

*P*roblems for Practice

1. Two point charges  $+ 10 \mu\text{C}$  and  $- 10 \mu\text{C}$  are separated by a distance of 2.0 cm in air.  
 (i) Calculate the potential energy of the system, assuming the zero of the potential energy to be at infinity. (ii) Draw an equipotential surface of the system. [CBSE D 04]

(Ans. - 45 J)

2. Two point charges A and B of values  $+ 15 \mu\text{C}$  and  $+ 9 \mu\text{C}$  are kept 18 cm apart in air. Calculate the work done when charge B is moved by 3 cm towards A. [CBSE OD 2000]

(Ans. 1.35 J)

3. Two point charges  $20 \times 10^{-6} \text{C}$  and  $-4 \times 10^{-6} \text{C}$  are separated by a distance of 50 cm in air. (i) Find the point on the line joining the charges, where the electric potential is zero. (ii) Also find the electrostatic potential energy of the system. [CBSE OD OS] [ Ans.

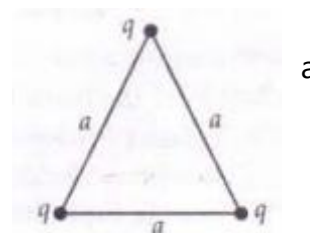
(i) 41 cm from the charge of  $20 \times 10^{-6} \text{C}$  (ii) -144 J]

4. Two charges, of magnitude 5 nC and -2 nC, are placed at points (2 cm, 0, 0) and (x cm, 0, 0) in region of space, where there is no other external field. If the electrostatic potential energy of the system is  $-0.5 \mu\text{J}$ , what is the value of x? [CBSE D OSC] (Ans. x = 4 cm)

5. Three point charges are arranged as shown in Fig. 2.36.

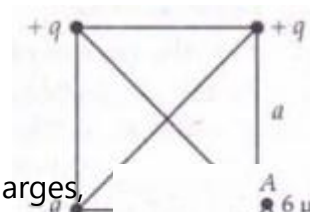
What is their mutual potential energy? Take  $q = 1.0 \times 10^{-4} \text{C}$  and

10 cm. (Ans. 0.27 J)

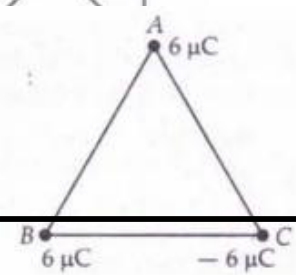


6. Determine potential energy of the charge configuration shown in Fig. 2.37.

Ans.  $\frac{q^2}{4\pi\epsilon_0} (-\sqrt{2})$



7. Find the amount of work done in arranging the three point charges,

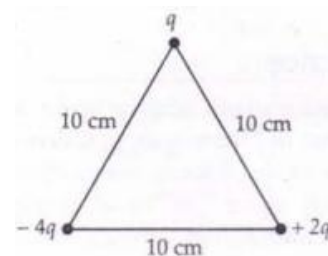


on the vertices of an equilateral triangle ABC, of Side 10 cm, as shown in the adjacent figure.

[CBSE Sample Paper 2011] (Ans. - 3.24 J )

8. Calculate the work done to dissociate the system of three charges placed on the vertices of a triangle as Shown in Fig. 2.38.

Here  $q = 1.6 \times 10^{-10}$  C. [CBSE D 08; OD 13] (Ans.  $2.304 \times 10^{-8}$  J)

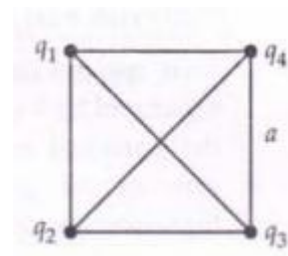


9. What is the electrostatic potential energy of the Charge configuration shown in Fig. 2.39 ? Take

$q_1 = + 1.0 \times 10^{-8}$  C ,  $q_2 = -2.0 \times 10^{-8}$  C,

$q_3 = + 3.0 \times 10^{-8}$  C,  $q_4 = + 2.0 \times 10^{-8}$  C

And  $a = 1.0$  metre. (Ans. -  $6.36 \times 10^{-7}$  J)



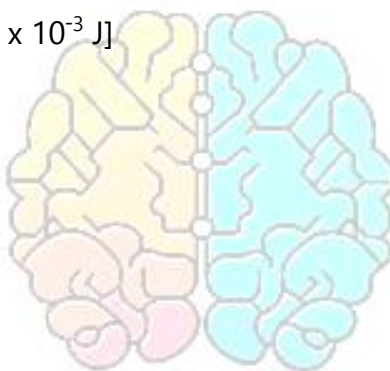
10. Three point charges + q, + 2q and Q are placed at the three vertices of an equilateral triangle. Find the value of charge Q (in terms of q), so that electric potential Energy of the system is zero. (Ans.  $Q = - 2q / 3$ )

11. An electron (charge = -e) is placed at each of the Eight comers of a cube of side a and an  $\alpha$ -particle (charge = + 2e) at the centre of the cube. Calculate the potential energy of the system. (Ans.  $3.89 \times 10^{10} e^2 / a$  joule)

12. Two identical particles, each having a charge of  $2.0 \times 10^{-4}$  C and mass of 10 g, are kept at a Separation of 10 cm and then released. What would be the speeds of the particles when the separation Becomes large? (Ans.  $600 \text{ ms}^{-1}$ )

13. Find the amount of work done in rotating an electric Dipole, of dipole moment  $3.2 \times 10^{-8} \text{ cm}$ , from its Position of stable equilibrium, to the position of Unstable equilibrium, in a uniform electric field of intensity  $10^4 \text{ N / C}$ . [CBSE Sample Paper 2011] (Ans.  $6.4 \times 10^{-4} \text{ J}$ )

14. An electric dipole consists of two opposite charges each of magnitude  $1 \mu\text{C}$  separated by  $2 \text{ cm}$ . The Dipole is placed in an external electric field of  $10^5 \text{ NC}^{-1}$  Find (i) the maximum torque exerted by the field on the dipole (ii) the work which the external agent will have to do in turning the dipole through  $180^\circ$  starting from the position  $\theta = 0^\circ$ . [Ans. (i)  $2 \times 10^{-3} \text{ Nm}$  (ii)  $4 \times 10^{-3} \text{ J}$ ]



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