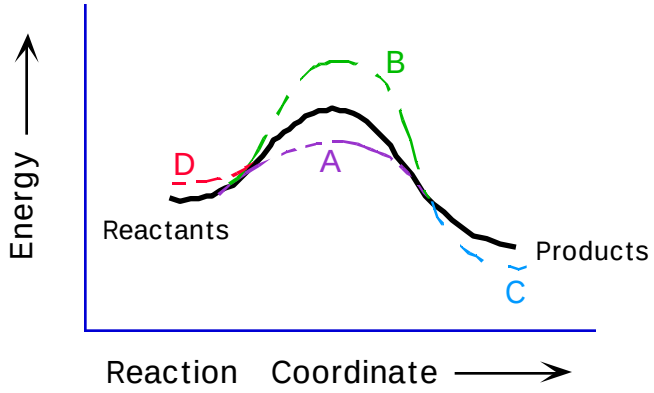
129. (Catalysts) Which curve illustrates the effect of a catalyst on the reaction diagram, given that it speeds up the rate of a reaction?

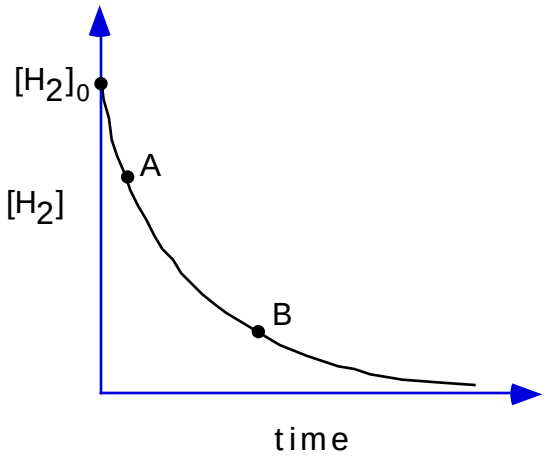
A, B, C, D



160. For the reaction:

$$H_2 + I_2 \longrightarrow 2HI$$

The dependence of the concentration of H_2 on time is shown below.



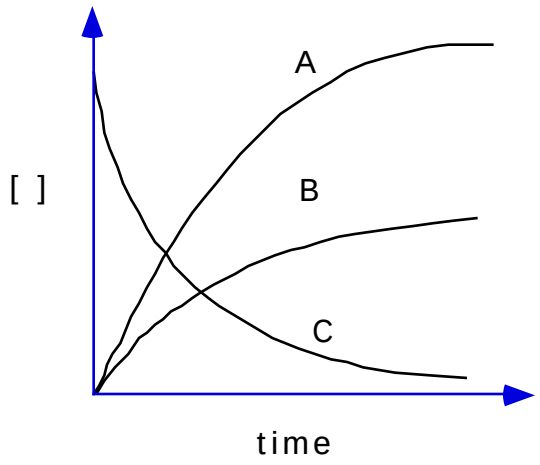
Is the reaction rate faster at point A or point B?

A, B, both rates are the same

161. For the reaction:

$$2NO_2(g) \longrightarrow 2NO(g) + O_2(g)$$

Each of the following curves corresponds to one of the species in the reaction shown above. Which curve represents the time dependence of the concentration of O_2?



A, **B**, C

162. For the reaction:

$$BrO_3^-(aq) + 5Br^-(aq) + 6H^+(aq) \longrightarrow 3Br_2(l) + 3H_2O(l)$$

The following initial rate data were obtained:

Experiment	$[BrO_3^-]_o$	$[Br^-]_o$	$[H^+]_o$	Relative Initial Rate
1	0.10M	0.10M	0.10M	1
2	0.20M	0.10M	0.10M	2
3	0.20M	0.20M	0.10M	4
4	0.10M	0.10M	0.20M	4

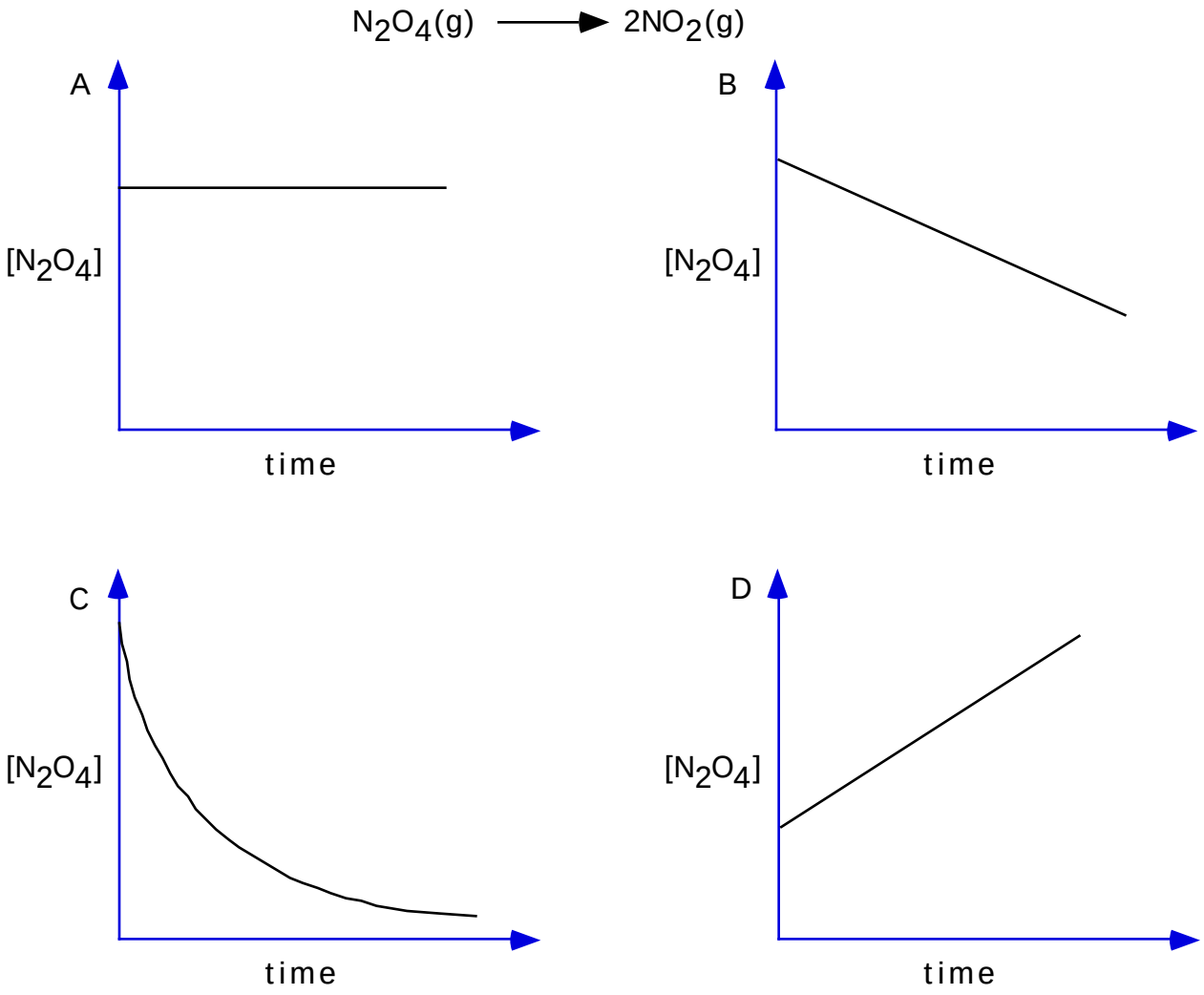
Which of the following rate laws is correct?

A. Rate = $k[BrO_3^-]^1[Br^-]^2[H^+]^1$

B. Rate = $k[BrO_3^-]^1[Br^-]^1[H^+]^2$

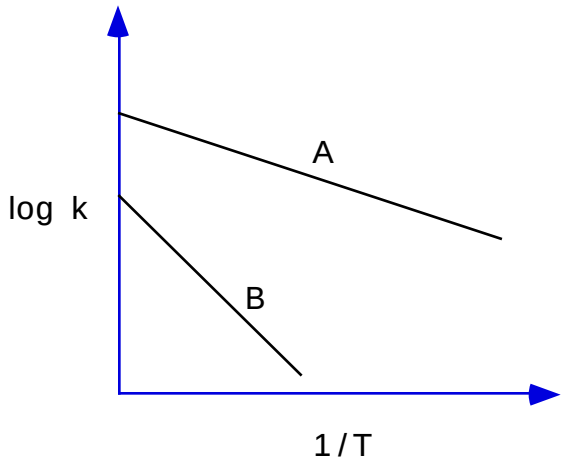
A, **B**

163. Which graph best describes the following reaction if it is first order in N_2O_4?



A, B, **C**, D

164. The diagram below shows Arrhenius plots for two chemical reactions. Which reaction has the larger activation energy?



A, **B**

165. The empirical rate law for the reaction

$$2NO_2(g) + F_2(g) \longrightarrow 2NO_2F(g)$$

is Rate = $k[NO_2][F_2]$.

Which of the following mechanisms is consistent with this rate law?

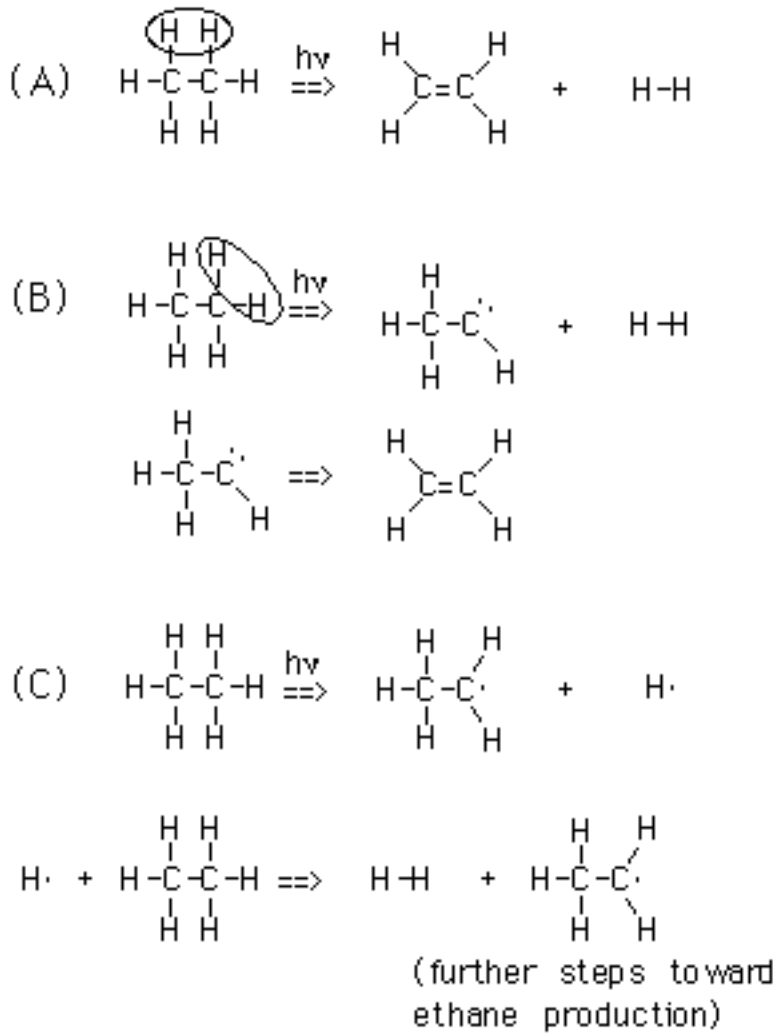
A) $NO_2\ (g) + F_2\ (g) \mathrel{<==>} NO_2F(g) + F(g)$ fast
$NO_2(g) + F(g) \text{ ---> } NO_2F(g)$ slow

B) $NO_2\ (g) + F_2(g) \mathrel{<==>} NO_2F(g) + F(g)$ slow
$NO_2(g) + F(g) \text{ ---> } NO_2F(g)$ fast

C) $F_2(g) \mathrel{<==>} F(g) + F(g)$ slow
$2NO_2(g) + 2F(g) \text{ ---> } 2NO_2F(g)$ fast

A, **B**, C

188. In the early 1960's, Okabe and McNesby (National Bureau of Standards) examined three mechanisms for the photolysis of ethane to ethylene and hydrogen. The three mechanisms - A, B, and C - were as follows:



If mechanism A occurs in this reaction, which hydrogen product(s) would be observed when a mixture of C2H6 and C2D6 are photolyzed?

HD, **H2 and D2**, H2 and D2 and HD

If mechanism A occurs in this reaction, which hydrogen product(s) would be observed when H3CCD3 is photolyzed?

HD, H2 and D2, H2 and D2 and HD

If mechanism B occurs in this reaction, which hydrogen product(s) would be observed when a mixture of C2H6 and C2D6 are photolyzed?

HD, **H2 and D2**, H2 and D2 and HD

If mechanism B occurs in this reaction, which hydrogen product(s) would be observed if when H3CCD3 is photolyzed?

HD, **H2 and D2**, H2 and D2 and HD

If mechanism C occurs in this reaction, which hydrogen product(s) would be observed when a mixture of C2H6 and C2D6 are photolyzed?

HD, H2 and D2, **H2 and D2 and HD**

If mechanism C occurs in this reaction, which hydrogen product(s) would be observed when H3CCD3 is photolyzed?

HD, H2 and D2, **H2 and D2 and HD**

The actual experimental results were as follows:

When a mixture of C2H6 and C2D6 was photolyzed, the reaction yielded large quantities of almost exclusively H2 and D2. When H3CCD3 was photolyzed, again H2 and D2 were formed almost exclusively. Which mechanism best fits these data?

A, **B**, C

(Adapted from *The Same and Not The Same* by Roald Hoffmann, Columbia University Press, 1995.)

214. Which of the following is true of a catalyst?

It changes the equilibrium constant
It speeds up only the rate of the forward reaction
It is consumed in the course of the reaction
It lowers the activation energy for a reaction

234. (First-order kinetics, nuclear chemistry) **Demonstration:** Each student has a coin. Have the class stand up and, before doing the demonstration, explain that each student will be tossing their coin at the same time; if a student's coin is a "heads," the student will sit down. The students who tossed tails remain standing and toss their coins again, all at the same time. Again, students who toss a "heads" on this second coin flip will sit down. Those who tossed tails, who are still standing, now do a third coin toss and,

again, those with a “heads” sit down. After explaining the procedure, ask the class to predict how many coin tosses it will take until essentially the whole class is seated. (The choices provided will depend on the class size; a good approximation to the right number of tosses will be the closest power of two that just exceeds the lecture size. For example, for a class of 150, a good answer would be 8, as $2^8=256$. Reasonable choices from which to choose would be 4, **8**, and 12 tosses.) After making the prediction, the demonstration is conducted. The demonstration can also be conducted quantitatively, with the number of students standing counted after each coin toss. These data can be plotted/projected on linear and/or semilog paper.

Based on a demonstration performed by Dudley Herschbach.