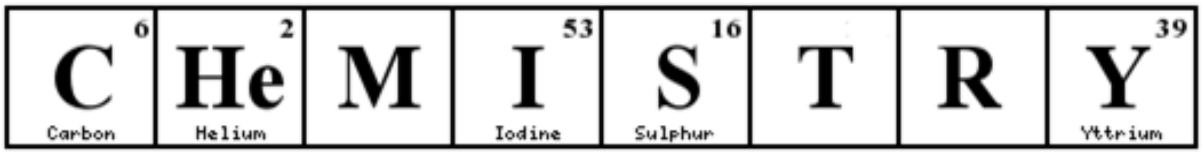
NONSUCH
HIGH SCHOOL FOR GIRLS



Building Work 2025

The aims of this building work are:

Objective 1: *To identify and review key areas of your Y12 exam to improve your A-level outcomes.*

Objective 2: *To review command words that will support you answering A-level Chemistry questions to the highest standard.*

Objective 3: *To continue wider reading and associated skills*

This work has three parts:

1. **Reviewing your Y12 exam** and improving key topics.
2. **Literacy activity** – identifying command words that will support you answering A-level Chemistry questions to the highest standard.
3. A **wider reading task**

Remember there is always assistance in our Chemistry Drop-In sessions. These are held in S9 on Tuesday and Thursday lunchtimes – all are welcome.

1. Reviewing your Y12 exam

All students should be reviewing the key areas of improvement, following analysis of their Y12 exam paper.

Please add your key 5 areas of the specification below, your action and the date of completion.

Actions should include: reviewing on UpLearn, Kerboodle or using MAChemGuy (on Youtube) and could include practising exam questions.

If you are resitting the exam in September you should complete the above and then practise questions using the relevant sections of the *Intervention Booklet* that you have been given.

Topic	**Specification Point(s)**	**Action**	**Date**

2. Literacy Activity

Identifying command words will support you answering A-level Chemistry questions to the highest standard. OCR issues the following guidance on each Assessment Objective.

AO1: Demonstrating Knowledge & Understanding

- **Define / State** – Give precise meanings.
- **Name / Identify / List** – Provide facts or items.
- **Describe** – Set out characteristics/details.
- **Outline** – Summarise main points.
- **Give** – Provide a short answer without explanation.

AO2: Applying Knowledge & Understanding

- **Apply / Use** – Put knowledge into context.
- **Calculate** – Work out numerical answers, showing workings.
- **Determine / Find** – Obtain a result or answer.
- **Complete / Construct / Draw** – Add or build diagrams, tables, equations.
- **Convert** – Change items into another format (e.g., g → moles).

AO3: Analysis, Interpretation & Evaluation

- **Analyse** – Break down information, examine relationships, interpret.
- **Compare / Contrast** – Identify similarities and differences.
- **Explain** – Provide reasons or describe mechanisms.
- **Deduce** – Infer from given information or data.
- **Interpret** – Translate information into meaning.
- **Discuss** – Balanced account including different viewpoints.
- **Evaluate** – Make a judgement based on evidence and criteria.
- **Suggest** – Propose ideas, hypotheses, or methods.
- **Predict** – Forecast likely outcomes based on understanding.
- **Justify** – Provide reasons or evidence supporting a decision.

Why This Matters

1. **Decoding Questions**: You must grasp what each command word is asking—e.g., "Explain" vs. "Describe."
2. **Mark Scheme Alignment**: OCR's grading rubric is structured around these command words—responding accurately improves marks.
3. **Skill Development**: Understanding and practicing responses builds progression from recall (AO1), through application (AO2), to analysis and critical thinking (AO3).

Complete the following questions, paying attention to the command word in the question.

AO1: Demonstrating Knowledge & Understanding

- **Describe** – Set out characteristics/details.

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1. A student is provided with hydrated copper(II) nitrate, $Cu(NO_3)_2 \bullet 3H_2O$.

The student needs to prepare a standard solution of $Cu(NO_3)_2 \bullet 3H_2O$ with a concentration of 0.200 mol dm^{-3}. The student has access to usual laboratory apparatus and equipment.

Describe how the student would prepare 100.0 cm^3 of this solution, giving quantities, apparatus and method.

[5]

AO2: Applying Knowledge & Understanding

- **Complete** – Add or build diagrams, tables, equations.

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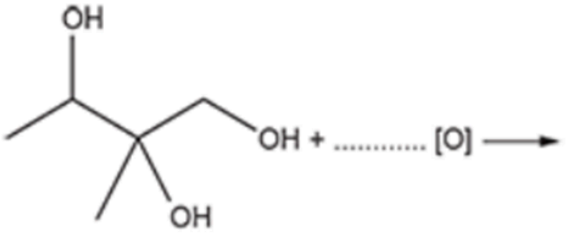
2. Compound **C**, shown below, is refluxed with excess acidified potassium dichromate(VI) to form a single organic product and one other product.

Complete the equation for this reaction.



Compound C

[3]

3. This question is about enthalpy changes of reactions involving hydrocarbons.

Nonane, C_9H_{20}, can be broken down by heat to form pentane, C_5H_{12}, and ethene, C_2H_4.

$C_9H_{20}(g) \rightarrow C_5H_{12}(g) + 2C_2H_4(g)$ $\Delta H = +186$ kJ mol^{-1} **Reaction 1**

The enthalpy changes of combustion of $C_9H_{20}(g)$ and $C_2H_4(g)$ are shown in the table below.

Hydrocarbon	$\Delta_c H$ / kJ mol^{-1}
$C_9H_{20}(g)$	–6171
$C_2H_4(g)$	–1411

Use ΔH in **Reaction 1** and the enthalpy changes of combustion in the table to **determine** the enthalpy change of combustion of $C_5H_{12}(g)$.

$\Delta_c H$ (C_5H_{12}(g)) = ... kJ mol^{-1} [**2**]

AO3: Analysis, Interpretation & Evaluation

- **Suggest** – Propose ideas, hypotheses, or methods.

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4. Methanol, CH_3OH, is manufactured by the reaction of carbon monoxide, CO, with hydrogen, H_2.

$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ $\Delta H = -91$ kJ mol^{-1}

The industrial manufacture of methanol has used a copper-based catalyst.

Chemists have recently developed a new method for making methanol that uses a nickel-gallium catalyst. This allows methanol to be produced at a lower temperature than the old method.

Suggest two reasons why using a lower temperature is beneficial to the environment.

1

2

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[2]

3. Wider Reading Task

Read the **Chemistry World** article and complete the review sheet.

Why highly unsaturated molecules are so abundant in the interstellar medium

Study explores cascade of fragmentation events

Computer simulations of saturated organic molecules being bombarded by high-energy photons and particles have led an international team of researchers to propose fresh ideas surrounding how complex unsaturated molecules form in dense interstellar clouds.

As technologies that allow us to observe interstellar media develop, scientists are discovering that more complex organic molecules are surprisingly abundant in space. 'These organic molecules are ubiquitous in the universe, so anywhere you point your telescope you can see organic molecules, some of which are precursors to amino acids or nuclear bases,' says Felipe Fantuzzi of the University of Kent in the UK, who co-led the work. 'To understand how these molecules that are essential to life are formed, and how they are delivered to planets, I think, is the most important question in astrochemistry,' he adds.

Specifically, understanding how unsaturated molecules form in interstellar media is essential to explain the chemical diversity of molecular clouds such as Sagittarius B2, a molecular cloud complex found close to the centre of the Milky Way. 'The carbon–carbon double bond is rife for oxidation mechanisms, so that's where you start to see some really interesting chemistry and the formation of unique functional groups,' says Julia Lehman, an expert in interstellar spectroscopy at the University of Birmingham, UK, who wasn't involved in the research.

Fantuzzi and their co-workers used Born–Oppenheimer molecular dynamics simulations to investigate how cosmic rays and x-rays that penetrate dense molecular clouds ionise and fragment saturated molecules into unsaturated products. They focused on four key molecules with a high degree of saturation – ethanolamine, propanol, butanenitrile and glycolamide – which are found in molecular clouds and seen as potential precursors to more complex biomolecules. While Born–Oppenheimer molecular dynamics has been used to study molecular fragmentation in the past, this is the first time it was applied to the field of astrochemistry. 'Essentially you are running a classical molecular dynamics simulation, but for every step of the dynamics, you are also solving the Schrödinger equation,' explains Fantuzzi. This technique allowed the researchers to study the electronic structure of the radicals formed under high energy processes, and from that they proposed a series of fragmentation routes that favour structures with the highest possible number of π bonds.

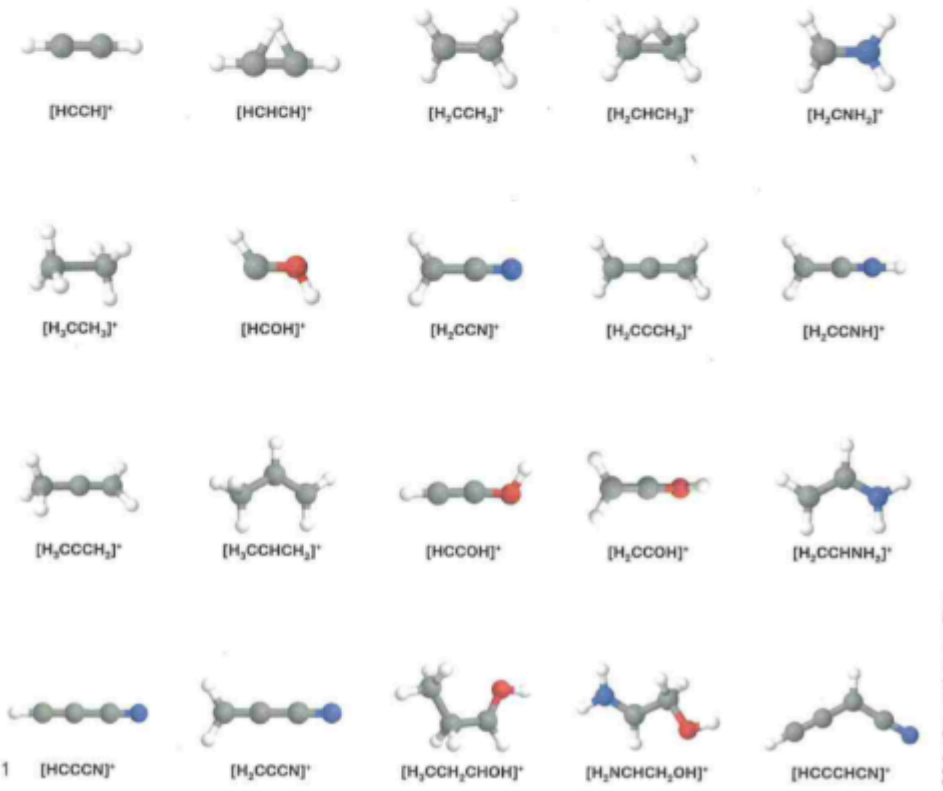
They identified 56 cationic fragments that could be formed from the four saturated molecules under the high energy conditions of Sagittarius B2. Most of these fragments contain at least one π bond. Of these unsaturated fragments, 21 have already been observed in interstellar media so the high energy events described in this study could explain their formation. However, a considerable proportion have not yet been detected experimentally and are proposed by the team as potential targets for future investigation by spectroscopists.

'The researchers have done a really good job of looking into one possible route towards the formation of unsaturated molecules, but it opens up a lot of other questions,' says Lehman. For example, she'd like to know what reactions take place following the fragmentation and what fragmentation happens under lower energy conditions. 'If these molecules are theorised to be there, then we need to turn around and start characterising these in the lab so that the observationalists can then detect them.'

Charley James

Reference

J Londoño-Restrepo *et al*, *Chem. Sci.*, 2025, 16, 3051 (DOI: 10.1039/d4sc07986h)



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Chemistry Topic: Alkenes

Title of Article: Why highly unsaturated molecules are so abundant in the interstellar medium	
Source:	**Date of Publication:**
Chemistry strand: Organic/inorganic/physical?	

Summary of Article:

1. *Read the text*
2. *Break it down into sections*
3. *Identify the key points in each section*
4. *Write the summary*
5. *Check the summary against the article*

In your opinion, what are the 3 most important pieces of information you gathered from the article?	
1	
2	
3	

The article refers to propanol. Draw three different structures of propan-1-ol.		
Molecular structure	Structural formula	Displayed formula

Specification Links		
How does this article link to what you studied at GCSE? *(Be clear and specific)*		
What key words have been used in this article? Select 5 key words and complete their definitions below.		
Keyword:		**Definition:**
1		
2		
3		
4		
5		

Date Completed:

Feedback from your teachers:

Teacher Checked	Purple	Blue	Green	Yellow	Orange

Purple:

- Your questions have been completed showing your working out
- Your analysis of the Y12 exam paper is complete and topics reviewed
- The review of the scientific article is fully completed with an exceptional level of detail
- The summary is clear and specific summarising the main points of the article
- The 3 facts and figures are clearly categorised (perhaps into more than one category)
- There is a clear and very detailed link back to the specification and what you are studying.
- All 5 definitions are of complex key terms and concepts from the article

Blue:

- Your questions have been completed showing your working out
- Your analysis of the Y12 exam paper is complete and topics reviewed
- The review of the scientific article is fully completed with a high level of detail.
- The summary is clear, summarising the main points of the article
- There is a clear link back to the specification and what you are studying.
- 1 or 2 of the definitions are of complex key terms and concepts from the article

Green:

- Your questions have been completed showing your working out
- Your analysis of the Y12 exam paper is complete and topics reviewed
- The review of the scientific article is fully completed and all areas filled in.
- But there is potential for more detail to be added such as the specification links.
- Key words are completed but could be more complex words/concepts from the article.

Yellow:

- Your questions are incomplete
- Your analysis of the Y12 exam paper is complete, however the review of topics is incomplete
- The review of the scientific article is incomplete
- The review of the scientific article but sections lack detail, such as definitions, or the written areas (Summary and links to study). Key words are likely to be more basic words/concepts from the article.
- OR Your Review is partially completed, eg 2 out 3 facts or 3 out of 5 definitions.

Orange:

- Your questions are incomplete
- Your analysis of the Y12 exam paper is incomplete
- The review of the scientific article is incomplete. Whole sections are not completed, eg definitions