276.

Problem 27.15 (RHK)

A certain charge Q is to be divided into two parts $(Q-q)$ and q. We have to find the relation of Q to q if the two parts, placed a given distance apart, are to have a maximum Coulomb repulsion.

Solution:

It is given that a certain charge Q is to be divided into two parts $(Q-q)$ and q. We have to find the relation of Q to q such that there is maximum Coulomb repulsion for a fixed separation between the two charges.

As the Coulomb force is proportional to the product of the charges, we have to maximise the function

$$f(q) = q(Q-q).$$

Condition for extremum of this function is

$$\frac{df(q)}{dq} = 0.$$

We thus have the equation

$$Q - q_{max} - q_{max} = 0,$$

or

$$q_{max} = \frac{Q}{2} .$$