CHEMISTRY YEAR 11 - MODULE 4 - LESSON 10

Hess's Law Applied — Heat of Combustion & Consolidation

Use this worksheet after reading the lesson to practise the key ideas and prove you can meet the success criteria.

Name _____

Date _____

Class _____

1. Key Ideas

Engineers designing a car to run on ethanol vs octane need to know which fuel delivers more energy — per mole, per gram, and per litre. They calculate these values entirely on paper using the three methods you have built across Lessons 6–9. This lesson puts them all together: when to use bond energies, when to use ΔH° f values, and when Hess's Law is the only option.

- Energy per gram = |ΔH c | ÷ M (kJ g^{-1}) — the mass-based fuel comparison
- Why the three ΔH calculation methods are equivalent when applied to the same reaction

2. Success Criteria

By the end, you should be able to:

- Energy per gram = |ΔH c | ÷ M (kJ g^{-1}) — the mass-based fuel comparison
- Bond energy method → approximate; ΔH°f method → more accurate; Hess's Law → depends on data quality
- ΔH°f method and Hess's Law combustion cycle are mathematically equivalent

3. Key Terms

Enthalpy change (ΔH)
The heat energy exchanged at constant pressure during a reaction.

Exothermic
A reaction releasing heat to surroundings (ΔH < 0).

Endothermic
A reaction absorbing heat from surroundings (ΔH > 0).

Calorimetry
The experimental measurement of heat changes during chemical processes.

Hess's Law
The total enthalpy change is independent of the pathway taken.

Entropy
A measure of the disorder or randomness of a system.

4. Activity: Build the Lesson Map

Use the lesson to complete the table. Keep answers brief but specific.

Prompt	Your answer
Main concept	
Important example	
Common mistake to avoid	
How this links to the next lesson	

5. Short Answer Questions

1. Explain this lesson goal in your own words: "Energy per gram = |ΔH c | ÷ M (kJ g^{-1}) — the mass-based fuel comparison". Use one specific example from the lesson.

BAND 3 2 MARKS

2. Apply this idea to a new example: "Bond energy method → approximate; ΔH°f method → more accurate; Hess's Law → depends on data quality". Show your reasoning clearly.

BAND 4 3 MARKS

3. Analyse why this idea matters for understanding Hess's Law Applied — Heat of Combustion & Consolidation: "ΔH°f method and Hess's Law combustion cycle are mathematically equivalent".

BAND 5 4 MARKS

6. Extend: Apply the Idea

BAND 5/6 5 MARKS

A student gives a memorised answer about Hess's Law Applied — Heat of Combustion & Consolidation but does not use evidence or reasoning.

Improve the answer by writing a stronger response that uses accurate terminology, a relevant example and a clear explanation.

7. Multiple Choice

1. What is the best first step when answering a question about Hess's Law Applied — Heat of Combustion & Consolidation?

☐ A. Identify the key concept being tested

☐ B. Write every fact from memory

☐ C. Ignore the command word

☐ D. Skip examples and evidence

2. Which answer would show stronger understanding of Hess's Law Applied — Heat of Combustion & Consolidation?

☐ A. An answer with accurate terms and reasoning

☐ B. A copied definition only

☐ C. A single-word response

☐ D. An answer with no example

3. What should you do if a question asks you to explain?

☐ A. Link the idea to a reason or cause

☐ B. List unrelated facts

☐ C. Only draw a diagram

☐ D. Write the shortest possible answer

8. Success Criteria Proof

Finish with evidence that you can do each success criterion.

SUCCESS CRITERION 1

Prove that you can: Energy per gram = |ΔH c | ÷ M (kJ g^{-1}) — the mass-based fuel comparison

BAND 3 2 MARKS

SUCCESS CRITERION 2

Prove that you can: Bond energy method → approximate; ΔH°f method → more accurate; Hess's Law → depends on data quality

BAND 4 3 MARKS

SUCCESS CRITERION 3

Prove that you can: ΔH°f method and Hess's Law combustion cycle are mathematically equivalent

BAND 5 4 MARKS

One thing I still need help with: