Reaction Rates

1. For the reaction $BrO_3^- + 5Br^- + 6H^+ \rightarrow 3Br_2 + 3H_2O$, the value of $\frac{-\Delta[BrO_3^-]}{\Delta t} = 1.5 \times 10^{-2}$ mol/(L·s) at a particular time. What is the value of $\frac{-\Delta[Br^-]}{\Delta t}$ at the same instant?

2. The reaction, A + 2B ⟶ Products, was found to have the rate law, Rate = $k[A][B]^2$. While holding the concentration of A constant, the concentration of B was increased from x to $3x$. Predict by what factor the rate of the reaction will increase.

3. For the hypothetical reaction A + B → Products, the following initial rates of reaction have been measured for the given reactant concentrations.

Test	[A] (*M*)	[B] (*M*)	Rate (mol/(L·hr))
1	0.010	0.020	0.020
2	0.015	0.020	0.030
3	0.010	0.010	0.005

What is the rate law expression for this reaction?

4. For the chemical reaction $H_2O_2 + 2H^+ + 2I^- \rightarrow I_2 + 2H_2O$, the rate law expression is Rate = $k[H_2O_2][I^-]$. The following mechanism has been suggested.

$H_2O_2 + I^- \rightarrow HOI + OH^-$

$OH^- + H+ \rightarrow H_2O$

$HOI + H^+ + I^- \rightarrow I_2 + H_2O$

Identify all intermediates included in this reaction.

5. Consider the following rate data for the reaction below at a particular temperature.

2A + 3B ⟶ Products

Experiment	Initial [A] (*M*)	Initial [B] (*M*)	Initial Rate of Loss of A (mol/(L·s))
1	0.10	0.30	1.00×10^{-5}
2	0.10	0.60	2.00×10^{-5}
3	0.20	0.90	1.20×10^{-4}

What is the rate equation for this reaction?

6. Consider a chemical reaction involving compounds A and B that is found to be first order in A and second order in B. What will the reaction rate be for experiment 2?

Experiment	Rate (mol/(L·s))	Initial [A] (*M*)	Initial [B] (*M*)
1	0.10	1.0	0.2
2	?	2.0	0.6

7. The data below were determined for the following reaction.

$S_2O_8^{2-} + 3I^- \rightarrow 2SO_4^{2-} + I_3$

Experiment	$[S_2O_8^{2-}]$ (*M*)	I^- (*M*)	Initial Rate (mol/(L·s))
1	0.10	0.40	1.4×10^{-5}
2	0.20	0.40	2.8×10^{-5}
3	0.20	0.20	1.4×10^{-5}

What is the rate equation for this reaction?

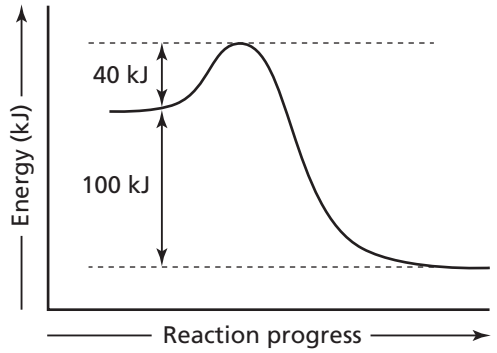
8. For the reaction A + B ⟶ C, the rate relationship is found to be Rate = k[A][B]^2. What is the overall reaction order for this reaction?

9. For the rate law expression Rate = k[A][B]^2, what happens to the rate if the concentration of B is increased by a factor of 2?

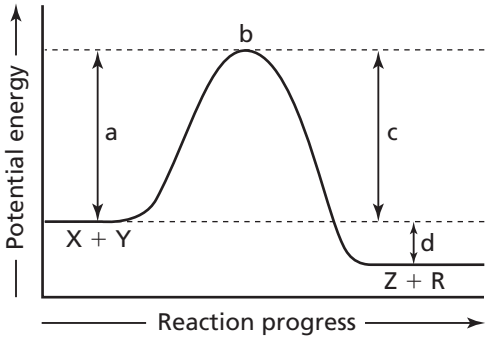
10. Calculate the specific rate constant for the reaction A + B ⟶ C, when the rate expression is Rate = k[A]^2[B].

Experiment	Initial [A] (*M*)	Initial [B] (*M*)	Initial Rate of Formation of C (mol/(L·s))
1	0.10	0.10	2.0×10^{-4}
2	0.20	0.10	8.0×10^{-4}
3	0.20	0.20	1.6×10^{-3}

11. The following figure shows the energy diagram of some reactants changing into products. Explain what the numbers in the diagram represent.



12. The following figure shows the potential energy diagram for a reaction. Explain what this diagram tells you about the reaction.



13. Explain how the following mechanism can be used to determine the rate expression for a chemical reaction A + 2B ⟶ AB_2.

Step 1	B + B ⟶ B_2	slow
Step 2	B_2 + A ⟶ AB + B	fast
Step 3	B + AB ⟶ AB_2	fast

14. What is the rate law expression for the following mechanism?

Step 1	AB + C_2 ⟶ AC_2 + B	slow
Step 2	B + AB ⟶ AB_2	fast
Step 3	AC_2 + AB_2 ⟶ A_2C_2 + B_2	fast
Step 4	A_2C_2 + B_2 ⟶ A_2C + B_2C	fast