Key

Kinetics: Practice Quiz

1. What is the half-life for the decomposition of Nitrosyl Chloride (NOCl), a yellow gas that is toxic and irritating to the lungs, when the concentration of NOCl is 0.15 M? The rate constant for this second order reaction is 8.0×10^{-8} L mol^{-1} s^{-1}.

$\frac{1}{[A]_t} - \frac{1}{[A]_0} = kt$ $\quad \frac{1}{\frac{1}{2}(0.15)} - \frac{1}{0.15} = 8.0 \times 10^{-8} \cdot t_{1/2}$

$8.33 \times 10^{7}\ s = t_{1/2}$

2. An elevated level of the enzyme alkaline phosphatase (ALP) in the serum is an indication of possible liver or bone disorder. The level of serum ALP is so low that it is very difficult to measure directly. However, ALP catalyzes a number of reactions, and its relative concentration can be determined by measuring the rate of one of these reactions under controlled conditions. One such reaction is the conversion of p-nitrophenyl phosphate (PNPP) to p-nitrophenoxide ion (PNP) and phosphate ion. Control of temperature during the test is very important; the rate of the reaction increases 1.47 times if the temperature changes from 30C to 37C. What is the activation energy for the ALP-catalyzed conversion of PNPP to PNP and phosphate?

273
37
310

assume 2 s.f. there

$\ln \frac{K_2}{K_1} = -\frac{Ea}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$ $\quad \ln 1.47 = -\frac{Ea}{8.314}\left(\frac{1}{310} - \frac{1}{303}\right)$

$\ln 1.47 = Ea \cdot 8.9636 \times 10^{-6}$

$0.38526 / 8.9636 \times 10^{-6} = Ea = 4.30 \times 10^{4}\ J$

3. Chemical reactions occur when reactants collide. For what reasons may a collision fail to produce a chemical reaction?

The collision may not occur with sufficient energy or the molecules may not be oriented as needed.

4. For the reaction A → B + C the following data were obtained at 30°C.

Experiment	[A], mol L^{-1}	Rate, mol L^{-1} h^{-1}
1	0.170	0.0500
2	0.340	0.100
3	0.680	0.200

note "hour"

a. What is the rate equation, and what is the order of the reaction?

rate = K[A] ; first order

b. Calculate the rate constant for the reaction.

$K = 0.294\ h^{-1}$

5. How will each of the following effect the rate of the reaction
$CO(g) + NO_2(g) \rightarrow CO_2(g) + NO(g)$ if the rate law for the reaction is Rate = $k[NO_2]^2$?

a. Decreasing the pressure of NO_2 from 0.50 atm to 0.250 atm. rate decreases by a factor of 4

b. Increasing the concentration of CO from 0.01 M to 0.03 M. no change in the rate

c. Increasing the temperature.

In general an increase in temperature increases the reaction rate.