AP CHEMISTRY • EXERCISE SHEET

6.6 Introduction to Enthalpy of Reaction

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on the **enthalpy of reaction**.

You must be able to:

- interpret ΔH_{rxn} (heat at constant pressure)
- scale ΔH with the amount reacted
- use the sign to classify a reaction

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

Enthalpy of reaction

ΔH_{rxn} is the heat exchanged at constant pressure for the amounts in the balanced equation. A **negative** value is exothermic, **positive** is endothermic.

Scaling with amount

ΔH is proportional to the moles reacted. If a reaction releases 200 kJ per mole, then 2 mol releases 400 kJ; 0.5 mol releases 100 kJ.

Per the equation as written

The value belongs to the equation as written. Doubling all coefficients doubles ΔH; reversing the equation flips the sign.

A worked scaling

If $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ has $\Delta H = -890$ kJ, burning 0.25 mol CH_4 releases $0.25 \times 890 = 222.5$ kJ.

2 Practice

Now apply the methods above.

2.1 What does a negative ΔH_{rxn} mean? [1]

2.2 A reaction releases 150 kJ/mol. How much for 3 mol? [1]

2.3 How does reversing a reaction change ΔH? [1]

3 Exam-style questions

3.1 If a reaction as written has $\Delta H = -100$ kJ, then doubling all coefficients gives [1]

- **A** -50 kJ
- **B** -100 kJ
- **C** -200 kJ
- **D** $+100$ kJ

3.2 The reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ has $\Delta H = -92$ kJ.

(a) State whether it is exo- or endothermic. [1]

(b) Find the heat released when 1.0 mol NH_3 forms. [2]

3.3 Combustion of methane releases 890 kJ/mol. Find the heat released by burning 8.0 g of methane ($M = 16$ g/mol). [3]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **6.6 Introduction to Enthalpy of Reaction** lesson on the **Learn** page;
- read the **Introduction to Enthalpy of Reaction** section of the AP Chemistry handout on the **Know** page.

Solutions

2.1 The reaction is exothermic (releases heat).

2.2 450 kJ.

2.3 It flips the sign.

3.1 C —ΔH scales with the coefficients, so it doubles to -200 kJ.

3.2 (a) Exothermic. (b) ΔH is -92 kJ per 2 mol NH_3, so per 1 mol it is -46 kJ.

3.3 8.0 g $\div$ 16 $= 0.50$ mol; heat $= 0.50 \times 890 = 445$ kJ.