Physicsaholics

DPP - 3 (Electrostatics)

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Q 1. Determine the electrostatic potential energy of a system consisting of two charges $7\mu C$ and $-2\mu C$ (and with no external field) placed at (−9 cm,0,0) and (9 cm,0,0) respectively.

(a) $-0.7\ J$ (b) $-1.4\ J$

(c) $0.7\ J$ (d) $1.4\ J$

Q 2. Two points charges a and b of values $5 \times 10^{-9} C$ and $3 \times 10^{-9} C$ are kept 6 cm apart in air. calculate the work done when charge B is moved 1 cm towards charge A:

(a) $4.5 \times 10^{-7} J$ (b) $5.4 \times 10^{-7} J$

(c) $4.5 \times 10^{-9} J$ (d) $5.4 \times 10^{-9} J$

Q 3. Three chargers $q_1 = -2C$, $q_2 = 4C$ and $q_3 = 2C$ are at the three corners of an equilateral triangle of side 9cm. Then the electric potential energy of the system is:

(a) $4 \times 10^{11} J$ (b) $-4 \times 10^{11} J$

(c) $4 \times 10^{9} J$ (d) $-4 \times 10^{9} J$

Q 4. Two identical charged particles having equal charge Q, are placed at a distance d apart, from where they are released. Find out kinetic energy of each particle when they are infinitely away from each other: $\left(k = \frac{1}{4\pi\varepsilon_0}\right)$

(a) $\frac{kQ^2}{d}$ (b) $\frac{2kQ^2}{d}$

(c) $\frac{3kQ^2}{2d}$ (d) $\frac{kQ^2}{2d}$

Q 5. Two equal charges q are placed at a distance 2a and a third charge −2q is placed at the midpoint. The potential energy of the system is

(a) $\frac{9q^2}{8\pi\varepsilon_0 a}$ (b) $\frac{q^2}{8\pi\varepsilon_0 a}$

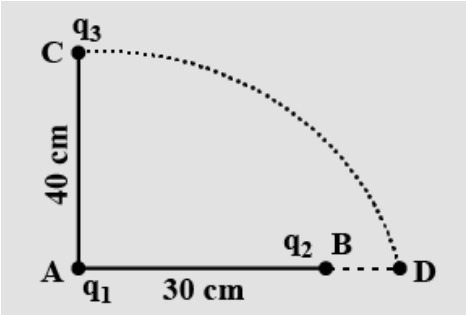
(c) $\frac{-7q^2}{8\pi\varepsilon_0 a}$ (d) $\frac{6q^2}{8\pi\varepsilon_0 a}$

Q 6. Identical charges -q each are placed at the eight corners of a cube of side a. Find the electrostatic potential energy of a charge +q placed at the center of the cube:

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

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

Q 7. Two charges $q_1$and q_2 are placed 30cm apart as shown. A third charge q_3 is moved along the circle of radius 40cm from C to D. The change in the potential energy of the system is $\frac{q_3 K}{4\pi\varepsilon_0}$. Find K



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

Q 8. A system consists of two charges $4\mu C$ and $-3\mu C$ with no external field placed at (-5 cm, 0, 0) and (5 cm, 0, 0) respectively. The amount of work required to separate the two charges (slowly) infinitely away from each other is
(a) 1.1 J (b) 2 J (c) 2.5 J (d) 3 J

Q 9. Calculate the electrostatic potential energy of an electron-proton system of hydrogen atom. In the first Bohr orbit of hydrogen atom, the radius of the orbit is $5.3 \times 10^{-11} m$:
(a) $-4.35 \times 10^{-18} J$ (b) $-2.175 \times 10^{-18} J$
(c) $-4.35 \times 10^{-19} J$ (d) $-2.175 \times 10^{-19} J$

Q 10. point charge $q_1 = +2.4\ \mu C$ is held stationary at the origin. A second point charge $q_2 = -4.3\ \mu C$ moves from the point x = 0.15m, y = 0 to the point x = 0.250m, y = 0.250m. The amount of work is done by the electric force on q_2 is nearly $-356 \times 10^{-x} J$. Find x:
(a) 2 (b) 3 (c) 4 (d) 5

Answer Key

Q.1 a	**Q.2 a**	**Q.3 b**	**Q.4 d**	**Q.5 c**
Q.6 d	**Q.7 a**	**Q.8 a**	**Q.9 a**	**Q.10 b**