

# The Arrhenius Equation

Chemistry

How rate constant varies with temperature.

**The rate constant depends exponentially on temperature and activation energy.**

$$k = Ae^{(-E_a/RT)} \cdot \ln k = \ln A - E_a/RT$$

**Plot  $\ln k$  against  $1/T$**

Straight line.

**Gradient =  $-E_a/R$**

**Higher  $E_a$**

**More temperature-sensitive**

**10°C rise near room temperature roughly doubles many rates**

A rule of thumb, not a law.

## THE COMMON MISTAKE

✗ **Using Celsius**

✓ **T must be in kelvin**

The equation is exponential in  $1/T$ ; using Celsius gives a meaningless or infinite result near zero.

A is the pre-exponential factor, related to collision frequency and orientation.  $E_a$  is in  $\text{J mol}^{-1}$  when  $R = 8.314$ .