

CH302 Worksheet 13. Typical kinetics questions you see on quizzes and exams. Before you solve, please write down the classic type of kinetics question this is.

1. Write the rate of the reaction $2\text{O}_3 \rightarrow 3\text{O}_2$ in terms of $\Delta[\text{O}_3]/\Delta t$.

Question type: _____

2. Consider the following stoichiometric reaction: $2\text{A} + \text{B} \rightarrow \text{C} + \text{D}$ The reaction rates are measured with the following results:

| Initial rate | $[\text{A}]_0$ | $[\text{B}]_0$ |
|--------------|----------------|----------------|
| 1 | 2 | 1 |
| 2 | 4 | 1 |
| 1 | 2 | 2 |

What is the order of the reaction with respect to $[\text{B}]_0$?

Question type: _____

3. The first-order rate constant is $k = 3.4 \times 10^{-3} \text{ sec}^{-1}$ for the decomposition of cyclobutane and the half-life is 204 seconds.



What fraction of a sample of cyclobutane remains after 612 seconds under the specified conditions?

Question type: _____

4. The reaction $\text{A} + 3\text{B} \rightarrow \text{C} + 2\text{D}$ has a rate constant $k = 1.0 \times 10^{-5} \text{ sec}^{-1}$ at 27°C . If the activation energy for the reaction is 20,000 cal/mol, what is the value of the rate constant at 0°C ?

Question type: _____

5.

The following data were collected for the following reaction at a particular temperature.



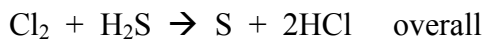
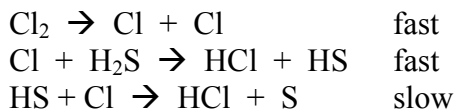
Three experiments give

| Trial | Initial [A] M | Initial [B] M | Initial rate $\Delta[C]/\Delta t$ M/min |
|-------|------------------|------------------|---|
| 1 | 0.1 | 0.1 | 4.0×10^{-4} |
| 2 | 0.2 | 0.2 | 3.2×10^{-3} |
| 3 | 0.1 | 0.2 | 1.6×10^{-3} |

What is the rate law expression for this reaction?

Question type: _____

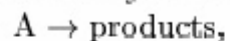
6. What is the rate law for the following multi-step mechanism?



Question type: _____

7.

A first order elementary reaction,



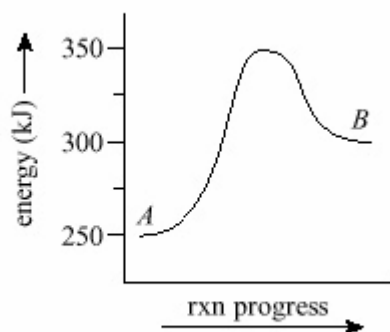
has a rate constant of $3.16 \times 10^8 \text{ sec}^{-1}$. At an instant in time, a concentration of $3.16 \times 10^{-6} \text{ M}$ of species A is created.

How long does it take for the concentration to fall by a factor of 4?

Question type: _____

8.

Consider the potential energy diagram shown below.



What is the activation energy E_a for the reaction $A \rightarrow B$?

Question type: _____