Ideal gas law

Combined gas law:

$$\frac{p \cdot V}{T} = const \quad \Longleftrightarrow \quad \frac{p_1 \cdot V_1}{T_1} = \frac{p_2 \cdot V_2}{T_2}$$

Amount of substance consisting of N molecules:

$$N_A = 6.02 \cdot 10^{23} \quad \Longrightarrow \quad n = \frac{N}{N_A} moles$$

Ideal gas law and the universal gas constant:

$$p \cdot V = n \cdot R \cdot T$$

$$R = 8.31 \frac{J}{mole \cdot K}$$

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Problem 1.
What is the volume occupied by 1 mole of an ideal gas at a temperature of 0℃ and a pressure of $101.3\ kPa$?

Problem 2.
How many moles of air are in $1\ m^3$ at normal conditions ($p = 101.3\ kPa$ and $T = 273\ K$)?

Problem 3.
You are filling a birthday balloon with air at normal conditions using a pump that allows for a constant airflow of $0.5\ m^3/min$. After 12 seconds of filling up, you decide that the balloon is big enough and stop the pump. What will be the pressure inside this balloon when it heats up to the room temperature of 22℃ and assumes the volume of 105 liters (1 liter is $1000\ cm^3$)?