1. ELECTROSTATICS

TARGET: NEET & JEE MAINS 2021/22/23

CLASS 12TH MODULES

COVERS NCERT CHAPTER -1 & 2

EXERCISE 1: LEVEL 1

EXERCISE 2: LEVEL 2

EXERCISE 3: NEET PYQs

AGARWAL

NEET SYLLABUS

UNIT I: Electrostatics

- Electric charges and their conservation. Coulomb's law-force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.
- Electric field, electric field due to a point charge, electric field lines; electric dipole, electric field due to a dipole; torque on a dipole in a uniform electric field.
- Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside)
- Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges: equipotential surfaces, electrical potential energy of a system of two point charges and of electric diploes in an electrostatic field.
- Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor, Van de Graaff generator.

EXERCISE-1 (OBJECTIVE QUESTIONS)

SECTION (A) : PROPERTIES OF CHRAGE AND COULOMB'S LAW

A -1. Three charges + 4q, −q and +4q are kept on a straight line at position (0, 0, 0), (a, 0, 0) and (2a, 0, 0) respectively. Considering that they are free to move along the x-axis only

(a) All the charges are in stable equilibrium (b) All the charges are in unstable equilibrium

(c) Only the middle charge is in stable equilibrium (d) Only middle charge is in unstable equilibrium

A -2. Two identical metallic sphere are charged with 10 and -20 units of charge. If both the spheres are first brought into contact with each other and then are placed to their previous positions, then the ratio of the force in the two situations will be :-

(a) 8 : 1 (b) 1 : 8 (c) 2 : 1 (d) 1 : 2

A -3. Two equal and like charges when placed 5 cm apart experience a repulsive force of 0.144 newton. The magnitude of the change in microcoulombs will be :

(a) 0.2 (b) 2 (c) 20 (d) 12

A -4. Two charges of +1 μC & 5 μC are placed 4 cm apart, the ratio of the force exerted by both charges on each other will be-

(a) 1 : 1 (b) 1 : 5 (c) 5 : 1 (d) 25 : 1

A -5. A negative charge is placed at some point on the line joining the two +Q charges at rest. The direction of motion of negative charge will depend upon the :

(a) position of negative charge alone (b) magnitude of negative charge alone

(c) both on the magnitude and position of negative charge

(d) magnitude of positive charge.

A -6. A body has 80 microcoulomb of charge. Number of additional electrons on it will be:

(a) 8×10^{-5} (b) 80×10^{5} (c) 5×10^{14} (d) 1.28×10^{-17}

A -7. Coulomb's law for the force between electric charges most closely resembles with :

(a) Law of conservation of energy (b) Newton's law of gravitation

(c) Newton's 2nd law of motion (d) The law of conservation of charge

A -8. A charge Q_1 exerts force on a second charge Q_2. If a 3rd charge Q_3 is brought near, the force of Q_1 exerted on Q_2.

(a) Will increase (b) Will decrease (c) Will remain unchanged

(d) Will increase if Q_3 is of the same sign as Q_1 and will decrease if Q_3 is of opposite sign

A -9. A charge particle q_1 is at position (2, – 1, 3). The electrostatic force on another charged particle q_2 at (0, 0, 0) is :

(a) $\frac{q_1 q_2}{56\pi\epsilon_0}(2\hat{i}-\hat{j}+3\hat{k})$ (b) $\frac{q_1 q_2}{56\sqrt{14}\pi\epsilon_0}(2\hat{i}-\hat{j}+3\hat{k})$

(c) $\frac{q_1 q_2}{56\pi\epsilon_0}(\hat{j}-2\hat{i}-3\hat{k})$ (d) $\frac{q_1 q_2}{56\sqrt{14}\pi\epsilon_0}(\hat{j}-2\hat{i}-3\hat{k})$

A -10. Three charge +4q, Q and q are placed in a straight line of length ℓ at points distance 0, $\ell/2$ and ℓ respectively. What should be the value of Q in order to make the net force on q to be zero?

(a) –q (b) –2q (c) –q/2 (d) 4q

A -11. Two point charges placed at a distance r in air exert a force F on each other. The value of distance R at which they experience force 4F when placed in a medium of dielectric constant K = 16 is :

(a) r (b) r/4 (c) r/8 (d) 2r

Section (B) : ELECTRIC FIELD

B -1. If an electron is placed in a uniform electric field, then the electron will :

(a) Experience no force.

(b) Moving with constant velocity in the direction of the field.

(c) Move with constant velocity in the direction opposite to the field.

(d) Accelerate in direction opposite to field.

B -2. If Q = 2 coloumb and force on it is F = 100 newton, then the value of field intensity will be :

(a) 100 N/C (b) 50 N/C (c) 200 N/C (d) 10 N/C

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B -3. Two infinite linear charges are placed parallel at 0.1 m apart. If each has charge density of 5μ C/c, then the force per unit length of one of linear charges in N/m is :

(a) 2.5 (b) 3.25 (c) 4.5 (d) 7.5

B -4. The intensity of an electric field at some point distant r from the axis of infinite long pipe having charges per unit length as q will be :

(a) proportional to r^2 (b) proportional to r^3

(c) inversely proportional to r. (d) inversely proportional to r^2.

B -5. The electric field intensity due to a uniformly charged sphere is zero :

(a) at the centre (b) at infinity

(c) at the centre and at infinite distance (d) on the surface

B -6. Two spheres of radii 2 cm and 4 cm are charged equally, then the ratio of charge density on the surfaces of the spheres will be-

(a) 1 : 2 (b) 4 : 1 (c) 8 : 1 (d) 1 : 4

B -7. Total charge on a sphere of radii 10 cm is 1 μC. The maximum electric field due to the sphere in N/C will be

(a) 9×10^{-5} (b) 9×10^{3} (c) 9×10^{5} (d) 9×10^{15}

B -8. A charged water drop of radius 0.1 μm is under equilibrium in some electric field. The change on the drop is equivalent to electronic charge. The intensity of electric field is ($g = 10\ m/s^2$)

(a) 1.61 NC^{-1} (b) 26.2 NC^{-1} (c) 262 NC^{-1} (d) 1610 NC^{-1}

B -9. Two large sized charged plates have a charge density of $+\sigma$ and $-\sigma$. The resultant force on the proton located midway between them will be -

(a) $\sigma e/\varepsilon_0$ (b) $\sigma e/2\varepsilon_0$ (c) $2\sigma e/\varepsilon_0$ (d) zero

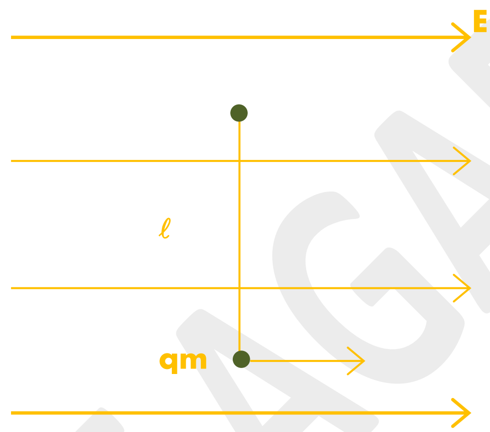
B -10. Two parallel charged plates have a charge density $+\sigma$ and $-\sigma$. The resultant force on the proton located outside the plates at some distance will be

(a) $2\sigma e/\varepsilon_0$ (b) $\sigma e/\varepsilon_0$ (c) $\sigma e/2\varepsilon_0$ (d) zero

B -11. There is a uniform electric field in x-direction. If the work done by external agent in moving a charge of 0.2 C through a distance of 2 metre slowly along the line making an angle of 60° with x-direction is 4 joule, then the magnitude of E is:

(a) $\sqrt{3}$ N/C (b) 4 N/C (c) 5 N/C (d) 20 N/C

B -12. A simple pendulum has a length ℓ, mass of bob m. The bob is given a charge q coulomb. The pendulum is suspended in a uniform horizontal electric field of strength E as shown in figure, then calculate the time period of oscillation when the bob is slightly displace from its mean position is :



(a) $2\pi\sqrt{\frac{\ell}{g}}$ (b) $2\pi\sqrt{\left\{\frac{\ell}{g+\frac{qE}{m}}\right\}}$ (c) $2\pi\sqrt{\left\{\frac{\ell}{g-\frac{qE}{m}}\right\}}$ (d) $2\pi\sqrt{\left\{\frac{\ell}{g^2+\left(\frac{qE}{m}\right)^2}\right\}}$

B -13. Charge 2Q and –Q are placed as shown in figure. The point at which electric field intensity is zero will be :

(a) Somewhere between –Q and 2Q (b) Somewhere on the left of –Q

(c) Somewhere on the right of 2Q

(d) Somewhere on the right bisector of line joining –Q and 2Q

B -14. The maximum electric field intensity on the axis of a uniformly charged ring of charge q and radius R will be :

(a) $\frac{1}{4\pi\varepsilon_0}\frac{q}{3\sqrt{3}R^2}$ (b) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{3R^2}$ (c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{3\sqrt{3}R^2}$ (d) $\frac{1}{4\pi\varepsilon_0}\frac{3q}{2\sqrt{3}R^2}$

B -15. A charged particle of charge q and mass m is released from rest in an uniform electric field E. Neglecting the effect of gravity, the kinetic energy of the charged particle after time 't' seconds is

(a) $\frac{Eqm}{t}$ (b) $\frac{E^2q^2t^2}{2m}$ (c) $\frac{2E^2t^2}{mq}$ (d) $\frac{Eq^2m}{2t^2}$

Section (C) : ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE

C-1. A force of 3000 N is acting on a charge of 3 coloumb moving in a uniform electric field. Two potential difference between two point at a distance of 1 cm in this filed is :

(a) 10V (b) 90V (c) 1000V (d) 9000V

C-2. If we move in a direction opposite to the electric lines of force :

(a) electrical potential decreases. (b) electrical potential increases.

(c) electrical potential remains unchanged (d) nothing can be said.

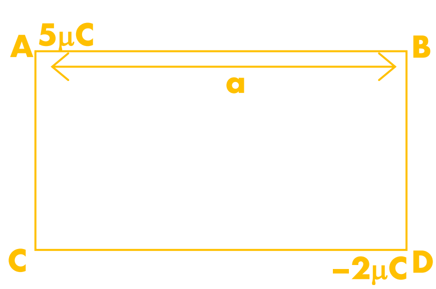
C-3. The distance between two plates is 2 cm, when an electric potential difference of 10 volt is applied between the plates, then the value of electric field will be -

(a) 20 N/C (b) 500 N/C (c) 5 N/C (d) 250 N/C

C-4. Potential difference between centre and the surface of sphere of radius R and having uniform volume charge density ρ within it will be :

(a) $\frac{\rho R^2}{6\varepsilon_0}$ (b) $\frac{\rho R^2}{4\varepsilon_0}$ (c) 0 (d) $\frac{\rho R^2}{2\varepsilon_0}$

C-5. In the figure shown two point charges $5\mu C$ and $-2\mu C$ are placed at two corners of a square. The potential difference between the other two corners due to these charges will be (in V)



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(a) 5400/a (b) 6000/a (c) 0
(d) cannot be determined

C-6. The potential due to a point charge at distance r is

(a) Proportional to r
(b) Inversely proportional to r
(c) Proportional to r^2
(d) Inversely proportional to r^2

C-7. The dimensions of potential difference are -

(a) $ML^2T^{-2}Q^{-1}$ (b) $MLT^{-2}Q^{-1}$ (c) $MT^{-2}Q^{-2}$ (d) $ML^2T^{-1}Q^{-1}$

C-8. An object is charged with positive charge. The potential at that object will be -

(a) Positive only
(b) Negative only
(c) Zero always
(d) May be positive, negative or zero.

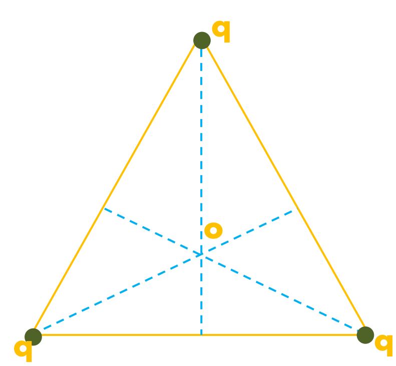
C-9. Two points (0, a) and (0, –a) have charges q and –q respectively then the electric potential at origin will be-

(a) zero (b) kq/a (c) kq/2a (d) $ka/4a^2$

C-10. The charges of same magnitude q are placed at four corners of a square of side a. The value of potential at the centre of square will be -

(a) 4kq/a (b) $4\sqrt{2}kq/a$ (c) $4kq\sqrt{2a}$ (d) $kq/a\sqrt{2}$

C-11. Three equal charges are placed at the three corners of an equilibrium triangle as shown in the figure. The statement which is true for electric potential V and the filed intensity E at the centre of the triangle



(a) V = 0, E = 0 (b) V = 0, E ≠ 0 (c) V ≠ 0, E = 0 (d) V ≠ 0, E ≠ 0

C-12. The potential at 0.5 Å from a proton is

(a) 0.5 volt (b) Bμ volt (c) 28.8 volt (d) 2 volt

C-13. An infinite number of charges of equal magnitude q, but alternate charge of opposite sign are placed along the x-axis at x = 1, x = 2, x = 4, x = 8,... and so on. The electric potential at the point x = 0 due to all these charges will be-

(a) kq/2 (b) kq/3 (c) 2kq/3 (d) 3kq/2

C-14. The electric potential inside a uniformly positively charged non conducting solid sphere has the value which

(a) Increase with Increases in distance from the centre.

(b) Decrease with Increases in distance from the centre.

(c) Is equal at all the points (d) Is zero at all the points.

C-15. The potential difference between two isolated spheres of radii r_1 and r_2 is zero. The ratio of their charges Q_1/Q_2 will be-

(a) r_1/r_2 (b) r_2/r_1 (c) r_1^2/r_2^2 (d) r_1^3/r_2^3

C-16. 64 charged drops coalesce to form a bigger charged drop. The potential of bigger drop will be times that of smaller drop -

(a) 4 (b) 16 (c) 64 (d) 8

C-17. The electric potential outside a uniformly charged sphere at a distance 'r' is ('a' being the radius of the sphere)-

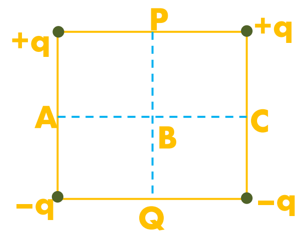
(a) Directly proportional to a^3 (b) Directly proportional to r.

(c) Inversely proportional to r. (d) Inversely proportional to a^3.

C-18. At a certain distance from a point charge the electric field is 500 V/m and the potential is 300 V. What is the distance?

(a) 6 m (b) 12 m (c) 36 m (d) 144 m

C-19. Figure represents a square carrying charges +q, +q, –q at its four corners as shown. Then the potential will be zero at points



(a) A, B, C, P and Q (b) A, B and C (c) A, P, C and Q (d) P, B and Q

C-20. Two equal positive charges are kept at points A and B. The electric potential at the points between A and B (excluding these points) is studied with moving from A to B. The potential

(a) continuously increases (b) continuously decreases

(c) Increases then decreases (d) decreases than increases

C-21. A semicircular ring of radius 0.5 m is uniformly charged with a total charge of 1.5×10^{-9} coul. The electric potential at the centre of this ring is :

(a) 27 V (b) 13.5 V (c) 54 V (d) 45.5 V

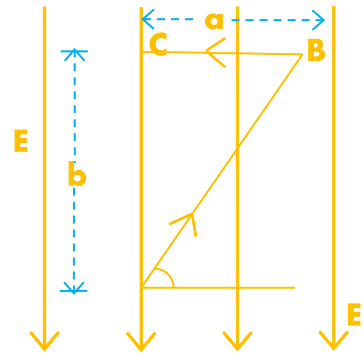
C-22. When a charge of 3 coul is placed in a uniform electric field it experiences a force of 3000 newton. The potential difference between two points separated by a distance of 1 cm along field with in this field is:

(a) 10 volt (b) 90 volt (c) 1000 volt (d) 3000 volt

C-23. The kinetic energy which an electron acquires when accelerated (from rest) through a potential difference of 1 volt is called :

(a) 1 joule (b) 1 electron volt (c) 1 erg (d) 1 watt

C-24. The potential difference between point A and B in the given uniform electric filed is :



(a) Ea (b) $E\sqrt{(a^2+b^2)}$ (c) Eb (d) $(Eb/\sqrt{2})$

C-25. An equipotential surface and a line of force :

(a) never intersect each other (b) intersect at 45°

(c) intersect at 60° (d) intersect at 90°

C-26. A particle of charge Q and mass m travels through a potential difference V from rest. The final momentum of the particle is :

(a) $\frac{mV}{Q}$ (b) $2Q\sqrt{mV}$ (c) $\sqrt{2m\,QV}$ (d) $\sqrt{\frac{2QV}{m}}$

C-27. If a uniformly charged spherical shell of radius 10 cm has a potential V at a point distant 5 cm from its centre, then the potential at a point distant 15 cm from the centre will be :

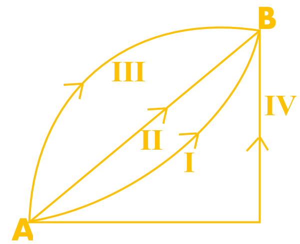
(a) $\frac{V}{3}$ (b) $\frac{2V}{3}$ (c) $\frac{3}{2}V$ (d) 3V

SECTION (D) : ELECTRIC POTENTIAL ENERGY OF A PARTICLE

D-1. A nucleus has a charge of + 50e. A proton is located at a distance of 10^{-12} m. The potential at this point in volt will be-

(a) 14.4×10^4 (b) 7.2×10^4 (c) 7.2×10^{-12} (d) 14.4×10^8

D-2. Under the influence of charge, a point charge q is carried along different paths from a point A to point B, then work done will be

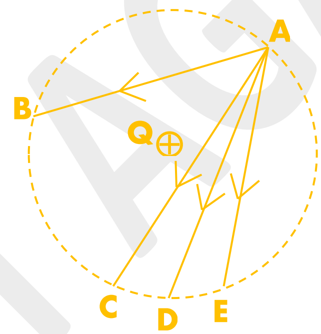


(a) Maximum for path four.
(b) Maximum for path one.
(c) Equal for all paths
(d) Minimum for path three.

D-3. An electron moving in a electric potential field V_1 enters a higher electric potential field V_2, then the change in kinetic energy of the electron is proportional to

(a) $(V_2 - V_1)^{1/2}$
(b) $V_2 - V_1$
(c) $(V_2 - V_1)^2$
(d) $\frac{(V_2 - V_1)}{V_2}$

D-4. In the electric field of charge Q, another charge is carried from A to B, A to C, A to D and A to E, then work done will be



(a) minimum along path AB.
(b) minimum along path AD.
(c) minimum along path AE.
(d) zero along all the paths.

D-5. The work done to take an electron from rest where potential is – 60 volt to another point where potential is – 20 volt is given by -

(a) 40 eV
(b) –40 eV
(c) 60 eV
(d) –60 eV

D-6. If a charge is shifted from a low potential region to high potential region the electrical potential energy:

(a) increases
(b) Decreases
(c) Remains constant
(d) May increase or decrease.

SECTION (E) : POTENTIAL ENERGY OF A SYSTEM OF POINT CHARGES (ONLY FOR JEE MAIN)

E-1. In H atom, an electron is rotating around the proton in an orbit of radius r. Work done by an electron in moving once around the proton along the orbit will be -

(a) ke/r (b) ke^2/r^2 (c) $2\pi re$ (d) zero

E-2. When the separation between two charges in increased, the electric potential energy of the charges

(a) increases (b) decreases

(c) remains the same (d) may increase or decrease

E-3. You are given an arrangement of three point charges q, 2q and xq separated by equal finite distances so that electric potential energy of the system is zero. Then the value of x is :

(a) $-\frac{2}{3}$ (b) $-\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{2}$

SECTION (F) : SELF ENERGY AND ENERGY DENSITY (ONLY FOR JEE MAIN)

F-1. A sphere of radius 1 cm has potential of 8000 V. The energy density near the surface of sphere will be:

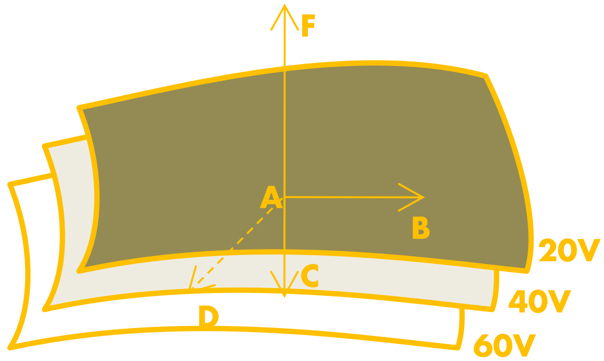
(a) 64×10^5 J/m^3 (b) 8×10^3 J/m^3 (c) 32 J/m^3 (d) 2.83 J/m^3

F-2. If 'n' identical water drops assumed spherical each charged to a potential energy U coalesce to a single drop, the potential energy of the single drop is(Assume that drops are uniformly charged):

(a) $n^{1/3}$ U (b) $n^{2/3}$ U (c) $n^{4/3}$ U (d) $n^{5/3}$ U

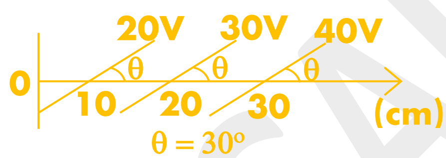
Section (G) : QUESTIONS BASED ON RELATION BETWEEN $\vec{E}$ AND V :

G-1. A family of equipotential surfaces are shown. The direction of the electric field at point A is along -



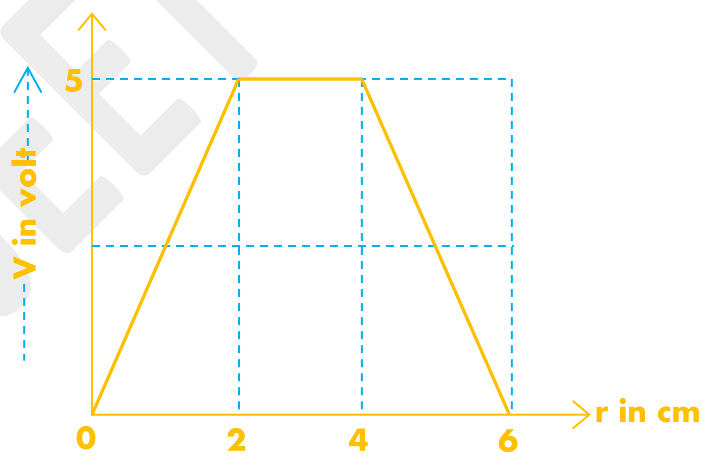
(a) AB (b) AC (c) AD (d) AF

G-2. Some equipotential surfaces are shown in the figure. The magnitude and direction of the electric field is



(a) 100 V/m making angle 120^0 with the x-axis
(b) 100 V/m making angle 60^0 with the x-axis
(c) 200 V/m making angle 120^0 with the x-axis
(d) none of the above

G-3. The variation of potential with distance r from a fixed point is shown in Figure. The electric field at r = 5 cm, is :



(a) (2.5) V/cm (b) (–2.5) V/cm (c) (–2/5) cm (d) (2/5) V/cm

G-4. The electric field and the electric potential at a point are E and V respectively

(a) If E = 0, V must be zero
(b) If V = 0, E must be zero
(c) If E ≠ 0, V cannot be zero
(d) None of these

G-5. The electric field in a region is directed outward and is proportional to the distance r from the origin. Taking the electric potential at the origin to be zero, the electric potential at a distance r :

(a) Is uniform in the region
(b) Is proportional to r
(c) Is proportional to r^2
(d) Increases as one goes away from the origin.

SECTION (H) : DIPOLE

H-1. The force on a charge situated on the axis of a dipole is F. If the charge is shifted to double the distance, the acting force will be-

(a) 4F (b) F/2 (c) F/4 (d) F/8

H-2. A dipole of dipole moment p, is placed in an electric field $\vec{E}$ and is in stable equilibrium. The torque required to rotate the dipole from this position by angle θ will be -

(a) pE cos θ (b) pE sin θ (c) pE tan θ (d) –pE cosθ

H-3. The electric potential at a point due to an electric dipole will be -

(a) $\frac{k(\vec{p}.\vec{r})}{r^3}$ (b) $\frac{k(\vec{p}.\vec{r})}{r^2}$ (c) $\frac{k(\vec{p}\times\vec{r})}{r}$ (d) $\frac{k(\vec{p}\times\vec{r})}{r^2}$

H-4. The ratio of electric fields due to an electric dipole on the axis and on the equatorial line at equal distance will be

(a) 4 : 1 (b) 1 : 2 (c) 2 : 1 (d) 1 : 1

H-5. An electric dipole is made up of two equal and opposite charges of 2×10^{-6} coulomb at a distance of 3 cm. This is kept in an electric field of 2×10^5 N/C, then the maximum torque acting on the dipole -

(a) 12×10^{-1} Nm (b) 12×10^{-3} Nm (c) 24×10^{-3} Nm (d) 24×10^{-1} Nm

H-6. The distance between two singly ionised atoms is 1Å. If the charge on both ions is equal and opposite then the dipole moment in coulomb-metre is

(a) 1.6×10^{-29}
(b) 0.16×10^{-29}
(c) 16×10^{-29}
(d) $1.6 \times 10^{-29}/4\pi\varepsilon_0$

H-7. The electric potential in volt at a distance of 0.01 m on the equatorial line of an electric dipole of dipole moment p is -

(a) $p/4\pi\varepsilon_0 \times 10^{-4}$ (b) zero (c) $4\pi\varepsilon_0 p \times 10^{-4}$ (d) $4\pi\varepsilon_0/p \times 10^{-4}$

H-8. The electric potential in volt due to an electric dipole of dipole moment 2×10^{-8} C-m at a distance of 3m on a line making an angle of 60^0 with the axis of the dipole is -

(a) 0 (b) 10 (c) 20 (d) 40

H-9. A dipole of electric dipole moment P is placed in a uniform electric field of strength E. If θ is the angle between positive directions of P and E, then the potential energy of the electric dipole is largest when θ is :

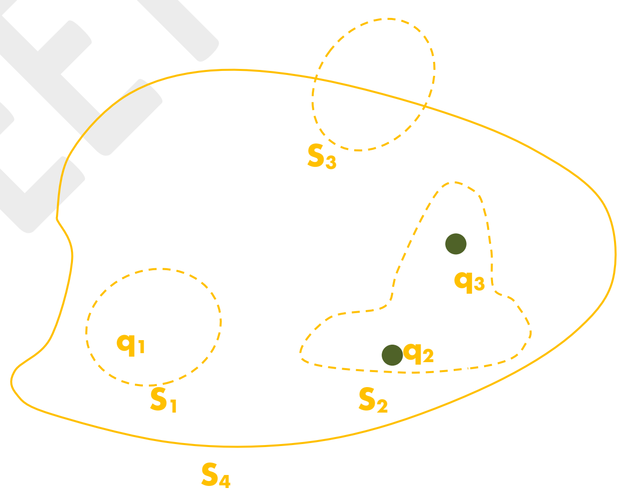
(a) zero (b) $\pi/2$ (c) π (d) $\pi/4$

SECTION (I) : FLUX CALCULATION AND GAUSS'S LAW

I-1. Total flux coming out of some closed surface is :

(a) q/ε_0 (b) ε_0/q (c) $q\varepsilon_0$ (d) $\sqrt{q/\varepsilon_0}$

I-2. Three charges $q_1 = 1 \times 10^{-6}$, $q_2 = 2 \times 10^{-6}$, $q_3 = -3 \times 10^{-6}$ C have been placed, as shown in figure, in four surfaces S_1, S_2, S_3 and S_4 electrical flux emitted from the surface S_2 in $N-m^2/C$ will be



(a) $36\pi \times 10^3$ (b) $-36\pi \times 10^3$ (c) $36\pi \times 10^9$ (d) $-36\pi \times 10^9$

I-3. Eight charges, 1μC, –7μC, –4μC, 10μC, 2μC, –5μC, –3μC and 6μC are situated at the eight corners of a cube of side 20 cm. A spherical surface of radius 80 cm encloses this cube. The centre of the sphere coincides with the centre of the cube. Then the total outgoing flux from the spherical surface (in unit of volt meter) is

(a) $36\pi \times 10^3$ (b) $684\pi \times 10^3$ (c) zero (d) none of the above

I-4. A closed cylinder of radius R and length L is placed in a uniform electric field E, parallel to the axis of the cylinder. Then the electric flux through the cylinder must be -

(a) $2\pi R^2E$ (b) $(2\pi R^2 + 2\pi RL)E$ (c) $2\pi RLE$ (d) zero

SECTION (J) : CONDUCTOR, IT'S PROPERTIES & ELECTRIC PRESSURE (ONLY FOR JEE MAIN)

J-1. For an electrostatic system which of the statement is always true :

(1) Electric lines are parallel to metallic surface

(2) Electric field inside a metallic surface is zero.

(3) Electric lines of force are perpendicular to equi-potential surface.

(a) (1) and (2) only (b) (2) and (3) only (c) (1) and (3) only (d) (1), (2) and (3)

J-2. A conducting shell of radius 10 cm is charged with 3.2×10^{-19} C. The electric potential at a distance 4cm from its centre in volt be

(a) 9×10^{-9} (b) 288 (c) 2.88×10^{-8} (d) zero

J-3. The potential on the conducting spheres of radii r_1 and r_2 is same, the ratio of their charge densities will be

(a) r_1/r_2 (b) r_2/r_1 (c) r_1^2/r_2^2 (d) r_2^2/r_1^2

J-4. Two metallic spheres which have equal charges, but their radii are different, are made to touch each other and then separated apart. The potential the spheres will be -

(a) Same as before (b) More for bigger (c) More for smaller (d) Equal

J-5. Two spheres of radii R and 2R are given source equally positive charged and then connected by a long conducting wire, then the positive charge will

(a) Flow from smaller sphere to the bigger sphere. (b) Flow from bigger sphere to the smaller sphere.

(c) Now flow. (d) Oscillate between the spheres.

J-6. The electric field near the conducting surface of a uniform change density σ will be -

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(a) σ/ε_0 and parallel to surface. (b) $2\sigma/\varepsilon_0$ and parallel to surface.

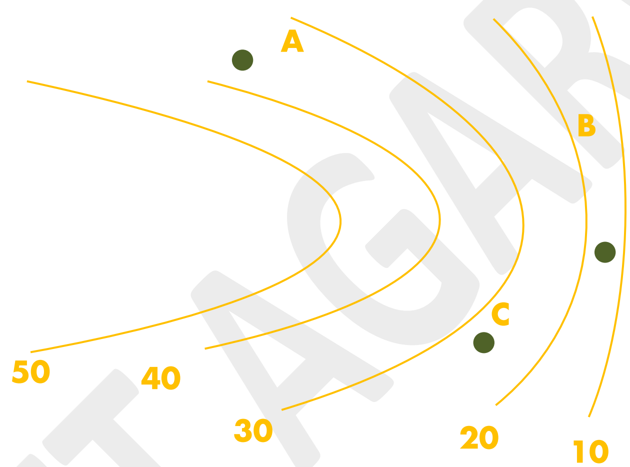
(c) σ/ε_0 and perpendicular to surface. (d) $2\sigma/\varepsilon_0$ and perpendicular to surface.

J-7. An unchanged conductor A is brought close to another positive charged conductor B, then the charge on B

(a) will increase but potential will be constant. (b) will be constant but potential will increase

(c) will be constant but potential decreases. (d) the potential and charge on both are constant.

J-8. The fig. shows lines of constant potential in a region in which an electric field is present. The value of the potential are written in brackets of the points A, B and C, the magnitude of the electric field is greatest at the point



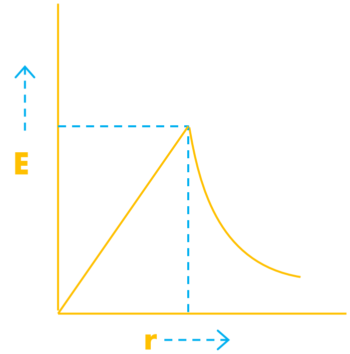
(a) A (b) B (c) C (d) A & C

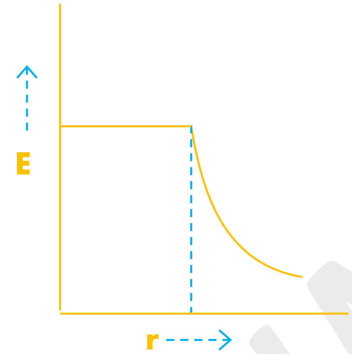
J-9. The electric charge in uniform motion produces -

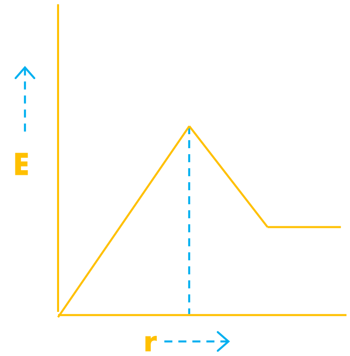
(a) an electric field only (b) a magnetic field only

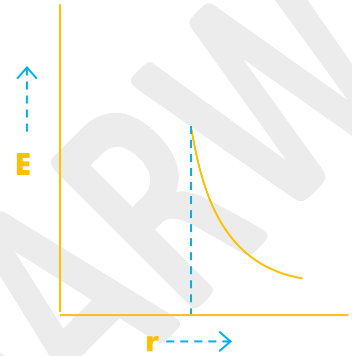
(c) both electric and magnetic fields (d) neither electric nor magnetic fields

J-10. Which of the following represents the correct graph for electric field intensity and the distance r from the centre of a hollow charged metal sphere or solid metallic conductor of Radius R :

(a)


(b)


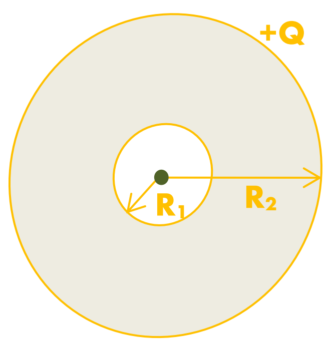
(c)


(d)


J-11. A neutral metallic object is placed near a finite metal plate carrying a positive charge. The electric force on the object will be :

(a) towards the plate
(b) away from the plate
(c) parallel to the plate
(d) zero

J-12. Figure shows a thick metallic sphere. If it is given a charge +Q, then electric field will be present in the region



(a) $r < R_1$ only
(b) $r > R_1$ and $R_1 < r < R_2$
(c) r R_2 only
(d) $r = R_2$ only

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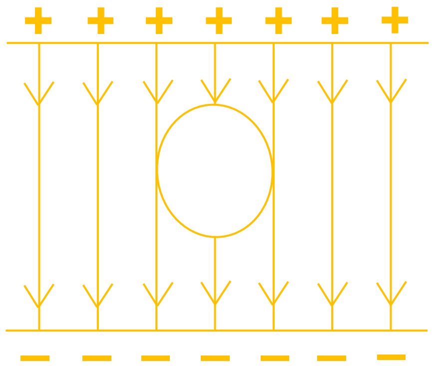
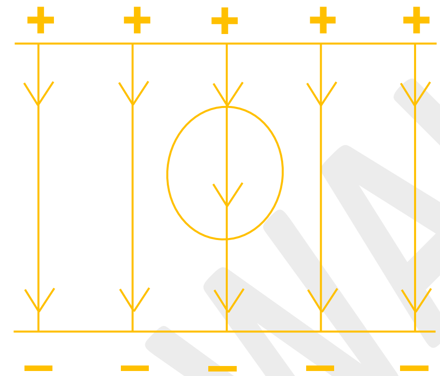
J-13. An changed sphere of metal is placed in a uniform electric field produced by two large conducting parallel plates having equal and opposite charges, then lines of force look like

(a)

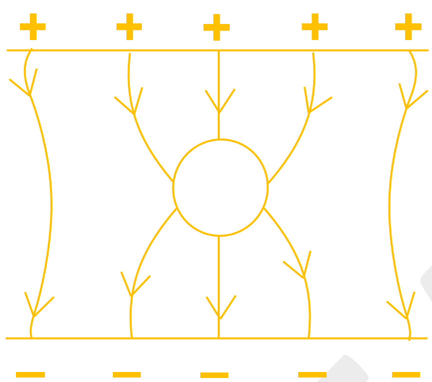
(a)



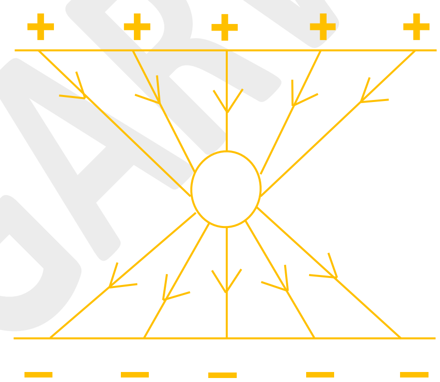
(b)



(c)



(d)



J-14. You are travelling in a car during a thunder storm, in order to protect yourself from lightening would you prefer to :

(a) Remain in the car

(b) Take shelter under a tree

(c) Get out and be flat on the ground

(d) Touch the nearest electrical pole

J-15. The amount of work done in Joules in carrying a charge +q along the closed path PQRSP between the oppositely charged metal plates is (where E is electric field between the plates)

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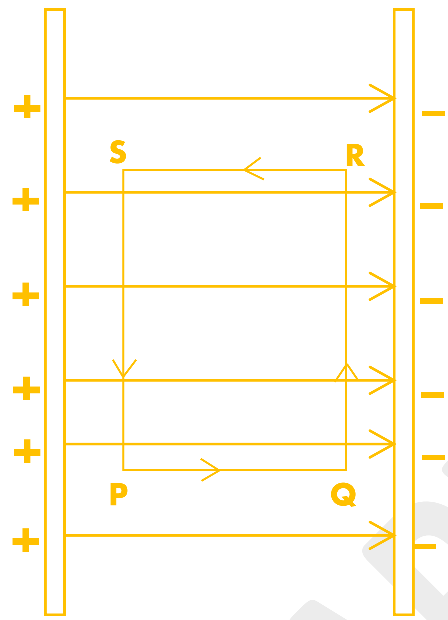
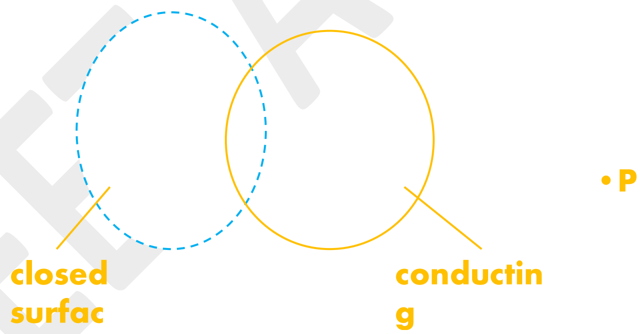


(a) zero
(b) q
(c) qE (PQ + QR + SR + SP)
(d) q/ε_0

J-16. Figures shows a closed surface which intersects a conducting sphere. If a positive charge is placed at the point P, the flux of the electric field through the closed surface



(a) will remain zero
(b) will become positive
(c) will become negative
(d) will become undefined

J-17. Two similar very small conducting spheres having charges 40 μC and –20 μC are some distance apart. Now they are touched and kept at same distance. The ratio of magnitude the initial to the final force between them is :

(a) 8 : 1
(b) 4 : 1
(c) 1 : 8
(d) 1 : 1

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EXERCISE -2 (PART – I) : OBJECTIVE QUESTIONS

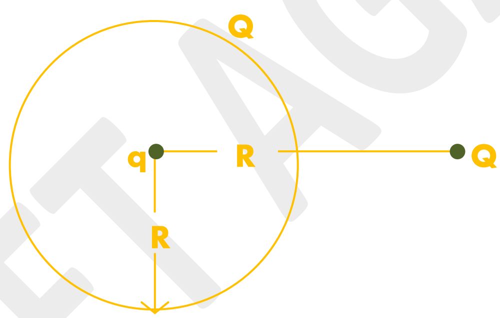
1. Two point charges of the same magnitude and opposite sign are fixed at points A and B. A third small point charge is to be balanced at point P by the electrostatic force due to these two charges. The point P :

(a) lies on the perpendicular bisector of line AB (b) is at the mid point of line AB

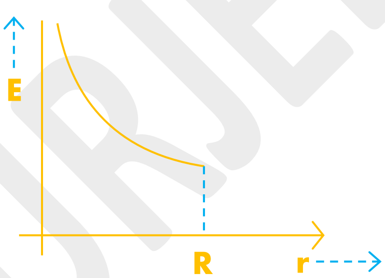
(c) lies to the left of A (d) none of these.

2. A charge 'q' is placed at the centre of a conducting spherical shell of radius R, which is given a charge Q. An external charge Q′ is also present at distance R′ (R′ > R) from ' q '. Then the resultant field will be best represented for region r < R by :

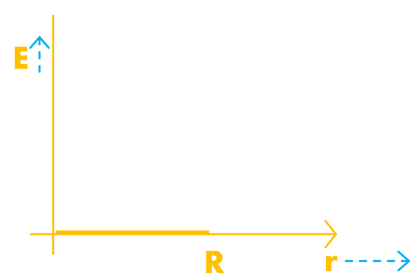
[where r is the distance of the point from q]



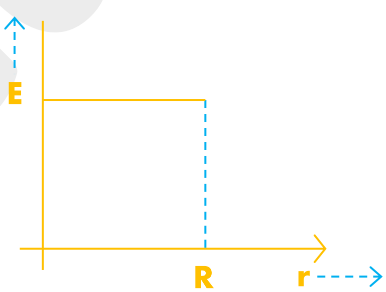
(a)



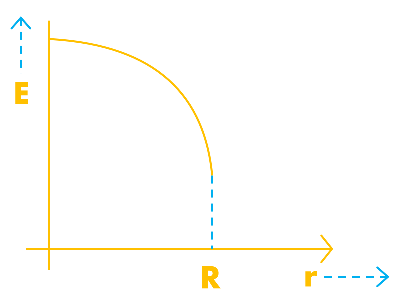
(b)



(c)



(d)



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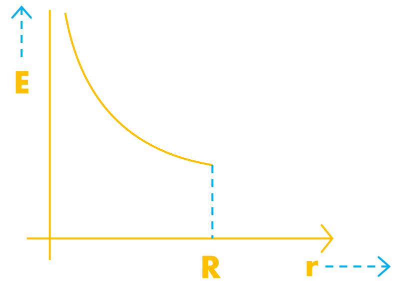
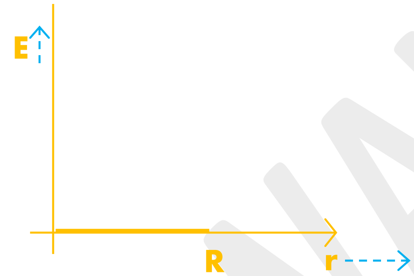
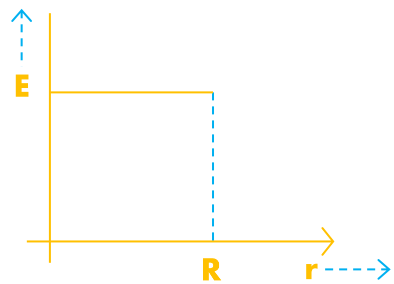
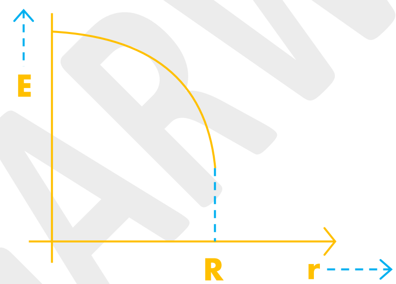
3. In the above question if Q′ is removed then which option is correct :

(a)


(b)


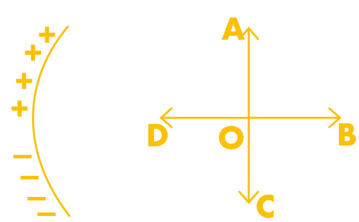
(c)


(d)


4. The electric field near the centre of a uniformly charged nonconducting disc is E. If the nonconducting disc is now replaced by a conducting disc, with the charge same as before, the new electric field at the same point is

(a) 2E (b) E (c) E/2 (d) None of these

5. The linear charge density on upper half of a segment of ring is and a lower half it is. The direction of electric field at centre O of ring is :



(a) along OA (b) along OB (c) along OC (d) along OD

6. A charged particle ‘q’ is shot from a large distance with speed v towards a fixed charged particle Q. It approaches Q upto a closest distance r and then returns. If q were given a speed ‘2V’, the closest distance of approach would be :

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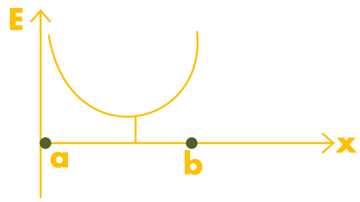
(a) r (b) 2r (c) – r (d) $\frac{r}{4}$

7. Two point charges a & b whose magnitudes are same are positioned at a certain distance from each other a is at origin. Graph is drawn between electric field strength a points between a & b and distance x from a. E is taken positive if it is along the line joining from a to b. From the graph it can be decided that



(a) a is positive, b is negative (b) a and b both are positive

(c) a and b both are negative (d) a is negative, b is positive

8. The net charge given to an isolated conducting solid sphere:

(a) must be distributed uniformly on the surface (b) may be distributed uniformly on the surface

(c) must be distributed uniformly in the volume (d) may be distributed uniformly in the volume.

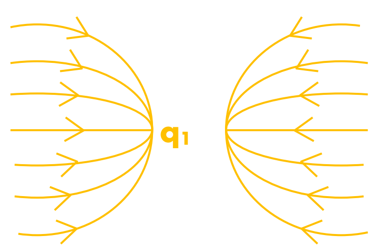
9. The net charge given to a solid insulating sphere :

(a) must be distributed uniformly in its volume (b) may be distributed uniformly in its volume

(c) must be distributed uniformly on its surface

(d) the distribution will depend upon whether other charges are present or not.

10. The given figure gives electric lines of force due to two charges q_1 and q_2. What are the signs of the two charges?



(a) Both are negative (b) Both are positive

(c) q_1 is positive but q_2 is negative (d) q_1 is negative but q_2 is positive

11. In an electron gun, electrons are accelerated through a potential difference of V volt. Taking electronic charge and mass to be respectively e and m, the maximum velocity attained by them is :

(a) $\frac{2eV}{m}$ (b) $\sqrt{\frac{2eV}{m}}$ (c) 2 m/ev (d) $(V^2/2em)$

12. In a cathode ray tube if V is the potential difference between the cathode and anode, the speed of the electrons, when they reach the anode is proportional to (Assume initial velocity = 0)

(a) V (b) 1/V (c) $\sqrt{V}$ (d) $(V^2/2em)$

13. A square of side 'a' is lying in xy plane such that two of its sides are lying on the axis. If an electric field $\vec{E} = E_0 x\hat{k}$ is applied on the square. The flux passing through the square is

(a) E_0a^3 (b) $\frac{E_0a^3}{2}$ (c) $\frac{E_0a^3}{3}$ (d) $\frac{E_0a^2}{2}$

14. Select the correct statement :

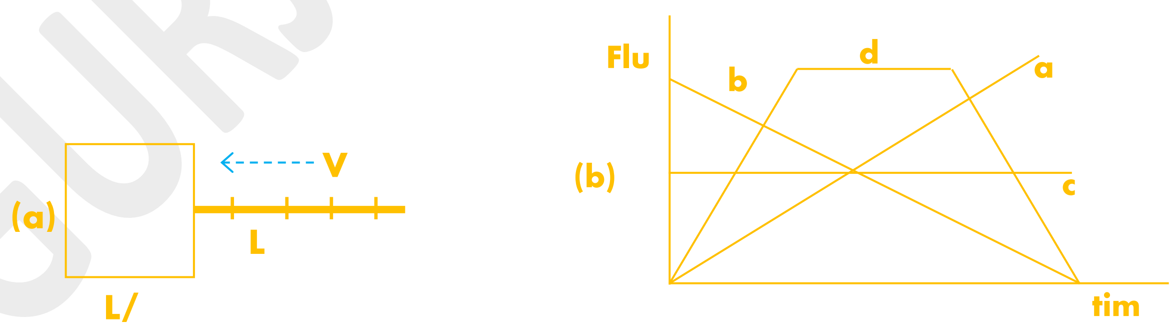
(a) The electric lines of force are always closed curves

(b) Electric line of force is parallel to equipotential surface

(c) Electric line of force is perpendicular to equipotential surface

(d) Electric line of force is always the path of a positively charged particle.

15. Figure (a) shows an imaginary cube of edge L/2. A uniformly charged rod of length L moves towards left at a small but constant speed v. At t = 0, the left end just touches the centre of the face of the cube opposite it. Which of the graph shown in fig.(b) represents the flux of the electric field through the cube as the rod goes through it?

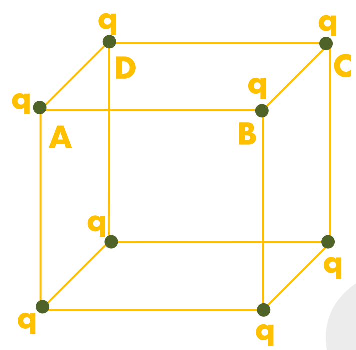


(a) a (b) b (c) c (d) d

16. Electric charges are distributed in a small volume. The flux of the electric field through a spherical surface of radius 10cm surrounding the total charge is 25 V-m. The flux over a concentric sphere of radius 20cm will be

(a) 25 V-m (b) 50 V-m (c) 100 V-m (d) 200 V-m

17. Eight point charges (can be assumed as small spheres uniformly charged and their centres at the corner of the cube) having values q each are fixed at vertices of a cube. The electric flux through square surface ABCD of the cube is



(a) $\frac{q}{24\ \varepsilon_0}$ (b) $\frac{q}{12\ \varepsilon_0}$ (c) $\frac{q}{6\ \varepsilon_0}$ (d) $\frac{q}{8\ \varepsilon_0}$

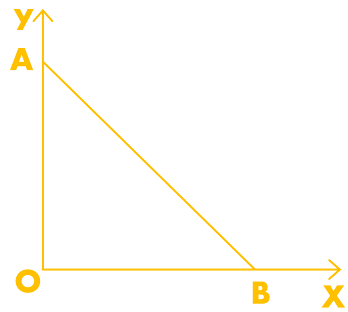
18. An electric dipole of moment $\vec{p}$ is placed at the origin along the x-axis. The angle made by electric field with x-axis at a point P, whose position vector makes an angle θ with x-axis, is (where $\tan\alpha = \frac{1}{2}\tan\theta$)

(a) α (b) θ (c) $\theta + \alpha$ (d) $\theta + 2\alpha$

19. A charged wire is bent in the from of a semi-circular arc of radius a. If charge per unit length is λ coulomb/metre, the electric field at the centre O is :

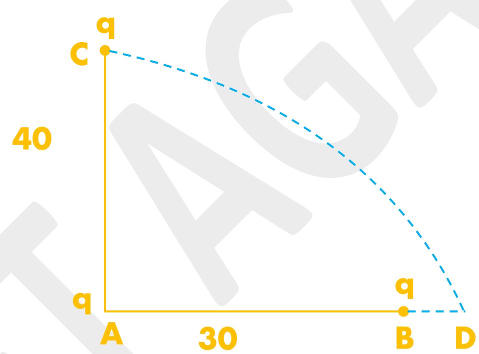
(a) $\frac{\lambda}{2\pi a^2\varepsilon_0}$ (b) $\frac{\lambda}{4\pi^2\varepsilon_0 a}$ (c) $\frac{\lambda}{2\pi\varepsilon_0 a}$ (d) zero

20. 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 [co-ordinates (o, a)] to another point B [co-ordinates(a, o)] along the straight pat AB is :



(a) zero (b) $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2}a$ (c) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\frac{a}{\sqrt{2}}$ (d) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2}a$

21. Two charges q_1 and q_2 are placed 30 cm apart, as shown in the figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in the potential energy of the system is $\frac{q_3}{4\pi\varepsilon_0}k$, where k is :



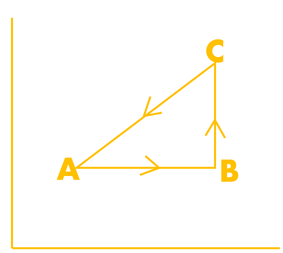
(a) $8q_2$ (b) $8q_1$ (c) $6q_2$ (d) $6q_1$

22. In order to balance the weight of an electron in an electric field E the magnitude and the direction of the electric field will be (g = 10 m/s^2)

(a) 5.68×10^{-11} N/C vertically upwards (b) 5.68×10^{-11} N/C vertically downwards

(c) 5.68×10^{-10} N/C vertically upwards (d) 5.68×10^{-10} N/C vertically downwards

23. As shown in the figure, on bringing a charge Q from point A to B and from B to C, the work done are 2 joules and –3 joules respectively. The work done in bringing the charge from C to A will then be



(a) –1 J (b) 1 J (c) 2 J (d) 5 J

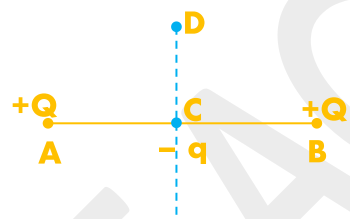
24. A conducting sphere of radius 'R' in vaccum carries a charge 'q'. There is a imaginary concentric spherical surface of radius R_0 (> R). If half the energy stored in the surrounding space lies from conducting surface to imaginary surface, then radius R_0 of this spherical surface is :

(a) 4R (b) 9R (c) 2R (d) R

25. Two identical pith-balls of mass m and having charge q are suspended from a point by weightless strings of length 'l'. If both the strings make an angle of θ with the vertical, then the distance between the balls will be (taking θ to be small)

(a) $(q^2 l/2\pi \in_0 mg)^{1/3}$ (b) $(q^2 l/4\pi \in_0 mg)^{1/3}$ (c) $(ql^2/4\pi \in_0 mg)^{1/3}$ (d) $(ql^2/2\pi \in_0 mg)^{1/3}$

26. Two similar charge of +Q, as shown in figure are placed at A and B. –q charge is placed at point C midway between A and B, –q charge will oscillate if.



(a) it is moved towards A (b) it is moved towards B

(c) it is moved upwards AB (d) distance between A and B is reduced

27. A uniform electric field having a magnitude E_0 and direction along the positive X-axis exists. If the potential V is zero at x = 0, then its value at X = + x will be

(a) $V_{(x)} = + xE_0$ (b) $V_{(x)} = - xE_0$ (c) $V_{(x)} = + x^2E_0$ (d) $V_{(x)} = - x^2E_0$

28. Two point charge +3μC and +8μC repel each other with a force of 40 N. If a charge of –5μC is added to each of them, then the force between them will become

(a) –10 N (b) + 10 N (c) + 20 N (d) – 20 N

29. Five point charges each of +q coulomb are placed on the five vertices of a regular hexagon of side L metre. The force acting on a point charge –q coulomb placed at the centre of the hexagon will be

(a) zero (b) $\frac{Kq^2}{L^2}$ newton (c) $\frac{Kq}{L^2}$ newton (d) $\frac{2Kq^2}{L^2}$ newton

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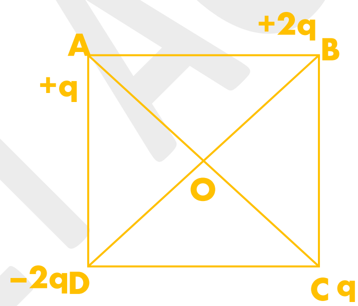
30. A charge q is placed at the centre of the line joining two equal charge Q to establish equilibrium. The system of three charges will be in equilibrium if q is equal to

(a) + Q/4 (b) + Q/2 (c) – Q/2 (d) – Q/4

31. Two point charges placed at a certain distance r in air exert a force F on each other. The distance r at which these charges will exert the same force in medium of dielectric constant k is given be

(a) r (b) r/k (c) $r/\sqrt{k}$ (d) None of these

32. Four charges are arranged at the corners of a square ABCD, as shown in the adjoining figure. The force on the charge kept at the centre O is



(a) zero (b) Along the diagonal AC

(c) Along the diagonal BD (d) Perpendicular to side AB

33. A total charge Q is broken in two parts Q_1 and Q_2 and they are placed at a distance R from each other. The maximum force of repulsion between them will occur, when

(a) $Q_2 = \frac{Q}{R}, Q_1 = Q - \frac{Q}{R}$ (b) $Q_2 = \frac{Q}{4}, Q_1 = Q - \frac{2Q}{3}$

(c) $Q_2 = \frac{Q}{4}, Q_1 = \frac{3Q}{4}$ (d) $Q_1 = \frac{Q}{2}, Q_2 = \frac{Q}{2}$

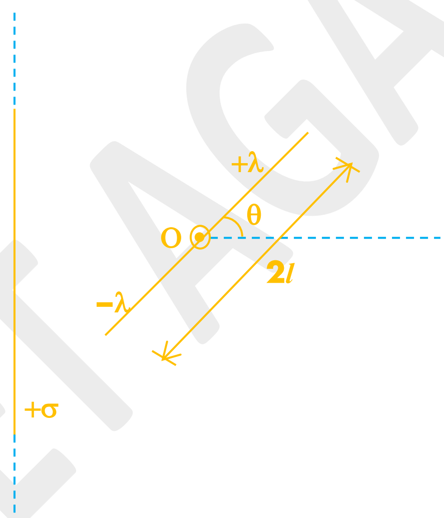
34. Two small spheres each having the charge +Q are suspended by insulating threads of length L from a hook. This arrangement is taken in space where there is no gravitational effect, then the angle between the two suspensions and the tension in each will be.

(a) $180^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{(2L)^2}$ (b) $90^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$ (c) $180^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{2L^2}$ (d) $180^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

35. +2 C and + 6 C two charges are repelling each other with a force of 12 N. If each charge is given –2 C of charge, then the value of the force will be

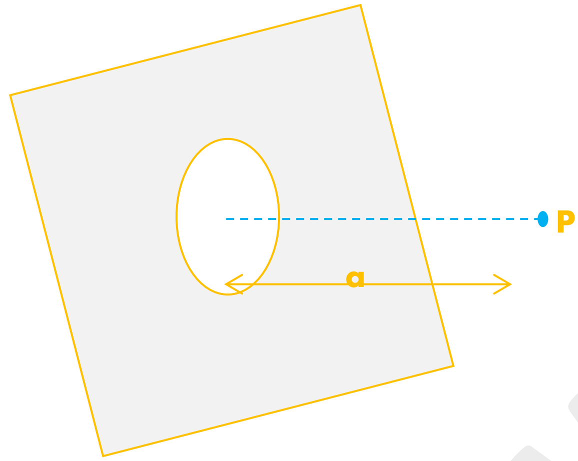
(a) 4 N (attractive) (b) 4 N (repulsive) (c) 8 N (repulsive) (d) Zero

36. A large sheet carries uniform surface charge density σ. A rod of length 2ℓ has a linear charge density λ on the half and $-\lambda$ on the second half. The rod is hinged at mid-point O and makes angle θ with the normal to the sheet. The electric force experienced by the rod is



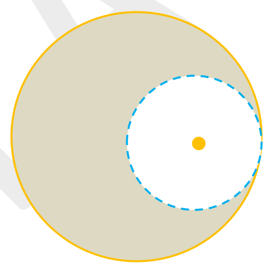
(a) 0 (b) $\frac{\sigma\lambda\ell^2}{2\epsilon_0}\sin\theta$ (c) $\frac{\sigma\lambda\ell^2}{\epsilon_0}\sin\theta$ (d) None of these

37. An infinitely large non - conducting plane of uniform surface charge density σ has circular aperture of certain radius curved out from it. The electric field at a point which is at a distance 'a' from the centre of the aperture (perpendicular to the plane) is $\frac{\sigma}{2\sqrt{2}\epsilon_0}$. Find the radius of aperture:



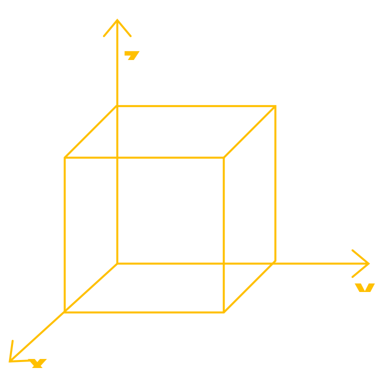
(a) $a\sqrt{2}$ (b) a (c) 2a (d) 3a

38. A solid non-conducting sphere of Radius R, having a spherical cavity of radius $\frac{R}{2}$ as shown, carries a uniformly distributed charge q. The electric field at the centre of the cavity is E. If there were no cavity and charge remains same (q), the field at the same point will be



(a) E (b) $\frac{3}{4}E$ (c) $\frac{7}{8}E$ (d) None of these

39. Electric field in a region is given by $\vec{E} = -4x\hat{i} + 6y\hat{j}$. Then find the charge enclosed in the cube of side 1m oriented as shown in the diagram.



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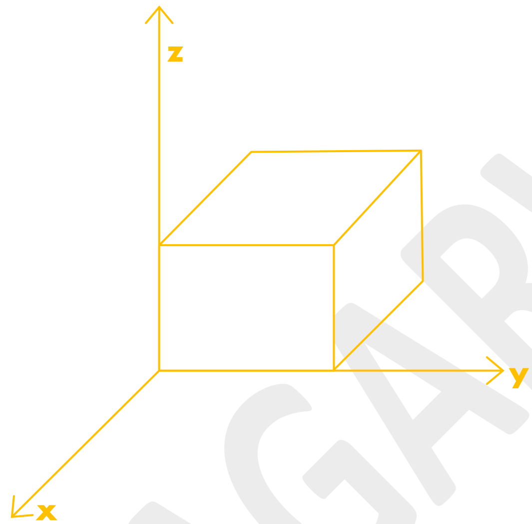
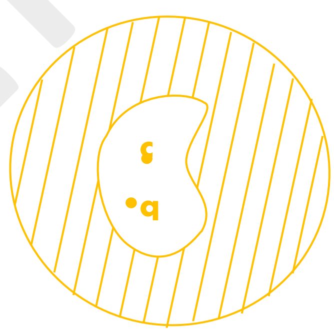
(a) $\in_0$ (b) $2\in_0$ (c) $4\in_0$ (d) $6\in_0$

40. Figure above shows a closed Gaussian surface in the shape of a cube of edge length 3.0 m. There exists an electric field given by $\vec{E} = [(2.0x + 4.0)\hat{i} + 8.0\,\hat{j} + 3.0\,\hat{k}]$ N/C, where x is in metres, in the region in which it lies. The net charge in coulombs enclosed by the cube is equal to



(a) – 54 $\in_0$ (b) 6 $\in_0$ (c) –6 $\in_0$ (d) 54 $\in_0$

41. The figure shows a charge q placed inside a cavity in an unchanged conductor. Now if an external electric field is switched on :



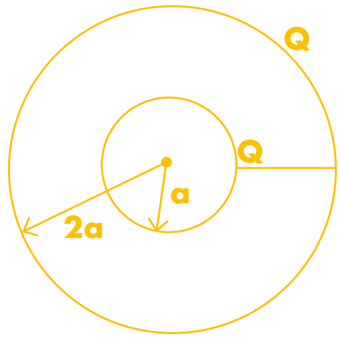
(a) only induced charge on outer surface will redistribute.

(b) only induced charge on inner surface will redistribute.

(c) both induced charge on outer and inner surface will redistribute.

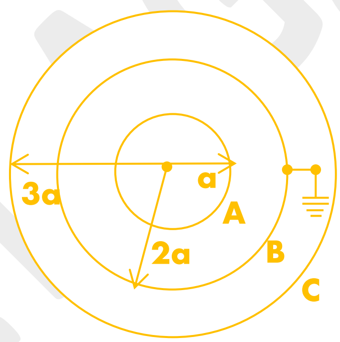
(d) force on charge q placed inside the cavity will change.

42. Figure shows a solid metal sphere of radius a surrounded by a concentric thin metal shell of radius 2a. Initially both are having charges Q each. When the two are connected by a conducting wire as shown in the figure, then amount of heat produced in this process will be:



(a) $\frac{KQ^2}{2a}$ (b) $\frac{KQ^2}{4a}$ (c) $\frac{KQ^2}{6a}$ (d) $\frac{KQ^2}{8a}$

43. Figure shows a system of three concentric metal shells A, B and C with radii a, 2a and 3a respectively. Shell B is earthed and shell C is given a charge Q. Now if shell C is connected to shell A, then the final charge on the shell B, is equal to :

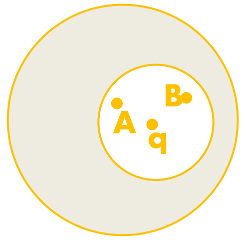


(a) $-\frac{4Q}{13}$ (b) $-\frac{8Q}{11}$ (c) $-\frac{5Q}{3}$ (d) $-\frac{3Q}{7}$

PART – II : MISCELLANEOUS QUESTIONS

SECTION (A) : ASSERTION/REASONING

A- 1. **STATEMENT-1 :** A point charge q is placed at centre of spherical cavity inside a spherical conductor as shown. Another point charge Q is placed outside the conductor as shown. Now as the point charge Q is pushed away from conductor, the potential difference (V_A – V_B) between two point A and B within the cavity of sphere remains constant.



STATEMENT-2 : The electric field due to charges on outer surface of conductor and outside the conductor is zero at all point inside the conductor.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(c) Statement-1 is True, Statement-2 is False

(d) Statement-1 is False, Statement-2 is True

EXERCISE - 3 NEET (PREVIOUS YEARS QUESTIONS)

1. A hollow metal sphere of radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre **[NEET 2019]**

(a) decreases as r increases for r < R and for r > R (b) increases as r increases for r < R and for r > R

(c) zero as r increases for r < R, decreases as r increases for r > R

(d) zero as r increases for r < R, increases as r increases for r > R

2. Two point charges A and B, having charges +Q, and –Q respectively, are placed at certain distance apart and force acting between them is F. If 25% charge of A is transferred to B, then force between the charges becomes

[NEET 2019]

(a) $\frac{4F}{3}$ (b) F (c) $\frac{9F}{16}$ (d) $\frac{16F}{9}$

3. Two parallel infinite line charges with linear charge densities $+\lambda$ C/m and $-\lambda$ C/m are placed at a distance of 2R in free space. What is the electric field mid-way between the two line charges? **[NEET 2019]**

(a) $\frac{\lambda}{2\pi\varepsilon_0 R}$N/C (b) zero (c) $\frac{2\lambda}{2\pi\varepsilon_0 R}$N/C (d) $\frac{\lambda}{2\varepsilon_0 R}$N/C

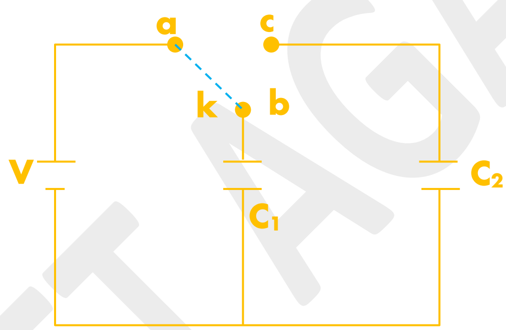
4. Two metal spheres, one of radius R and the other of radius 2R respectively have the same surface charge density σ. They are brought in contact and separated. What will be the new surface charge densities on them?

(a) $\sigma_1 = \frac{5}{6}\sigma, \sigma_2 = \frac{5}{2}\sigma$ (b) $\sigma_1 = \frac{5}{2}\sigma, \sigma_2 = \frac{5}{6}\sigma$

(c) $\sigma_1 = \frac{5}{2}\sigma, \sigma_2 = \frac{5}{3}\sigma$ (d) $\sigma_1 = \frac{5}{3}\sigma, \sigma_2 = \frac{5}{6}\sigma$ **[Odisha NEET 2019]**

5. Two identical capacitors C_1 and C_2 of equal capacitance are connected as shown in the circuit. Terminals a and b of the key k are connected to charge capacitor C_1 using battery of emf V volt. Now disconnecting a and b the terminals b and c are connected. Due to this, what will be the percentage loss of energy?

[Odisha NEET 2019]



(a) 75% (b) 0% (c) 50% (d) 25%

6. An electron falls from rest through a vertical distance h in a uniform and vertically upward directed electric field E. The direction of electric field is now reversed, keeping its magnitude the same. A proton is allowed to fall from rest in it through the same vertical distance h. The time of fall of the electron, in comparison to the time of fall of the proton is **[NEET 2018]**

(a) smaller (b) 5 time greater (c) 10 times greater (d) equal

7. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is **[NEET 2018]**

(a) Independent of the distance between the plates

(b) Linearly proportional to the distance between the plates

(c) Proportional to the square root of the distance between the plates

(d) Inversely proportional to the distance between the plates

8. A toy car with charge q moves on a frictionless horizontal plane surface under the influence of a uniform electric field $\vec{E}$. Due to the force $q\vec{E}$, its velocity increases from 0 to 6 m/s^{-1} in one second duration. At that instant the direction of the field is reversed. The car continues to move for two more seconds under the influence of this field. The average velocity and the average speed of the toy car between 0 to 3 second are respectively

[NEET 2018]

(a) 2 $m\ s^{-1}$, 4 $m\ s^{-1}$ (b) 1 $m\ s^{-1}$, 3 $m\ s^{-1}$ (c) 1 $m\ s^{-1}$, 3.5 $m\ s^{-1}$ (d) 1.5 $m\ s^{-1}$, 3 $m\ s^{-1}$

9. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system **[NEET 2017]**

(a) decreased by a factor of 2 (b) remains the same

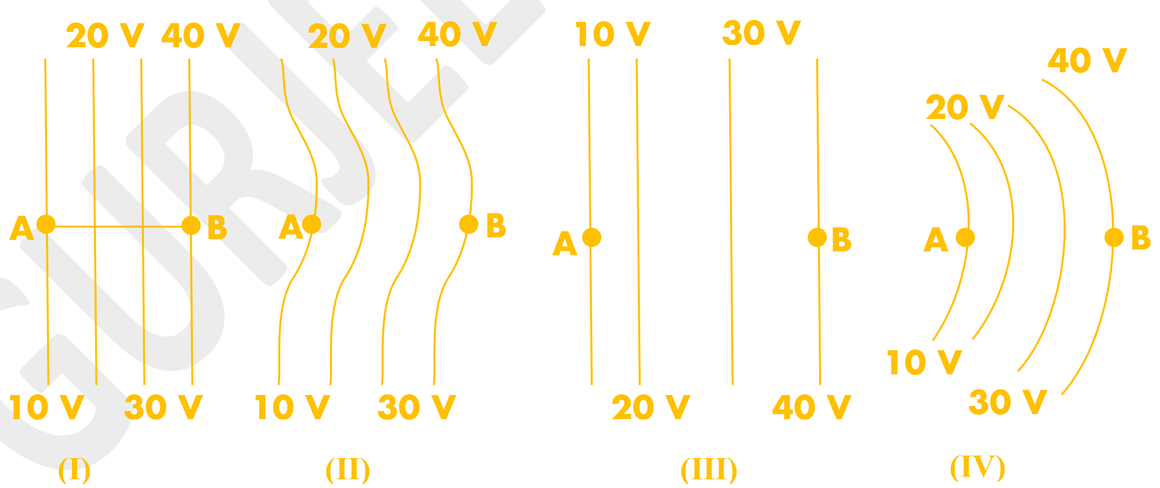
(c) increases by a factor of 2 (d) increase by a factor of 4

10. Suppose the charge of a proton and an electron differ slightly. One of them is –e, the other is (e + Δe). If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero, then Δe is of the order of [Given: mass of hydrogen m_h = 1.67 $\times 10^{-27}$ kg]

[NEET 2017]

(a) 10^{-23} C (b) 10^{-37} C (c) 10^{-47} C (d) 10^{-20} C

11. The diagram below show regions of equipotentials. **[NEET 2017]**



A positive charge is moved from A to B in each diagram.

(a) In all the four cases the work done is the same.

(b) Minimum work is required to move q in figure (I).

(c) Maximum work is required to move q in figure (II).

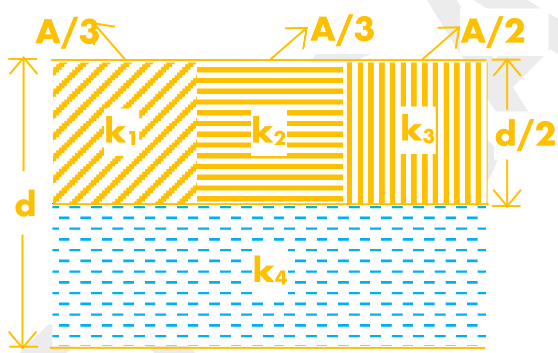
(d) Maximum work is required to move q in figure (III).

12. An electric dipole is placed at an angle of 30° with an electric field intensity 2×10^5 N C^{-1}. It experiences a torque equal to 4 N m. The charge on the dipole, if the dipole length is 2 cm, is **[NEET-II 2016]**

(a) 8 mC (b) 2 mC (c) 5 mC (d) 7μC

13. A parallel-plate capacitor of area A, plate separation d and capacitance C is filled with four dielectric materials having dielectric constants k_1, k_2, k_3 and k_4 as shown in the figure. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then its dielectric constant k is given by

[NEET-II 2016]]



(a) $k = k_1 + k_2 + k_3 + 3k_4$ (b) $k = \frac{2}{3}(k_1 + k_2 + k_3) + 2k_4$

(c) $\frac{2}{k} = \frac{3}{k_1 + k_2 + k_3} + \frac{1}{k_4}$ (d) $\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} + \frac{3}{2k_4}$

14. Two identical charged spheres suspended from a common point by two massless strings of lengths l, are initially at a distance d ($d << l$) apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. Then v varies as a function of the distance x between the spheres, as **[NEET-I 2016]**

(a) $v \propto x^{-1/2}$ (b) $v \propto x^{-1}$ (c) $v \propto x^{1/2}$ (d) $v \propto x$

15. A parallel plate air capacitor has capacity C, distance of separation between plates is d and potential difference V is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is

[2015]

(a) $\dfrac{CV^2}{d}$ (b) $\dfrac{C^2V^2}{2d^2}$ (c) $\dfrac{C^2V^2}{2d}$ (d) $\dfrac{CV^2}{2d}$

16. If potential (in volts) in a region is expressed as V(x, y, z) = 6xy – y + 2yz, the electric field (in N/C) at point (1, 1, 0) is **[2015]**

(a) $-(2\hat{i}+3\hat{j}+\hat{k})$ (b) $-(6\hat{i}+9\hat{j}+\hat{k})$ (c) $-(3\hat{i}+5\hat{j}+3\hat{k})$ (d) $-(6\hat{i}+5\hat{j}+2\hat{k})$

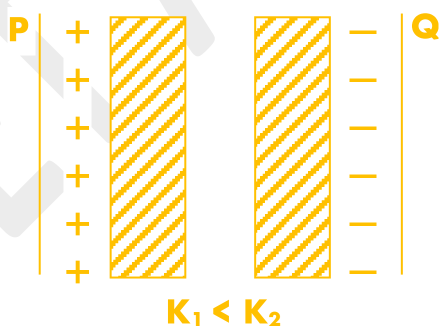
17. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect? **[2015 Cancelled]**

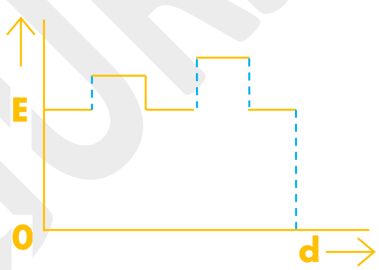
(a) The change in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$. (b) The charge on the capacitor is not conserved.

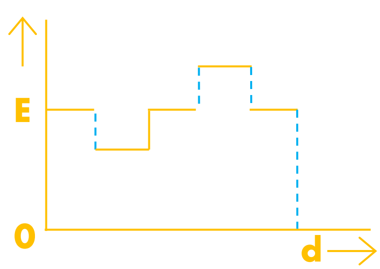
(c) The potential difference between the plates decreases K times.

(d) The energy stored in the capacitor decreases K times

18. Two thin dielectric slabs of dielectric constant K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field E between the plates with distance d as measured from plate P is correctly shown by **[2014]**



(a) 

(b) 

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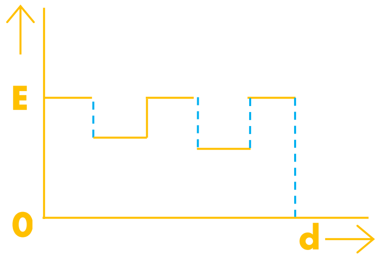
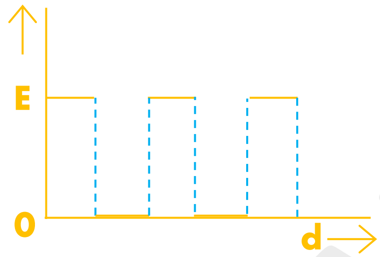
(c) 

(d) 

19. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are **[2014]**

(a) zero and $\frac{Q}{4\pi\varepsilon_0 R^2}$

(b) $\frac{Q}{4\pi\varepsilon_0 R}$ zero and

(c) $\frac{Q}{4\pi\varepsilon_0 R}$ and $\frac{Q}{4\pi\varepsilon_0 R^2}$

(d) both are zero

20. In a region, the potential is represented by V(x, y, z) = 6x – 8xy – 8y + 6yz, where V is in volts and x, y, z are in metres. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is **[2014]**

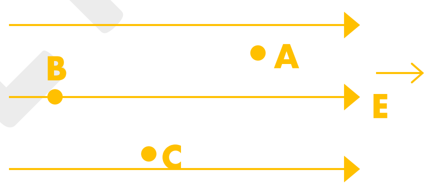
(a) $6\sqrt{5}$ N

(b) 30 N

(c) 24 N

(d) $4\sqrt{35}$ N

21. A, B and C are three points in a uniform electric field. The electric potential is **[NEET 2013]**



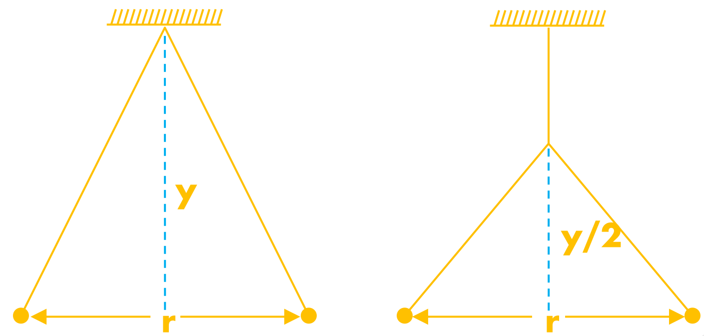
(a) maximum at C

(b) same at all the three points A, B and C

(c) maximum at A

(d) maximum at B

22. Two pith balls carrying equal charges are suspended from a common point by strings of equal length, the equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become **[NEET 2013]**



(a) $\left(\frac{2r}{\sqrt{3}}\right)$ (b) $\left(\frac{2r}{3}\right)$ (c) $\left(\frac{1}{\sqrt{2}}\right)^2$ (d) $\left(\frac{r}{\sqrt[3]{2}}\right)$

23. An electric dipole of dipole moment p is aligned parallel to a uniform electric field E. The energy required to rotate the dipole by 90° is **[Karnataka NEET 2013]**

(a) p^2E (b) pE (c) infinity (d) pE^2

24. A charge q is placed at the centre of the line joining two equals charges Q. The system of the three charges will be in equilibrium if q is equal to **[Karnataka NEET 2013]**

(a) –Q/4 (b) Q/4 (c) –Q/2 (d) Q/2

25. An electric dipole of moment p is placed in an electric field of intensity E. The dipole acquires a position such that the axis of the dipole makes an angle θ with the direction of the field. Assuming that the potential energy of the dipole to be zero when θ = 90°, the torque and the potential energy of the dipole will respectively be

[2012]

(a) $pE\sin\theta, -pE\cos\theta$ (b) $pE\sin\theta, -2pE\cos\theta$ (c) $pE\sin\theta, 2pE\cos\theta$ (d) $pE\cos\theta, -pE\sin\theta$

26. Four point charges –Q, –q, 2q and 2Q are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is **[2012]**

(a) Q = –q (b) $Q = -\frac{1}{q}$ (c) Q = q (d) $Q = \frac{1}{q}$

27. What is the flux through a cube of side a if a point charge of q is at one of its corner?

[2012]

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(a) $\frac{2q}{\varepsilon_0}$ (b) $\frac{q}{8\varepsilon_0}$ (c) $\frac{q}{\varepsilon_0}$ (d) $\frac{q}{2\varepsilon_0}6a^2$

28. A parallel plate capacitor has a uniform electric field E in the place between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is **[Mains 2012, 2011, 2008]**

(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) $\varepsilon_0 EAd$

29. Two metallic spheres of radii 1 cm and 3 cm are given charges of -1×10^{-2} C and 5×10^{-2} C, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is **[Mains 2012]**

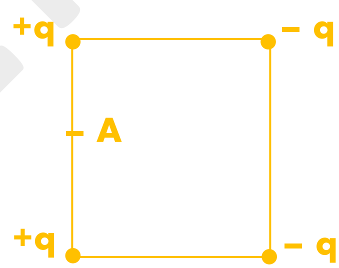
(a) 2×10^{-2} C (b) 3×10^{-2} C (c) 4×10^{-2} C (d) 1×10^{-2} C

30. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will **[2011]**

(a) increase four times (b) be reduced to half

(c) remain the same (d) be doubled

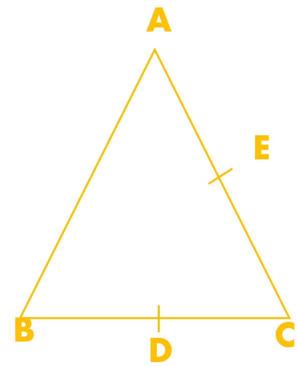
31. Four electric charges +q, +q and –q are placed at the corners of a square of side 2L (see figure). The electric potential at point A, midway between the two charges +q and +q, is **[2011]**



(a) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}(1+\sqrt{5})$ (b) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\frac{1}{\sqrt{5}}\right)$ (c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$ (d) zero

32. Three charges, each +q, are placed at the corners of an isosceles triangle 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

[Mains 2011]



(a) $\frac{3qQ}{4\pi\varepsilon_0 a}$ (b) $\frac{3qQ}{8\pi\varepsilon_0 a}$ (c) $\frac{qQ}{4\pi\varepsilon_0 a}$ (d) zero

33. The electric potential V at any point (x, y, z), all in meters in space is given by $V = 4x^2$ volt. The electric field at the point (1, 0, 2) in volt/meter, is **[Mains 2011]**

(a) 8 along negative X-axis (b) 8 along positive X-axis

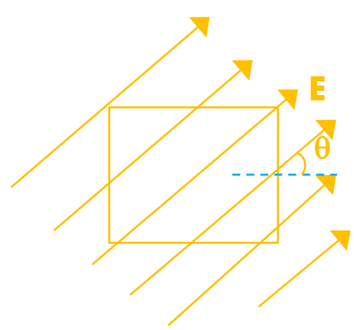
(c) 16 along negative X-axis (d) 16 along positive X-axis

34. Two Positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron)

[2010]

(a) $\frac{4\pi\varepsilon_0 Fd^2}{e^2}$ (b) $\sqrt{\frac{4\pi\varepsilon_0 Fe^2}{d^2}}$ (c) $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$ (d) $\frac{4\pi\varepsilon_0 Fd^2}{q^2}$

35. A square surface of side L meters in the plane of the paper is placed in a uniform electric field E(volt/m) acting along the same plane at an angle θ with the horizontal side of the square as shown in figure. The electric flux linked to the surface, in units of volt m is **[2010]**



(a) EL^2 (b) $EL^2\cos\theta$ (c) $EL^2\sin\theta$ (d) zero

36. 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 the same (total) energy stored in it, as the first combination has. The value of C_2 in terms of C_1, is then **[2010]**

(a) $\frac{2C_1}{n_1n_2}$ (b) $16\frac{n_2}{n_1}C_1$ (c) $2\frac{n_2}{n_1}C_1$ (d) $\frac{16C_1}{n_1n_2}$

37. Two parallel metal plates having charges +Q and –Q face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will **[Mains 2010]**

(a) become zero (b) increase (c) decrease (d) remain same

38. The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is **[Mains 2010]**

(a) zero (b) E (c) $\frac{E}{2}$ (d) $\frac{E}{3}$

39. Three concentric spherical shells have radii a, b ad c (a < b < c) and have surface charge densities σ, –σ 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

[2009]

(a) $V_C = V_B \neq V_A$ (b) $V_C \neq V_B \neq V_A$ (c) $V_C = V_B = V_A$ (d) $V_C = V_A \neq V_B$

40. Three capacitors each of the capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be **[2009]**

(a) $3C, \frac{V}{3}$ (b) $\frac{C}{3}, 3V$ (c) 3C, 3V (d) $\frac{C}{3}, \frac{V}{3}$

41. The electric potential at a point (x, y, z) is given by $V = -x^2y - xz^3 + 4$. The electric field at that point is

(a) $\vec{E} = \hat{i}2xy + \hat{j}(x^2 + y^2) + \hat{k}(3xz - y^2)$ (b) $\vec{E} = \hat{i}z^3 + \hat{j}xyz + \hat{k}z^2$ **[2009]**

(c) $\vec{E} = \hat{i}(2xy - z^3) + \hat{j}xy^2 + \hat{k}3z^2x$ (d) $\vec{E} = \hat{i}(2xy + z^3) + \hat{j}x^2 + \hat{k}3xz^2$

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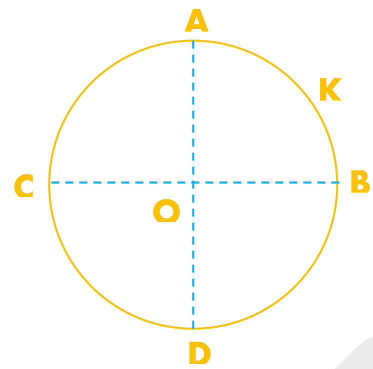
42. A thin conducting ring of radius R is given a charge +Q. The electric field at the centre O of the ring due to the charge on the part AKB of the ring is E. The electric field at the centre due to the charge on the part ACDB of the ring is **[2008]**



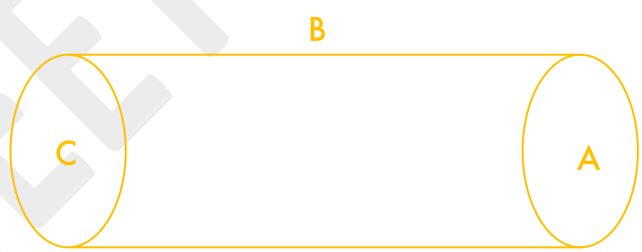
(a) E along KO (b) 3E along OK (c) 3E along KO (d) E along OK

43. The electric potential at a point in free space due to charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at that point is **[2008]**

(a) $4\pi\varepsilon_0 Q \times 10^{20}$ volt/m (b) $12\pi\varepsilon_0 Q \times 10^{22}$ volt/m

(c) $4\pi\varepsilon_0 Q \times 10^{22}$ volt/m (d) $12\pi\varepsilon_0 Q \times 10^{20}$ volt/m

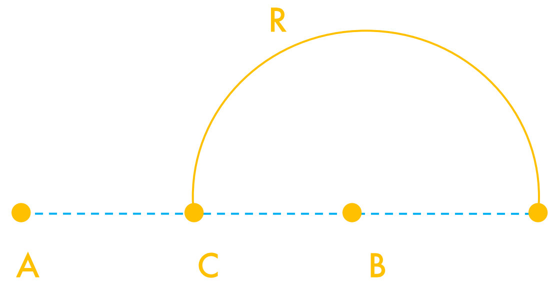
44. A hollow cylinder has a charge q coulomb within it. If ϕ is the electric flux in units of voltmeter associated with the curved surface B, the flux linked with the plane surface A in units of V-m will be **[2007]**



(a) $\frac{q}{2\varepsilon_0}$ (b) $\frac{\phi}{3}$ (c) $\frac{q}{\varepsilon_0} - \phi$ (d) $\frac{1}{2}\left(\frac{q}{\varepsilon_0} - \phi\right)$

45. Charges +q and −q are placed at points A and B respectively which are a distance 2L apart, C is the midpoint between A and B. The work done in moving a charge +Q along the semicircle CRD is

[2007]



(a) $\frac{qQ}{2\pi\varepsilon_0 L}$ (b) $\frac{qQ}{6\pi\varepsilon_0 L}$ (c) $-\frac{qQ}{6\pi\varepsilon_0 L}$ (d) $\frac{qQ}{4\pi\varepsilon_0 L}$

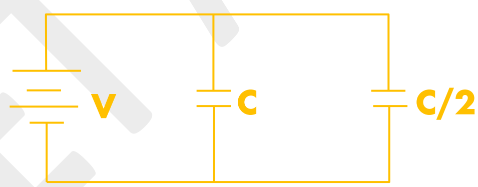
46. Three point charges +q, −2q and +q are placed at points (x = 0, y = a, z = 0), (x = 0, y = 0, z = 0) and $(x = a, y = 0, z = 0)$ respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are **[2007]**

(a) $\sqrt{2}qa$ along the line joining points (x = 0, y = a, z = 0) and (x = a, y = a, z = a)

(b) qa along the line joining points (x = 0, y = 0, z = 0) and (x = a, y = a, z = 0)

(c) $\sqrt{2}qa$ along + x direction (d) $\sqrt{2}qa$ along + y direction.

47. Two condensers, one of capacity C and other of capacity C/2 are connected to a V-volt battery, as shown in the figure. The work done in charging fully both the condensers is **[2007]**



(a) $\frac{1}{4}CV^2$ (b) $\frac{3}{4}CV^2$ (c) $\frac{1}{2}CV^2$ (d) $2CV^2$.

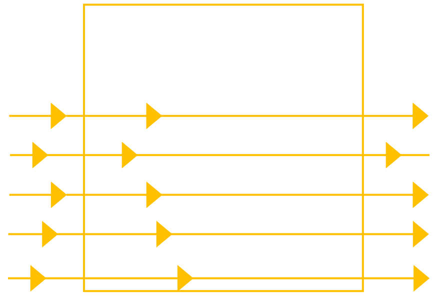
48. A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an insulting handle. As a result the potential difference between the plates **[2006]**

(a) increases (b) decreases (c) does not change (d) becomes zero

49. An electric dipole of moment $\vec{p}$ is lying along a uniform electric field $\vec{E}$. The work done in rotating the dipole by 90° is **[2006]**

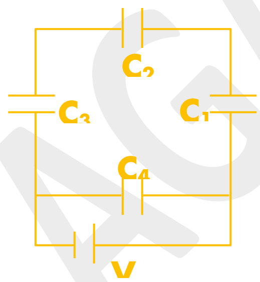
(a) pE (b) $\sqrt{2}pE$ (c) pE/2 (d) 2pE.

50. A square surface of side L meters is in the plane of the paper. A uniform electric field $\vec{E}$ (volt/m), also in the plane of the paper is limited only to the lower half of the square surface (see figure). The electric flus in SI units associated with the surface is **[2006]**



(a) EL^2 (b) $EL^2/2\varepsilon_0$ (c) $EL^2/2$ (d) zero

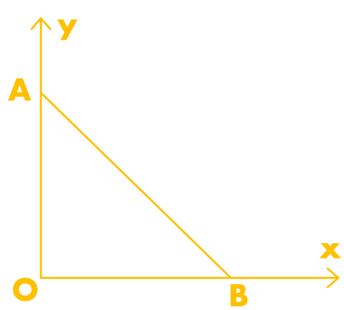
51. A network of four capacitors of capacity equal to $C_1 = C$, $C_2 = 2C$, $C_3 = 3C$ and $C_4 = 4C$ are connected to a battery as shown in the figure. The ratio of the charges on C_2 and C_4 is **[2005]**



(a) 4/7 (b) 3/22 (c) 7/4 (d) 22/3

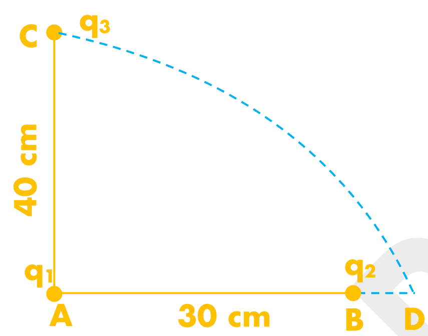
52. As per the diagram a point charge +q is placed at the origin O. Work done in taking another point charge –Q from the point A [coordinates (0, a)] to another point B [coordinates (a, 0)] along the straight path AB is

[2005]



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

53. Two charges q_1 and q_2 are placed 30 cm apart, as shown in the figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in the potential energy of the system is $\frac{q_3}{4\pi\varepsilon_0}k$, where k is : **[2005]**



(a) $8q_1$ (b) $6q_1$ (c) $8q_2$ (d) $6q_2$

54. A bullet of mass 2 g is having a charge of 2 μC. Through what potential difference must it be accelerated, starting from rest, to acquire a speed of 10 m/s? **[2004]**

(a) 5 kV (b) 50 kV (c) 5 V (d) 50 V

55. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a uniform electric field E. If its dipole moment is along the direction of the field, the force on it and its potential energy are respectively

(a) $2q \cdot E$ and minimum (b) $q \cdot E$ and $p \cdot E$ **[2004]**

(c) zero and minimum (d) $q \cdot E$ and maximum

56. Three capacitors each of capacity 4 μF are to be connected in such a way that the effective capacitance is 6 μF. This can be done by **[2003]**

(a) connecting all of them in series (b) connecting them in parallel

(c) connecting two in series and one in parallel (d) connecting two in parallel and one in series

57. A charge q is located at the centre of a cube. The electric flux through any face is **[2003]**

(a) $\frac{2\pi q}{6(4\pi\varepsilon_0)}$ (b) $\frac{4\pi q}{6(4\pi\varepsilon_0)}$ (c) $\frac{\pi q}{6(4\pi\varepsilon_0)}$ (d) $\frac{q}{6(4\pi\varepsilon_0)}$

58. Identical charges (–q) are placed at each corners of cube of side b then electrostatic potential energy of charge (+q) which is placed at centre of cube will be **[2002]**

(a) $\frac{-4\sqrt{2}q^2}{\pi\varepsilon_0 b}$ (b) $\frac{-8\sqrt{2}q^2}{\pi\varepsilon_0 b}$ (c) $\frac{-4q^2}{\sqrt{3}\pi\varepsilon_0 b}$ (d) $\frac{8\sqrt{2}q^2}{4\pi\varepsilon_0 b}$

59. A capacitors of capacity C_1 charged upto V volt and then connected to an unchanged capacitor of capacity C_2, The final potential difference across each will be **[2002]**

(a) $\frac{C_2 V}{C_1 + C_2}$ (b) $\frac{C_1 V}{C_1 + C_2}$ (c) $\left(1+\frac{C_2}{C_1}\right)$ (d) $\left(1-\frac{C_2}{C_1}\right)V$

60. Some charge is being given to a conductor. Then its potential is **[2002]**

(a) maximum at surface (b) maximum at centre

(c) remain same throughout the conductor (d) maximum somewhere between surface and centre.

61. A dipole of dipole moment $\vec{p}$ is placed in uniform electric field $\vec{E}$ then torque acting on it is given by

[2001]

(a) $\vec{\tau} = \vec{p}\cdot\vec{E}$ (b) $\vec{\tau} = \vec{p}\times\vec{E}$ (c) $\vec{\tau} = \vec{p}+\vec{E}$ (d) $\vec{\tau} = \vec{p}-\vec{E}$

62. Energy per unit volume for a capacitor having area A and separation d kept at potential difference V is given by

[2001]

(a) $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$ (b) $\frac{1}{2\varepsilon_0}\frac{V^2}{d^2}$ (c) $\frac{1}{2}CV^2$ (d) $\frac{Q^2}{2C}$

63. A charge Q μC is placed at the centre of a cube, the flux coming out from each face will be

[2001]

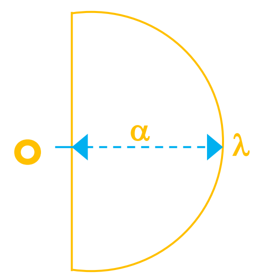
(a) $\frac{Q}{6\varepsilon_0}\times 10^{-6}$ (b) $\frac{Q}{6\varepsilon_0}\times 10^{-3}$ (c) $\frac{Q}{24\varepsilon_0}$ (d) $\frac{Q}{8\varepsilon_0}$

64. A charge Q is situated at the corner of a cube, the electric flux passed through all the six faces of the cube is

[2000]

(a) $\frac{Q}{6\varepsilon_0}$ (b) $\frac{Q}{8\varepsilon_0}$ (c) $\frac{Q}{\varepsilon_0}$ (d) $\frac{Q}{2\varepsilon_0}$

65. Electric field at centre O of semicircle of radius a having linear charge density λ given as **[2000]**

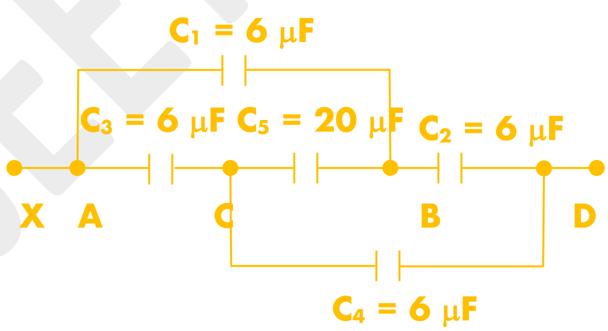


(a) $\frac{2\lambda}{\varepsilon_0 a}$ (b) $\frac{2\pi}{\varepsilon_0 a}$ (c) $\frac{\lambda}{2\pi\varepsilon_0 a}$ (d) $\frac{\lambda}{\pi\varepsilon_0 a}$

66. A capacitor is charged with a battery and energy stored in U. After disconnecting battery another capacitor of same capacity is connected in parallel to the first capacitor. Then energy stored in each capacitor is **[2000]**

(a) U/2 (b) U/4 (c) 4U (d) 2U.

67. What is the effective capacitance between points X and Y? **[1999]**



(a) 12 (b) 18 μF (c) 24 μF (d) 6 μF

68. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance **[1999]**

(a) increases K times (b) remains unchanged

(c) decreases K times (d) increases K^{-1} times.

69. In bringing an electron towards another electrons, the electrostatic potential energy of the system **[1999]**

(a) becomes zero (b) increases (c) decrease (d) remains same

70. A parallel plate condenser with oil between the plates (dielectric constant of oil K = 2) has a capacitance C. If the oil is removed, then capacitance of the capacitor becomes **[1999]**

(a) $\frac{C}{\sqrt{2}}$ (b) 2C (c) $\sqrt{2}C$ (d) $\frac{C}{2}$

71. A hollow insulated conduction sphere is given a positive charge of 10 μC. What will be the electric field at the centre of the sphere of its radius is 2 metres? **[1998]**

(a) 20 $\mu C\ m^{-2}$ (b) 5 $\mu C\ m^{-2}$ (c) zero (d) 8 $mC\ m^{-2}$

72. A particle of mass m and charge q is placed at rest in a uniform electric field E and then released. The kinetic energy attained by the particle after moving a distance y is **[1998]**

(a) qEy (b) qE^2y (c) qEy^2 (d) q^2Ey

73. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p. If the distance of Q from the dipole is r (much larger than the size of the dipole), then the electric field at Q is proportional to **[1998]**

(a) p^2 and r^{-3} (b) p and r^{-2} (c) p^{-1} and r^{-2} (d) p and r^{-3}

74. A point charge + q is placed at the centre of a cube of side l. The electric flux emerging from the cube is **[1996]**

(a) $\frac{6ql^2}{\varepsilon_0}$ (b) $\frac{q}{6l^2\varepsilon_0}$ (c) zero (d) $\frac{q}{\varepsilon_0}$.

75. The energy stored in a capacitor of capacity C and potential V is given by **[1996]**

(a) $\frac{CV}{2}$ (b) $\frac{C^2V^2}{2}$ (c) $\frac{C^2V}{2}$ (d) $\frac{CV^2}{2}$

76. Two metallic spheres of radii 1 cm and 2 cm are given charges 10^{-2} C and 5 × 10^{-2} C respectively. If they are connected by a conducting wire, the final charge on the smaller sphere is **[1995]**

(a) 3×10^{-2}C (b) 4×10^{-2}C (c) 1×10^{-2}C (d) 2×10^{-2}C

77. There is an electric field E in x-direction. If the work done on moving a charge of 0.2 C through a distance of 2 m along a line making an angle 60° with x-axis is 4 J, then what is the value of E? **[1995]**

(a) 5 N/C (b) 20 N/C (c) $\sqrt{3}$ N/C (d) 4 N/C.

78. A charge q is placed at the centre of the line joining two exactly equal positive charges Q. The system of three charged will be in equilibrium, if q is equal to **[1995]**

(a) –Q (b) Q/2 (c) –Q/4 (d) +Q

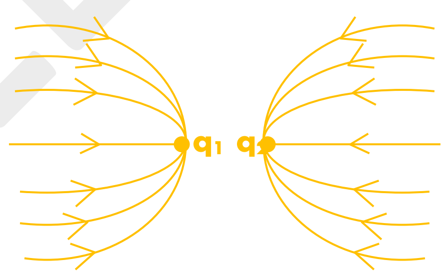
79. An electric dipole of moment p is placed in the position of stable equilibrium in uniform electric field of intensity E. This is rotated through an angle θ from the initial position. The potential energy of the electric dipole in the final position is **[1994]**

(a) $-pE\cos\theta$ (b) $pE(1 - \cos\theta)$ (c) $pE\cos\theta$ (d) pe $\sin\theta$.

80. Charge q_2 is at the centre of a circular path with radius r. Work done in carrying charge q_1, once around this equipotential path, would be **[1994]**

(a) $\frac{1}{4\pi\varepsilon_0} \times \frac{q_1q_2}{r^2}$ (b) $\frac{1}{4\pi\varepsilon_0} \times \frac{q_1q_2}{r}$ (c) zero (d) infinite.

81. The given figure gives electric lines of force due to two charges q_1 and q_2. What are the signs of the two charges?



(a) q_1 is positive but q_2 is negative (b) q_1 is negative but q_2 is positive

(c) Both are negative (d) Both are positive **[1994]**

82. A hollow metallic sphere of radius 10 cm is charged such that potential of its surface is 80 V. The potential at the centre of the sphere would be **[1994]**

(a) 80 V (b) 800 V (c) zero (d) 8 V.

83. Point charges +4q, −q and +4q are kept on the X-axis at point x = 0, x = a and x = 2a respectively. Then **[1998]**

(a) only −q is in stable equilibrium

(b) all the charges are in stable equilibrium

(c) all of the charges are in unstable equilibrium

(d) none of the charges is in equilibrium

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ANSWER KEY

EXERCISE - 1

Section (A) :

A -1.	(b)	A -2.	(a)	A -3.	(a)
A -4.	(a)	A -5.	(a)	A -6.	(c)
A -7.	(b)	A -8.	(c)	A -9.	(d)
A -10.	(a)	A -11.	(c)		

Section (B) :

B-1.	(d)	B-2.	(b)	B-3.	(c)
B-4.	(c)	B-5.	(c)	B-6.	(b)
B-7.	(c)	B-8.	(c)	B-9.	(a)
B-10.	(d)	B-11.	(d)	B-12.	(d)
B-13.	(b)	B-14.	(c)	B-15.	(b)

Section (C) :

C-1.	(a)	C-2.	(b)	C-3.	(b)
C-4.	(a)	C-5.	(c)	C-6.	(b)
C-7.	(a)	C-8.	(d)	C-9.	(a)
C-10.	(b)	C-11.	(c)	C-12.	(c)
C-13.	(c)	C-14.	(b)	C-15.	(a)
C-16.	(b)	C-17.	(c)	C-18.	(a)
C-19.	(b)	C-20.	(d)	C-21.	(a)
C-22.	(a)	C-23.	(b)	C-24.	(c)
C-25.	(d)	C-26.	(c)	C-27.	(b)

Section (D) :

D-1.	(b)	D-2.	(c)	D-3.	(b)
D-4.	(d)	D-5.	(b)	D-6.	(d)

Section (E) :

E-1.	(d)	E-2.	(d)	E-3.	(a)

Section (F) :

F-1.	(d)	F-2.	(d)

Section (G) :

G-1.	(d)	G-2.	(c)	G-3.	(a)
G-4.	(d)	G-5.	(c)		

Section (H) :

H-1.	(d)	H-2.	(b)	H-3.	(a)
H-4.	(c)	H-5.	(b)	H-6.	(a)
H-7.	(b)	H-8.	(b)	H-9.	(c)

Section (I) :

I-1.	(a)	I-2.	(b)	I-3.	(c)
I-4.	(d)				

Section (J) :

J-1.	(b)	J-2.	(c)	J-3.	(b)
J-4.	(d)	J-5.	(a)	J-6.	(c)
J-7.	(c)	J-8.	(b)	J-9.	(c)
J-10.	(d)	J-11.	(a)	J-12.	(c)
J-13.	(c)	J-14.	(a)	J-15.	(a)
J-16.	(b)	J-17.	(a)		

EXERCISE - 2

PART - I

1.	(d)	2.	(a)	3.	(a)
4.	(b)	5.	(c)	6.	(d)
7.	(a)	8.	(a)	9.	(b)
10.	(a)	11.	(b)	12.	(c)

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13.	(b)	**14.**	(c)	**15.**	(d)
16.	(a)	**17.**	(c)	**18.**	(a)
19.	(c)	**20.**	(a)	**21.**	(a)
22.	(b)	**23.**	(b)	**24.**	(c)
25.	(a)	**26.**	(c)	**27.**	(b)
28.	(a)	**29.**	(b)	**30.**	(d)
31.	(c)	**32.**	(c)	**33.**	(d)
34.	(a)	**35.**	(d)	**36.**	(a)
37.	(b)	**38.**	(c)	**39.**	(b)
40.	(d)	**41.**	(a)	**42.**	(b)
43.	(b)				

PART - II

Section (A) :

A -1. (a)

EXERCISE -3

1.	(c)	**2.**	(c)	**3.**	(d)
4.	(d)	**5.**	(c)	**6.**	(a)
7.	(a)	**8.**	(b)	**9.**	(a)
10.	(b)	**11.**	(a)	**12.**	(b)
13.	(c)	**14.**	(a)	**15.**	(d)
16.	(a)	**17.**	(b)	**18.**	(c)
19.	(b)	**20.**	(d)	**21.**	(d)
22.	(d)	**23.**	(b)	**24.**	(a)
25.	(a)	**26.**	(a)	**27.**	(b)
28.	(c)	**29.**	(b)	**30.**	(c)
31.	(c)	**32.**	(d)	**33.**	(a)
34.	(c)	**35.**	(d)	**36.**	(d)
37.	(c)	**38.**	(a)	**39.**	(d)
40.	(b)	**41.**	(d)	**42.**	(d)
43.	(c)	**44.**	(d)	**45.**	(c)
46.	(a)	**47.**	(b)	**48.**	(a)
49.	(a)	**50.**	(d)	**51.**	(b)
52.	(a)	**53.**	(c)	**54.**	(b)
55.	(c)	**56.**	(c)	**57.**	(b)
58.	(c)	**59.**	(b)	**60.**	(c)
61.	(b)	**62.**	(a)	**63.**	(a)
64.	(b)	**65.**	(c)	**66.**	(b)
67.	(d)	**68.**	(c)	**69.**	(b)
70.	(d)	**71.**	(c)	**72.**	(a)
73.	(d)	**74.**	(d)	**75.**	(d)
76.	(d)	**77.**	(b)	**78.**	(c)
79.	(b)	**80.**	(c)	**81.**	(c)
82.	(a)	**83.**	(c)		

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