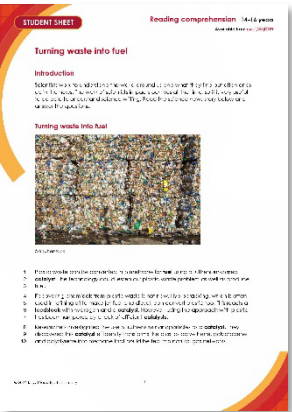
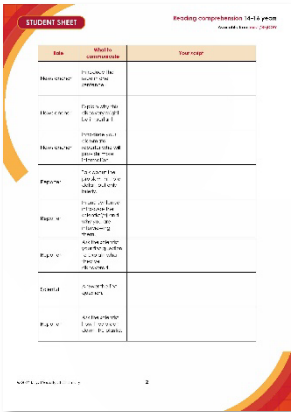


Turning waste into fuel

This resource forms part of the **crude oil** (14-16) topic package where you will find more resources to embed literacy skills development into your teaching. You can edit all the linked files in this resource to best suit the needs of your learners.

Reading components

Reading comprehension sheet, present the news slides and script are also available from: rsc.li/3EjtOF9

		
Reading comprehension worksheet: a simplified summary of a research article with comprehension questions and a glossary.	Present the news script: a template groups can write into.	Present the news slides: instructions and hints for a group presentation task.

Learning objectives

- 1 Use active reading strategies to help you understand a science news story.
- 2 Use the glossary to support your understanding of unfamiliar words.
- 3 Know what key information to look for when reading a science news story.
- 4 Understand how people write about science differently depending on their audiences.
- 5 Confidently talk about the science news story, with consideration for your audience.

Questions 1–6, 8–9 in the student sheet support learning objectives 1 and 2. Question 7 supports learning objective 3. Questions 10–12 support learning objective 4 and the 'Present the news' extension task supports learning objective 5.

Introduction

Reading about science is pivotal for understanding the world around us and the events and discoveries that effect our lives. In this reading comprehension, learners will actively engage with a simple text about a research article. *Education in Chemistry* has collated and distilled a wealth of science research news stories (see rsc.li/4jvfRU0). This reading comprehension resource is based on one of these stories relevant to the **crude oil** (14–16) topic.

Reading comprehension activity

The story text has line numbers so you can easily direct learners to parts of the text. The line numbers can be disabled, more information on how to do this is available on Microsoft support: bit.ly/4cHKkeW

Model active reading

Before reading, show the headline and ask learners 'what do you think this text is about?' Read all the way through once without interruptions to allow learners to use context clues in the text to support their understanding and problem-solve unfamiliar vocabulary.

Read the text a second time and prompt learners throughout to actively engage with the text. You can ask:

- 'How would you rephrase what's just been said?'
- 'What is this news story about?'
- 'Can you summarise this news story in a sentence?'
- 'Are any words in this text new to you?'

Find more information in: rsc.li/49Xyts5

Consider using playback or recording software, so that learners can listen to the text on a device as they read along.

Question 7 asks learners to write a summary of the news story for their classmates. You can work through this question as a class first, before tasking learners to draw out the required information from the text independently. You can get learners to peer mark the summaries.

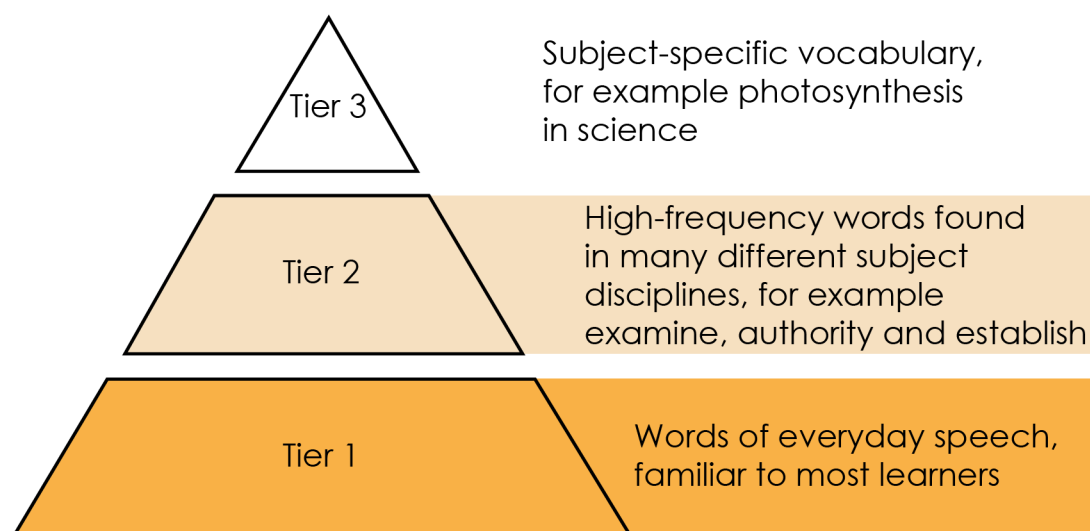
Taking it further

To answer questions 10 and 11, give learners access to a longer and more complex version of the reading comprehension text. This is available to download and print or

can be viewed online. Give learners a printed version to annotate in question 10. See: **Turning mixed plastic waste into natural gas** (rsc.li/3RW42d9).

Glossary of relevant terms

The glossary is pre-populated with vocabulary from the story that learners may need support with. The Education Endowment Foundation recommends prioritising teaching tier 2 and tier 3 terms, which learners are less likely to hear or read outside of their science lessons. More information on tier 2 and 3 terms can be found on the Education Endowment Foundation website, as well as reports and practical tools: bit.ly/4imgji2



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Some words in the glossary are key terms and link with our key terms support resources (rsc.li/3Ys0jYi). For more challenge, remove or edit entries and task learners with researching and then populating the glossary.

Extension task: present the news

Instruct learners to present the science news story they have read as an item in a news programme.

Split learners into groups of three or four and assign each of them one of three roles – news anchor, reporter, or scientist. If there are more than three per group, assign multiple scientists. It's important that everyone says something during the presentation.

- Project the 'Present the news' slides on the board. Slide 2 is the reading comprehension text to read aloud. Explain the task (slide 3) and provide learners with printouts of what each role needs to do (slides 4–6).

- Talk through the slide called 'What does a good news presentation look like?' (slide 7).
- Give learners the script template and direct them to prepare, as a group, what they want to say in the presentation. This will firstly involve reading the introduction on the script template, which you can do as a class if necessary. Allow learners about 45 minutes to prepare.
- Revisit the slide called 'What does a good news presentation look like?' (slide 7) before inviting the groups to present (allow five minutes per group).
- Direct learners to fill in the feedback sheet on the script template while their classmates are presenting. After all groups have presented, invite reflections and make notes of any learnings for the next speaking and listening activity.

Oracy Cambridge's 'Oracy skills framework' provides more information about speaking and listening skills. For more information, see: bit.ly/4jBaTEG

Metacognition

This resource supports learners to develop their metacognitive skills in three key areas.

Aspect	Ideas for prompts
Plan	• Question 7 provides learners with a series of prompts to scaffold their summary of the science news story. • The 'present the news' script introduction contains questions for learners to ask themselves when planning the presentation, for example about keeping to time.
Monitor	• Ask learners questions when reading the text aloud (see section called 'model active reading') to prompt them to monitor their understanding throughout the task. • The comprehension questions prompt learners to assess how much the active reading strategies help them to understand the text and what other strategies they can employ to aid their understanding.
Evaluate	• Invite feedback on answers to the questions which use the 1–10 scale and collate a reading strategy 'cheat sheet' as a class. Revisit this cheat sheet next time you do a reading comprehension activity. • Use the populated feedback table to reflect as a class on the strengths of the presentations and identify things to work on next time you do a class speaking and listening activity.

Example answers and guidance

1. Recovering chemicals from plastic waste is important because it can reduce lessen our plastic waste problem and it can also create fuel.
2. Learner's answer should include mention of ruthenium, polyethene, polypropene, polystyrene and methane. Learner's own answer, which may include the following points: Using ruthenium particles as a catalyst, researchers discover that ruthenium effectively transforms polyethene, polypropene and polystyrene into methane.
3. Scientific words: methane, fuel, catalyst, chemicals, hydrocracking, refining, hydrogen, ruthenium, nanoparticles, natural gas, feedstock, polyethene, polypropene, polystyrene.
The point of this exercise is simply to prompt learners to consider which potentially unfamiliar words are specific to science or chemistry, compared to for example connecting words. The list above is an example and there may be variation in answers.
4. Any similar definitions to the below, use these definitions to check for accuracy:
 - (a) Catalyst – a substance that can speed up a reaction without being used up; it does this by lowering the activation energy for the reaction.
 - (b) Fuel – a substance that can transfer useful energy as heat when it is burned.
 - (c) Refining– the process of making different products from a basic product.

Learners rate how much the glossary is helping them. Do a rough show of hands to gauge confidence and note learners' responses.

5. Ask learners to share what they think is the most important point of the news story.
Look for a good understanding of the most important point of the news story.
Example answer – plastic waste, converted into methane for fuel, lessen plastic waste problem, ruthenium-based catalyst.

Learners rate how much circling words is helping them. Do a rough show of hands to gauge confidence and note learners' responses.

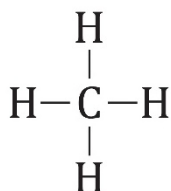
6. Ask learners to share what they have learned from reading the news article.

Learners rate their confidence explaining the story. Do a rough show of hands to gauge confidence and note learners' responses. Ask learners to share their strategies for the benefit of the class.

How learners rate the techniques in questions 3 and 4, and their confidence to explain the story, can inform your approach to future reading comprehension activities.

7. Indicative answers for summary of story.
- What have the scientists discovered? (Findings)
 - How to turn plastic waste into gas for fuel.
 - What was the problem they were trying to solve? (Context)
 - The build-up of waste plastic.
 - Why does their discovery matter? (Relevance/application)
 - Natural gas is a finite resource (fossil fuel), so being able to produce fuel is very valuable.
 - Think about who it matters to and what impact it could have for them. (Impact)
 - It could reduce plastic waste and make more methane for fuel. Methane can be fed into the natural gas networks, so it has an impact for the UK public.

8.



9. Learner's own answer, which may include the following points:
- (a) A catalyst speeds up a chemical reaction by lowering the activation energy of the reaction. Catalysts are not used up in the reactions.
- (b) Any named catalyst and a description of the catalysed experiment e.g. amylase is a natural catalyst (enzyme) in saliva that speeds up the breakdown of starch into sugar. This is why bread tastes sweeter the longer you chew it. Learners may reference the practical hydrogen peroxide decomposition using different catalysts if this has been covered in class: rsc.li/4a2Xdzj

Taking it further

10. Learners should highlight the full article in different colours using the prompts below. See the highlighted text below as an example.

- What have the scientists discovered? (the finding)
- What was the problem they were trying to solve (the context)
- Why does their discovery matter? (relevance/application)

Turning mixed plastic waste into natural gas with catalysis

Original article by James Urquhart.

How a ruthenium-based catalyst reaches 99% yield

Plastic waste can now be efficiently converted into methane using a ruthenium-based catalyst. The technology could help mitigate the planet's growing plastic waste problem while producing methane for use as a fuel or chemical feedstock in a more environmentally friendly way than fracking.

Recovering chemicals and fuel from plastic waste streams is nothing new. Processes including pyrolysis, which break down plastics using high temperatures and catalytic processes, can recover useful materials. However, these approaches create several products, including waste, and require additional processing.

Another process called hydrocracking, which is often used in refining oil to make jet fuel and diesel, can convert plastic too. This reacts a feedstock with hydrogen and a catalyst at much lower temperatures and produces less waste. However, using the approach with plastic has been hampered by a lack of efficient and selective catalysts that can outperform thermal methods.

Researchers at the Swiss Federal Institute of Technology in Lausanne investigated the use of ruthenium nanoparticles on zeolite supports as a catalyst. They discovered that the catalyst efficiently transforms polyethene, polypropene and polystyrene into methane that could be fed into natural gas networks.

11. Answers will vary, but can include a selection of the following:

- the article is longer
- it contains more details about the discovery and what related research has been done
- it contains more scientific words.

12. In the text and annotations look out for an awareness of different writing formats and an appreciation that different audiences have different needs or interests. For example:

- (a) shorter version, links to other interesting articles, key message up front, relevant pictures or video clips;
- (b) longer version, lots of detail, including information on who did the research and maybe their contact information;
- (c) simplifying complicated language, pictures to aid understanding.

Example script for 'Present the news'

Role	What to communicate	Example script
News anchor	Introduce the issue in one sentence.	Plastic waste is an enormous global issue.
News anchor	Explain why this discovery might be important.	And scientists may have found a new way to tackle it.
News anchor	Introduce your classmate reporter who will provide more information.	Here is our reporter (learner name) to tell us more.
Reporter	Talk about the problem in more detail, but only briefly.	Plastic waste causes huge environmental problems.
Reporter	In one sentence, introduce the scientist(/s) and why you are interviewing them.	I'm here with scientist, (learner name) to hear about a new way to turn plastic waste into something more useful.
Reporter	Ask the scientist to explain what they have discovered.	What is it that you have discovered?
Scientist	Answer the first question.	We have discovered how to turn plastic waste into methane.
Reporter	Ask the scientist how they break down the plastic.	How do you break down the plastic?
Scientist	Respond to the question.	We use a catalyst made from ruthenium, to break down the plastic.
Reporter	Ask the scientist to explain the word catalyst.	Can you tell our viewers what a ruthenium catalyst is?
Scientist	Respond to the question.	A catalyst is a chemical that speeds up chemical reactions. Ruthenium is a chemical element.
Reporter	Ask what the methane is used for.	So, with the help of this catalyst, waste plastic is converted to methane. What can you then use the methane for?
Scientist	Respond to the question.	The methane can be fed into the natural gas network and used as a fuel.
Reporter	Thank the scientist.	Thank you so much for your time today,
Scientist	Acknowledge the thanks.	Not a problem, thank you for having me.
News anchor	Say something in response to what the scientist and the reporter have said, which reflects what your audience might be thinking. Thank the reporter. This will end the presentation.	Thank you to our reporter (learner name) for that report on how we can reduce plastic waste and produce fuel at the same time. What a wonderful discovery.

Acknowledgements

Vocabulary tier diagram: Beck, Isabel L., Margaret G. McKeown, and Linda Kucan. *Bringing Words to Life: Robust Vocabulary Instruction*. New York: Guilford Press, 2013.