

Question 1

The compound AX_2 decomposes according to the equation, $2AX_2(g) \rightarrow 2AX(g) + X_2(g)$. In one experiment, $[AX_2]$ was measured at various times and the following data were obtained. Based on this data, the average rate over the entire experiment is:

Time (s)	$[AX_2]$ (mol/L)	
0	0.0500	
2.0	0.0448	A) $1.0 \times 10^{-3} \text{ mol/L}\cdot\text{s}$
6.0	0.0300	B) $-1.0 \times 10^{-3} \text{ mol/L}\cdot\text{s}$
8.0	0.0249	C) $-2.1 \times 10^{-3} \text{ mol/L}\cdot\text{s}$
10.0	0.0209	D) $6.87 \times 10^{-3} \text{ mol/L}\cdot\text{s}$
20.0	0.0088	E) $3.43 \times 10^{-3} \text{ mol/L}\cdot\text{s}$

Question 2

The rate law for the general reaction
 $aA + bB + \dots \rightarrow cC + dD \dots$ is

$$\text{Rate} = k[A]^m[B]^n \dots,$$

where the exponents m and n represent the partial orders with respect to the reactants. If the reaction is first order in A and second order in B , and time is measured in minutes (min), what are the units for k ?

- A) mol/L·min
- B) L·min/mol
- C) L² /mol²·min
- D) min/mol²·L²
- E) mol²/L²·min

[Question 3]

Which of the following changes would result in the rate decreasing by a factor of 4?

- A) A reaction is first order with respect to reactant A, and $[A]$ is doubled.
- B) A reaction is second order with respect to reactant B, and $[B]$ is halved.
- C) A reaction is second order with respect to reactant C, and $[C]$ is tripled.

Question 4

Given the the following rate law, what are the partial orders with respect to HNO_2 and NO and the overall reaction order (in that sequence) for :

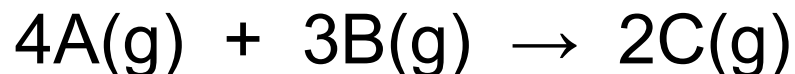
$$\text{Rate} = k[\text{HNO}_2]^4/[\text{NO}]^2 .$$

- A) 2, 0, 6
- B) 4, 2, 6
- C) 4, 2, 2
- D) 4, -2, 2
- E) 2, -2, 0

Question 5

What is the partial order with respect to A for the reaction having the experimental data below?

Concentrations are initial concentrations in mol/L and the rate given is initial rate in mol/L·min.



Exp.	[A] (mol/L)	[B] (mol/L)	Init. Rate (M/min)
1	0.100	0.100	5.00
2	0.300	0.100	45.0
3	0.100	0.200	10.0
4	0.300	0.200	90.0

A) 0

B) $\frac{1}{2}$

C) 1

D) 2

E) 3

[Question 6]

Which of the following sets of units corresponds to a rate constant for an overall reaction rate order of 1/2?

A) mol/L s

B) yr⁻¹

C) (mol/L)^{1/2} s⁻¹

D) (mol/L)^{-5/2} min⁻¹

[Question 7]

What is the order in reactant if a plot of the natural logarithm of [reactant] vs. time is linear?

- A) 0
- B) 1
- C) 2
- D) $1/2$
- E) -2

[Question 8]

A decomposition reaction has a rate constant of 0.0012 y^{-1} . How long does it take for [reactant] to reach 12.5% of its original value?

- A) $5.8 \times 10^2 \text{ yr}$
- B) 72.5 yr
- C) $1.32 \times 10^3 \text{ yr}$
- D) 193 yr
- E) $1.7 \times 10^3 \text{ yr}$

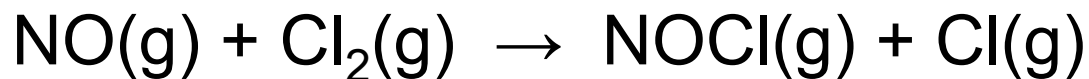
[Question 9]

The rate constant of a reaction is $4.7 \times 10^{-3} \text{ s}^{-1}$ at $25 \text{ }^\circ\text{C}$, and the activation energy is 33.6 kJ/mol . What is the value of k at $75 \text{ }^\circ\text{C}$?

- A) $3.3 \times 10^{-2} \text{ s}^{-1}$
- B) $9.17 \times 10^{-3} \text{ s}^{-1}$
- C) $2.99 \times 10^{44} \text{ s}^{-1}$
- D) $4.30 \times 10^7 \text{ s}^{-1}$
- E) $7.46 \times 10^{-50} \text{ s}^{-1}$

[Question 10]

Aqua regia, a mixture of hydrochloric and nitric acids, has been used since alchemical times as a solvent for many metals, including gold. Its orange color is due to the presence of nitrosyl chloride. Consider this one-step gaseous reaction for the formation of this compound:



If $\Delta H^\circ = 83 \text{ kJ/mol}$ and $E_{a(\text{fwd})}$ is 86 kJ/mol , calculate $E_{a(\text{rev})}$.

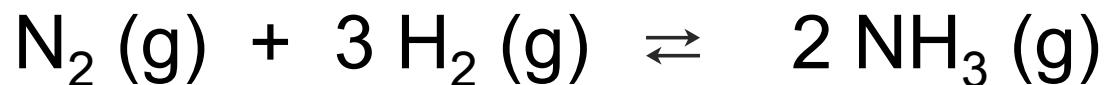
- A) 169 kJ
- B) -86 kJ
- C) 3 kJ
- D) 83 kJ
- E) -83 kJ

[Question 11]

The rate of disappearance of a reactant

- A) decreases with time.
- B) increases with time.
- C) stays the same throughout the reaction.

[Question 12]



The rate at which ammonia is formed is _____ that of the rate at which nitrogen is consumed.

- A) the same
- B) two times
- C) half
- D) three times

[Question 13]

The value of a rate

- A) is always negative.
- B) is always positive.
- C) can be either positive or negative.

[Question 14]

Based on the following rate law, which of the following statements is true: $\text{Rate} = k[\text{A}]^2[\text{B}]$

- A) The reaction is first order in A, second order in B, and third order overall.
- B) The reaction is second order in A, first order in B, and second order overall.
- C) The reaction is second order in A, first order in B, and third order overall.
- D) The reaction is first order in A, second order in B, and second order overall.

[Question 15]

Based on the following rate law: $\text{Rate} = k[\text{A}]^2[\text{B}]$, what will be the effect on the rate if the concentration of A is doubled and the concentration of B is tripled?

- A) The rate will increase by a factor of 18.
- B) The rate will increase by a factor of 12.
- C) The rate will increase by a factor of 6.
- D) The rate will increase by a factor of 4.

[Question 16]

For a first order reaction, the plot of $\ln [A]$ versus time can be characterized as

- A) a curve.
- B) a straight line with a negative slope.
- C) a straight line with a positive slope.

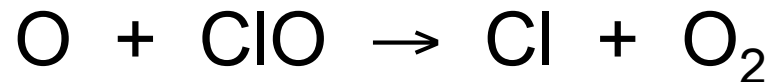
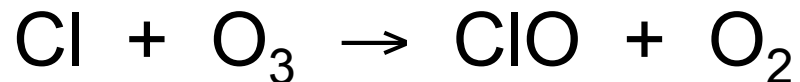
[Question 17]

After three half lives, what percentage of the initial reactant remains in a first-order decay?

- A) 6.25
- B) 12.5
- C) 25
- D) 50

[Question 18]

In the reaction mechanism below, ____ is the catalyst and ____ is the intermediate, respectively.



- A) ClO, Cl
- B) Cl, ClO
- C) O₂, Cl

[Question 19]

The rate constant for a reaction is $4.65 \text{ Lmol}^{-1}\text{s}^{-1}$.
What is the overall order of the reaction?

- A) zero
- B) first
- C) second
- D) third
- E) More information is needed to determine the overall order.

Question 20

At 298 K, if the activation energy of a reaction decreases by 10.0 kJ/mol, from 100.0 to 90.0 kJ/mol, what effect will this have on the rate of reaction?

- A) The rate will increase by a factor of >50 .
- B) The rate will decrease by a factor of >50 .
- C) The rate will increase by a factor of <50 .
- D) The rate will decrease by a factor of <50 .
- E) The rate will not change unless temperature changes.

[Answer Key – Chapter 14]

1. B

2. C

3. B

4. D

5. D

6. C

7. B

8. E

9. A

10. C

11. A

12. B

13. B

14. C

15. B

16. B

17. B

18. B

19. C

20. A