

Be sure to show all work, use the correct number of significant figures, circle final answers and use correct units in all problems.

1. Consider the data (below) gathered for the following reaction:  $A + B \rightarrow C$  (8 points)

$[A]$ (M)	$[B]$ (M)	$\Delta[C]/\Delta t$ (initial) M/s
0.100	0.200	$6.80 \times 10^{-6}$
0.100	0.400	$2.72 \times 10^{-5}$
0.200	0.400	$5.44 \times 10^{-5}$

- What is the order of the reaction with respect to A: \_\_\_\_\_ B: \_\_\_\_\_ Overall order: \_\_\_\_\_
  - What is the numerical value for the rate constant?
  - Write the rate law for the reaction.
  - What is the value of the rate when  $[A] = 0.337$  M and  $[B] = 0.122$  M?
2. In basic solution,  $(CH_3)_3CCl$  reacts according to the equation below.
- $$(CH_3)_3CCl + OH^- \rightarrow (CH_3)_3COH + Cl^-$$
- The accepted mechanism for the reaction is
- $$(CH_3)_3CCl \rightarrow (CH_3)_3C^+ + Cl^- \quad (\text{slow})$$
- $$(CH_3)_3C^+ + OH^- \rightarrow (CH_3)_3COH \quad (\text{fast})$$
- What is a rate law that is consistent with the mechanism for this reaction? (2 points)
  - Are intermediates present in the reaction? If so, list them. (2 points)
3. For a chemical reaction, the activation energy for the forward reaction is +187 kJ and the activation energy for the backward reaction is +112 kJ. What is the overall energy change for the forward reaction? (4 points)
4. What is the half-life of a first order reaction with a rate constant of  $0.457 \text{ s}^{-1}$ ? (4 points)