Answer to Question #62390, Chemistry / General Chemistry

Problem 3.106 (Chapter 3)

Consider a sample of calcium carbonate in the form of a cube measuring 2.305 in. on each edge.

1) If the sample has a density of 2.70 g/cm3 , how many oxygen atoms does it contain?

Answer:
1 in. = 2.54 cm

$$a = 2.54\ cm\ \times 2.305 = 5.8547\ cm$$
$$V = a^3 = 5.8547^3 = 200.68\ cm^3$$
$$m = 200.68\ cm^3 \times 2.70\ \frac{g}{cm^3} = 541.85\ g$$

Mr = 100.0869 g/mol

$$n(\text{calcium carbonate}) = \frac{541.85\ g}{100.0869\ \frac{\text{g}}{\text{mol}}} = 5.41\ mol$$

$CaCO_3$

$$n(O) = 3 \times n(\text{calcium carbonate}) = 3 \times 5.41\ mol = 16.23\ mol$$
$$N(O) = n(O) \times N_A = 16.23\ mol \times 6.20 \times 10^{23}\ mol^{-1} = 100.63 \times 10^{23}$$
$$= \mathbf{1.01 \times 10^{25}\ atoms}$$