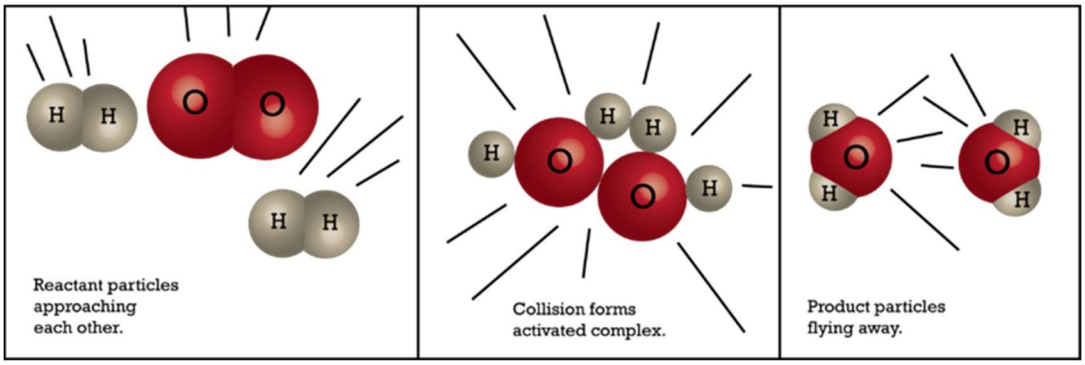
2. COLLISION THEORY OF CHEMICAL REACTIONS

CH40S UNIT 2 KINETICS WIEBE

1

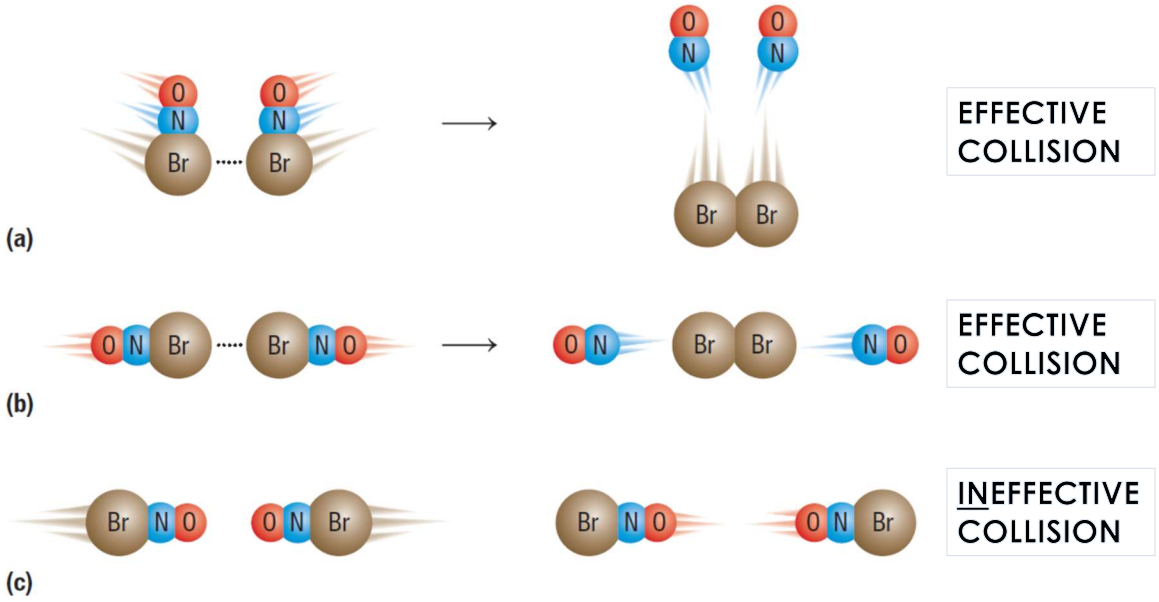
COLLISION THEORY

collision theory the theory that chemical reactions can occur only if reactants collide with proper orientation and with enough kinetic energy to break reactant bonds and form product bonds



2

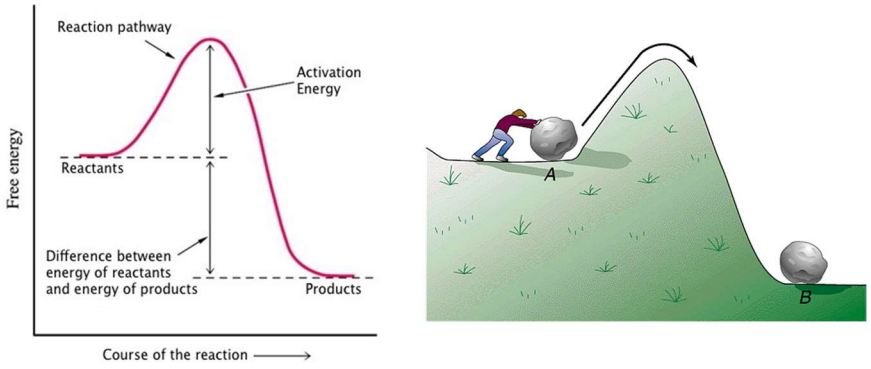
COLLISION THEORY - ORIENTATION



3

COLLISION THEORY – ENERGY

The minimum amount of energy required for a collision to be effective is called the **activation energy, E_a.**

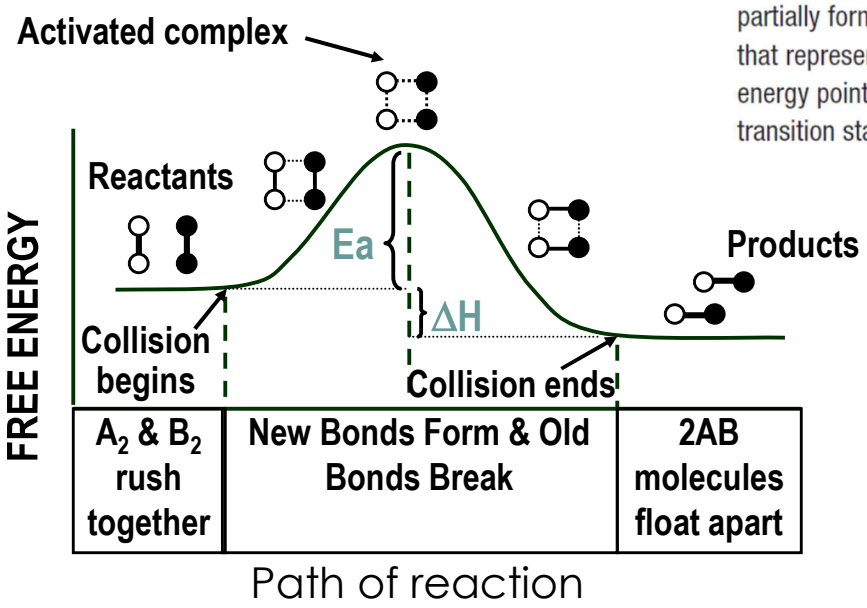


The difference in energy between the reactant molecules and the products molecules is called the **enthalpy (H)**

4

A CLOSER LOOK

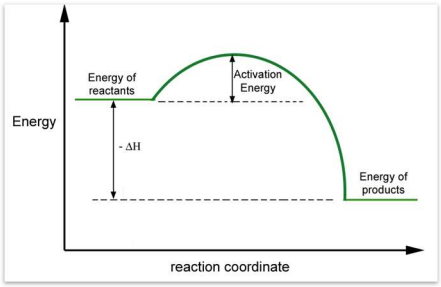
activated complex an unstable arrangement of atoms containing partially formed and unformed bonds that represents the maximum potential energy point in the change; also called the transition state



5

COLLISION THEORY – ENERGY

EXOTHERMIC: the reaction releases energy into the surroundings as it proceeds, and surroundings become hotter.



Standard Notation:

Reactants → Products + **ENERGY (kJ)**

ΔH Notation:

Reactants → Products **ΔH = - ENERGY (kJ)**

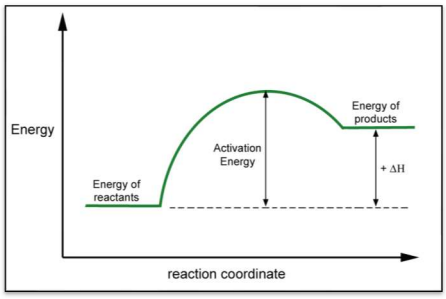
$CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l)$ **+ 882.0 kJ/mol**

$CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l)$ **ΔH = - 882.0 kJ/mol**

6

COLLISION THEORY – ENERGY

ENDOTHERMIC: the reaction absorbs energy from the surroundings as it proceeds, and surroundings become colder



Standard Notation:

Reactants + **ENERGY (kJ)** → Products

ΔH Notation:

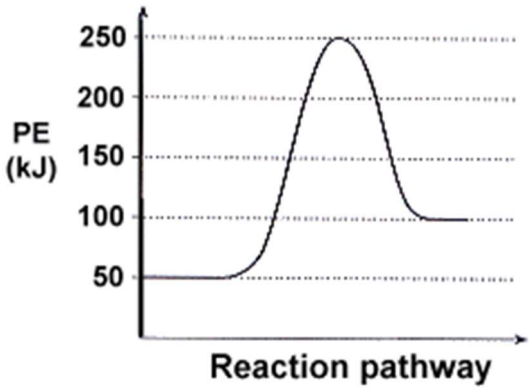
Reactants → Products **ΔH = + ENERGY (kJ)**

$Ba(OH)_2 \cdot 8H_2O(s) + NH_4SCN(s) + \textbf{ENERGY (kJ)} \rightarrow Ba(SCN)_2(aq) + 2\ NH_3(g) + 10\ H_2O(l)$

7

EXAMPLE #1

Determine the activation energy and the ΔH for the decomposition of nitrogen monoxide into its elements, as represented by the energy diagram below. Write the balanced chemical reaction in standard notation as well as ΔH notation. Identify it as exothermic or endothermic.

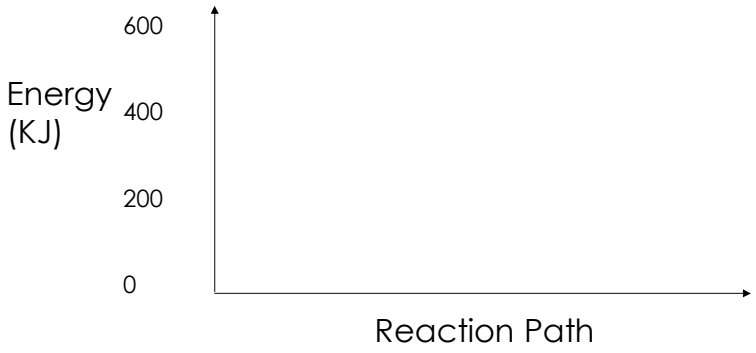


8

EXAMPLE #2

Draw the potential energy diagram for the following chemical reaction if the energy of the reactant molecules is 400 kJ and the activation energy is 200 kJ. Identify the reaction as exothermic or endothermic.

$H_2 + I_2 \rightarrow 2HI$ $\Delta H = -170$ kJ



9