

PENANG SANGAM HIGH SCHOOL
P.O.BOX 44, RAKIRAKI

LESSON NOTES

Subject: Chemistry

Year/Level: 12

Week 13

Strand	3 Quantitative Chemistry
Sub Strand	3.3 Physical chemistry
Content Learning Outcome	To differentiate between endothermic and exothermic reaction using examples and graphs.

Endothermic and Exothermic reactions

- A chemical reaction is always accompanied by a change in energy (enthalpy change).
- Energy change occurs in the form of absorbing heat from the surrounding or releasing heat to the surrounding.
- The general rule is:
 - **Breaking** chemical bonds **needs** energy.
 - **Forming** chemical bonds **releases** energy.

Endothermic reaction-

- when more energy is required to break existing bonds than the energy that is released when new bonds are formed, heat is **absorbed**.
- are recognised by the **temperature of the surrounding decreasing**.
- Examples include thermal decomposition, base dissolving in water, melting, ammonium chloride and potassium nitrate dissolving in water.

Exothermic reaction

- If in the formation of new bonds more energy is released than is required to break the existing bonds, **heat is given out**.
- are recognized by the temperature of the surrounding increasing.
- Examples include combustion, respiration, neutralisation, dissolving acids in water, freezing and corrosion of metals.

*The symbol H is used to represent the **enthalpy** (heat content) of a chemical.

*The enthalpy of a chemical cannot be measured by itself; however, the **change in enthalpy (ΔH)** during a reaction can be measured.

$$\text{Change in enthalpy} = \text{Energy of products} - \text{Energy of reactants}$$

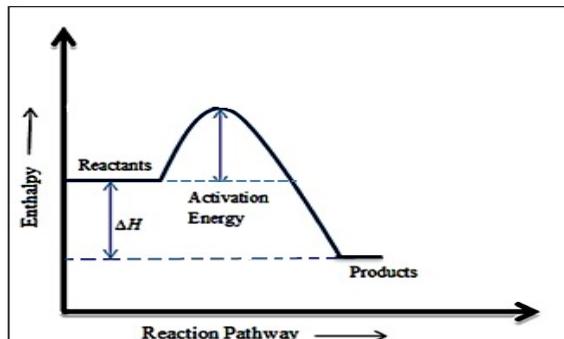
$$\Delta H = H_p - H_r$$

Note: If the ΔH is **negative**, the reaction is **exothermic** since heat energy is released.

If the ΔH is **positive**, the reaction is **endothermic** since heat energy is absorbed.

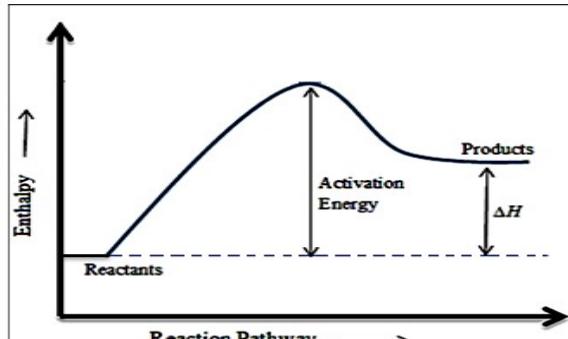
The amount of heat energy being absorbed or released depends on the strength of the bonds being broken or formed respectively.

Exothermic reaction



reaction.

Endothermic Reaction



b e

Note: the activation energy (E_a) is measured from the peak of the curve to the level of reactants.

Significance of activation energy

Small E_a means a faster rate of reaction

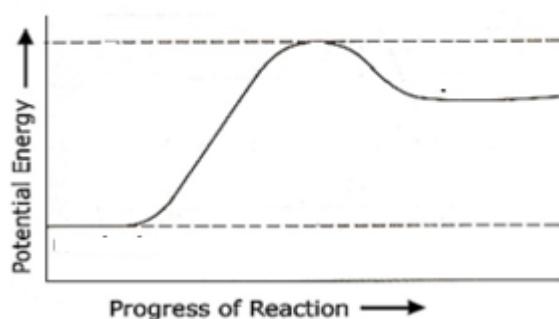
Large E_a means a slower rate of reaction

Comparison of exothermic and endothermic reactions

Exothermic	Endothermic
Heat is released to the surrounding	Heat is absorbed from the surrounding
Temperature of surrounding increases	Temperature of surrounding decreases
Enthalpy of products is less than enthalpy of reactants	Enthalpy of products is more than enthalpy of reactants
Enthalpy change (ΔH) is negative since $\Delta H = H_p - H_r, \Delta H < 0$	Enthalpy change (ΔH) is positive since $\Delta H = H_p - H_r, \Delta H > 0$
Reaction container becomes warm	Reaction container becomes cool

Activity

- Consider the diagram given below.



Label the graph, indicate whether its endothermic or exothermic reaction with justification.
