Answer on Question #69267 Physics / Other

A small object has charge Q. Charge q is removed from it and placed on a second small object. The two objects are placed 1 m apart. For the force that each object exerts on the other to be a maximum, q should be

Solution:

The force between charges $Q - q$ and q is equal

$$F = k\frac{(Q-q)q}{r^2} = k\frac{Qq - q^2}{r^2}.$$

The maximum force condition (extremum of F) is given by

$$\frac{dF}{dq} = 0.$$

Thus

$$\frac{d}{dq}(Qq - q^2) = Q - 2q = 0.$$

Finally

$$q = \frac{Q}{2}.$$

Answers: $q = \frac{Q}{2}$.