A Calculation of Relative Isotopic Mass

Problem 2-32

The following ratios of masses were obtained with a mass spectrometer: $^{19}\text{F}/^{12}\text{C} = 1.5832$; $^{35}\text{Cl}/^{19}\text{F} = 1.8406$; $^{81}\text{Br}/^{35}\text{Cl} = 2.3140$. Determine the mass of a $^{81}\text{Br}$ atom in atomic mass units.

(Hint: What is the mass of a $^{12}\text{C}$ atom?)

Solution:

Solve the hint first: a $^{12}\text{C}$ atom has a mass of 12.0000 u exactly (definition of atomic mass scale)

Now it’s just solving the ratios.

$^{19}\text{F} = 1.5832 \frac{u^{19}\text{F}}{u^{12}\text{C}} \times 12.0000 \text{ u} = 18.9984 \text{ u}$

$^{35}\text{Cl} = 1.8406 \frac{u^{35}\text{Cl}}{u^{19}\text{F}} \times 18.9984 \text{ u} = 34.96845504 \text{ u}$

$^{81}\text{Br} = 2.3140 \frac{u^{81}\text{Br}}{u^{35}\text{Cl}} \times 34.96845504 \text{ u} = 80.91700496256 \text{ u}$