Alkanes: saturated structures and patterns

Student activity • observation and reasoning

YEAR 11 / LESSON 77 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

The question

How does carbon valency explain the alkane formula?

Build unbranched alkanes up to five carbons and relate every added carbon to the hydrogen count. Explain the limits of the acyclic formula.

Equipment

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

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

Course coverage: Shared core: 4.19–4.21. Unbranched alkanes through pentane; saturation and general formula.

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

YEAR 11 / LESSON 77 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

1. Build methane, ethane, propane, butane and pentane using four bonds at carbon and one at hydrogen.

2. Record a molecular formula beside each model and draw all bonds for propane and pentane.

3. Find the increment between adjacent members and derive H=2n+2 for an open single-bonded carbon chain.

4. Use the formula to check the five models and identify any missing terminal hydrogens.

5. Explain saturated in terms of carbon–carbon bonds; distinguish this use from a saturated solution.

6. Rotate and bend a model without breaking bonds and explain why it remains the same molecule.

Cleanup

• Return shared equipment and retain corrected reasoning.

Record your evidence

Blank spaces are for your own work

YEAR 11 / LESSON 77 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Reference and task data

For acyclic alkanes, C_nH_{2n+2}. Carbon normally has valency four and hydrogen one. These compounds contain only carbon and hydrogen, with no C=C or C≡C bonds. The rule is not the formula for cyclic saturated hydrocarbons. Molecular models do not show real atomic scale or electron movement.

Task	My structure / working	Reason / correction
n=1–2		
n=3–4		
n=5 and general rule		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

YEAR 11 / LESSON 77 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

1. Give formulae of methane, propane and pentane.

2. Draw fully displayed propane.

3. Explain saturated for an alkane.

4. Explain why each added carbon adds two hydrogens in this series.

5. Why does bending a butane model not produce a structural isomer?

6. Does saturated here mean no more solute can dissolve?