

4. The number of molecules in  $M_{\text{sam}} = 1 \mu\text{g} = 10^{-6} \text{ g}$  of ink is (using Eqs. 20-2, 20-3, with  $M = 18 \text{ g/mol}$ )

$$N = N_{\text{A}} \frac{M_{\text{sam}}}{M} = (6.02 \times 10^{23} / \text{mol}) \left( \frac{1 \times 10^{-6} \text{ g}}{18 \text{ g/mol}} \right) \approx 3 \times 10^{16} .$$

The number of creatures in our galaxy, with the assumption made in the problem, is about  $N' = 5 \times 10^9 \times 10^{11} = 5 \times 10^{20}$ . So the statement is wrong by a factor of about 20,000.