

Fill in the blanks

1. The expression relating reaction rate with concentration of reactants is called the _____ law.

Answer: rate

2. In the rate equation, k represents the rate _____.

Answer: constant

3. The sum of powers of concentration terms in a rate equation is called the _____ of reaction.

Answer: order

4. A reaction whose rate is independent of concentration is called a _____ order reaction.

Answer: zero

5. For the reaction $\text{Rate} = k[\text{A}]^2[\text{B}]$, the overall order is _____.

Answer: three

6. The rate law of a reaction is determined _____.

Answer: experimentally

7. Reactions occurring in a single step are called _____ reactions.

Answer: elementary

8. Reactions occurring through several steps are called _____ reactions.

Answer: complex

9. The unit of rate constant for a first order reaction is _____.

Answer: s^{-1}

10. The unit of rate constant for a second order reaction is _____.

Answer: $\text{L mol}^{-1} \text{s}^{-1}$

Short QAs

1. **What is a rate law?**

Rate law is the expression that relates the rate of a reaction to the concentration of reactants.

2. **What is meant by rate constant?**

Rate constant is the proportionality constant in the rate equation.

3. **What is the order of a reaction?**

The sum of powers of concentration terms in the rate equation is called the order of reaction.

4. **What is a zero order reaction?**

A zero order reaction is one whose rate is independent of reactant concentration.

5. **Why cannot rate law be predicted from a balanced chemical equation?**

Rate law cannot be predicted theoretically because it depends on the reaction mechanism and must be determined experimentally.

6. **What is an elementary reaction?**

An elementary reaction is a reaction that occurs in a single step.

7. **What is a complex reaction?**

A complex reaction occurs through a series of elementary steps.

8. **What is the unit of rate constant for a first order reaction?**

The unit of rate constant for a first order reaction is s^{-1} .

9. **What is the unit of rate constant for a second order reaction?**

The unit of rate constant for a second order reaction is $\text{L mol}^{-1} \text{s}^{-1}$.

10. What does the exponent of concentration terms indicate in a rate equation?

The exponent indicates how sensitive the reaction rate is to the concentration of reactants.

MCQs

1. Rate of reaction depends upon:

- A) Concentration
- B) Temperature
- C) Catalyst
- D) All of these

Answer: D) All of these

Explanation: Reaction rate is affected by concentration, temperature, pressure, and catalysts.

2. The expression relating reaction rate to concentration of reactants is called:

- A) Equilibrium law
- B) Rate law
- C) Gas law
- D) Hess law

Answer: B) Rate law

Explanation: Rate law expresses reaction rate in terms of reactant concentrations.

3. Rate law is also known as:

- A) Gas equation
- B) Ionic equation
- C) Rate equation
- D) Thermodynamic law

Answer: C) Rate equation

Explanation: Rate law and rate equation are the same.

4. In the equation $\text{Rate} = k[A]^x[B]^y$, k represents:

- A) Order
- B) Rate constant
- C) Temperature
- D) Pressure

Answer: B) Rate constant

Explanation: k is the proportionality constant called rate constant.

5. **The powers x and y in rate law are determined:**

- A) Theoretically
- B) Experimentally
- C) By balancing equation
- D) By molecular mass

Answer: B) Experimentally

Explanation: Exponents in rate law are found experimentally.

6. **In a rate law, powers of concentration terms may or may not be equal to:**

- A) Atomic masses
- B) Stoichiometric coefficients
- C) Atomic numbers
- D) Charges

Answer: B) Stoichiometric coefficients

Explanation: Rate law exponents are not always equal to balanced equation coefficients.

7. **For the reaction $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$, the rate law is:**

- A) $k[\text{NO}][\text{O}_2]$
- B) $k[\text{NO}]^2[\text{O}_2]$
- C) $k[\text{NO}][\text{O}_2]^2$
- D) $k[\text{NO}]^2[\text{O}_2]^2$

Answer: B) $k[\text{NO}]^2[\text{O}_2]$

Explanation: Experimentally, rate depends on square of NO concentration and first power of O₂ concentration.

8. **If concentration of NO is doubled in the reaction $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$, rate becomes:**

- A) Half
- B) Double
- C) Four times
- D) Eight times

Answer: C) Four times

Explanation: Rate depends on [NO]², so doubling NO increases rate by 2² = 4 times.

9. **If concentration of O₂ is doubled in the reaction $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$, rate becomes:**

- A) Half
- B) Double
- C) Four times
- D) Eight times

Answer: B) Double

Explanation: Rate depends on first power of O₂ concentration.

10. **The sum of powers of concentration terms is called:**

- A) Molecularity
- B) Order of reaction
- C) Activation energy
- D) Rate constant

Answer: B) Order of reaction

Explanation: Overall order equals the sum of exponents in the rate equation.

11. **For Rate = $k[\text{A}]^{1/2}[\text{B}]^{3/2}$, the overall order is:**

- A) 1

- B) 2
- C) 3
- D) 4

Answer: B) 2

Explanation: Adding exponents gives overall order.

12. **For Rate = $k[A]^{3/2}[B]^{-1}$, the order is:**

- A) 1
- B) 2
- C) 1/2
- D) 3/2

Answer: C) 1/2

Explanation: Order may also be fractional.

13. **A reaction whose rate is independent of concentration is called:**

- A) First order reaction
- B) Second order reaction
- C) Zero order reaction
- D) Third order reaction

Answer: C) Zero order reaction

Explanation: In zero order reactions, concentration has no effect on rate.

14. **The order of a reaction can be:**

- A) Zero
- B) Fractional
- C) Whole number
- D) All of these

Answer: D) All of these

Explanation: Reaction order may be zero, integer, or fractional.

15. **Reactions occurring in a single step are called:**

- A) Complex reactions
- B) Reversible reactions

C) Elementary reactions

D) Slow reactions

Answer: C) Elementary reactions

Explanation: Elementary reactions occur in one step only.

16. Reactions occurring through several elementary steps are called:

A) Elementary reactions

B) Complex reactions

C) Neutralization reactions

D) Redox reactions

Answer: B) Complex reactions

Explanation: Complex reactions proceed through multiple steps.

17. Oxidation of ethane to CO_2 and H_2O is an example of:

A) Elementary reaction

B) Complex reaction

C) Instantaneous reaction

D) Zero order reaction

Answer: B) Complex reaction

Explanation: It proceeds through intermediate compounds.

18. Nitration of phenol gives:

A) Only o-nitrophenol

B) Only p-nitrophenol

C) Both o-nitrophenol and p-nitrophenol

D) Only benzene

Answer: C) Both o-nitrophenol and p-nitrophenol

Explanation: Nitration of phenol gives ortho and para products as side reactions.

19. The unit of rate constant for a first order reaction is:

A) $\text{mol L}^{-1} \text{s}^{-1}$

B) s^{-1}

C) $\text{L mol}^{-1} \text{s}^{-1}$

D) $\text{mol}^2 \text{L}^{-2} \text{s}^{-1}$

Answer: B) s^{-1}

Explanation: First order rate constant has unit time^{-1} .

20. **The unit $\text{L mol}^{-1} \text{s}^{-1}$ corresponds to:**

A) Zero order reaction

B) First order reaction

C) Second order reaction

D) Third order reaction

Answer: C) Second order reaction

Explanation: Second order rate constant has units $\text{L mol}^{-1} \text{s}^{-1}$.