283.

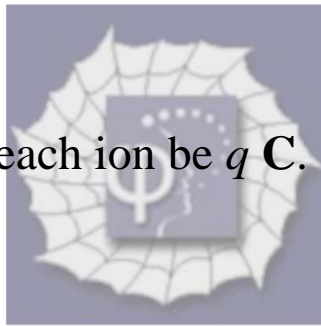## Problem 27.26 (RHK)

The electrostatic force between two identical ions that are separated by a distance of 5.0×10^{-10} m *is* 3.7×10^{-9} N. (a) *We have to find the charge on each ion.* (b) *We have to find the number of electrons that are missing from each ion.*

Solution:

Let the charge on each ion be q **C**. Separation of the two ions is

$r = 5.0 \times 10^{-10}$ m.

The magnitude of electrostatic force on each ion due to the other is

$F = 3.7 \times 10^{-9}$ N.

Therefore, by Coulomb's law we have

$$\frac{q^2}{4\pi\varepsilon_0 r^2} = F.$$

And

$$q = \left(\frac{3.7 \times 10^{-9} \times 25 \times 10^{-20}}{8.99 \times 10^9} \right)^{\!\! 1\!/\!2} C = 3.2 \times 10^{-19} \ C.$$

The magnitude of charge on an electron is

$e = 1.6 \times 10^{-19}$ C.

Therefore,

$q = 2e.$

We thus find that 2 electrons are missing from each ion for it to have 2 units of positive charge.