

Problem 64

Estimate the mass of a virus.

Solution

From page 10,

$$10^{-15} \text{ m} = \text{diameter of proton}$$

$$10^{-7} \text{ m} = \text{diameter of typical virus.}$$

Use these facts to find how many protons are in a typical virus.

$$\# \text{ of protons} = \frac{\text{diameter of typical virus}}{\text{diameter of proton}} = \frac{10^{-7} \text{ m}}{10^{-15} \text{ m}} = 10^8$$

Assuming the virus is made up completely of carbon atoms, which have 6 protons each, the mass is

$$10^8 \text{ protons} \times \frac{1 \text{ C atom}}{6 \text{ protons}} \times \frac{12.01 \text{ amu}}{1 \text{ C atom}} \times \frac{1.66 \times 10^{-27} \text{ kg}}{1 \text{ amu}} \approx 3 \times 10^{-19} \text{ kg.}$$

The fact that a carbon atom has 12.01 atomic mass units is found in the periodic table, and the fact that 1 atomic mass unit = 1.66×10^{-27} kg is in Appendix C on page 891.