14. As computer processor speeds increase, it is necessary for engineers to increase the number of circuit elements packed into a given area. Individual circuit elements are often connected using very small copper “wires” deposited directly onto the surface of the chip. In current generation processors, these copper interconnects are about 65 nm wide. How many copper atoms would be in a 1-mm length of such an interconnect, assuming a square cross section. (the density of copper is 8.96 g/cm³.)

First find volume in 1 mm length:

\[
(65 \times 10^{-9} \text{cm})(65 \times 10^{-7} \text{cm})(1 \text{ cm}) = 4.225 \times 10^{-12} \text{cm}^3
\]

\[
\left(\frac{8.96 \text{g}}{\text{cm}^3}\right)\left(\frac{4.225 \times 10^{-12} \text{cm}^3}{1}\right)\left(\frac{1 \text{ mol Cu}}{63.55 \text{g Cu}}\right)\left(\frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol Cu}}\right) = 3.6 \times 10^{11} \text{ atoms Cu}
\]