Answer on Question #42609, Physics, Electromagnetism

Task: equal charges Q is broken in two parts Q_1 & 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=Q/R,Q_1=Q-Q/R b) Q_2=Q/4,Q=Q-2Q/3 c) Q_2=Q/4,Q_1=3Q/4 d) Q_1=Q/2,Q_2=Q/2

Solution:

Since Q is broken in two parts Q_1 & Q_2,let Q_1=x and Q_2=(Q-x). Force of repulsion between them is

$U_{Q_1,Q_2} = k\frac{Q_1 \cdot Q_2}{R^2}$,where k - Coulomb's constant.

$U_{Q_1,Q_2} = k\frac{x \cdot (Q-x)}{R^2}$.

The maxim U_m force of repulsion between them will occur if the condition $\frac{dU}{dx} = 0.$

$$\frac{dU}{dx} = \frac{k}{R^2}(Q-2x) = 0 \Rightarrow Q-2x = 0 \Rightarrow x = \frac{Q}{2} \Rightarrow Q_1 = \frac{Q}{2}, Q_2 = Q - \frac{Q}{2} = \frac{Q}{2}.$$

Answer: d) Q1=Q/2,Q2=Q/2.