PENANG SANGAM HIGH SCHOOL
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LESSON NOTES

Subject: Chemistry **Year/Level:** 12

Week 14

Strand	3 Quantitative Chemistry
Sub Strand	3. 3 Physical Chemistry
Content Learning Outcome	To define enthalpy change and calculate change in enthalpy for any given reaction.

Enthalpy Change

The **enthalpy change** is the energy change occurring during a reaction.

This unit of measurement is useful for calculating the **amount of energy per mole either released (- sign is used) or produced (+ sign is used) in a reaction.**

Example

1. $C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -390$ kJ/mol

- ✓ The equation shows that 390 kJ of heat energy is **given out** when 1 mole of **carbon** dioxide is formed from its elements.
- ✓ This reaction is **exothermic** since the ΔH is negative.

2. $\frac{1}{2} H_{2\,(g)} + \frac{1}{2} I_{2\,(g)} \rightarrow HI_{(l)}$ $\Delta H = +25.9$ kJ/mol

- ✓ The equation shows that 25.9 kJ of heat energy is **absorbed** from the surrounding when 1 mole of HI is formed from its elements.
- ✓ This reaction is **endothermic** since the ΔH *is* positive.

Note: the overall energy change during a reaction is known as the enthalpy change (ΔH) and the unit for enthalpy change is KJ/ mol as the unit for energy is KJ.

Worked example for calculating enthalpy changes

Using the given reaction equation, calculate the amount of heat released when 6 g of carbon undergoes combustion.

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393.5$ kJ/mol

Solution

The given equation shows that when 12 g (1 mole) of carbon undergoes combustion, 393.5 kJ of heat energy is released.

Thus, 12 g : - 393.5 kJ

6 g : X

$$X = \frac{6\ g \times -393.5\ kJ}{12\ g}$$

$= -196.75$ kJ

Therefore, the ΔH when 6 g of carbon undergoes combustion is **-196.75 kJ.**

Activity

1. Consider the reaction given below and answer the question Consider the reaction given below and answer the questions that follow.

   $S_{(s)} + O_{2\ (g)} \rightarrow SO_{2\ (g)}$ $\Delta H = -296.8$ kJ/mol

   i) Is the reaction exothermic or endothermic? Give a reason for your answer.

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   ii) Calculate the heat energy released when 65g of Sulphur is burnt.

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2. Consider the following equation which represents the burning of methane:

   $CH_4\ (g) + 2O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (g)$ $\Delta H = -895$ kJ/mol

   Calculate the amount of energy released when 15g of methane undergoes combustion.

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