6. **C**—The value will be decreased by one-half for each half-life. Using the following table:

Half-lives	Remaining
0	0.100
1	0.0500
2	0.0250
3	0.0125
4	0.00625

Four half-lives = 4(200 s) = 800 s

7. **C**—This is the definition of the activation energy.

8. **B**—The friction supplies the energy needed to start the reaction. The energy needed to start the reaction is the activation energy.

9. **C**—Beginning with the generic rate law: Rate = $k[CO]^m[Cl_2]^n$, it is necessary to determine the values of m and n (the orders). Comparing Experiments 2 and 3, the rate doubles when the concentration of CO is doubled. This direct change means the reaction is first order with respect to CO. Comparing Experiments 1 and 3, the rate doubles when the concentration of Cl_2 is doubled. Again, this direct change means the reaction is first order. This gives: Rate = $k[CO]^1[Cl_2]^1 = k[CO][Cl_2]$.

10. **C**—The compound appears in the rate law, so a change in its concentration will change the rate. The reaction is first order in $(CH_3)_3CBr$, so the rate will change directly with the change in concentration of this reactant.

11. **B**—All substances involved, directly or indirectly, in the rate-determining step will change the rate when their concentrations are changed. The ion is required in the balanced chemical equation, so it cannot be a spectator ion, and it must appear in the mechanism. Catalysts will change the rate of a reaction. Since H^+ does not affect the rate, the reaction is zero order with respect to this ion.

12. **D**—The rate law depends on the slow step of the mechanism. The reactants in the slow step are Cl and $CHCl_3$ (one of each). The rate law is first order with respect to each of these. The Cl is half of the original reactant molecule Cl_2. This replaces the [Cl] in the rate law with $[Cl_2]^{1/2}$. Do not make the mistake of using the overall reaction to predict the rate law.

Free-Response Question

You have 15 minutes to answer the following multipart question. You may use a calculator and the tables in the back of the book.

Question 1

$$2\ ClO_2(aq) + 2\ OH^-(aq) \rightarrow ClO_3^-(aq) + ClO_2^-(aq) + H_2O(l)$$

A series of experiments were conducted to study the above reaction. The initial concentrations and rates are in the following table.

EXPERIMENT	INITIAL CONCENTRATIONS (mol/L)		INITIAL RATE OF FORMATION OF ClO_3^- (mol/L min)
	$[OH^-]$	$[ClO_2]$	
1	0.030	0.020	0.166
2	0.060	0.020	0.331
3	0.030	0.040	0.661