

**Lesson 36: Kinetics(rate laws)** text: 567-581

what to know:

- what is meant by reaction rates, how they are measured and expressed, §14-1
- reactions rates and concentrations of reactants (rate laws, rate constants, reaction order, etc.) and how they are determined from experimental data, §14-2
- relationships between reactant concentration and time(half-life), §14-3

questions:

1. Consider the experiment for the reaction,  $A + 2B \rightleftharpoons C + 2D$ .

Experiment	Initial [A]	Initial [B]	Rate( $\Delta[C]/s$ )
A.	0.0020	0.015	$3.0 \times 10^{-4}$
B.	0.0050	0.015	$3.0 \times 10^{-4}$
C.	0.0040	0.045	$9.0 \times 10^{-4}$

What is the order of reaction with respect to A? with respect to B? overall

2. Consider the reaction,  $2NOBr(g) \rightleftharpoons Br_2(g) + 2NO(g)$ , which is 2nd order with respect to NOBr.

If  $-\Delta[NOBr]/s$  is  $3.2 \times 10^{-2}$  M/s at  $10^\circ C$  when  $[NOBr]$  is 0.20 M:

a. what is the rate of  $[Br_2]$  formation in molarity per minute?

b. what is the rate constant at  $10^\circ C$  in terms of  $[NOBr]/s$ ?

3. Given the following data for reaction:  $A + 2B \rightleftharpoons 2C$

Experiment	Initial [A]	Initial [B]	Initial rate( $\Delta[C]/s$ )
A.	$2.00 \times 10^{-4}$	$3.00 \times 10^{-3}$	$6.00 \times 10^{-12}$
B.	$4.00 \times 10^{-4}$	$9.00 \times 10^{-3}$	$7.20 \times 10^{-11}$
C.	$2.00 \times 10^{-4}$	$9.00 \times 10^{-3}$	$1.80 \times 10^{-11}$
D.	$8.00 \times 10^{-4}$	$9.00 \times 10^{-3}$	$2.88 \times 10^{-10}$

The rate of reaction is given by which of the following?

$k[A]^0[B]^0$	$k[A]^1[B]^0$	$k[A]^2[B]^0$	$k[A]^3[B]^0$
$k[A]^0[B]^1$	$k[A]^1[B]^1$	$k[A]^2[B]^1$	$k[A]^3[B]^1$
$k[A]^0[B]^2$	$k[A]^1[B]^2$	$k[A]^2[B]^2$	$k[A]^3[B]^2$
$k[A]^0[B]^3$	$k[A]^1[B]^3$	$k[A]^2[B]^3$	$k[A]^3[B]^3$

4. Given the following data for the reaction,  $2A + B \rightleftharpoons 2C$ .

Experiment	Initial [A]	Initial [B]	$\Delta[C]/s$
A.	0.120	0.050	$1.20 \times 10^{-5}$
B.	0.040	0.050	$4.00 \times 10^{-6}$
C.	0.040	0.100	$8.00 \times 10^{-6}$

a. What is the order of the reaction with respect to A? B?

b. What is the value for  $\Delta[B]/s$  in the reaction for experiment A?

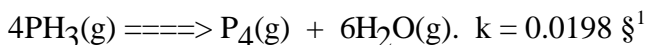
c. What is the value for the specific rate constant for the reaction in terms of C formed?

5. Given the relationship,  $\ln([A]_0/[A]) = kt$  for a first order reaction.

a. What is the specific rate constant if the half-life is 80 minutes? Give your answer in  $s^{-1}$  units.

b. What is the time required for 90% of A to react if the specific rate constant is  $2.0 \times 10^{-5} s^{-1}$

Given the relationship,  $\ln([PH_3]_0/[PH_3]) = kt$ , for the first order decomposition,



a. Calculate the half-life for the reaction in seconds.

b. What is the concentration of  $PH_3$  after the reaction has gone for 100 seconds with an initial concentration of 0.20M?