3.1 Definition

The heat capacity is defined by $C = \frac{\delta Q}{\partial T}$. It allows to calculate the heat energy which is needed to produce an increase in temperature of a material. To be independent of the special system, we define a specific heat capacity by dividing with the mass or the number of atoms (mols) of our sample. Most important is the knowledge of the thermodynamic contact of the system. If, e.g., the pressure is constant, so a fraction of the heat energy does not increase the temperature of the system but increases the volume of the system. Therefor the specific heat capacity of a gas is much higher at constant pressure (C_p) in comparison to constant volume (C_v).
Starting with the first axioms of thermodynamics

$$dU = \delta Q + dW \tag{3.1}$$

and taking

$$dW = 0 \qquad \text{for} \qquad V = const. \tag{3.2}$$

we get

$$C_V = \frac{dU}{dT} \qquad . \tag{3.3}$$

A main point for the calculation of the specific heat capacity is therefor the calculation of the inner energy.