

Bond Energy & Enthalpy Change

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

Nitrogen gas makes up 78% of the atmosphere — yet most living things cannot use it directly. The bond holding two nitrogen atoms together requires 945 kJ mol^{-1} to break, one of the highest bond energies known. Every chemical reaction is fundamentally about breaking old bonds and forming new ones — and bond energies let you calculate ΔH from first principles, without running a single experiment.

- Bond energy = average energy to break 1 mol of a bond in the gaseous state (kJ mol^{-1})
- Why bond energy calculations give approximate ΔH values (average bonds, gaseous state assumption)

2. Success Criteria

By the end, you should be able to:

- Bond energy = average energy to break 1 mol of a bond in the gaseous state (kJ mol^{-1})
- Bond breaking is always endothermic; bond forming is always exothermic
- $\Delta H = \Sigma B(\text{reactants}) - \Sigma B(\text{products})$: reactants first

3. Key Terms

$\Sigma B(\text{reactants})$

$\text{kJ } \Sigma B(\text{reactants}) = \dots$ (b) 3CO_2 ; $6 \times \text{C}=\text{O} = \dots$

$\Sigma B(\text{products})$

$\text{kJ } \Sigma B(\text{products}) = \dots$ (c) $\Delta H = \Sigma B(r) - \Sigma B(p) = \dots$
Exo/endo.

endothermic

A reaction that absorbs heat energy from the surroundings ($\Delta H > 0$).

Enthalpy change (ΔH)

The heat energy exchanged at constant pressure during a reaction.

Exothermic

A reaction releasing heat to surroundings ($\Delta H < 0$).

Calorimetry

The experimental measurement of heat changes during chemical processes.

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: "Bond energy = average energy to break 1 mol of a bond in the gaseous state (kJ mol^{-1})". Use one specific example from the lesson.

BAND 3 **2 MARKS**

2. Apply this idea to a new example: "Bond breaking is always endothermic; bond forming is always exothermic". Show your reasoning clearly.

BAND 4 **3 MARKS**

3. Analyse why this idea matters for understanding Bond Energy & Enthalpy Change: " $\Delta H = \Sigma B(\text{reactants}) - \Sigma B(\text{products})$: reactants first".

BAND 5 **4 MARKS**

6. Extend: Apply the Idea

BAND 5/6

5 MARKS

A student gives a memorised answer about Bond Energy & Enthalpy Change 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 Bond Energy & Enthalpy Change?

- 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 Bond Energy & Enthalpy Change?

- 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: Bond energy = average energy to break 1 mol of a bond in the gaseous state (kJ mol^{-1})

BAND 3 2 MARKS

SUCCESS CRITERION 2

Prove that you can: Bond breaking is always endothermic; bond forming is always exothermic

BAND 4 3 MARKS

SUCCESS CRITERION 3

Prove that you can: $\Delta H = \Sigma B(\text{reactants}) - \Sigma B(\text{products})$: reactants first

BAND 5 4 MARKS

One thing I still need help with:
