Scientific notation. A representative eight-atom piece of crystalline silicon is a cube. The length of an edge of the cube is 545 pm. Note: 1 pm ≡ 10-12m. The mass of one silicon atom is 4.66×10-26 kg. A cube contains eight atoms.

Calculate the volume of the cube. Using scientific notation, write the volume in units of m3.

Write the mass of the cube in kg. Use scientific notation.

From your answers to parts a and b, calculate the density of crystalline silicon. Give the density in kg/m3.

Convert density from kg/m3 to g/cm3. Note that 1 kg ≡ 103g and 1 m3 = 106 cm3.

Solution:

1. $V(cube)=a^3$

$a=545pm=545\times10^{-12}$ m;

$V(cube)=(545\times10^{-12})^3 =545^3\times10^{-36}=161878625\times10^{-36}=0.162\times10^{-27}$ m^3

2. $m(Si)=n\times m(one\ Si\ atom)=8\times4.66\times10^{-26} =37.28\times10^{-26}$ kg

3. $\rho=\dfrac{m}{V}$;

$\rho(Si)=\dfrac{37.28\times10^{-26}}{0.162\times10^{-27}} =2301\dfrac{kg}{m^3}$;

4. $2301\dfrac{kg}{m^3} =\dfrac{2301\times103}{106}=2235.87\dfrac{g}{cm^3}$.

Answer: V(cube)= 0.162×10^{-27} m^3; m(Si)= 37.28×10^{-26} kg; ρ(Si)= $2301\dfrac{kg}{m^3} =2235.87\dfrac{g}{cm^3}$