SmartKalike

CBSE Class 12 · Chemistry

Chemical Kinetics

10 most probable questions for Boards 2027

Q1. 1 mark · Multiple choice

Which of the following lists contains factors that can affect the rate of a chemical reaction?
(A) Temperature, reactant concentration and catalyst
(B) Product colour, container shape and pressure only
(C) Atomic number, isotope abundance and solvent mass
(D) Volume of the container, product density and reaction name

Answer

(A) Temperature, reactant concentration and catalyst — reaction rate depends on concentration, temperature and catalyst.

Q2. 2 marks · Short answer

Define the rate of a chemical reaction. Distinguish between its average rate and instantaneous rate.

Answer

1. Meaning — The rate of a chemical reaction is the change in concentration of a reactant or product per unit time; average rate applies over an interval, whereas instantaneous rate applies at a particular instant.
2. Measurement — Average rate uses concentration change divided by the elapsed time; instantaneous rate is the rate at a specified time, determined from the slope of the tangent to the concentration–time curve.

Q3. 3 marks · Medium answer

For the reaction aA + bB → cC + dD, write the expression for the reaction rate in terms of the rates of change of the concentrations of A, B, C and D.

Answer

1. For the reaction aA + bB → cC + dD, the reaction rate is expressed as $r = -(1/a)\Delta[A]/\Delta t = -(1/b)\Delta[B]/\Delta t = (1/c)\Delta[C]/\Delta t = (1/d)\Delta[D]/\Delta t$.
2. Here, Δ[A], Δ[B], Δ[C] and Δ[D] denote changes in concentration over the same time interval, Δt. The negative signs indicate decreasing reactant concentrations, while the positive signs indicate increasing product concentrations; each expression gives the same reaction rate.

Q4. 5 marks · Long answer

The first-order rate constant for the decomposition of ethyl iodide is 1.60×10^{-5} s^{-1} at 600 K. Its activation energy is 209 kJ mol^{-1}. Calculate the rate constant at 700 K using the Arrhenius equation. Use R = 8.314 J K^{-1} mol^{-1}.

Answer

$\log(k_2/k_1) = E_a(T_2 - T_1)/(2.303R\ T_1T_2)$
$\log(k_2/(1.60 \times 10^{-5})) = (209000 \times (700 - 600))/(2.303 \times 8.314 \times 600 \times 700)$
$= 1.033$
$k_2/(1.60 \times 10^{-5}) = 10\text{^}1.033$
$k_2 = 1.60 \times 10^{-5} \times 10\text{^}1.033$
$\therefore k_2 = 1.73 \times 10^{-4}\ s^{-1}$

Q5. 7 marks · Very long answer

For the reaction 2A + B → 3C, write the relationship between the rates of change of the concentrations of A, B and C and the reaction rate. Explain how average and instantaneous reaction rates are represented using concentration–time data, and distinguish between the two rates.

Answer

1. Stoichiometric relationship — For 2A + B → 3C, the reaction rate is r = −(1/2)Δ[A]/Δt = −Δ[B]/Δt = (1/3)Δ[C]/Δt. The negative signs denote decreases in reactant concentrations, while the positive sign denotes an increase in product concentration.
2. Concentration–time basis — Average rate is calculated from the concentration change over a time interval: r_{av} = −(1/2)Δ[A]/Δt = −Δ[B]/Δt = (1/3)Δ[C]/Δt. The concentration changes are obtained from the concentrations at the beginning and end of that interval.
3. Time basis — Instantaneous rate is the rate at a particular instant, rather than over an interval. It is obtained from the slope of the tangent to the concentration–time curve at the specified time.
4. Comparison — Average rate depends on the time interval chosen, whereas instantaneous rate refers to one particular time. Reactant concentrations decrease and product concentration increases; the stoichiometric relationship expresses the same reaction rate in terms of each species.

Q6. 1 mark · Very short answer

What are the units of reaction rate when concentration is expressed in mol L^{-1} and time in seconds?

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/chemical-kinetics

Q7. 2 marks · Short answer

For the rate expression Rate = $k[A]^{1}\square^{2}[B]^{3}\square^{2}$, determine the overall order of the reaction. Also distinguish between an elementary reaction and a complex reaction.

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/chemical-kinetics

Q8. 3 marks · Medium answer

State the units of the rate constant for zero-, first- and second-order reactions. Define molecularity and explain how it differs from reaction order with respect to whether it can be fractional or zero.

Full answer on SmartKalike: https://smartkalike.com/cbse/class-12/chemistry/chemical-kinetics

Q9. 5 marks · Long answer

Define a rate law and write the general rate expression for aA + bB → cC + dD. Explain why the exponents in the rate law need not match the stoichiometric coefficients, and why the rate law must be determined experimentally rather than inferred from the balanced equation.

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Q10. 7 marks · Very long answer

For a bimolecular reaction at 300 K, the collision frequency is 4.0×10^{8} s^{-1}, the activation energy is 20.0 kJ mol^{-1}, and the steric factor is 0.10. Using Rate = $ZABe^{-Ea/RT}P$, calculate the rate. Explain why not all collisions produce products, and state what the steric factor accounts for.

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