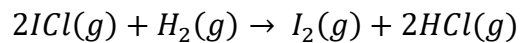


Name: _____

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- 1) **(15 pts)** The following kinetic data were obtained for the reaction:



Experiment	Initial Concentration (mmol L ⁻¹)		
	[ICl] ₀	[H ₂] ₀	Initial Rate (mol L ⁻¹ s ⁻¹)
1	1.5	1.5	3.7x10 ⁻⁷
2	3.0	1.5	7.4x10 ⁻⁷
3	3.0	4.5	2.2x10 ⁻⁶
4	4.7	2.7	??

- (a) Write the rate law for the reaction (5 pts)

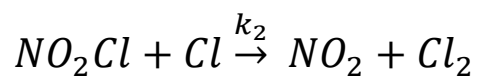
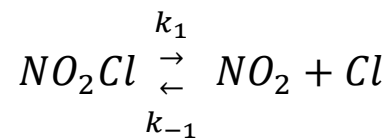
- (b) From the data, determine the value of the rate constant (5 pts)

- (c) Predict the reaction rate for Experiment 4 (5 pts)

Name: _____

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2) **(20 pts)** The mechanism for the decomposition for NO_2Cl is:



Write out the differential rate law under the following conditions (make sure to eliminate intermediates from your answer):

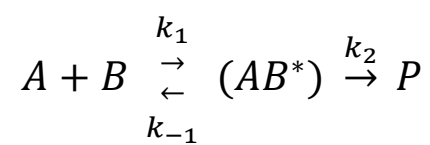
a) high concentration of NO_2 (10 pts)

b) low concentration of NO_2 (10 pts)

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3) **(15 pts)** A common scheme used to describe reactions in liquids is:

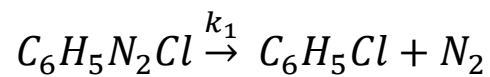


Write the expression for the rate law in the activation-controlled limit.

Name: _____

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- 4) **(15 pts)** The decomposition of benzene diazonium chloride

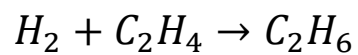


follows first order kinetics with a rate constant of $4.3 \times 10^{-5} \text{ s}^{-1}$ at 20°C . If the initial partial pressure of $C_6H_5N_2Cl$ is 0.0088 atm, calculate its partial pressure after 10.0 hours.

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- 5) **(10 pts)** Estimate the steric factor P for the following reaction at 355° C



given the following experimental factors: $A = 1.24 \times 10^6 \text{ L mol}^{-1} \text{ s}^{-1}$, $\sigma = 0.50 \times 10^{-18} \text{ m}^2$, and $\mu = 1.9 \times 10^{-3} \text{ kg mol}^{-1}$

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- 6) **(10 pts)** The hydrolysis of sucrose is a part of the digestive process. To investigate how strongly the rate depends on our body temperature, calculate the rate constant for the hydrolysis of sucrose at 35.0°C, given that $k=1.0 \text{ mL mol}^{-1} \text{ s}^{-1}$ at 37.0°C (normal body temperature), and the activation energy of the reaction is 108 kJ mol^{-1} .

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- 7) **(15 pts)** Certain bacteria use the enzyme penicillinase to decompose penicillin and render it inactive. The Michaelis–Menten constants for this enzyme and substrate are:

$$K_m = 5.3 \times 10^{-5} \text{ mol L}^{-1}$$

$$k_2 = 2.6 \times 10^3 \text{ s}^{-1}.$$

- a) At what substrate concentration will the rate of decomposition be half of the maximum rate? Must show all work for full credit (10 pts)

- b) What is the significance of k_2 in the Michaelis-Menten model of enzyme kinetics (one sentence)? (5 pts)