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PHYSICS

GRADE - 12

• LIVE

PROBLEMS ON ELECTROSTATICS

| SURI SIR |

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Problems on Electrostatics

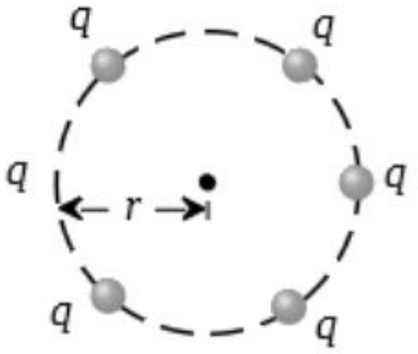
Q. A point charge is surrounded symmetrically by six identical charges at distance r as shown in the figure. How much work is done by the forces of electrostatic repulsion when the point charge q at the centre is sent to infinity

A zero

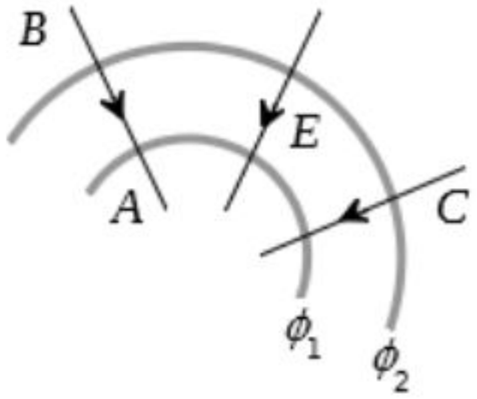
B $6q^2/4\pi\varepsilon_0 r$

C $q^2/4\pi\varepsilon_0 r$

D $12q^2/4\pi\varepsilon_0 r$



Q. In moving from A to B along an electric field line, the electric field does 6.4×10^{-19} J of work on an electron. If ϕ_1, ϕ_2 are equipotential surfaces, then the potential difference $(V_C - V_A)$ is



A -4V

B 4V

C Zero

D 64 V

Q. Two point charge -q and +q/2 are situated at the origin and at the point (a, 0, 0) respectively. The point along the X-axis where the electric field vanishes is

A $x=\frac{a}{\sqrt{2}}$

B $x=\sqrt{2}a$

C $x=\frac{\sqrt{2}a}{\sqrt{2}-1}$

D $x=\frac{\sqrt{2}a}{\sqrt{2}+1}$

Q. Charge of $+\frac{10}{3}\times 10^{-9}C$ are placed at each of the four corners of a square of side 8 cm. The potential at the intersection of the diagonals is

A $150\sqrt{2}$ volt

B $1500\sqrt{2}$ volt

C $900\sqrt{2}$ volt

D 900 volt

Q. A charge (-q) and another charge (+Q) are kept at two points A and B respectively. Keeping the charge (+Q) fixed at B, the charge (-q) at A is moved to another point C such that ABC forms an equilateral triangle of side l. The net work done in moving the charge (-q) is

A $\frac{1}{4\pi\varepsilon_o}\frac{Qq}{l}$

B $\frac{1}{4\pi\varepsilon_o}\frac{Qq}{l^2}$

C $\frac{1}{4\pi\varepsilon_o}Qql$

D zero

Q. An infinite line charge produce a field of 7.182×10^8 N/C at a distance of 2 cm. The linear charge density is

A 7.27×10^{-4} C/m

B 7.98×10^{-4} C/m

C 7.11×10^{-4} C/m

D 7.04×10^{-4} C/m

Q. Two thin wire rings each having a radius R are placed at a distance d apart with their axes coinciding. The charges on the two rings are +q and -q. The potential difference between the centres of the two rings is (JEE 2005)

A zero

B $\frac{Q}{4\pi\varepsilon_o}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$

C $QR/4\pi\varepsilon_0 d^2$

D $\frac{Q}{2\pi\varepsilon_o}\left[\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right]$

Q. Two charges $+3.2 \times 10^{-19}$ and -3.2×10^{-19} C placed 2.4m apart to form an electric dipole. It is placed in a uniform electric field of intensity 4×10^5 volt/m. The electric dipole moment is

A 15.36×10^{-29} coulomb × m

B 15.36×10^{-19} coulomb × m

C 7.68×10^{-29} coulomb × m

D 7.68×10^{-19} coulomb × m

Q. In a region the electric potential is given by V = 2x + 2y - 3z obtain the expression for electric field :

A $-2\hat{i}-2\hat{j}+3\hat{k}$

B $3\hat{i}+4\hat{j}-2\hat{k}$

C $2\hat{i}-2\hat{j}-3\hat{k}$

D None of these

Q. An electric dipole, made of positive and negative charges, each of 1 μC and placed at a distance 2 cm apart. If the dipole is placed in an electric field of 10^5 N/C, then the maximum torque which the field can exert on the dipole, if it is turned from a position $\theta = 0^o$ to $\theta = 180^o$ is:

A 2×10^{-3} N-m

B 3×10^{-3} N-m

C 4×10^{-3} N-m

D 2.8×10^{-3} N-m

Q. What work must be done to rotate an electric dipole through an angle θ with the electric field, if an electric dipole of moment p is placed in an uniform electric field E with p parallel to E?

A $W = pE(1 - \cos\theta)$

B $W = pE(1 + \cos\theta)$

C $W = 2pE(1 - \cos\theta)$

D None of these

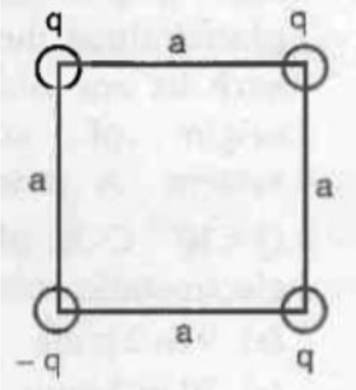
Q. Electric dipole moment of combination shown in the figure, is :

A $qa + qa\sqrt{2} + qa$

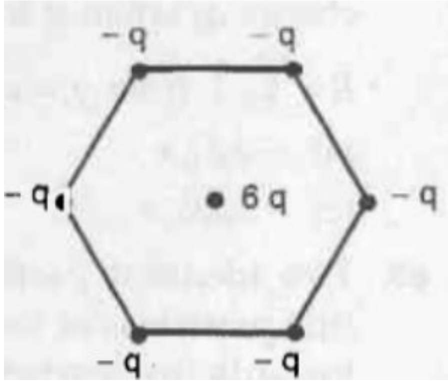
B $2\sqrt{2}qa$

C $\sqrt{2}qa$

D $(\sqrt{2}+1)qa$



Q. Six negative equal charges are placed at the vertices of a regular hexagon. 6q charge is placed at the centre of the hexagon. The electric dipole moment of the system is :



A zero

B 6qa

C 3qa

D None of the above

Q. Two positive charges of magnitude 'q' are placed at the ends of a side (side 1) of a square of side '2a'. Two negative charges of the same magnitude are kept at the other corners. Starting from rest, if a charge Q moves from the middle of side 1 to the centre of square, its kinetic energy at the centre of square is (jee 2011)

A zero

B $\frac{1}{4\pi\varepsilon_o}\frac{2qQ}{a}\left(1+\frac{1}{\sqrt{5}}\right)$

C $\frac{1}{4\pi\varepsilon_o}\frac{2qQ}{a}\left(1-\frac{2}{\sqrt{5}}\right)$

D $\frac{1}{4\pi\varepsilon_o}\frac{2qQ}{a}\left(1-\frac{1}{\sqrt{5}}\right)$

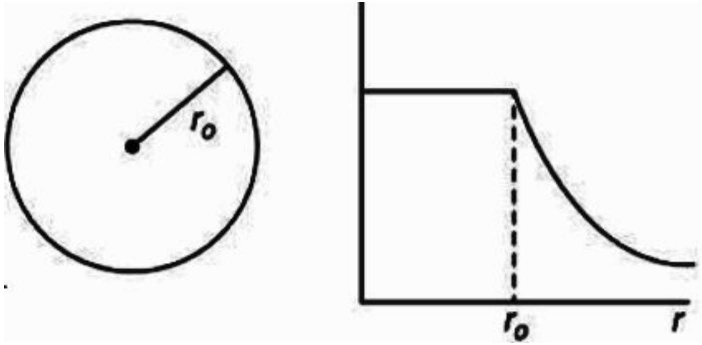
Q. The given figure shows variation with distance r from centre o (jee 2019)

A electric field of a uniformly charged sphere.

B potential of a uniformly charged spherical shell.

C potential of a uniformly charged sphere.

D electric field of a uniformly charged spherical shell



Q. An electric field of 1000 V/m is applied to an electric dipole at angle of 45^{o}. The value of electric dipole moment is 10^{-29} C m. What is the potential energy of dipole? (jee 2019)

A -20×10^{-18} J

B -7×10^{-27} J

C -10×10^{-29} J

D -9×10^{-20} J

Q. A charge Q is distributed over three concentric spherical shells of radii a, b, c ($a < b < c$) such that their surface charge densities are equal to another. The total potential at a point at distance r from their common centre, where $r < a$, would be (Homework Question)

A $\dfrac{1}{12\pi\varepsilon_o}\dfrac{ab+bc+ca}{abc}$

B $\dfrac{Q\left(a^2+b^2+c^2\right)}{4\pi\varepsilon_o\left(a^3+b^3+c^3\right)}$

C $\dfrac{Q}{4\pi\varepsilon_o\left(a+b+c\right)}$

D $\dfrac{Q(a+b+c)}{4\pi\varepsilon_0\left(a^2+b^2+c^2\right)}$

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