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# Chemistry Grade 11 — Chapter 7

Chemical Kinetics

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*Independent practice MCQs from the supplied Class 11 Chemistry notes pack. Total: 50 questions.*

## A. Important / Main Topics

**1. The rate of a chemical reaction is defined as the change in:**

(A) Concentration of reactant or product per unit time
(B) Mass of reactant per unit time
(C) Temperature per unit time
(D) Volume of gas per unit time

**Correct Answer: A**

*Explanation: The rate of reaction is the change in concentration of reactants or products per unit time.*

**2. The unit of reaction rate is:**

(A) mol dm□³
(B) mol dm□³ s□¹
(C) mol s□¹
(D) dm³ s□¹

**Correct Answer: B**

*Explanation: The unit of concentration is mol dm□³ and time is second, so unit of reaction rate is mol dm□³ s□¹.*

**3. The rate of a reaction is generally:**

(A) Constant throughout the reaction
(B) Lowest at the beginning and increases with time
(C) Highest at the beginning and decreases with time
(D) Independent of concentration

**Correct Answer: C**

*Explanation: The rate measured from a time interval is highest at the beginning and decreases continuously as reactants are consumed.*

**4. The rate law for a reaction is determined:**

(A) From the balanced chemical equation
(B) From the stoichiometric coefficients
(C) From the molar masses
(D) Experimentally

**Correct Answer: D**

*Explanation: The effect of a change in reactant concentration on reaction rates cannot be derived from a chemical.*

**5. For the reaction A → Products, if doubling [A] doubles the rate, the order with respect to A is:**

(A) First
(B) Zero
(C) Second
(D) Third

**Correct Answer: A**

*Explanation: If doubling [A] doubles the rate, the rate is directly proportional to the first power of concentration of A.*

**6. The half-life of a first-order reaction is:**

(A) frac1k[A□]
(B) frac0.693k
(C) frac[A□]2k
(D) frac2k[A□]

**Correct Answer: B**

*Explanation: For a first-order reaction, the half-life is given by t□/□ = frac0.693k.*

**7. The minimum energy required for a reaction to occur is called:**

(A) Enthalpy
(B) Entropy
(C) Activation energy
(D) Free energy

**Correct Answer: C**

*Explanation: The minimum amount of energy, in addition to the average kinetic energy, which the particles must possess for effective collisions, is called activation energy.*

**8. A catalyst increases the rate of a reaction by:**

(A) Increasing the activation energy
(B) Increasing the enthalpy change
(C) Decreasing the temperature
(D) Decreasing the activation energy

**Correct Answer: D**

*Explanation: A catalyst provides a new mechanism for the reaction with low energy of activation, thus increasing the rate of reaction.*

**9. In a reaction mechanism, the slowest step is called the:**

(A) Rate-determining step
(B) Intermediate step
(C) Fast step
(D) Elementary step

**Correct Answer: A**

*Explanation: The slowest step in the reaction mechanism, which determines the overall rate of the reaction, is called the rate-determining step.*

**10. According to the Arrhenius equation, as temperature increases, the rate constant:**

(A) Decreases
(B) Increases
(C) Remains constant
(D) Becomes zero

**Correct Answer: B**

*Explanation: Rate constant k varies with temperature. It increases with temperature which in turn increases rate of reaction.*

**11. The rate constant k is defined as the rate when:**

(A) The temperature is 0^circC
(B) The reaction just starts
(C) The molar concentration of each reactant is unity
(D) The reaction reaches equilibrium

**Correct Answer: C**

*Explanation: The rate constant can be defined as the rate of reaction when the molar concentration of each reactant is unity.*

**12. For a zero-order reaction, the rate is:**

(A) Directly proportional to reactant concentration
(B) Inversely proportional to reactant concentration
(C) Proportional to the square of reactant concentration
(D) Independent of reactant concentration

**Correct Answer: D**

*Explanation: For a zero-order reaction, the rate is proportional to $[A]^0$, which is independent of concentration.*

**13. Which of the following reactions is an example of a pseudo-first-order reaction?**

(A) Hydrolysis of an alkyl halide in excess water
(B) Decomposition of N□O□
(C) Oxidation of NO by O□
(D) Decomposition of NH□NO□

**Correct Answer: A**

*Explanation: A bimolecular reaction for which solvent is in excess and its concentration remains constant is called a pseudo-first-order reaction.*

**14. The activated complex is also known as the:**

(A) Reaction intermediate
(B) Transition state
(C) Catalyst
(D) Product

**Correct Answer: B**

*Explanation: The activated complex is also called the transition state.*

**15. In the Arrhenius equation, k = Ae□E_a/RT, the term A is related to the:**

(A) Activation energy
(B) Enthalpy change
(C) Frequency of collision and orientation
(D) Entropy change

**Correct Answer: C**

*Explanation: The Arrhenius constant A is related to the frequency of collision and orientation of the reacting molecules.*

**16. If the half-life of a first-order reaction is 30 seconds, the rate constant is:**

(A) 0.693 s□¹
(B) 0.346 s□¹
(C) 0.0115 s□¹
(D) 0.0231 s□¹

**Correct Answer: D**

*Explanation: t□/□ = frac0.693k, so k = frac0.69330 = 0.0231 s□¹.*

**17. The rate law for the reaction 2NO□ + F□ → 2NO□F is Rate = k[NO□][F□]. The overall order of the reaction is:**

(A) 2
(B) 1
(C) 3
(D) 0

**Correct Answer: A**

*Explanation: The sum of exponents is 1 + 1 = 2, so the overall order is 2.*

**18. Which of the following is an example of a second-order reaction?**

(A) Decomposition of N□O□
(B) Decomposition of NO□
(C) Decomposition of NH□NO□
(D) Hydrolysis of an alkyl halide

**Correct Answer: B**

*Explanation: Decomposition of NO□ — this correctly answers the question.*

**19. Which of the following is an example of a third-order reaction?**

(A) 2NO□ → 2NO + O□
(B) H□ + Br□ → 2HBr
(C) 2NO + O□ → 2NO□

(D) $N_2O_4 \rightarrow 2NO_2$

**Correct Answer: C**

*Explanation: The oxidation of NO by $O_2$ is a third-order reaction with rate law Rate = $k[NO]^2[O_2]$.*

**20. The reaction between $H_2$ and $Br_2$ to produce HBr has a rate law of Rate = $k[H_2][Br_2]^{1/2}$. The overall order of the reaction is:**

(A) 1
(B) 2
(C) 2.5
(D) 1.5

**Correct Answer: D**

*Explanation: The overall order is 1 + 0.5 = 1.5, a fractional order reaction.*

**21. According to the collision theory, which of the following is necessary for an effective collision?**

(A) Sufficient energy and correct orientation
(B) High activation energy and random orientation
(C) Low kinetic energy and correct orientation
(D) High temperature and high pressure

**Correct Answer: A**

*Explanation: For the collision to be effective, the molecules must have activation energy and must be correctly oriented.*

**22. What is the effect of a catalyst on the equilibrium constant (K_c) of a reaction?**

(A) It increases K_c
(B) It has no effect on K_c
(C) It decreases K_c
(D) It changes K_c depending on the reaction

**Correct Answer: B**

*Explanation: It has no effect on K_c — this correctly answers the question.*

**23. For a reaction with Δ G^circ < 0:**

(A) The reaction is non-spontaneous
(B) The reaction is at equilibrium
(C) The reaction is spontaneous
(D) The reaction is impossible

**Correct Answer: C**

*Explanation: If Δ G^circ is negative, the process is spontaneous in the forward direction.*

**24. Which of the following statements about a catalyst is correct?**

(A) It increases the activation energy
(B) It changes the enthalpy of the reaction
(C) It is consumed during the reaction
(D) It provides a new mechanism with lower activation energy

**Correct Answer: D**

*Explanation: A catalyst provides a new mechanism for the reaction with low energy of activation.*

**25. The number of molecules with kinetic energy at least equal to E_a at temperature T is proportional to the:**

(A) Shaded area under the Maxwell-Boltzmann curve to the right of E_a
(B) Area under the entire Maxwell-Boltzmann curve
(C) Peak of the Maxwell-Boltzmann curve
(D) Width of the Maxwell-Boltzmann curve

**Correct Answer: A**

*Explanation: The number of molecules with kinetic energy at least equal to E_a at temperature T is proportional to the shaded area under the Maxwell-Boltzmann kinetic energy curve.*

## B. Less Important / Secondary Topics

**26. The reaction rate increases two to three times for every:**

(A) 10 K increase in temperature
(B) 1 K increase in temperature
(C) 100 K increase in temperature
(D) 1°C increase in temperature

**Correct Answer: A**

*Explanation: It was found that, in general, the reaction rate increases two to three times for every 10 K increase in temperature.*

**27. In a potential energy diagram, the peak represents the:**

(A) Reactants
(B) Activated complex
(C) Products
(D) Intermediate

**Correct Answer: B**

*Explanation: In a potential energy diagram, the peak represents the Activated complex.*

**28. A catalyst that is in the same phase as the reactants is called a:**

(A) Heterogeneous catalyst
(B) Enzyme
(C) Homogeneous catalyst
(D) Promoter

**Correct Answer: C**

*Explanation: In homogeneous catalysis, the catalyst and the reactant are in the same phase.*

**29. For a reaction with Δ H = +50 kJ/mol and Δ S = +0.100 kJ/K, the reaction is spontaneous at:**

(A) All temperatures
(B) No temperatures
(C) Temperatures below 500 K
(D) Temperatures above 500 K

**Correct Answer: D**

*Explanation: For spontaneity, Δ G = Δ H - TΔ S < 0, so T > Δ H/Δ S = 50/0.100 = 500 K.*

**30. The rate of an enzyme-catalyzed reaction is independent of:**

(A) Product concentration
(B) Substrate concentration
(C) Enzyme concentration
(D) Temperature

**Correct Answer: A**

*Explanation: The rate of an enzyme-catalyzed reaction is generally independent of product concentration.*

**31. The reaction 2N□O → 2N□ + O□ has the rate law Rate = k[N□O]. The reaction occurs in two steps. If the first step is the slow step, the mechanism is:**

(A) 2N□O → 2N□ + O□ (one step)
(B) N□O → N□ + O (slow); N□O + O → N□ + O□ (fast)
(C) N□O + N□O → 2N□ + O□ (slow)
(D) N□O → N□ + O□ (slow); O□ → O + O (fast)

**Correct Answer: B**

*Explanation: The rate law indicates that one N□O molecule is involved in the rate-determining step, which is consistent with the first step being slow.*

**32. According to the Arrhenius equation, a plot of ln k versus 1/T gives a straight line with slope equal to:**

(A) E_a/R

(B) E_a
(C) -E_a/R
(D) -E_a

**Correct Answer: C**

*Explanation: According to the Arrhenius equation, a plot of ln k versus 1/T gives a straight line with slope equal to -E_a/R.*

**33. Which of the following is NOT a factor that affects the rate of a chemical reaction?**

(A) Concentration of reactants
(B) Temperature
(C) Presence of a catalyst
(D) Initial volume of the container

**Correct Answer: D**

*Explanation: The initial volume of the container is not a direct factor affecting the rate of a chemical reaction.*

**34. The rate law for the reaction $2H_2 + 2NO \rightarrow N_2 + 2H_2O$ is Rate = $k[H_2][NO]^2$. What is the overall order of the reaction?**

(A) 3
(B) 1
(C) 2
(D) 4

**Correct Answer: A**

*Explanation: 3 — this correctly answers the question.*

**35. Given that Δ H^circ = +117 kJ/mol and Δ S^circ = +0.175 kJ/(K mol) for the decomposition of $MgCO_3$, the temperature above which the reaction becomes feasible is:**

(A) 500 K
(B) 669 K
(C) 720 K
(D) 800 K

**Correct Answer: B**

*Explanation: $\Delta G = \Delta H - T\Delta S = 0$, so $T = \Delta H/\Delta S = 117/0.175 = 668.57\ K \approx 669\ K$.*

**36. For a reaction A + B → AB, the rate is doubled when the concentration of A is doubled, but the rate remains unchanged when the concentration of B is doubled. The rate law is:**

(A) Rate = k[A][B]
(B) Rate = $k[A]^2$
(C) Rate = k[A]
(D) Rate = k[B]

**Correct Answer: C**

*Explanation: The rate is directly proportional to [A] and independent of [B], so the rate law is Rate = k[A].*

**37. The unit of the rate constant for a second-order reaction is:**

(A) $s^{-1}$
(B) mol $dm^{-3}$ $s^{-1}$
(C) $mol^{-2}$ $dm^6$ $s^{-1}$
(D) $mol^{-1}$ $dm^3$ $s^{-1}$

**Correct Answer: D**

*Explanation: For a second-order reaction, Rate = $k[A]^2$, so k = Rate/$[A]^2$ = (mol $dm^{-3}$ $s^{-1}$)/(mol $dm^{-3}$)$^2$ = $mol^{-1}$ $dm^3$ $s^{-1}$.*

**38. The half-life of a second-order reaction is:**

(A) Inversely proportional to initial concentration
(B) Independent of initial concentration
(C) Directly proportional to initial concentration

(D) Directly proportional to the rate constant

**Correct Answer: A**

*Explanation: For a second-order reaction, t□/□ = frac1k[A□]. Therefore, half-life is inversely proportional to initial concentration.*

**39. In a potential energy diagram, the highest peak corresponds to the:**

(A) Reactants
(B) Rate-determining step
(C) Products
(D) Intermediate

**Correct Answer: B**

*Explanation: The highest peak in a potential energy diagram corresponds to the rate-determining step (the slowest step with the highest activation energy).*

**40. For the reaction H□ + I□ → 2HI, the rate law is Rate = k[H□][I□]. If the reaction occurs in a single step, what would be the predicted rate law?**

(A) Rate = k[H□]²
(B) Rate = k[I□]²
(C) Rate = k[H□][I□]
(D) Rate = k[H□]²[I□]

**Correct Answer: C**

*Explanation: If the reaction occurs in a single step, the rate law is determined by the stoichiometry of the reactants. The predicted rate law would be Rate = k[H□][I□].*

**41. Which of the following statements about the Arrhenius equation is correct?**

(A) The rate constant decreases with increasing temperature
(B) The activation energy increases with temperature
(C) The Arrhenius constant A decreases with temperature
(D) The rate constant increases with increasing temperature

**Correct Answer: D**

*Explanation: The rate constant increases with increasing temperature — this correctly answers the question.*

**42. In a first-order reaction, the time required for the concentration to decrease from 1.0 M to 0.25 M is:**

(A) Two half-lives
(B) One half-life
(C) Three half-lives
(D) Four half-lives

**Correct Answer: A**

*Explanation: From 1.0 M to 0.5 M is one half-life, and from 0.5 M to 0.25 M is another half-life. Total = two half-lives.*

**43. Which of the following is a correct statement about a heterogeneous catalyst?**

(A) It is in the same phase as the reactants
(B) It is in a different phase from the reactants
(C) It is always a gas
(D) It is consumed in the reaction

**Correct Answer: B**

*Explanation: In heterogeneous catalysis, the catalyst and reactants are in different phases.*

**44. The reaction 2NO + 2H□ → N□ + 2H□O has the mechanism: 2NO + H□ → N□ + H□O□ (slow) H□O□ + H□ → 2H□O (fast) The experimental rate law for this reaction is:**

(A) Rate = k[NO][H□]
(B) Rate = k[N□][H□O]
(C) Rate = k[NO]²[H□]
(D) Rate = k[H□]²

**Correct Answer: C**

*Explanation: The slow step involves 2 NO and 1 H□, so the rate law is Rate = k[NO]²[H□].*

**45. For the reaction 2NO□(g) + F□(g) → 2NO□F(g), the rate law is Rate = k[NO□][F□]. Which of the following mechanisms is consistent with this rate law?**

(A) 2NO□ + F□ → 2NO□F (one step)
(B) NO□ + F□ → NO□F + F (fast); NO□ + F → NO□F (slow)
(C) F□ → 2F (slow); 2NO□ + 2F → 2NO□F (fast)
(D) NO□ + F□ → NO□F + F (slow); NO□ + F → NO□F (fast)

**Correct Answer: D**

*Explanation: The rate law indicates that one NO□ and one F□ are involved in the rate-determining step, which is consistent with mechanism C.*

**46. The reaction 2H□ + 2NO → N□ + 2H□O has a rate law of Rate = k[H□][NO]². Which of the following statements is correct?**

(A) The reaction is third order overall
(B) The reaction is first order overall
(C) The reaction is second order overall
(D) The reaction is zero order overall

**Correct Answer: A**

*Explanation: The reaction is third order overall — this correctly answers the question.*

**47. Which of the following is true for a reaction with Δ G^circ = 0?**

(A) The reaction is spontaneous
(B) The reaction is at equilibrium
(C) The reaction is non-spontaneous
(D) The reaction is impossible

**Correct Answer: B**

*Explanation: If Δ G^circ = 0, the system is in equilibrium.*

**48. The Arrhenius equation can be used to determine:**

(A) The equilibrium constant
(B) The enthalpy change
(C) The activation energy
(D) The entropy change

**Correct Answer: C**

*Explanation: The Arrhenius equation can be used to determine The activation energy.*

**49. For a first-order reaction, the rate constant is 0.0231 s□¹. The half-life of the reaction is:**

(A) 10 s
(B) 20 s
(C) 40 s
(D) 30 s

**Correct Answer: D**

*Explanation: For a first-order reaction, the rate constant is 0.0231 s□¹. The half-life of the reaction is 30 s.*

**50. Which of the following statements about the effect of a catalyst on a reversible reaction is correct?**

(A) It increases the rate of both forward and reverse reactions equally
(B) It increases the rate of the forward reaction only
(C) It increases the rate of the reverse reaction only
(D) It changes the equilibrium constant

**Correct Answer: A**

*Explanation: It increases the rate of both forward and reverse reactions equally — this correctly answers the question.*