Answer on Question #75790, Physics / Mechanics — Relativity

Question In deep space, the dumber density of atoms is 10^6 atoms/m^3 and the temperature is 2.7K. What volume in cubic meters is occupied by 1.5 mol of gas? If this volume is a cube, what is the length of one of its edges?

Solution We will use following relation for ideal gas:

$$p = nkT$$

from where we can find the pressure:

$$p = 10^6 \cdot 1.38 \cdot 10^{-23} \cdot 2.7 \approx 3.7 \cdot 10^{-17}\, Pa$$

Next we use

$$pV = \nu RT$$

from were we can find volume of 1.5 mole:

$$V = \frac{\nu RT}{p} = \frac{1.5 \cdot 8.31 \cdot 2.7}{3.7 \cdot 10^{-17}} \approx 9.1 \cdot 10^{17}\, m^3$$

So that would cube with edge:

$$\sqrt[3]{V} \approx 969\, km$$