

MASTERMIND SCHOLARS EDUCATIONAL ALLIANCE
CHEMISTRY – RATE OF CHEMICAL REACTION
OBJECTIVES ASSIGNMENTS



INSTRUCTIONS

Please make sure to read every question carefully and select the best option as answer

Write the option letter followed by the sentence of that letter

Example

1. Which factor does **not** affect the rate of a chemical reaction?

- A. Temperature
- B. Surface area
- C. Medium
- D. Color of the reactants

Answer Presentation

1. Which factor does **not** affect the rate of a chemical reaction?

Answer : D (Colour of the reactants)

Choose the correct answer from the alternatives lettered A to D

1. Which of the following expresses the rate of disappearance of a reactant A in a reaction?

- A. $R = + \frac{d[A]}{dt}$
- B. $R = - \frac{d[A]}{dt}$
- C. $R = \frac{d[A][B]}{dt}$
- D. $R = - \frac{d[B]}{dt}$

2. For the reaction $2A + 3B \rightarrow 5C + 6D$, the rate of formation of product D is expressed as:

- A. $R = \frac{d[D]}{dt}$
- B. $R = \frac{1}{6} \frac{d[D]}{dt}$
- C. $R = \frac{1}{5} \frac{d[D]}{dt}$
- D. $R = -\frac{1}{6} \frac{d[D]}{dt}$

3. In a reaction with fractional coefficients $\frac{1}{2}A + \frac{1}{3}B \rightarrow \frac{1}{4}C + \frac{1}{5}D$, the rate of consumption of B is:

- A. $-3 \frac{d[B]}{dt}$
- B. $-\frac{1}{3} \frac{d[B]}{dt}$
- C. $\frac{d[B]}{dt}$
- D. $-5 \frac{d[B]}{dt}$

4. If the rate of disappearance of B in $3A + \frac{1}{2}B \rightarrow 2C$ is $0.015 \text{ mol dm}^{-3} \text{ s}^{-1}$, the rate of disappearance of A is:

- A. $0.03 \text{ mol dm}^{-3} \text{ s}^{-1}$
- B. $0.09 \text{ mol dm}^{-3} \text{ s}^{-1}$
- C. $0.01 \text{ mol dm}^{-3} \text{ s}^{-1}$
- D. $0.06 \text{ mol dm}^{-3} \text{ s}^{-1}$

5. Which factor does **not** affect the rate of a chemical reaction?

- A. Temperature
- B. Surface area
- C. Medium
- D. Color of the reactants

6. In the decomposition of hydrogen peroxide $2\text{H}_2\text{O}_{2(\text{aq})} \rightarrow 2\text{H}_2\text{O}_{(\text{l})} + \text{O}_{2(\text{g})}$, which is the correct catalyst?

- A. Platinum
- B. Manganese(IV) oxide
- C. Vanadium(V) oxide
- D. Concentrated H_2SO_4

7. The role of a positive catalyst in a reaction is to:

- A. Increase the activation energy
- B. Decrease the rate of reaction
- C. Provide an alternative pathway with lower activation energy
- D. Be consumed during the reaction

8. For the reaction $\frac{1}{2}N_2 + \frac{2}{3}H_2 \rightarrow NH_3$ if the rate of formation of NH_3 is $0.012 \text{ moldm}^{-3}\text{s}^{-1}$

- A. $0.018 \text{ moldm}^{-3}\text{s}^{-1}$
- B. $0.009 \text{ moldm}^{-3}\text{s}^{-1}$
- C. $0.008 \text{ moldm}^{-3}\text{s}^{-1}$
- D. $0.012 \text{ moldm}^{-3}\text{s}^{-1}$

9. According to collision theory, a reaction occurs when:

- A. Molecules collide with any energy
- B. Molecules collide with sufficient energy and proper orientation
- C. Molecules are in solid state
- D. Molecules have zero activation energy

10. Increasing the surface area of a solid reactant increases the reaction rate because:

- A. It increases the total volume of the reactant
- B. It allows more particles to collide effectively per unit time
- C. It reduces temperature
- D. It changes the reaction pathway

11. The reaction rate for $A + B \rightarrow C + D$ with all coefficients 1 is:

- A. $R = \frac{d[A]}{dt}$
- B. $R = -\frac{d[A]}{dt} = -\frac{d[B]}{dt} = \frac{d[C]}{dt} = \frac{d[D]}{dt}$
- C. $R = -\frac{d[C]}{dt}$
- D. $R = -\frac{d[D]}{dt}$

12. For $2N_2O_5 \rightarrow 4NO_2 + O_2$, the rate of formation of NO_2 is:

- A. $\frac{1}{2} \frac{d[NO_2]}{dt}$
- B. $\frac{1}{4} \frac{d[NO_2]}{dt}$
- C. $\frac{d[NO_2]}{dt}$
- D. $-\frac{1}{4} \frac{d[NO_2]}{dt}$

13. Which factor increases reaction rate by increasing kinetic energy of molecules?

- A. Catalyst
- B. Concentration
- C. Temperature
- D. Surface area

14. In the Haber process $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the industrial catalyst is:

- A. MnO_2
- B. Ni
- C. Iron (Fe)
- D. Pt/Rh

15. A negative catalyst (inhibitor) works by:

- A. Reducing activation energy
- B. Increasing activation energy
- C. Being consumed in reaction
- D. Increasing product yield

16. Which of the following shows the correct expression for the rate of reaction for $3A + \frac{1}{2}B \rightarrow 2C$?

- A. $R = -\frac{1}{3} \frac{d[A]}{dt} = -2 \frac{d[B]}{dt} = \frac{1}{2} \frac{d[C]}{dt}$
- B. $R = -3 \frac{d[A]}{dt} = -\frac{1}{2} \frac{d[B]}{dt} = 2 \frac{d[C]}{dt}$
- C. $R = -\frac{1}{2} \frac{d[A]}{dt} = -\frac{d[B]}{dt}$
- D. $R = \frac{d[A]}{dt} = \frac{d[B]}{dt} = \frac{d[C]}{dt}$

17. For $2KClO_{3(s)} \rightarrow 2KCl_{(s)} + 3O_{2(g)}$, MnO_2 acts to:

- A. Lower temperature required and provide alternative pathway
- B. Increase pressure
- C. Remove products
- D. Slow the reaction

18. The rate of a chemical reaction is defined as:

- A. Amount of reactant formed per unit time
- B. Amount of reactant consumed per unit time
- C. Amount of product formed per unit time
- D. Both B and C

19. In $\frac{1}{2}N_2 + \frac{2}{3}H_2 \rightarrow NH_3$, if $R_{NH_3} = 0.012$, rate of consumption of N_2 is:

- A. 0.024
- B. 0.006
- C. 0.012
- D. 0.018

20. Effective collisions occur when:

- A. Molecules collide at any speed
- B. Molecules have enough energy and proper orientation
- C. Molecules are stationary
- D. Only reactants are solids

21. Which of the following increases the frequency of collisions without changing temperature?

- A. Concentration of reactants
- B. Using a negative catalyst
- C. Decreasing pressure
- D. Lowering surface area

22. The effect of temperature on reaction rate is explained by:

- A. Collision theory
- B. Le Chatelier's principle
- C. Stoichiometry
- D. Catalysis

23. The reaction $C_2H_4(g) + H_2(g) \rightarrow C_2H_6(g)$ uses which catalyst?

- A. Vanadium(V) oxide
- B. Nickel or Platinum
- C. Manganese dioxide
- D. Sulfuric acid

24. Which statement about catalysts is correct?

- A. They are consumed
- B. They provide alternative pathway
- C. They increase activation energy
- D. They decrease reaction rate

25. Which is an example of an organic reaction catalyzed by H_2SO_4 ?

- A. Hydrogenation of ethene
- B. Esterification
- C. Decomposition of H_2O_2
- D. Decomposition of KClO_3

26. In $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$, industrial catalyst is:

- A. Pt/Rh
- B. Fe
- C. MnO_2
- D. V_2O_5

27. Which factor affects the number of effective collisions but not the energy per molecule?

- A. Temperature
- B. Concentration
- C. Negative catalyst
- D. Both B and C

28. For $2\text{H}_2\text{O}_{2(\text{aq})} \rightarrow 2\text{H}_2\text{O}_{(\text{l})} + \text{O}_{2(\text{g})}$, which molecule's concentration decreases?

- A. H_2O
- B. O_2
- C. H_2O_2
- D. All of the above

29. In reaction rate expression $R = -\frac{1}{2} \frac{d[A]}{dt}$, the factor $\frac{1}{2}$ comes from:

- A. Stoichiometric coefficient of A
- B. Temperature
- C. Catalyst
- D. Surface area

30. Which reaction is slowed down by glycerol?

- A. Hydrogenation of ethene
- B. Decomposition of H_2O_2
- C. Contact process
- D. Haber process

31. Increasing concentration increases reaction rate because:

- A. Molecules have more collisions
- B. Activation energy increases
- C. Molecules move slower
- D. Temperature decreases

32. Which of the following is true for all balanced reactions?

- A. Rate of change of reactants = Rate of change of products
- B. Rate of reactants > Rate of products
- C. Rate of products > Rate of reactants
- D. Rate of reaction is independent of stoichiometry

33. Which is a feature of a positive catalyst?

- A. Increases energy barrier
- B. Increases reaction rate
- C. Consumed in reaction
- D. Decreases product formation

34. If rate of A = 0.09 and reaction is $3A + \frac{1}{2}B \rightarrow 2C$, rate of C is:

- A. 0.03
- B. 0.06
- C. 0.09
- D. 0.12

35. The orientation factor in collision theory ensures:

- A. Molecules collide head-on for reaction
- B. Molecules collide at any angle
- C. Molecules do not collide
- D. Molecules collide only with catalyst

36. The effect of medium on reaction rate is due to:

- A. Solubility and polarity
- B. Activation energy
- C. Temperature only
- D. Stoichiometry

37. In $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{SO}_{3(g)}$, V_2O_5 acts to:

- A. Decrease concentration of O_2
- B. Provide alternative path with lower activation energy
- C. Increase temperature
- D. Slow the reaction

38. Rate of reaction is zero-order with respect to a reactant if:

- A. Doubling concentration doubles rate
- B. Rate independent of concentration
- C. Rate decreases with temperature
- D. Rate decreases with surface area

39. Which reaction involves a reversible process catalyzed by H_2SO_4 ?

- A. Hydrogenation of ethene
- B. Esterification
- C. Decomposition of KClO_3
- D. Decomposition of H_2O_2

40. Rate of reaction with unitary coefficients is:

- A. Different for each substance
- B. Same for all substances when properly scaled
- C. Always negative
- D. Always positive

41. Increasing particle size of solid reactant:

- A. Increases reaction rate
- B. Decreases reaction rate
- C. Has no effect
- D. Acts as catalyst

42. In $3\text{A} + \frac{1}{2}\text{B} \rightarrow 2\text{C}$, if $R_B = 0.02$, $R_A = ?$

- A. 0.03
- B. 0.04
- C. 0.06
- D. 0.01

43. Reaction rate depends on:

- A. Activation energy
- B. Frequency of effective collisions
- C. Orientation of molecules
- D. All of the above

44. Decomposition of KClO_3 is catalyzed to:

- A. Increase pressure
- B. Increase oxygen evolution rate
- C. Produce K_2O
- D. Slow reaction

45. Which of the following is true for all catalysts?

- A. They are consumed
- B. Provide lower activation energy pathway
- C. Increase reactant concentration
- D. Reduce temperature

46. The reaction $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$ occurs faster with:

- A. Pt/Rh
- B. Fe
- C. MnO_2
- D. Ni

47. For $\frac{1}{2}A + \frac{1}{3}B \rightarrow \frac{1}{4}C + \frac{1}{5}D$, the rate of C formation:

- A. $4 \frac{d[C]}{dt}$
- B. $\frac{1}{2} \frac{d[C]}{dt}$
- C. $5 \frac{d[C]}{dt}$
- D. $-4 \frac{d[C]}{dt}$

48. Which of the following is an example of a negative catalyst?

- A. MnO_2
- B. Glycerol in H_2O_2 decomposition
- C. Fe in Haber process
- D. Ni in hydrogenation

49. Effective collisions per second increase when:

- A. Temperature increases
- B. Concentration increases
- C. Surface area increases
- D. All of the above

50. The rate of disappearance of reactant A equals the rate of appearance of product B when:

- A. Coefficients are 1 and properly scaled
- B. Only at equilibrium
- C. Only with catalyst
- D. Only at high temperature