Exercises (Lecture 5)

1. From the ideal gas law pV = nRT, calculate how many molecules are contained in a cubic centimeter (cm3) of air at a pressure of 1013.25 hPa and a temperature of 15 °C? (R = 8.3145 J-mol^{-1}-K^{-1}; N_A = 6.022 ×10^{23} molecules/mole)

Answer: 2.55×10^{19} molecules

2. How many oxygen molecules are there in a cm^3 of air at a pressure of 1013.25 hPa and a temperature of 15 °C?
Answer: 5.35×10^{18} molecules

3. The table below gives the molecular weights and volume percentages for the standard atmosphere. Use them to show that the molecular weight of air is 28.964 g/mol.

Gas	M (g/mol)	% by volume
N_2	28.0134	78.084
O_2	31.9988	20.9476
A_r	39.948	0.934
CO_2	44.00995	0.0314

4. Explain why moist air is lighter than dry air (at the same pressure and temperature).

5. Why weather balloons get larger as they rise through the atmosphere to regions of lower pressure?

6. Why hot-air balloons ascend through the atmosphere?

7. Why warm air collects near the ceiling and cooler air collects at ground level?