

PENANG SANGAM HIGH SCHOOL

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LESSON NOTES

WEEK 18

Year/Level: 13A/B

Subject: Chemistry

Strand 3	Reactions
Sub Strand 3.2	Thermochemistry
Content Learning Outcome	By the end of this lesson students should be able: • Define bond energy. • Identify the uses of bond energies. • Perform calculations on bond energy using the bond energy data.

Bond Energy/ Bond Enthalpy

- ★ Amount of energy required to break a chemical bonds to give uncharged fragments.

Note:

- ★ For bonds to be broken ,energy is supplied---an endothermic process(ΔH -positive)

- ★ Formation of bonds releases energy----an exothermic process(ΔH - negative)

The bond energies depend on:

1. Bond polarity

- ★ As bond polarity increases the bond energy also increases.

2. Bond Order

$$\text{Bond order} = \frac{\text{number of shared electrons}}{2}$$

Example:

Compound	Bond order
C-C	1
C=C	2
C $\equiv$ C	3

- ★ **As bond order increases bond energy also increases.**

3. Bond Strength

- ★ Related to bond length.

- ★ As bond length decreases bond strength increases thus bond energy increases.

Uses of Bond Energy

- ★ Indicates whether the bond is single, double or triple.

- ★ Determines the chemical properties, bonding etc.
- ★ To calculate the enthalpy change in a chemical reaction.

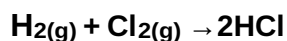
Note:

Bond energies do not vary from compound to compound.

$\Delta H^\circ = \text{total energy required to break bonds} + \text{total energy released in bond formation}$

Example:

Use the bond energy given below to predict the heat of reaction in kJ for the following reaction.



Bond Energy:

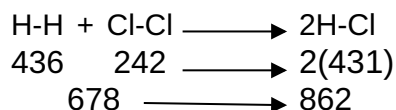
H-H = 436kJ/mol

Cl-Cl = 242kJ/mol

H-Cl = 431kJ/mol

Solution

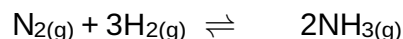
Ensure that the equation is balanced.



$$\begin{aligned}\Delta H^\circ &= \text{Bonds broken} - \text{bonds formed} \\ &= 678 - 862 \\ &= \underline{-184\text{kJ exothermic rxn}}\end{aligned}$$

Exercise

- Ammonia is obtained commercially according to the equation given below.



- Calculate the enthalpy change for the above reaction.

Bond energies in kJ/mol

N-N	H-H	N-H	N≡N
163	436	391	945

- Give the ΔH°_f ($\text{NH}_3(\text{g})$) and indicate whether the production of ammonia is endothermic or exothermic.