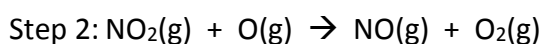
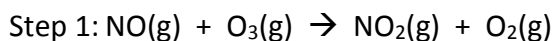


Kinetics Study Guide – Multiple Choice

1. If 87.5 percent of a sample of pure ^{131}I decays in 24 days, what is the half-life of ^{131}I ?
 - (A) 6 days
 - (B) 8 days
 - (C) 12 days
 - (D) 24 days

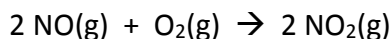


2. For the reaction represented above, the initial rate of decrease in $[\text{X}]$ was $2.8 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$. What was the initial rate of decrease in $[\text{Y}]$?
 - (A) $7.0 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
 - (B) $1.4 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$
 - (C) $2.8 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$
 - (D) $5.6 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$
3. Which of the following statements best explains why an increase in temperature of 5-10 Celsius degrees can substantially increase the rate of a chemical reaction?
 - (A) The activation energy for the reaction is lowered.
 - (B) The number of effective collisions between particles is increased.
 - (C) ΔH for the reaction is lowered.
 - (D) ΔG for the reaction becomes more positive.

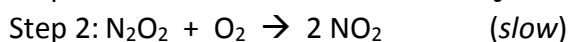
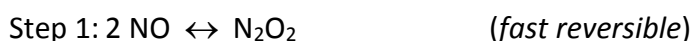


4. A reaction mechanism for the destruction of ozone, $\text{O}_3\text{(g)}$, is represented above. In the overall reaction, NO(g) is best described as
 - (A) a catalyst
 - (B) a reactant
 - (C) an intermediate
 - (D) a product
5. The rate law for the reaction of nitrogen dioxide and chlorine is found to be $\text{rate} = k [\text{NO}_2]^2 [\text{Cl}_2]$. By what factor does the rate of the reaction change when the concentrations of both NO_2 and Cl_2 are doubled?
 - (A) 2
 - (B) 3
 - (C) 6
 - (D) 8

6. A kinetics experiment is set up to collect the gas that is generated when a sample of chalk, consisting primarily of solid CaCO_3 , is added to a solution of ethanoic acid, CH_3COOH . The rate of reaction between CaCO_3 and CH_3COOH is determined by measuring the volume of gas generated at 25°C and 1 atm as a function of time. Which of the following experimental conditions is most likely to increase the rate of gas production?
- (A) Decreasing the volume of ethanoic acid solution used in the experiment.
 - (B) Decreasing the concentration of the ethanoic acid solution used in the experiment.
 - (C) Decreasing the temperature at which the experiment is performed.
 - (D) Decreasing the particle size of the CaCO_3 by grinding it into a fine powder.

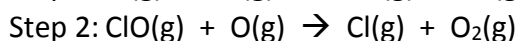
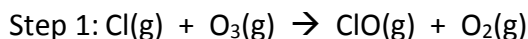


7. Consider the following mechanism for the reaction represented above.

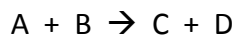


Which of the following statements is true?

- (A) Step 1 represents a unimolecular reaction.
- (B) Increasing the concentration of NO will decrease the overall rate of the reaction.
- (C) Raising the temperature will have no effect on the numerical value of the rate constant.
- (D) The rate law that is consistent with the mechanism is $\text{rate} = k[\text{NO}]^2[\text{O}_2]$.



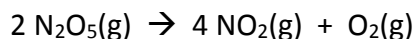
8. A proposed mechanism for destruction of ozone gas in the stratosphere is represented above. Which of the following is evidence that the mechanism is occurring?
- (A) The presence of $\text{Cl}(\text{g})$ increases the rate of the overall reaction.
 - (B) The presence of $\text{Cl}(\text{g})$ decreases the rate of the overall reaction.
 - (C) The presence of $\text{Cl}(\text{g})$ increases the equilibrium constant of the overall reaction.
 - (D) The presence of $\text{Cl}(\text{g})$ decreases the equilibrium constant of the overall reaction.
9. If the carbon isotope ^{11}C has a half-life of 20 minutes, what fraction of a sample of pure ^{11}C remains after 1 hour?
- (A) $\frac{1}{4}$
 - (B) $\frac{7}{30}$
 - (C) $\frac{1}{8}$
 - (D) $\frac{1}{16}$



10. The rate law for the reaction shown above is as follows: $\text{rate} = k[A]$. Which of the following changes to the system will increase the rate of the reaction?

- I. An increase in the concentration of A.
- II. An increase in the concentration of B.
- III. An increase in the temperature.

- (A) I only
- (B) I and II only
- (C) I and III only
- (D) I, II and III



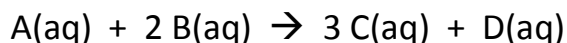
11. A sample of N_2O_5 was placed in an evacuated container, and the reaction represented above occurred. The value of $P_{\text{N}_2\text{O}_5}$, the partial pressure of $\text{N}_2\text{O}_5(\text{g})$, was measured during the reaction and recorded in the table below.

Time (min)	$P_{\text{N}_2\text{O}_5}$ (atm)	$\ln(P_{\text{N}_2\text{O}_5})$	$\frac{1}{P_{\text{N}_2\text{O}_5}}$ (atm^{-1})
0	150	5.0	0.0067
100	75	4.3	0.013
200	38	3.6	0.027
300	19	2.9	0.053

Which of the following correctly describes the reaction?

- (A) The decomposition of N_2O_5 is zero-order reaction.
- (B) The decomposition of N_2O_5 is a first-order reaction.
- (C) The decomposition of N_2O_5 is a second-order reaction.
- (D) The overall reaction order is 3.

Use the reaction below to answer questions 12-16.



12. Which of the following best represents the ratio of the initial rate of appearance of C with the initial rate of disappearance of B?

- (A) 1 : 2
- (B) 2 : 3
- (C) 3 : 1
- (D) 3 : 2

13. Which of the following is a correct expression for the rate of the reaction above?

(A) $\frac{-\Delta[A]}{2\Delta t}$

(B) $\frac{-\Delta[B]}{\Delta t}$

(C) $\frac{\Delta[C]}{3\Delta t}$

(D) $\frac{\Delta[D]}{3\Delta t}$

14. Five trials for the reaction above were carried out at 30°C. The following data were obtained.

Experiment	[A] ₀ (mol/L)	[B] ₀ (mol/L)	Initial Rate of Reaction (mol/L · hr)
1	0.240	0.480	8.00
2	0.240	0.120	2.00
3	0.360	0.240	9.00
4	0.120	0.120	0.500
5	0.240	0.0600	1.00

Which of the following is the correct rate expression for the reaction?

(A) Rate = k [A][B]²

(B) Rate = k [A][B]

(C) Rate = k [A]²[B]

(D) Rate = k [A]

15. What is the overall reaction order?

(A) 1

(B) 2

(C) 3

(D) 4

16. If the concentration of A was tripled and B was doubled, then how would the rate of reaction change?

(A) Rate would increase by a factor of 6.

(B) Rate would increase by a factor of 9.

(C) Rate would increase by a factor of 12.

(D) Rate would increase by a factor of 18.