Problem 59

Estimate the number of molecules that make up Earth, assuming an average molecular mass of 30 g/mol. (Note there are on the order of 10^{24} objects per mole.)

Solution

Start by looking up the mass of Earth: 5.98×10^{24} kg. Since we only want an estimate, round it up to 10^{25} kg. Also, round the average molecular mass to 10 g/mol = 0.01 kg/mol. The number of molecules in the Earth is therefore roughly

$$10^{25}\ \cancel{\text{kg}} \times \frac{1\ \cancel{\text{mol}}}{0.01\ \cancel{\text{kg}}} \times \frac{10^{24}\ \text{molecules}}{1\ \cancel{\text{mol}}} = 10^{51}\ \text{molecules}.$$