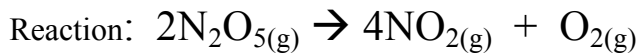


Exam 4

1) On the graph paper given (use your own for the practice exam), make a graph(s) using the following data and state whether the reaction is zero order, first or second order.



Time	$[\text{N}_2\text{O}_5]$
0	.0165
600	.0124
1200	.0093
1800	.0071
2400	.0053
3000	.0039
3600	.0029

a) State the order of the reaction _____

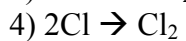
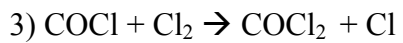
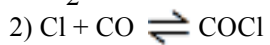
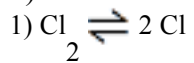
Give a one sentence reason/evidence for your answer:

b) What is the value of the rate constant? (Show work)

c) What is the half life?

d) What will be the concentration of N_2O_5 after 3950 sec?

2) A chemical reaction proceeds through the following steps:



What is the overall reaction equation? _____

Draw the reaction diagram:

List any intermediates that might be in the mechanism.(If none write none) _____

Which step has the lowest rate constant? _____

What is the rate determining step? _____

What is the rate law? (No intermediates in the rate law!)

3) The following data were collected from the reaction of
 $(\text{CH}_3)_3\text{CBr} + \text{OH}^- \rightarrow (\text{CH}_3)_3\text{COH} + \text{Br}^-$

$[\text{OH}^-]$	$[(\text{CH}_3)_3\text{CBr}]$	Rate M/sec
0.050	0.050	0.00050
0.10	0.050	0.0010
0.15	0.050	0.0015
0.050	0.10	0.00050
0.050	0.15	0.00050

What is the order of the reaction with respect to hydroxide? _____

What is the order of the reaction with respect to $(\text{CH}_3)_3\text{CBr}$? _____

What is the overall order of this reaction? _____

What is the rate law of the reaction?

What is the value of the rate constant? _____

What would happen to the rate if the concentration of hydroxide is doubled? _____

What would happen to the rate if the concentration of $(\text{CH}_3)_3\text{CBr}$ is doubled? _____

4) The decomposition of SO_2Cl_2 is first order and has a rate constant of $.000290 \text{ 1/sec}$. If the initial concentration is $.0335 \text{ M}$ What is the concentration after 900 sec ?

5) What is the half life of a second order reaction if 35% of the original concentration is left after 495 seconds?

What would be the half life if the reaction was first order?

6) The decomposition of compound A_2X_3 has a frequency factor of 2.1×10^{12} and an activation energy of 110 kJ/mole . What is the rate constant at 75°C ?

7) Complete the following table. Name the compounds that are given with the rules learned in class. Where the name is given draw the complete structure showing all bonds and all atoms, including hydrogen.

Name	Structure	Class of compound
	$ \begin{array}{ccccccc} & & \text{H} & \text{H} & \text{OH} & & \\ & & & & & & \\ \text{H}_3\text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{CH}_3 \\ & & & & & & \\ & & \text{H} & \text{H} & \text{H} & & \end{array} $	
	$ \begin{array}{ccccccc} & & \text{H} & & \text{H} & \text{H} & \\ & & & & & & \\ \text{H} & - & \text{C} & - & \text{C} & \equiv & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & & & & & \\ & & \text{H} & & \text{H} & & \text{H} & & & & \end{array} $	
Pentanoic acid		
4-octanone		
	$ \begin{array}{ccccccc} & & \text{H} & \text{H} & \text{H} & & \\ & & & & & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{NH}_2 \\ & & & & & & \\ & & \text{H} & \text{H} & \text{H} & & \end{array} $	
	$ \begin{array}{ccccccc} & & \text{H} & \text{H} & \text{O} & \text{H} & \text{H} & \\ & & & & & & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & & & \\ & & \text{H} & \text{H} & & \text{H} & \text{H} & & \end{array} $	
	$ \begin{array}{ccccccc} & & \text{H} & \text{CH}_3 & \text{H} & \text{H} & \\ & & & & & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & \\ & & \text{H} & \text{CH}_3 & \text{H} & \text{H} & \end{array} $	

8) For the following, write the type of reaction that is shown.

Reaction	Type
$\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}_3\text{C}-\text{C}=\text{C}-\text{C}-\text{CH}_3 \\ & \\ \text{H} & \text{H} \end{array} + \text{H}-\text{H} \longrightarrow \begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{C}-\text{CH}_3 \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$	
$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{O}=\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array} \xrightarrow{[\text{O}]} \begin{array}{c} \text{H} & \text{H} & \text{H} & \text{O} \\ & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{OH} \\ & & & \\ \text{H} & \text{H} & \text{H} & \end{array}$	
<p>alcohol + alcohol → ether + water</p>	
$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array} + \text{Br}-\text{Br} \longrightarrow \begin{array}{c} \text{H} & \text{Br} & \text{H} \\ & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array} + \text{H}-\text{Br}$	

9) For the following pairs of molecules, state the type of isomerism that is present

	Type of isomerism
$\begin{array}{c} \text{Br} \\ \\ \text{H}_3\text{C}-\text{C}-\text{F} \\ \\ \text{OH} \end{array} \quad \text{and} \quad \begin{array}{c} \text{Br} \\ \\ \text{F}-\text{C}-\text{CH}_3 \\ \\ \text{OH} \end{array}$	
$\begin{array}{c} \text{O} \\ \\ \text{H}_3\text{C}-\text{C}-\text{OH} \\ \\ \text{H}_2 \end{array} \quad \text{and} \quad \begin{array}{c} \text{O} \\ \\ \text{H}_3\text{C}-\text{O}-\text{C}-\text{CH}_3 \\ \\ \text{H}_2\text{C} \end{array}$	
$\begin{array}{c} \text{H}_2 & \text{H}_2 & \text{H}_2 & \text{CH}_3 \\ & & & \\ \text{HO}-\text{C}-\text{C}-\text{C}-\text{C} \\ & & & \\ \text{H}_2 & \text{H}_2 & \text{H}_2 & \end{array} \quad \text{and} \quad \begin{array}{c} \text{OH} \\ \\ \text{H}_2\text{C}-\text{CH}-\text{CH}_2 \\ & \\ \text{CH}_3 & \text{CH}_3 \end{array}$	
$\begin{array}{c} \text{H}_3\text{C} & \text{H}_2 & \text{H}_2 & \text{CH}_3 \\ & & & \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ & & & \\ \text{CH}_3 & \text{H}_2 & \text{H}_2 & \end{array} \quad \text{and} \quad \begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{C}-\text{C}-\text{C}-\text{CH}-\text{CH}_3 \\ & & & \\ \text{H}_2 & \text{H}_2 & \text{H}_2 & \end{array}$	

10) From the following compounds or types of compounds state the name of the functional group

	Functional Group
<p>aldehyde</p>	
$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ & & & & & \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} \quad \begin{array}{c} \text{C}=\text{O} \\ \\ \text{OH} \end{array}$	
$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}_2\text{N}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array}$	
$\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{OH} & \text{H} & \text{H} & \text{H} \\ & & & & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ & & & & & & \\ \text{H} & \text{H} & \text{CH}_3 & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$	

11) State if the following molecules or class of compounds are saturated or unsaturated

Compound or class of compound	Saturated or unsaturated
Alkenes	
$ \begin{array}{ccccccc} & \text{H} & & & \text{H} & \text{H} & \\ & & & & & & \\ \text{H} & - \text{C} & - \text{C} \equiv \text{C} & - & \text{C} & - & \text{C} - \text{H} \\ & & & & & & \\ & \text{H} & & & \text{H} & \text{H} & \end{array} $	
Alkanes	

12) For the following list the class of compound produced in the given reaction

Reaction	Class produced
Oxidation of a secondary alcohol	
Addition of water to an alkene	
Condensation of 2 alcohols	Water +

13) Draw and name the product of the following reactions:

pentanol + butanoic acid →	Structure: Name:
2-hexanol $\xrightarrow{[O]}$	Structure: Name:
Propyl ethanoate + water →	Structure: Name:

14) ${}_{91}\text{Pa}^{234}$ undergoes beta decay. What is the mass number of the resulting element? Write out the nuclear reaction.

15) ${}_{92}\text{U}^{234}$ undergoes alpha decay. What is the atomic number of the resulting element. Write out the nuclear reaction.

16) An ancient skull has a carbon -14 decay rate of 0.85 disintegrations per minute per gram of carbon. How old is the skull? C-14 has a decay rate of 15.3 disintegrations (min^{-1})(g C⁻¹), and its half life is 5730 yr.

17) A typical nuclear reactor produces about 1.0 MW of power per day. What is the minimum rate of mass loss required to produce this much energy?

18) The nuclide As-76 has a half-life of 26.0 hours. If a sample of As-76 weighs 344 g, what mass of As-76 remains after 538 minutes?