

Q- Two identical $+7.5\mu\text{C}$ point charges are initially 5.5cm apart. If they are released at the same instant from rest, how fast will they be moving when they are very far apart? Assume they have identical masses of 1.0 mg .

The electrostatic potential energy of the system of two charges is given by

$$U_E = \frac{Q_1 Q_2}{4\pi \epsilon_0 r}$$

Hence the Electrostatic Potential energy of the system will be

$$U_E = \frac{Q^2}{4\pi \epsilon_0 r} = \frac{9 \times 10^9 * (7.5 \times 10^{-6})^2}{5.5 \times 10^{-2}} = 9.2 \text{ J}$$

At very far away electrostatic potential energy will become zero.

As both particles are identical their velocities very far apart will be equal let v each.

Their kinetic energy at far away will be

$$2 * (1/2) mv^2 = mv^2 = 1.0 * 10^{-6} v^2.$$

Now as there is no other external force other than the electric one the law of conservation of energy will give

Gain in KE = Loss in E PE

$$\text{Or } 1.0 * 10^{-6} v^2 = 9.2 \text{ J}$$

Gives $v = 3033.2 \text{ m/s}$