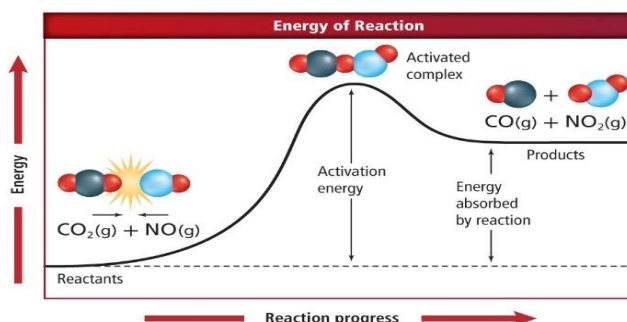
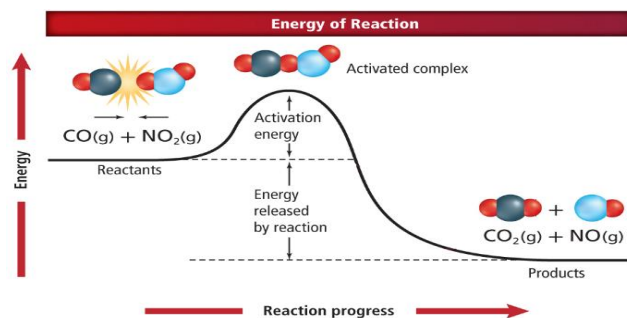


CHAPTER 11: Reaction Rates

- The **rate of a chemical reaction** is expressed as the rate at which a reactant is consumed or the rate at which a product is formed.
 - Reaction rates are generally calculated and expressed in moles per liter per second (mol/L • s).
 - In order to react, the particles in a chemical reaction must collide.
 - The rate of a chemical reaction is unrelated to the spontaneity of the reaction.
 - An **activated complex** is a temporary, unstable arrangement of atoms in which old bonds are breaking and new bonds are forming.
 - **Key factors** that influence the rate of chemical reactions include reactivity, concentration, surface area, temperature, and catalysts.
 - Raising the temperature of a reaction generally increases the rate of the reaction by increasing the collision frequency and the number of collisions that form an activated complex.
 - Catalysts increase the rates of chemical reactions by lowering activation energies.
 - The mathematical relationship between the rate of a chemical reaction at a given temperature and the concentrations of reactants is called the **rate law**.
- Rate** = $k[A]^m[B]^n$
- The rate law for a chemical reaction is determined experimentally using the method of initial rates.
 - The reaction mechanism of a chemical reaction must be determined experimentally.
 - For a complex reaction, the rate-determining step limits the instantaneous rate of the overall reaction.

$$\text{average reaction rate} = -\frac{\Delta[\text{reactant}]}{\Delta t}$$



1 The change in concentration of a reactants or products per unit of time is...

- CH A Chemical equilibrium
 11 B Catalyst
 C Equivalence
 D Reaction rate

The rate of a chemical reaction is expressed as the rate at which a reactant is consumed or the rate at which a product is formed. →D

2 What is the reaction rate of $H_2 + Cl_2 \rightarrow 2HCl$ knowing that the concentration for $[H_2]$ in the beginning of the reaction is 0.8M and then it became 0.2 M after 2s.

- CH A 0.1 mol/L.s B 0.2 mol/L.s
 11 C 0.3 mol/L.s D 0.4 mol/L.s

$(0.8M - 0.2M) \div 2s = 0.3 \text{ mol/L.s}$ →C

3 A temporary, unstable arrangement of atoms in which old bonds are breaking and new bonds are forming is called ____.

- CH A Reaction complex B Reaction substrate
 11 C Activated complex D Activated molecule

A temporary, unstable arrangement of atoms in which old bonds are breaking and new bonds are forming is called Activated complex →C

4 The energy required to initiate a reaction is called ____.

- CH A Initiation energy B Activation energy
 11 C Complex energy D Catalyst energy

The energy required to initiate a reaction is called Activation energy. →C

5 Activated complex is...

- CH A Stable status
 11 B Catalyst
 C Unstable status
 D one of the products formation

A temporary, unstable arrangement of atoms in which old bonds are breaking and new bonds are forming is called Activated complex →C

6 In general, which of the following does not cause a reaction rate to increase?

- CH A Increasing surface area
 11 B Increasing temperature
 C Increasing volume
 D Adding a catalyst

Key factors that influence the rate of chemical reactions include reactivity, concentration, surface area, temperature, and catalysts. →C

7 What is the overall reaction order of the following reaction? $\text{Rate} = k[A][B]^2$

- CH A 1st order B 2nd order
 11 C 3rd order D 4th order

Overall reaction equals the sum of reactants orders. →C

8 Which of the following is an acceptable unit for expressing a rate?

- CH A mol/L.s B L/s
 11 C M D mL/h

Reaction rates are generally calculated and expressed in moles per liter per second (mol/L.s). →A

CHAPTER 11: Reaction Rates

9 Doubling the concentration of one reactant in a reaction causes the reaction rate to double. What is the order of that reactant?

CH A 1st B 2nd

11 C 3rd D unable to determine

Doubling the concentration of one reactant in the 1st reaction causes the reaction rate to double

→A

10 In an exothermic reaction: products energy are..... the energy of reactants

CH A Have no relation B Less than

11 C Equals D Greater than

In an exothermic reaction: products energy are less than the energy of reactants

→B

11 In an endothermic reaction: energy of forming the reactants energy of breaking the products

CH A Equals half of the B Less than the

11 C Equals the D Greater than the

In an endothermic reaction: energy of forming the reactants greater than the energy of breaking the products

→D

12 Which of the following do not affect the reaction rate?

CH A Nature of the reactants B Nature of the products

11 C Temperature D Catalyst and inhibitors

Key factors that influence the rate of chemical reactions include reactivity, concentration, surface area, temperature, and catalysts.

→B

13 500g of wood dust burns faster than 500g of a piece of wood because...

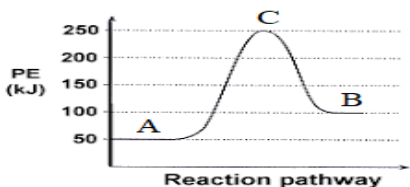
CH A Chemical composition B Concentration

11 C Temperature D Surface area

For the same mass, many small particles have more surface area than one large particle.

→D

14 Which of the following is the activated complex?



CH A A B B C C D D

11 An activated complex is a temporary, unstable arrangement of atoms in which old bonds are breaking and new bonds are forming.

→C

15 If the reaction order of the substance A is zero then changing its concentration ...

CH A Increases the reaction rate

11 B Decreases the reaction rate

C Stops the reaction

D Doesn't affect the reaction

Doesn't affect the reaction

→D

16 The reaction rate constant can be changed with...

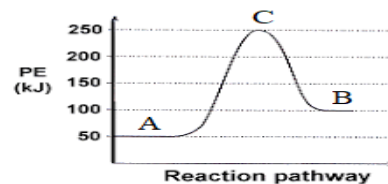
CH A Reactants concentration B Temperature

11 C Products concentration D Catalysts

The reaction rate constant can be changed with temperature.

→B

17 The following reaction is?



CH A Endothermic

11 B Exothermic

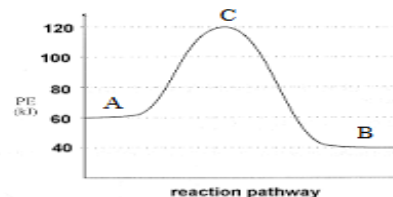
C Both endothermic and exothermic

D Polythermic

In endothermic reactions energy of products is more than energy of reactants.

→A

18 The following reaction is?



CH A Endothermic

11 B Exothermic

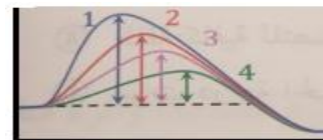
C Both endothermic and exothermic

D Polythermic

In exothermic reactions energy of reactants is more than energy of products.

→B

19 Which of the following enzymes are more reactive?



CH A A B B C C D D

11 The enzymes that can lowering activation energy more than the other enzymes will be the most active enzyme

→D

20 Reaction rate...Reactants concentration

CH A Directly related to

11 B Inversely related to

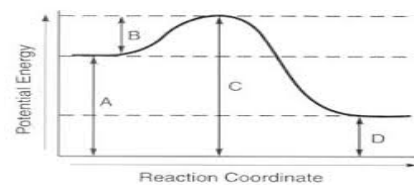
C Directly related to the square root of

D have no relationship

Reaction rate directly related to Reactants concentration.

→A

21 Which of the following is the activation energy?



CH A A B B C C D D

11 The minimum amount of energy that reacting particles must have to form the activated complex and lead to a reaction is called the activation energy.

→B