

Name key Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 What is the overall reaction order for the reaction that has the rate law; rate = $k[\text{H}_2][\text{NO}]^2$ (1 pt)

- (A) zero order (B) first order (C) second order (D) third order

2 For the zeroth order reaction: $\text{C} \rightarrow \text{product}$, which of the following graphs would be expected to give a straight line (1 pt)

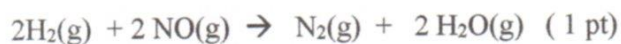
- (A) $[\text{C}]$ vs t (B) $1/[\text{C}]$ vs t (C) $[\text{C}]^2$ vs t^2 (D) $1/\ln[\text{C}]$ vs t^2
- 2nd*

integrated rate law chart

3 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

- (A) rate limiting energy (B) potential energy (C) net energy (D) activation energy

4 The reaction below (overall rxn) is first order in H_2 and second order in NO . What is the rate law for this reaction?



- (A) Rate = $2k[\text{H}_2]^{1/2}[\text{NO}]^{1/2}$ (B) rate = $k[\text{H}_2]^{1/2}[\text{NO}]$ (C) rate = $2k[\text{H}_2][\text{NO}]$ (D) rate = $k[\text{H}_2][\text{NO}]^2$

5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) Y (B) A_2X_2 (C) X_2 (D) XY

Y not used up during the reaction

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)



What is the value of m ? Show work.

[HgCl ₂] (M)	[C ₂ O ₄ ²⁻] (M)	Rate (M/s)
0.10	0.10	1.3 × 10 ⁻⁷
0.10	0.20	5.2 × 10 ⁻⁷
0.20	0.20	1.0 × 10 ⁻⁶

$$\frac{\text{rate}_3}{\text{rate}_2} = \frac{1.0 \times 10^{-6}}{5.2 \times 10^{-7}} = \frac{k \left[\frac{0.20}{0.10} \right]^m \left[\frac{0.20}{0.20} \right]^n}{k \left[\frac{0.20}{0.10} \right]^m \left[\frac{0.20}{0.20} \right]^n}$$

$$1.92 = (2)^m$$

$$m = 1$$

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

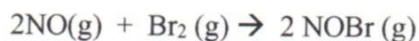
NW - 2 1/2 BA - 2 1/2

did not (m) - 1 1/2

upside down - 1

math + to - 1/2 pt

7. Given the following elementary reaction mechanism step (5 pts)



(a) What is the rate law?

$$\text{rate} = k[\text{NO}]^2[\text{Br}_2]$$

(b) What is the molecularity of the NO in the rate law?

-2

2 pt

bimolecular

1 pt each
1 pt

8 For the following reaction rate law, $\text{rate} = k [\text{BrO}_3^-]^{1/2} [\text{Br}^-] [\text{H}^+]^2$ (5 pts)

(a) what is the overall order of the rate law?

$$1/2 + 1 + 2 = 3.5 \quad (2.5 \text{ pt})$$

(b) What is the order of the $[\text{BrO}_3^-]$

$$1/2 \quad (2.5 \text{ pt})$$

Name key Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 A plot of $1/[\text{BrO}^-]$ vs time is linear for the reaction $3 \text{BrO}^-(\text{aq}) \rightarrow \text{BrO}_3^-(\text{aq}) + 2 \text{Br}^-(\text{aq})$ ^{pink} What is the order of the reaction with respect to BrO^- (1 pt)

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

integrated rate law
handout

2 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

- (A) rate limiting energy (B) potential energy (C) net energy (D) activation energy

3 A three step mechanism has been suggested for the formation of carbonyl chloride (1 pt)

Step 1: $\text{Cl}_2 \rightarrow 2 \text{Cl}$ (fast, equilibrium)

step 2: $\text{Cl} + \text{CO} \rightarrow \text{COCl}$ (fast, equilibrium)

step 3: $\text{COCl} + \text{Cl}_2 \rightarrow \text{COCl}_2 + \text{Cl}$ (slow) — rate determining

What is the molecularity of the rate determining step?

- (A) bimolecular (B) termolecular (C) unimolecular (D) none of these

4 The reaction below (overall rxn) is first order in H_2 and second order in NO . What is the rate law for this reaction?



- (A) rate = $k[\text{H}_2][\text{NO}]^2$ (B) Rate = $2k[\text{H}_2]^{1/2}[\text{NO}]^{1/2}$ (C) rate = $k[\text{H}_2]^{1/2}[\text{NO}]$ (D) rate = $2k[\text{H}_2][\text{NO}]$

5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) A_2X_2 (B) X_2 (C) Y (D) XY

Y is not used up during the reaction.

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)



NW-2 pt BA-2 pt

What is the value of n ?

	[HgCl ₂] (M)	[C ₂ O ₄ ²⁻] (M)	Rate (M/s)
1	0.10	0.10	1.3 x 10 ⁻⁷
2	0.10	0.20	5.2 x 10 ⁻⁷
	0.20	0.20	1.0 x 10 ⁻⁶

did n not n - 1/2

Upsidedown -1

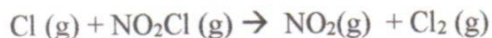
$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

math -1 to - 1/2 pt

$$\frac{\text{rate}_2}{\text{rate}_1} = \frac{5.2 \times 10^{-7}}{1.3 \times 10^{-7}} = \frac{k(0.1)^m (0.20)^n}{k(0.1)^m (0.10)^n}$$

$$4 = (2)^n \quad n = 2$$

7. Given the following elementary reaction mechanism step (5 pts)



(a) What is the rate law ?

$$\text{rate} = k[\text{Cl}][\text{NO}_2\text{Cl}]$$

(b) What is the molecularity of the Cl in the rate law ?

1 unimolecular 2pt

3pt 1pt 1pt

8 For the following reaction rate law, $\text{rate} = k[\text{BrO}_3^-]^{1/2}[\text{Br}^-][\text{H}^+]^2$ (5 pts)

(a) what is the overall order of the rate law?

$$\frac{1}{2} + 1 + 2 = 3\frac{1}{2} \quad 2.5 \text{ pts}$$

(b) What is the order of the $[\text{H}^+]$ 2

2.5 pts

Name Key Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 Using the method of initial rates for the reaction $A \rightarrow B$, if the initial concentration of A is doubled and the rate of reaction quadruples, what is the order of the reaction with respect to A? (1 pt)

- (A) second (B) fourth (C) first (D) zeroth

$$\text{rate} = k[A]^m$$

$$4 \text{ rate} = k[2A]^m \quad m = 2$$

2. The half life of the reaction shown below is found not to depend on the concentration of $H_2O_2(aq)$. (1 pt)



- (A) Zeroth (B) first (C) second (D) third

$$t_{1/2} = \frac{0.693}{k}$$

3 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

- (A) rate limiting energy (B) activation energy (C) potential energy (D) net energy

4 The reaction below (overall rxn) is second order in H_2 and first order in NO. What is the rate law for this reaction?



- (A) Rate = $2k[H_2]^{1/2}[NO]^{1/2}$ (B) rate = $k[H_2]^{1/2}[NO]$ (C) rate = $2k[H_2]^2[NO]$ (D) rate = $k[H_2][NO]^2$

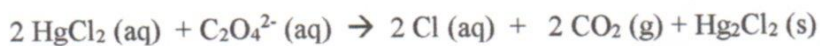
5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) X_2 (B) XY (C) Y (D) A_2X_2

used up but regenerated at end rxn

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)



NW - 2 1/2 BA - 2 1/2

What is the value of m ?

[HgCl ₂] (M)	[C ₂ O ₄ ²⁻] (M)	Rate (M/s)
0.10	0.20	5.2 x 10 ⁻⁷
0.20	0.20	1.0 x 10 ⁻⁶
0.10	0.10	1.3 x 10 ⁻⁷

did n not m - 1/2

upside down -1

math -1 to -1/2

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

$$\frac{\text{rate 2}}{\text{rate 1}} = \left(\frac{1.0 \times 10^{-6}}{5.2 \times 10^{-7}} \right) = \frac{k \left[\frac{0.20}{0.10} \right]^m \left[\frac{0.20}{0.20} \right]^n}{k \left[\frac{0.10}{0.10} \right]^m \left[\frac{0.20}{0.20} \right]^n}$$

$$1.92 = (2)^m \quad m = 1$$

7. Given the following elementary reaction mechanism step (5 pts)



3pt

(a) What is the rate law?

$$\text{rate} = k[\text{HF}]^2$$

1pt 1pt

(b) What is the molecularity of the HF in the rate law?

2 bimolecular

2pt

8 For the following reaction rate law, $\text{rate} = k[\text{BrO}_3^-]^{1/2}[\text{Br}^-][\text{H}^+]^2$ (5 pts)

(a) what is the overall order of the rate law?

$$1/2 + 2 + 1 = 3.5$$

2.5pt

(b) What is the order of the [Br⁻]

1 2.5pt

Name key Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 A plot of $\ln [\text{BrO}^-]$ vs time is linear for the reaction $3 \text{BrO}^-(\text{aq}) \rightarrow \text{BrO}_3^-(\text{aq}) + 2 \text{Br}^-(\text{aq})$ What is the order of the reaction with respect to BrO^- (1 pt)

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

2 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

- (A) rate limiting energy (B) potential energy (C) net energy (D) activation energy

3 A three step mechanism has been suggested for the formation of carbonyl chloride (1 pt)

Step 1: $\text{Cl}_2 \rightarrow 2 \text{Cl}$ (slow)

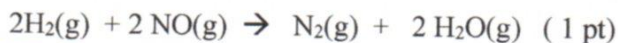
step 2: $\text{Cl} + \text{CO} \rightarrow \text{COCl}$ (fast, equilibrium)

step 3: $\text{COCl} + \text{Cl}_2 \rightarrow \text{COCl}_2 + \text{Cl}$ (fast equilibrium)

What is the molecularity of the rate determining step?

- (A) bimolecular (B) termolecular (C) unimolecular (D) none of these

4 The reaction below (overall rxn) is first order in H_2 and second order in NO . What is the rate law for this reaction?



- (A) $\text{rate} = k[\text{H}_2][\text{NO}]^2$ (B) $\text{Rate} = 2k[\text{H}_2]^{1/2}[\text{NO}]^{1/2}$ (C) $\text{rate} = k[\text{H}_2]^{1/2}[\text{NO}]$ (D) $\text{rate} = 2k[\text{H}_2][\text{NO}]$

5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) A_2X_2 (B) X_2 (C) Y (D) XY

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)



What is the value of n ?

$[\text{HgCl}_2]$ (M)	$[\text{C}_2\text{O}_4^{2-}]$ (M)	Rate (M/s)
0.10	0.10	1.3×10^{-7}
0.10	0.20	1.04×10^{-6}
0.20	0.20	1.0×10^{-6}

did m not n - 1/2

upside down - 1

NW - 2 1/2 BA - 2 1/2

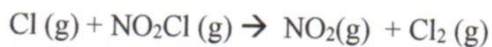
math - 1 to - 1/2 pt

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

$$\frac{1.04 \times 10^{-6}}{1.3 \times 10^{-7}} = k \left[\frac{0.10}{0.10} \right]^m \left[\frac{0.20}{0.10} \right]^n$$

$$8 = [2]^n \quad n = 3$$

7. Given the following elementary reaction mechanism step (5 pts)



(a) What is the rate law?

rate = $k[\text{Cl}][\text{NO}_2\text{Cl}]$

(b) What is the molecularity of the Cl in the rate law?

unimolecular

1 pt each

8 For the following reaction rate law, $\text{rate} = k[\text{BrO}_3^-]^2[\text{Br}^-]^3[\text{H}^+]^2$ (5 pts)

(a) what is the overall order of the rate law?

$2 + 3 + 2 = 7$

(b) What is the order of the $[\text{H}^+]$

2

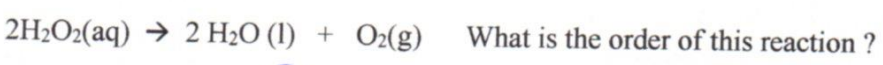
Name Key Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 Using the method of initial rates for the reaction $A \rightarrow B$, if the initial concentration of A is doubled and the rate of reaction is doubled, what is the order of the reaction with respect to A? (1 pt)

- (A) second (B) fourth (C) first (D) zeroth

2. The half life of the reaction shown below is found to be independent of the concentration of $H_2O_2(aq)$. (1 pt)

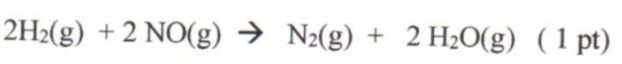


- (A) second (B) third (C) Zeroth (D) first

3 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

- (A) net energy (B) activation energy (C) rate limiting energy (D) potential energy

4 The reaction below (overall rxn) is first order in H_2 and second order in NO . What is the rate law for this reaction?



- (A) Rate = $2k[H_2]^{1/2}[NO]^{1/2}$ (B) rate = $k[H_2]^{1/2}[NO]$ (C) rate = $2k[H_2]^2[NO]$ (D) rate = $k[H_2][NO]^2$

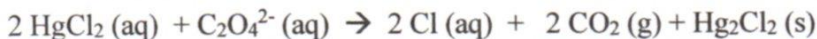
5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) X_2 (B) XY (C) Y (D) A_2X_2

catalyst not used by during rxn

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)



What is the value of m ?

$[\text{HgCl}_2] (\text{M})$	$[\text{C}_2\text{O}_4^{2-}] (\text{M})$	Rate (M/s)
0.20	0.20	2.1×10^{-6}
0.10	0.20	5.2×10^{-7}
0.10	0.10	1.3×10^{-7}

$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$

$$\frac{2.1 \times 10^{-6}}{5.2 \times 10^{-7}} = \frac{k [0.20]^m [0.20]^n}{k [0.10]^m [0.20]^n}$$

$$4 = [2]^m [1]^n$$

$$m = 2$$

NW - 2 1/2 BA - 2 1/2

did n not m - 1/2

up side down - 1/2

math - 1 to - 1/2

7. Given the following elementary reaction mechanism step (5 pts)



(a) What is the rate law?

$\text{rate} = k[\text{HF}]^2$

(b) What is the molecularity of the HF in the rate law?

bimolecular

3 pt

1 pt

1 pt

2 pt

8 For the following reaction rate law, $\text{rate} = k [\text{BrO}_3^-]^2 [\text{Br}^-] [\text{H}^+]^2$ (5 pts)

(a) what is the overall order of the rate law?

$2 + 1 + 2 = 5$

2.5 pt

(b) What is the order of the $[\text{BrO}_3^-]$

2

2.5 pt

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Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 What is the overall reaction order for the reaction that has the rate law; rate = $k[\text{H}_2][\text{NO}]^2$ (1 pt)

(A) zero order (B) first order (C) second order (D) third order

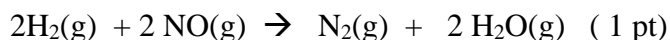
2 For the zeroth order reaction: $\text{C} \rightarrow \text{product}$, which of the following graphs would be expected to give a straight line (1 pt)

(A) $[\text{C}]$ vs t (B) $1/[\text{C}]$ vs t (C) $[\text{C}]^2$ vs t^2 (D) $1/\ln[\text{C}]$ vs t^2

3 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

(A) rate limiting energy (B) potential energy (C) net energy (D) activation energy

4 The reaction below (overall rxn) is first order in H_2 and second order in NO . What is the rate law for this reaction?



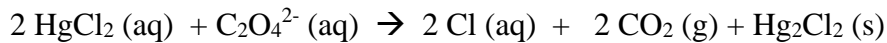
(A) Rate = $2k[\text{H}_2]^{1/2}[\text{NO}]^{1/2}$ (B) rate = $k[\text{H}_2]^{1/2}[\text{NO}]$ (C) rate = $2k[\text{H}_2][\text{NO}]$ (D) rate = $k[\text{H}_2][\text{NO}]^2$

5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) Y (B) A_2X_2 (C) X_2 (D) XY

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)

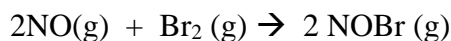


What is the value of m ? Show work.

$[\text{HgCl}_2] (\text{M})$	$[\text{C}_2\text{O}_4^{2-}] (\text{M})$	Rate (M/s)
0.10	0.10	1.3×10^{-7}
0.10	0.20	5.2×10^{-7}
0.20	0.20	1.0×10^{-6}

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

7. Given the following elementary reaction mechanism step (5 pts)



(a) What is the rate law ?

(b) What is the molecularity of the NO in the rate law ?

8 For the following reaction rate law, $\text{rate} = k [\text{BrO}_3^-]^{1/2} [\text{Br}^-][\text{H}^+]^2$ (5 pts)

(a) what is the overall order of the rate law? _____

(b) What is the order of the $[\text{BrO}_3^-]$ _____

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Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 A plot of $1/[\text{BrO}^-]$ vs time is linear for the reaction $3 \text{BrO}^-(\text{aq}) \rightarrow \text{BrO}_3^-(\text{aq}) + 2 \text{Br}^-(\text{aq})$ What is the order of the reaction with respect to BrO^- (1 pt)

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

2 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

- (A) rate limiting energy (B) potential energy (C) net energy (D) activation energy

3 A three step mechanism has been suggested for the formation of carbonyl chloride (1 pt)

Step 1: $\text{Cl}_2 \rightarrow 2 \text{Cl}$ (fast, equilibrium)

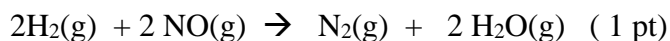
step2: $\text{Cl} + \text{CO} \rightarrow \text{COCl}$ (fast, equilibrium)

step3: $\text{COCl} + \text{Cl}_2 \rightarrow \text{COCl}_2 + \text{Cl}$ (slow)

What is the molecularity of the rate determining step?

- (A) bimolecular (B) termolecular (C) unimolecular (D) none of these

4 The reaction below (overall rxn) is first order in H_2 and second order in NO . What is the rate law for this reaction?



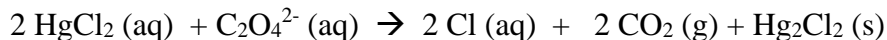
- (A) $\text{rate} = k[\text{H}_2][\text{NO}]^2$ (B) $\text{Rate} = 2k[\text{H}_2]^{1/2}[\text{NO}]^{1/2}$ (C) $\text{rate} = k [\text{H}_2]^{1/2} [\text{NO}]$ (D) $\text{rate} = 2k[\text{H}_2][\text{NO}]$

5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) A_2X_2 (B) X_2 (C) Y (D) XY

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)

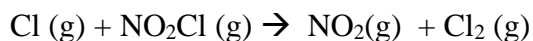


What is the value of n ?

$[\text{HgCl}_2]$ (M)	$[\text{C}_2\text{O}_4^{2-}]$ (M)	Rate (M/s)
0.10	0.10	1.3×10^{-7}
0.10	0.20	5.2×10^{-7}
0.20	0.20	1.0×10^{-6}

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

7. Given the following elementary reaction mechanism step (5 pts)



(c) What is the rate law ?

(d) What is the molecularity of the Cl in the rate law ?

8 For the following reaction rate law, $\text{rate} = k [\text{BrO}_3^-]^{1/2} [\text{Br}^-][\text{H}^+]^2$ (5 pts)

(c) what is the overall order of the rate law? _____

(d) What is the order of the $[\text{H}^+]$ _____

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Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 Using the method of initial rates for the reaction $A \rightarrow B$, if the initial concentration of A is doubled and the rate of reaction quadruples, what is the order of the reaction with respect to A ? (1 pt)

(A) second (B) fourth (C) first (D) zeroth

2. The half life of the reaction shown below is found not to depend on the concentration of H_2O_2 (aq). (1 pt)

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$ What is the order of this reaction ?

(A) Zeroth (B) first (C) second (D) third

3 What is the minimum energy barrier that must be overcome for a chemical reaction to occur ? (1 pt)

(C) rate limiting energy (B) activation energy (C) potential energy (D) net energy

4 The reaction below (overall rxn) is second order in H_2 and first order in NO. What is the rate law for this reaction ?

$2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2O(g)$ (1 pt)

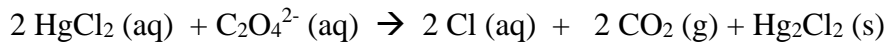
(A) Rate = $2k[H_2]^{1/2}[NO]^{1/2}$ (B) rate = $k[H_2]^{1/2}[NO]$ (C) rate = $2k[H_2]^2[NO]$ (D) rate = $k[H_2][NO]^2$

5. A reaction occurs by a two step mechanism shown below. (1 pt)

Step 1: $A_2X_2 + Y \rightarrow A_2X + XY$ **Step 2:** $A_2X_2 + XY \rightarrow A_2X + X_2 + Y$

What is the catalyst in this reaction ? (A) X_2 (B) XY (C) Y (D) A_2X_2

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)



What is the value of m ?

$[\text{HgCl}_2] (\text{M})$	$[\text{C}_2\text{O}_4^{2-}] (\text{M})$	Rate (M/s)
0.10	0.20	5.2×10^{-7}
0.20	0.20	1.0×10^{-6}
0.10	0.10	1.3×10^{-7}

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

7. Given the following elementary reaction mechanism step (5 pts)



(e) What is the rate law ?

(f) What is the molecularity of the HF in the rate law ?

8 For the following reaction rate law, $\text{rate} = k [\text{BrO}_3^-]^{1/2} [\text{Br}^-][\text{H}^+]^2$ (5 pts)

(e) what is the overall order of the rate law? _____

(f) What is the order of the $[\text{Br}^-]$ _____

Name _____ Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 A plot of $\ln [\text{BrO}^-]$ vs time is linear for the reaction $3 \text{BrO}^-(\text{aq}) \rightarrow \text{BrO}_3^-(\text{aq}) + 2 \text{Br}^-(\text{aq})$ What is the order of the reaction with respect to BrO^- (1 pt)

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

2 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

(D) rate limiting energy (B) potential energy (C) net energy (D) activation energy

3 A three step mechanism has been suggested for the formation of carbonyl chloride (1 pt)

Step 1: $\text{Cl}_2 \rightarrow 2 \text{Cl}$ (slow)

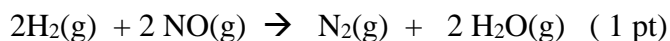
step2: $\text{Cl} + \text{CO} \rightarrow \text{COCl}$ (fast, equilibrium)

step3: $\text{COCl} + \text{Cl}_2 \rightarrow \text{COCl}_2 + \text{Cl}$ (fast equilibrium)

What is the molecularity of the rate determining step?

(A) bimolecular (B) termolecular (C) unimolecular (D) none of these

4 The reaction below (overall rxn) is first order in H_2 and second order in NO . What is the rate law for this reaction?



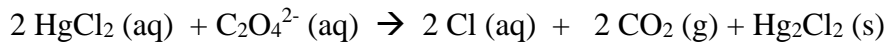
(A) $\text{rate} = k[\text{H}_2][\text{NO}]^2$ (B) $\text{Rate} = 2k[\text{H}_2]^{1/2}[\text{NO}]^{1/2}$ (C) $\text{rate} = k [\text{H}_2]^{1/2} [\text{NO}]$ (D) $\text{rate} = 2k[\text{H}_2][\text{NO}]$

5. A reaction occurs by a two step mechanism shown below. (1 pt)



What is the catalyst in this reaction? (A) A_2X_2 (B) X_2 (C) Y (D) XY

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)

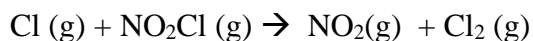


What is the value of n ?

$[\text{HgCl}_2]$ (M)	$[\text{C}_2\text{O}_4^{2-}]$ (M)	Rate (M/s)
0.10	0.10	1.3×10^{-7}
0.10	0.20	1.04×10^{-6}
0.20	0.20	1.0×10^{-6}

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

7. Given the following elementary reaction mechanism step (5 pts)



(g) What is the rate law ?

(h) What is the molecularity of the Cl in the rate law ?

8 For the following reaction rate law, $\text{rate} = k [\text{BrO}_3^-]^2 [\text{Br}^-]^3 [\text{H}^+]^2$ (5 pts)

(g) what is the overall order of the rate law? _____

(h) What is the order of the $[\text{H}^+]$ _____

Name _____ Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (20 total pts)

1 Using the method of initial rates for the reaction $A \rightarrow B$, if the initial concentration of A is doubled and the rate of reaction is doubled, what is the order of the reaction with respect to A? (1 pt)

(B) second (B)fourth (C) first (D) zeroth

2. The half life of the reaction shown below is found to be independent of the concentration of $H_2O_2(aq)$. (1 pt)

$2H_2O_2(aq) \rightarrow 2 H_2O(l) + O_2(g)$ What is the order of this reaction ?

(A) second (B) third (C) Zeroth (D) first

3 What is the minimum energy barrier that must be overcome for a chemical reaction to occur? (1 pt)

(E) net energy (B) activation energy (C) rate limiting energy (D) potential energy

4 The reaction below (overall rxn) is first order in H_2 and second order in NO. What is the rate law for this reaction ?

$2H_2(g) + 2 NO(g) \rightarrow N_2(g) + 2 H_2O(g)$ (1 pt)

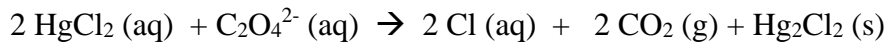
(A) Rate = $2k[H_2]^{1/2}[NO]^{1/2}$ (B) rate = $k [H_2]^{1/2} [NO]$ (C) rate = $2k[H_2]^2 [NO]$ (D) rate = $k[H_2][NO]^2$

5. A reaction occurs by a two step mechanism shown below. (1 pt)

Step 1: $A_2X_2 + XY \rightarrow A_2X_3 + Y$ **Step 2:** $A_2X_4 + Y \rightarrow A_2X + X_2 + XY$

What is the catalyst in this reaction ? (A) X_2 (B) XY (C) Y (D) A_2X_2

6 The following set of data was obtained by the method of initial rates for the reaction: (5 pts)



What is the value of m ?

$[\text{HgCl}_2] (\text{M})$	$[\text{C}_2\text{O}_4^{2-}] (\text{M})$	Rate (M/s)
0.20	0.20	2.1×10^{-6}
0.10	0.20	5.2×10^{-7}
0.10	0.10	1.3×10^{-7}

$$\text{Rate} = k[\text{HgCl}_2]^m[\text{C}_2\text{O}_4^{2-}]^n$$

7. Given the following elementary reaction mechanism step (5 pts)



- (i) What is the rate law ?
- (j) What is the molecularity of the HF in the rate law ?

8 For the following reaction rate law, $\text{rate} = k [\text{BrO}_3^-]^2 [\text{Br}^-][\text{H}^+]^2$ (5 pts)

- (i) what is the overall order of the rate law? _____
- (j) What is the order of the $[\text{BrO}_3^-]$ _____