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Problem 30. 25 (RHK)

As a space shuttle moves through the diluted ionised gas of the Earth's ionosphere, its potential is typically changed by $-1.0\ \text{V}$ *before it completes one revolution. By assuming that the shuttle is a sphere of radius* 10 m, *we have to estimate the amount of charge it collects.*

Solution:

We assume that the space shuttle is a sphere of radius $r = 10\ \text{m}$. It is given that after each revolution in the Earth's ionosphere the potential of the shuttle changes by $-1.0\ \text{V}$. Let the additional charge that the shuttle accumulates in each revolution be $q\ \text{C}$.

From the definition of electric potential, we have

$$V = \frac{q}{4\pi\varepsilon_0 r}.$$

Therefore,

$$q = -\frac{1.0\times 10}{8.99\times 10^{9}}\ \text{C} = -1.11\times 10^{-9}\ \text{C} = -1.11\ \text{nC}.$$