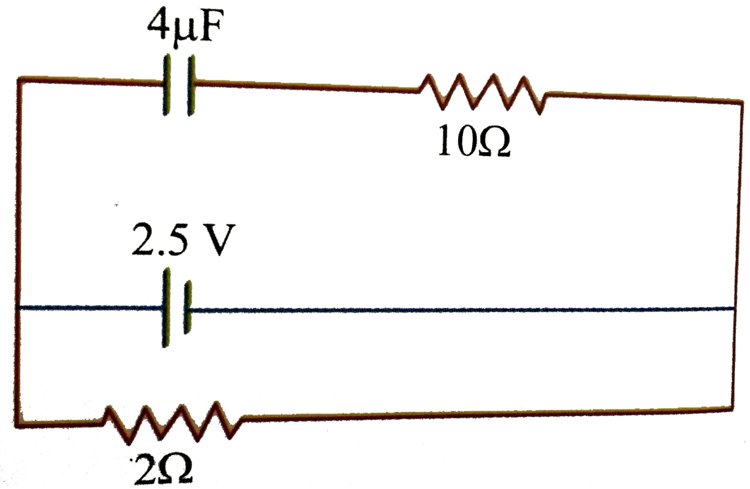
Ncert Exemplar

1. A capacitor of $4\mu F$ is connected as shown in the circuit. The internal resistance of the battery is 0.5Ω. The amount of charge on the capacitor plates will be



A. 0

B. $4\mu C$

C. $16\mu C$

D. $8\mu C$

Answer: D

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2. A positively charged particle is released from rest in a uniform electric field. The electric potential energy of the charge.

A. remains a constant because the electric field is uniform.

B. increases because the charge moves along the electric field.

C. decreases because the charge moves along the electric field.

D. decreases because the charge moves opposite to the electric field.

Answer: C

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3. Figure shows some equipotential lines distributed in space. A charged object is moved from point A to point B.

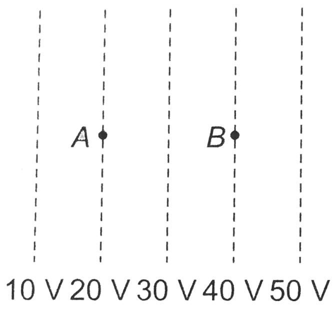

Fig. (i)

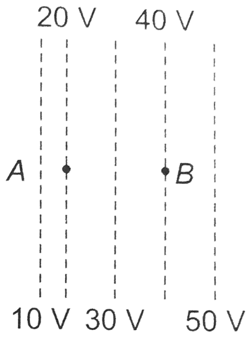

Fig. (ii)

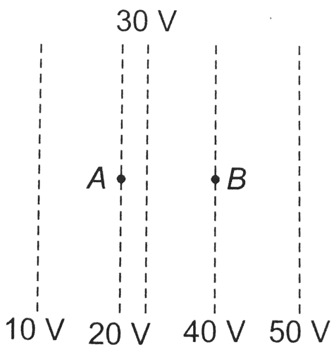

Fig. (iii)

A. The work done in figure (i) is the greatest.

B. The work done in figure (ii) is the least.

C. The work done is the same in figure (i), (ii) and (iii).

D. The work done in figure (iii) is greater than figure (ii) but equal to that in figure (i).

Answer: C

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4. The electrostatic potential on the surface of a charged concducting sphere is $100V$. Two statements are made in this regard

$S_1:$ at any inside the sphere, electric intensity is zero.

$S_2:$ at any point inside the sphere, the electrostatic potential is $100V$.

A. S_1 is true but S_2 is false

B. Both S_1 and S_2 are false

C. S_1 is true, S_2 is also true and S_1 is the cause of S_2

D. S_1 is true, S_2 is also true but the statements are independent.

Answer: C

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5. Equipotentials at a great distance from a collection of charges whose total sum is not zero are approximately

A. spheres

B. planes

C. paraboloids

D. ellipsoids.

Answer: A

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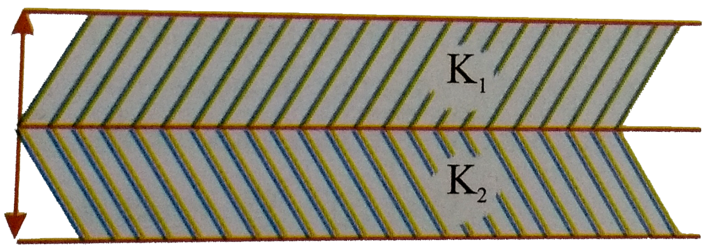
6. A parallel plate capacitor is made of two dielectric blocks in series. One of the blocks has thickness d_1 and dielectric constant K_1

and the other has thickness d_2 and dielectric constant K_2 as shown in figure. This arrangement can be through as a dielectric slab of thickness $d(=d_1+d_2)$ and effective dielectric constant K. The K is.



.

A. $\dfrac{K_1d_1+K_2d_2}{d_1+d_2}$

B. $\dfrac{K_1d_1+K_2d_2}{K_1+K_2}$

C. $\dfrac{(K_1+K_2)(d_1+d_2)}{K_2d_1+K_1d_2}$

D. $\dfrac{2K_1K_2}{K_1+K_2}$

Answer: C

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Assertion And Reason

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

Reason: Electrostatic forces are non-conservative.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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2. Electric field inside a conductor can be zero only, if potential inside the conductor is

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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3. Assertion: In case of charged spherical shells, E-r graph is discontinuous while V-r graph is continuous

Reason: According to Gauss's theorem only the charge inside a closed surface ca produce electric field at some point.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: B

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4. 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 ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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5. Assertion: Polar mlecules have permanent dipole moment.

Reason : In polar molecule, the centres of positive and negative charges coincide evcen wehen there is no external field.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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6. Assertion. Dielectric polarization 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 ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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7. Assertion: In the absence of an external electric field, the dipole moment per unit volume of a polar dicletric is zero.

Reason : The dipoles of a polar diclectric are randomaly oriented.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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8. Can there be a potential difference between two adjacent conductors that carry same amount of positive charge ?

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: B

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

Reason : A capacitor is so configured that it cofines the electric field lines within a small region of space.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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10. Assertion: Increasing the charge on the plates of a capacitor means increasing the capacitance.

Resion : Capacitance is directly proportinal to charge.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: D

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11. As the distance between the plates of a parallel plate capacitor decreased

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: A

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12. Assertion: The 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 ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: B

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13. Assertion. Capacity of a parallel plate condenser remains unaffected on introduced a conducting or insulating slab between the plates.

Reason. In both the cases, electric field intensity between the plates increases.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: D

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14. Assertion: Charge on all the condensers connected is series in the same.

Reason : Capacitance of capacitor is directly proportional to charge on it.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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15. Assertion- In a series combination of capacitors, charge on each capacitor is same.

Reason- In such a combination, charge cannot move only along one route.

A. If both assertion and reason are ture and reason is the correct explanation of assertion.

B. If both assertin and reason are ture 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.

Answer: C

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