

### assignment 3

(due before class on 3 Nov 2020)

1. For a reaction  $A + BC \rightarrow AB + C$  the reactive cross section,

$$\sigma = \begin{cases} 100 \text{\AA}^2 & \text{if } v > 5 \times 10^3 \text{ m/s} \\ 0 & \text{if } v < 5 \times 10^3 \text{ m/s} \end{cases}$$

What is the rate at 300 K if the reduced mass of the reactants is 1 amu? How long will it take to form a mole of C?

2. A treatment alternative to the deterministic approach to kinetics is the stochastic approach.

Read the article "Stochastic Approach to Reaction and Physico-Chemical Kinetics" by E. A. Boucher, attached as a supplement to today's (23 Oct 2020) lecture on Moodle. Outline the differences between the two methods and between their applications.

3. For the reaction  $H_2 + I_2 \xrightleftharpoons[k_{-1}]{k_1} 2HI$ ,  $k_1 = 10^{14} \cdot e^{-\frac{165 \text{ kJ/mol}}{RT}}$  and  $k_{-1} = 10^{13} \cdot e^{-\frac{185 \text{ kJ/mol}}{RT}} \text{ cm}^3/\text{mol s}$ .

What is the equilibrium constant  $K$  for a mixture of  $H_2$ ,  $I_2$  and  $HI$  at  $T = 300 \text{ K}$  and  $2000 \text{ K}$ ?

4. How does increasing the ionic strength affect the rate of the reaction  $H_2O_2 + 2H^+ + 2Br^- \rightarrow 2H_2O + Br_2$ ?

What ionic strength will cause a change of 25% in rate?