Bond breaking and making: the energy account

Student activity • observation and reasoning

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The question

Why does breaking a bond require energy?

Use an energy-account model to separate bond breaking from bond formation. Explain the overall reaction sign without saying that breaking bonds releases stored energy.

Equipment

- Booklet, pencil, periodic table and optional molecular model kit

Desk activity only; keep small model pieces away from mouths.

Course coverage: Chemistry only: 3.6C. Mean bond-energy bookkeeping, not an experiment or reaction mechanism.

Plan, model or apparatus sketch

Draw a labelled structure or model to explain your reasoning for this lesson.

Method and reasoning

Read the whole sequence before starting

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1. Draw a bonded pair and separated atoms. Show energy entering when the bond is broken.

2. Reverse the process and show energy released when the same bond forms.

3. Use an illustrative reaction needing 500 kJ mol^{-1} to break reactant bonds and releasing 650 kJ mol^{-1} when product bonds form. Calculate the net change.

4. Repeat for breaking 700 and forming 550 kJ mol^{-1}. Compare the sign and energy direction.

5. Explain why an exothermic reaction may still need ignition or another activation-energy input.

6. Correct a statement that burning methane releases energy simply because its C–H bonds break.

Cleanup

- Return shared equipment and retain corrected reasoning.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Original illustrative totals in kJ mol^{-1} for the reactions as written: A, breaking 500 and formation release 650; B, breaking 700 and formation release 550. Estimate ΔH=energy required for breaking−energy released by making. Values are energy magnitudes; assign the reaction sign after subtraction.

Task	My structure / working	Reason / correction
Breaking / making		
Example A		
Example B		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Is bond breaking endothermic or exothermic?

2. Is forming the same bond endothermic or exothermic?

3. Calculate ΔH for example A.

4. Calculate ΔH for example B.

5. Explain why ignition does not make combustion endothermic overall.

6. Correct the claim that bond breaking releases energy.