1.2 The perfect gas

The molecular picture of a perfect (ideal) gas will just be stated here. In the later performed statistical approach this microscopic picture will directly allow to calculate the macroscopic equations.

- Continuous and random distribution of atoms/molecules (rigid spheres)
- Speed of particles increases with temperature, internal energy of perfect gas depends on temperature ONLY
- No interaction of particles except elastic collisions, i.e. NO attractive or repulsive forces between particles
- The molecules are widely separated and move in paths that are largely unaffected by intermolecular forces.

The macroscopic picture of a perfect gas follows a general scheme applicable to all systems.

- Defined by an equation of state, e.g. $p = F(T, V, n)$, mostly containing three independent variables (i.e. knowledge of three variables fixes the fourth one)
- Extensive variables: depend on the extent of the system, e.g.
  - Volume V, mass m, internal energy U
  - However, for comparison of distinct compounds: molar or specific quantities
- Intensive variables: independent of the extent of the system, e.g.
  - Temperature T, pressure p, density ρ
  - Intensive variables of ideal mixtures: number average of a quantity Γ

    $$\Gamma = \frac{\sum_i N_i \Gamma_i}{\sum_i N_i} \tag{1.1}$$

    where Γ_i is the intensive property of particle type i and N_i the corresponding particle number. An example for an ideal mixture average value is temperature. Mixing N_a particles at T_a with N_b particles at T_b results in a weighted mean value

    $$T = \frac{N_a\, T_a + N_b\, T_b}{N_a + N_b} \tag{1.2}$$