# Arrhenius-Plot

Basics

- Many thermally excited reactions are described by

$$y = y_0 \exp - \frac{E_a}{kT}$$

  - With $E_a$ = activation energy (or enthalpy) of the process, and **k*T*** with its usual meaning.
  - This equation governs not only the equilibrium concentration of point defects, but also, for example, the emission of electrons from a hot wire or the growth of bacterial cultures.
- An Arrhenius plot of this equation is simply a plot of **log y** (or **ln *y***) over **1/*T*** (or **1/k*T***). This produces a straight line:

$$\ln y = \ln y_0 - \frac{E_a}{k_B} \cdot \frac{1}{T}$$

  - The (extrapolated) cut with the **ln y**-axis gives directly the value of the pre-exponential factor $y_0$, and the slope of the straight line gives the activation energy.
- An Arrhenius plot is extremely useful if data are determined experimentally. It shows at a glance if the scatter of the data points is small or large, if we have an Arrhenius relation at all (i.e. a straight line), and if we have enough data points to get unambigous values for the activation energy and the pre-exponential factor.

- In the following Java module, you can play a bit with the representations of the exponential law.
  - Shown is the function

$$c_V = c_0 \cdot \exp - \frac{H_F}{k_B}$$

  - in a direct plot and in an Arrhenius plot. You can change the values of the parameters and see what happens.