Since 1 mi = 1.609 km,

\[ 1.0 \times 10^3 \text{ mi} = (1.0 \times 10^3 \text{ mi})(1.609 \text{ km/mi}) = 1.6 \times 10^3 \text{ km} . \]

First, find the conversion between m^2 and in.^2. From 1 m = 100 cm = (100 cm)(2.54 in./cm) = 254 in., we get 1 m^2 = (254 in.)^2 = 1.55 \times 10^3 \text{ in.}^2. Thus the number of bacteria in question is

\[ N = \left[ (32 \times 10^6 \text{ bacteria/in.}^2)(1.55 \times 10^3 \text{ in.}^2/\text{m}^2) \right] (1.7 \text{ m}^2) = 8.4 \times 10^{10} \text{ bacteria} . \]

Let the mass of each nickel be \( m \) and the number of nickels whose total mass is \( M = 1 \text{ kg} \) be \( N \). Then \( M = Nm \). Since \( m = 5 \text{ g} = (5 \text{ g})(10^{-3} \text{ kg/g}) = 5 \times 10^{-3} \text{ kg} \),

\[ N = \frac{M}{m} = \frac{1 \text{ kg}}{5 \times 10^{-3} \text{ kg}} = 2 \times 10^2 . \]

First, convert in.^2 to cm^2: 1 in.^2 = (2.54 cm)^2 = 6.45 cm^2. Thus the active odor-detecting area in the human nose is \((3/4 \text{ in.}^2)(6.45 \text{ cm}^2/\text{in.}^2) = 4.84 \text{ cm}^2\), which means that the dog's sensory area is \(65 \text{ cm}^2/4.84 \text{ cm}^2 = 13 \text{ times greater}\).
Since 1 liter = 10³ ml and 1 ml = 1 cm³, 1.000 liter = (1.000 × 10³ cm³)(10⁻² cm/m)³ = 1.000 × 10⁻³ m³.

The diameter $D$ of each hydrogen atom is twice its radius, at about $D = 2(5.29177 \times 10^{-11} \text{ m}) = 1.058354 \times 10^{-10} \text{ m}$. A total of $N$ such atoms, lined up one "touching" the next, will have an end-to-end length of $ND$. If that length is 1.0 m, then

$$N = \frac{1.0 \text{ m}}{D} = \frac{1.0 \text{ m}}{1.058354 \times 10^{-10} \text{ m}} = 9.4 \times 10^9.$$