What is the total translational KE of the atoms if the balloon has a diameter 39.0 cm at 46.0 °C and the pressure inside the balloon is 121.6 kPa?

The average kinetic energy of a gas molecule is

$$KE_1 = \frac{3}{2}k_B T$$

where

$k_B = 1.38 \times 10^{-23}$ J/K - Boltzmann's constant;

$T = 273.15 + 46.0 = 319.15K$ - absolute temperature

$$KE = \frac{3}{2} * 1.38 \times 10^{-23} * 319.15 = 6.61 \times 10^{-21}\, J\ per\ atom$$

The number of atoms can be found from ideal gas law

$$\nu = \frac{PV}{RT}\ (moles)$$

where P is the pressure, V is the volume, ν is the number of molecules present, R is the gas constant (8.31J/(mol*K)), and T is the temperature in Kelvins.

$$P = 121.6\, kPa$$

$$V = \frac{4}{3}\pi\left(\frac{39}{2}\right)^3 \times 10^{-6} m^3$$

$$\nu = \frac{121.6 \times 10^3 Pa * \frac{4}{3}\pi\left(\frac{39}{2}\right)^3 \times 10^{-6} m^3}{8.31 \frac{\mathrm{J}}{\mathrm{mol} * \mathrm{K}} * 319.15K} = 1.424\, mol$$

Number of atoms

$$N = \nu N_A = 1.424 * 6.022 \times 10^{23} = 8.58 \times 10^{23}$$

Total translational KE:

$$KE = N * K_1 = 8.58 \times 10^{23} * 6.61 \times 10^{-21} J = 5668.55\, J \approx 5.67\, kJ$$