

Answer on Question #65160 - Chemistry - General Chemistry

Question: What is the number of oxygen atoms in a box filled with carbon dioxide that measures 1.55 ft long, 2.88 ft wide, and 0.518 ft deep?

Solution

1) Find the volume of the container (for the easier further calculations, find it in liters, so the dimensions of the container must be transferred into decimeters). 1 ft is 0.3048 m or 3.048 dm, so the volume of the container is

$$(3.048 * 1.55) * (3.048 * 2.88) * (3.048 * 0.518)$$

2) As none else is mentioned in the question, we assume that gas in the container is under normal conditions ($P = 101.3 \text{ kPa}$ and $T = 273.15 \text{ K}$). According to the ideal gas law,

$$* T,$$

where R is the gas constant ($8.314 \text{ J/mol}\cdot\text{K}$). So, the amount of substance of CO_2 is

$$n(\text{CO}_2) = \frac{PV}{RT}$$

3) Each CO_2 molecule contains 2 oxygen atoms. So, the number of oxygen atoms in the container can be found from the equation

$$N(\text{O}) = 2 * n(\text{CO}_2) * N_A$$

If other conditions different from normal (pressure, temperature) are mentioned in the question, you have to find the amount of substance of CO_2 according to the ideal gas law with your given pressure and temperature, and then find the number of atoms as shown.

Answer: the number of oxygen atoms in the container is $3.5166 * 10^{24}$.