



REVISION CHAPTER 11

Reaction rates



OCTOBER 9, 2023

PREPARED BY AMIRA MOHAMMED
Al Maha school

Student name :

Date :

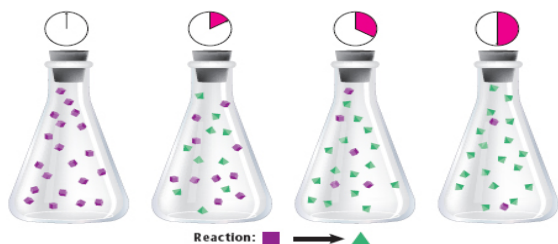
Rate of reaction

Choose the correct answer

1. Which of the following is the theory that states that atoms, molecules, and ions must collide for a chemical reaction to occur?

- A. ☐ collision theory
- B. ☐ accident theory
- C. ☐ reaction theory
- D. ☐ mechanism

2. Chemical A breaks down into chemical B. At $t=0$, $[A] = 0.100$ M. At $t=10.0$ s, $[A] = 0.075$ M. What is the average reaction rate?

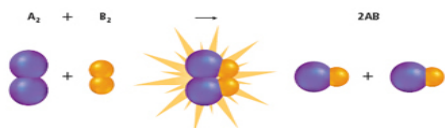


- A. ☐ 0.0925 mol/Ls
- B. ☐ 0.0975 mol/Ls
- C. ☐ 0.0025 mol/Ls
- D. ☐ 0.25 mol/Ls

3. How much time has passed when 5 mol/L have reacted at an average rate of 0.5 mol/L·s?

- A. ☐ 1.0 s
- B. ☐ 10 s
- C. ☐ 100 s
- D. ☐ 0.1 s

4. What is the name of the unstable molecule formed during the collision of A_2 and B_2 ?



- A. ☐ product
- B. ☐ reactant
- C. ☐ activated complex
- D. ☐ diatomic molecule

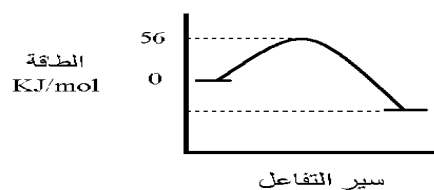
1- which of the following represent the activated complex for reaction $AB + AB \rightarrow A_2 + 2B$

- A. $A---A + 2B$
- B. $B---A---A--B$
- C. $A---B + 2B$
- D. $A---B---A---B$

2- The activation energy for the reversible reaction equal to



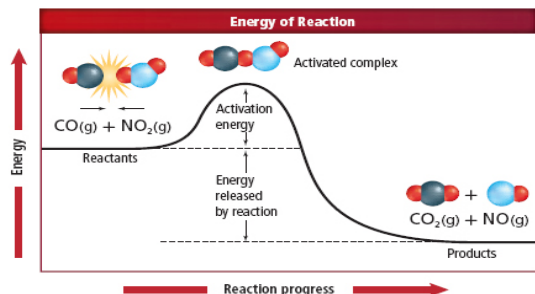
- A. 23 KJ
- B. 89 KJ
- C. 56 KJ
- D. 33 KJ



Student name :

Date :

5. Activation energy is _____.



- A. ☐ the energy released by a chemical reaction.
 B. ☐ the energy absorbed by a chemical reaction.
 C. ☐ the energy reacting particles must have to form the activated complex
 D. ☐ the energy produced by the combustion of the reactants

1. When the concentration of a reactant is increased, the _____.

- A. ☐ reaction speeds up
 B. ☐ reaction slows down
 C. ☐ reaction stops
 D. ☐ reaction rate does not change

2. When you increase the temperature of a chemical reaction, the _____.

- A. ☐ reaction speeds up
 B. ☐ reaction slows down
 C. ☐ reaction stops
 D. ☐ reaction rate does not change

3. What happens to the activation energy of the reaction when a catalyst is present?

Need

- A. ☐ The activation energy does not change.
 B. ☐ The activation energy decreases.
 C. ☐ The activation energy increases.
 D. ☐ The reaction stops.

4. Automobiles use a catalytic converter made of metal to ensure complete combustion of gasoline. What type of catalyst is present in automobiles?

Need

- A. ☐ homogeneous catalyst
 B. ☐ heterogeneous catalyst
 C. ☐ solid-state catalyst
 D. ☐ ephemeral catalyst

3- for this reaction $2\text{NO}_2(\text{g}) + \text{F}_2(\text{g}) \rightarrow 2\text{NO}_2\text{F}(\text{g})$ if you know the reaction rate law is $R = k[\text{NO}_2][\text{F}_2]$ the total order

- A. 1
 B. 2
 C. 3
 D. 4

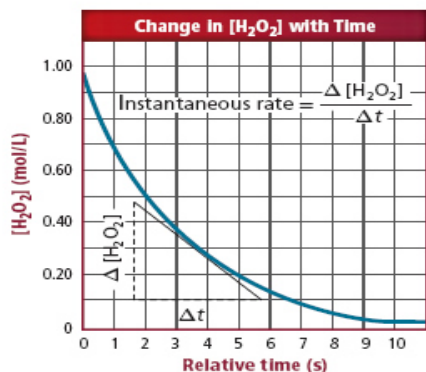
Student name :

Date :

5. What might an inhibitor do in a chemical reaction?

- A. ☐ speed up the reaction
- B. ☐ drive the reaction to completion
- C. ☐ raise the activation energy
- D. ☐ lower the activation energy

9. In the reaction of hydrogen peroxide, what happens to the instantaneous rate as time passes?



$$\text{Slope of line} = \frac{\Delta x}{\Delta y}$$

$$\text{Instantaneous rate} = \frac{\Delta [\text{H}_2\text{O}_2]}{\Delta t}$$

$$\frac{\Delta x}{\Delta y} = \frac{\Delta [\text{H}_2\text{O}_2]}{\Delta t}$$

- A. ☐ the rate increases
- B. ☐ the rate decreases
- C. ☐ the rate stays the same
- D. ☐ the rate doubles

8. As reactants are consumed and fewer particles are available to collide, most chemical reactions _____.

$$\text{Rate} = k[A]$$

- A. ☐ speed up
- B. ☐ slow down
- C. ☐ stop
- D. ☐ continue at the same rate

1. Three practical experiments were conducted to measure the initial rate of the reaction $A + B \rightarrow 2C$. The conditions were similar in the three experiments except for the concentrations of the reactants which were variable and the results were as follows:

(M/s) rate	[B] M	[A] M	experiment
4.8×10^{-4}	1.6	0.6	1
1.3×10^{-2}	1.6	1.8	2
1.2×10^{-4}	0.8	0.6	3

Write the law of rate of reaction, then find the value of constant rate and quality of units. ?.

The diagram represents the reaction of hydrogen peroxide decomposition

1- name the symbols A,B,C

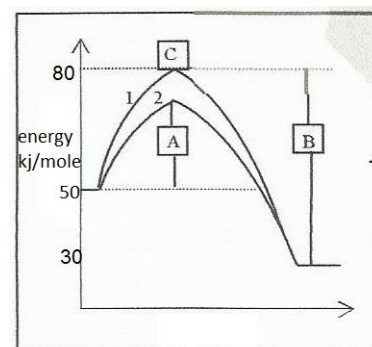
A is

B is C is

2- Is this reaction endothermic or exothermic reaction and why ?

.....
.....

3- Calculate E_a , E_a° , ΔH



Student name :

Date :

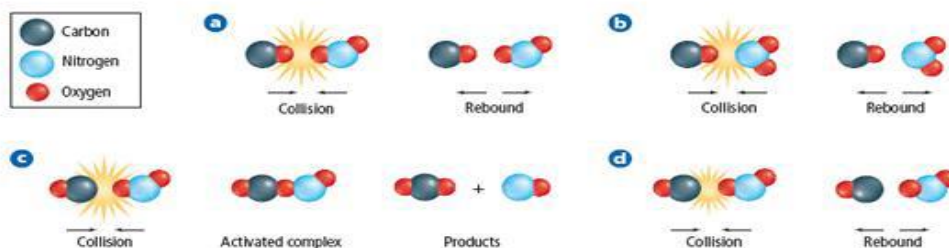
1. The term that describes the change in the concentration of a reactant divided by the change in time of the reaction is the

- A. ☐ rate constant
- B. ☐ average reaction rate
- C. ☐ activated complex
- D. ☐ chemical reaction

2. What is the term used to describe the minimum energy needed to form an activated complex?

- A. ☐ temperature
- B. ☐ kinetic energy
- C. ☐ activation energy
- D. ☐ potential energy

4. What factors might prevent a collision of molecules from resulting in a reaction?



- A. ☐ incorrect orientation
- B. ☐ insufficient energy
- C. ☐ both a and b
- D. ☐ none of the above

5. What will happen when you decrease the surface area of a reactant?

- A. ☐ The reaction speeds up.
- B. ☐ The reaction slows down.
- C. ☐ The reaction stops.
- D. ☐ The reaction rate does not change.

6. A substance that speeds up the reaction rate but is not consumed in the reaction is a(n) _____.

- A. ☐ reactant
- B. ☐ product
- C. ☐ catalyst
- D. ☐ inhibitor

7. What is the name given to a catalyst that exists in the same physical state as the reaction being catalyzed?

- A. ☐ homogeneous catalyst
- B. ☐ heterogeneous catalyst
- C. ☐ solid-state catalyst
- D. ☐ ephemeral catalyst

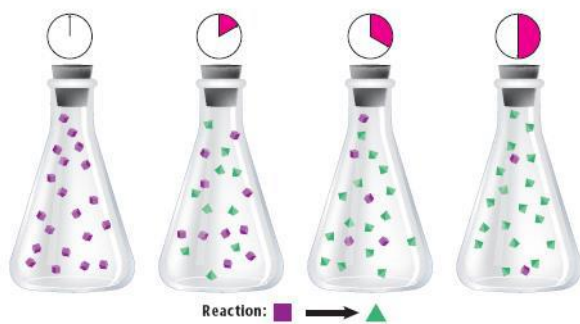
Student name :

Date :

13. What are the units that generally express a reaction rate?

- A. ☐ liters per mole per second
- B. ☐ moles per liter per second
- C. ☐ seconds per liter per mole
- D. ☐ seconds per mole per liter

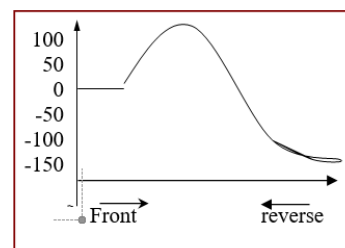
3. Chemical A breaks down into chemical B. At $t=0$, $[B] = 0.00 \text{ M}$. At $t=5.00 \text{ s}$, $[B] = 0.150 \text{ M}$. What is the average reaction rate?



- A. ☐ -0.0300 mol/Ls
- B. ☐ 0.0300 mol/Ls
- C. ☐ 0.300 mol/Ls
- D. ☐ -0.300 mol/Ls

look at The graph of energy in the following diagram and marking of reactant and product, activated complex ΔH , E_a , E_a^-

calculate ΔH أممي ΔH وعكسي ΔH و E_a و E_a^- .



Draw and label a graph of energy where the value of $E_a = 125 \text{ KJ/mol}$ and $E_a^- = 86 \text{ KJ/mol}$, place the reactors at the energy level 0,

- b) Calculate the front values ΔH and reverse ΔH ??
- C) Is the reaction exothermic or endothermic? Explain it??

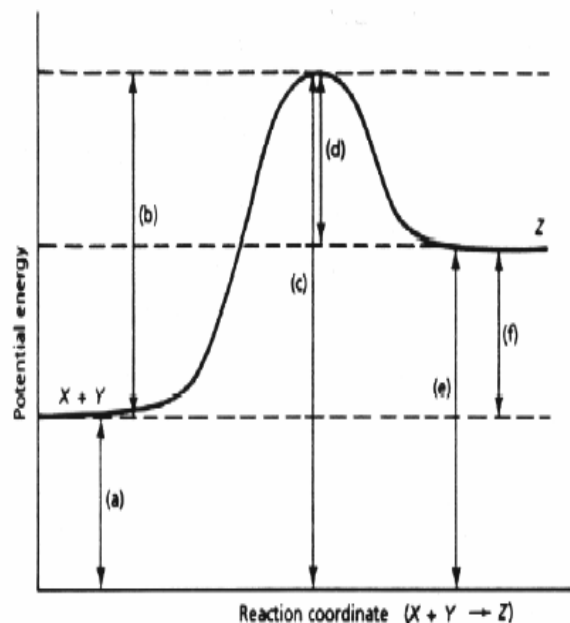
Draw and label a graph of energy where the value of $E_a = 154 \text{ KJ/mol}$ and $\Delta H = 136 \text{ KJ/mol}$, place the reactors at zero power level,

- b) calculate E_a^- activation energy for reverse reaction ??

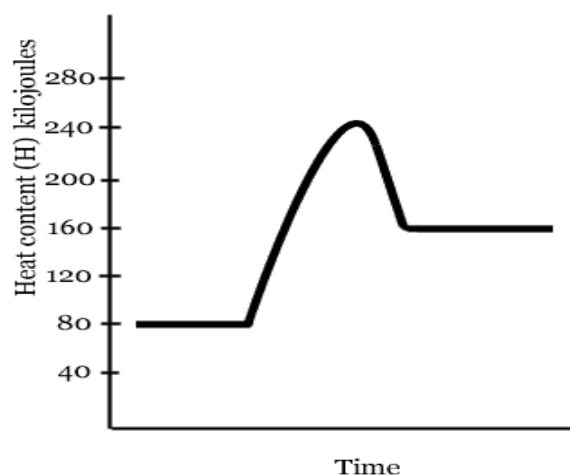
Student name :

Date :

1. Which of the letters a–f in the diagram represents the potential energy of the products? _____
2. Which letter indicates the potential energy of the activated complex? _____
3. Which letter indicates the potential energy of the reactants? _____
4. Which letter indicates the activation energy? _____
5. Which letter indicates the heat of reaction? _____
6. Is the reaction exothermic or endothermic? _____
7. Which letter indicates the activation energy of the reverse reaction? _____
8. Which letter indicates the heat of reaction of the reverse reaction? _____
9. Is the reverse reaction exothermic or endothermic? ____



1. The heat content of the reactants of the forward reaction is about _____ kilojoules.
2. The heat content of the products of the forward reaction is about _____ kilojoules.
3. The heat content of the activated complex of the forward reaction is about _____ kilojoules.
4. The activation energy of the forward reaction is about _____ kilojoules.
5. The heat of reaction (ΔH) of the forward reaction is about _____ kilojoules.
6. The forward reaction is _____ (endothermic or exothermic).
7. The heat content of the reactants of the reverse reaction is about _____ kilojoules.
8. The heat content of the products of the reverse reaction is about _____ kilojoules.
9. The heat content of the activated complex of the reverse reaction is about _____ kilojoules.
10. The activation energy of the reverse reaction is about _____ kilojoules.
11. The heat of reaction (ΔH) of the reverse reaction is about _____ kilojoules.
12. The reverse reaction is _____ (endothermic or exothermic).



Student name :

Date :

31. A reaction collision requires _____ to be effective.

- only enough energy
- favorable orientation
- enough energy and favorable orientation
- a reaction mechanism

32. If a collision between molecules is very gentle, the molecules are

- more likely to be oriented favorably.
- less likely to be oriented favorably.
- likely to react.
- likely to rebound without reacting.

36. Hydrogen iodide (HI) decomposes as $2\text{HI} \rightarrow \text{H}_2 + \text{I}_2$. The average reaction rate is expressed as:

$$\text{Average rate} = -\frac{1\Delta[\text{HI}]}{2\Delta t}$$

The negative sign used in the rate expression indicates that:

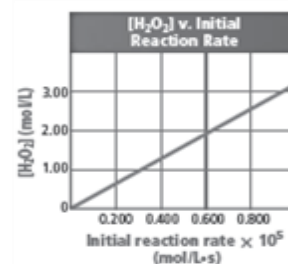
- There are repulsive forces between the reactants.
- The concentration of HI decreases with time.
- The concentration of the reactants is less than that of the product.
- The reaction rate is decreasing with time.

38. In the reaction $2\text{A} \rightarrow \text{B}$, the rate of a reaction is quadrupled when the concentration of A is doubled. The rate expression of the reaction is $r = k[\text{A}]^n$. Define the value of n .

- zero
- one
- two
- three

39. The upward-sloped straight line of the graph below indicates which type of relationship between the concentration of H_2O_2 and the initial reaction rate?

- absolute
- direct
- indirect
- inverse

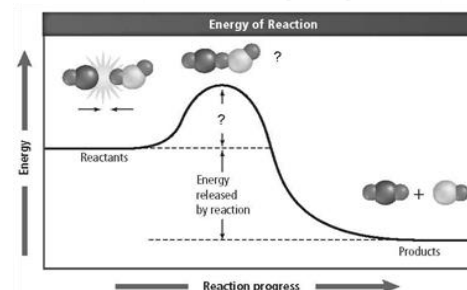


Enter the appropriate word(s) to complete the statement.

45. When a chemical reaction occurs, such as the one illustrated in the diagram, molecules collide with enough energy to overcome the _____ barrier.

46. For a chemical reaction to occur, such as the one illustrated in the diagram, molecules must collide with sufficient energy to form a(n) _____.

49. A/An _____ is a temporary, unstable arrangement of atoms in which old bonds are breaking and new bonds are forming.



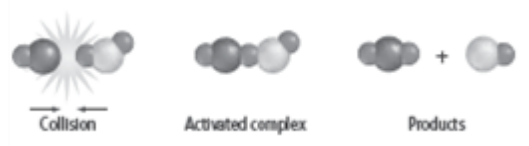
52. In a reaction of butyl chloride and water, the concentration of butyl chloride is 0.220M at the beginning of the reaction. After 4.00 seconds, the concentration of butyl chloride is 0.100M. Calculate the average reaction rate over the given time period expressed as moles of butyl chloride consumed per liter per second.

$$\text{Rate} = k[\text{A}]^m[\text{B}]^n$$

Student name :

Date :

71. In the reaction illustrated below, what two conditions are met which allow the reaction to occur?



76. The rate law expression for the reaction $2A + B \rightarrow C + D$ is $r = k[A]^2[B]$. If the concentrations of both the reactants are doubled, by how many times will the reaction rate increase?

77. Propane on reaction with chlorine (Cl_2) produces propyl chloride and hydrogen chloride (HCl). Calculate the final concentration of propyl chloride when the initial concentration of the product is 0.79 and the average reaction rate is 0.55 mol/(L·s). The data of time is given below .

Time (s)
Initial time =5.00
Final time =11.4

78. The reaction between sulfur and oxygen produces sulfur dioxide. The data is given in the table below:

Time (s)	[S] (M)	[O ₂] (M)	[SO ₂] (M)
$t_1 = 12$	0.082	0.067	0.000
$t_2 = 18$	0.040	0.020	0.041

- Calculate the average reaction rate expressed in moles of sulfur consumed per liter per second.
- Calculate the average reaction rate expressed in moles of oxygen consumed per liter per second.
- Calculate the average reaction rate expressed in moles of sulfur dioxide produced per liter per second.

80. The decomposition of hydrogen peroxide in the presence of iodide ion is of the first order. The reaction is $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$. Calculate the concentration of H_2O_2 when the rate of the reaction is 1.12×10^{-2} (mol/(L s)) and the rate constant is $1.01 \times 10^{-2} s^{-1}$.

82. Using information from the reaction rate table, calculate the average reaction rate expressed in moles H_2 consumed per liter per second.

Experimental Data for $H_2 + Cl_2 \rightarrow 2HCl$			
Time (s)	[H ₂] (M)	[Cl ₂] (M)	[HCl] (M)
0.00	0.045	0.065	0.000
5.00	0.035	0.055	

83. Using information from the reaction rate table, calculate the average reaction rate expressed in moles Cl_2 consumed per liter per second.

84. If the average reaction rate for the reaction, described with the table, expressed in moles of HCl formed, is 0.0075 mol/(L·s), what concentration of HCl would be present after 5 seconds?

85. List the three points that make up the Collision Theory Summary.

Collision Theory Summary
1.
2.
3.