

**Answers**

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	$5.44 \times 10^{-5}$

- a. What is the order of the reaction with respect to A: 1 B: 2 Overall order: 3

- b. What is the numerical value for the rate constant?

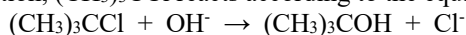
$$k = 1.70 \times 10^{-3}$$

- c. Write the rate law for the reaction. **rate =  $k[A][B]^2$**

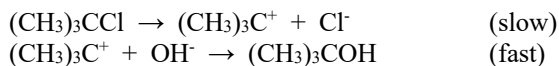
- d. What is the value of the rate when  $[A] = 0.337$  M and  $[B] = 0.122$  M?

$$\text{rate} = 8.53 \times 10^{-6}$$

2. In basic solution,  $(\text{CH}_3)_3\text{CCl}$  reacts according to the equation below.



The accepted mechanism for the reaction is



- a. What is a rate law that is consistent with the mechanism for this reaction? (2 points)

$$\text{rate} = k [(\text{CH}_3)_3\text{CCl}] \quad \text{slow step}$$

- b. Are intermediates present in the reaction? If so, list them. (2 points)

yes,  $(\text{CH}_3)_3\text{C}^+$

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)

**forward reaction is endothermic (reverse reaction has lower activation energy)**

$$\Delta H = 187 - 112 = +75 \text{ kJ}$$

4. What is the half-life of a first order reaction with a rate constant of  $0.457 \text{ s}^{-1}$ ? (4 points)

$$t_{1/2} = 1.52 \text{ s}$$