CAMBRIDGE ADVANCED NATIONALS

OCR
Oxford Cambridge and RSA

Sample question paper and mark scheme

DRAFT

LEVEL 3 CAMBRIDGE ADVANCED NATIONAL (AAQ) IN

APPLIED SCIENCE

Extended Certificate H151

For first teaching in 2025

F181: Science in society

Version 1.0 Modified (November 2023)

Introduction

This is Sample Assessment Material (SAM). It is an example exam paper that we publish alongside a new specification to help illustrate the intended style and structure of our question papers.

During the lifetime of the qualification, updates to the question paper template may happen. We always recommend you look at the most recent set of past papers where available.

We also produce two further specific resources to support you with using this SAM:

- An assessment story. We explain the research we have undertaken during the development of the qualification and how consultation with teachers, students and schools have helped shape our assessment approach.
- Annotated SAMs. We take you through the key points of the assessment and highlight the different types of questions your students will experience in the exam.

Tell us what you think

Your feedback plays an important role in how we develop, market, support and resource qualifications now and into the future. Here at OCR, we want teachers and students to enjoy and get the best out of our qualifications and resources, but to do that we need honest opinions to tell us whether we're on the right track or not. That's where you come in.

You can email your thoughts to **ProductDevelopment@OCR.org.uk** or visit the **OCR feedback page** to learn more about how you can help us improve our qualifications.

Designed and tested with teachers and students

Helping young people develop an ethical view of the world

Equality, diversity, inclusion and belonging (EDIB) are part of everything we do

Summary of updates

Date	Version	Page number	Summary of change
July 2023	1 DRAFT	All	Creation of document

Teacher support

We have a range of support services to help you at every stage, from preparation to delivery.

Our teacher support is designed to make teaching our qualifications straightforward, whether you are an experienced teacher, new to teaching, new to OCR, or not a subject specialist of the qualification you are teaching.

We offer free access to services such as Access to Scripts, ExamBuilder and ActiveResults, and you'll find comprehensive teaching resources and a range of professional development courses on our teacher website, Teach Cambridge.

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- Specification and non-exam assessment advice
- Updates on resource developments and training opportunities
- Information on our subject networks giving an opportunity to share ideas and expertise.

Further help and support

Visit our subject pages to find out more about the assessment and request trial access to **Teach Cambridge**.

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Work with us

As one of the major UK exam boards, OCR is responsible for creating and marking exams taken by over a million students each year. We work with over 10,000 professionals to create, check, mark and moderate our assessments.

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People and planet

OCR is part of Cambridge University Press & Assessment, which has clear commitments to champion sustainability, diversity, trust and respect for our people and planet.

We are committed to supporting a curriculum that helps young people develop an ethical view of the world. This enables them to take social responsibility, understand environmental issues and prepare them for the green jobs of the future.

Our equality, diversity, inclusion and belonging principles are that we:

- are respectful and considerate
- celebrate differences and promote positive attitudes to belonging
- include perspectives that reflect the diverse cultural and lifestyle backgrounds of our society
- challenge prejudicial views and unconscious biases
- promote a safe and supportive approach to learning
- are accessible and fair, creating positive experiences for all
- provide opportunities for everyone to perform at their best
- are contemporary, relevant and equip everyone to live and thrive in a global, diverse world
- create a shared sense of identity in a modern mixed society with one humanity.

To learn more, including our work on accessibility in our assessment materials, visit our People and planet page.

Oxford Cambridge and RSA

Level 3 Cambridge Advanced National (AAQ) in Applied Science (Extended Certificate)

H151 Unit F181: Science in society

Time allowed: 1 hour 15 minutes

You may use:
- scientific calculator
- ruler

You should have:
- the Insert (inserted)

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

Date of birth | D | D | M | M | Y | Y | Y | Y |

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.
- In the live exam there might be lined pages at the end of the question paper for you to use if you need extra space. Remember, you must clearly show the question numbers.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **50**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **12** pages.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions

Section A (Pre-release based section)

1 When scientists make new discoveries, a process called peer review takes place.

The scientist submits a written report about the new discovery to an editor.

The editor sends the report to a peer reviewer.

(a) (i) State **two** reasons why the peer review process is important.

1 .....

.....

2 .....

..... **[2]**

(ii) In **Source A**, Thomas Loerting would be a suitable person to be a peer reviewer for the report about the new ice.

Give **two** reasons why.

1 .....

.....

2 .....

..... **[2]**

(b) Scientists often work together in an international community of scientists.

(i) Give **one** piece of evidence in **Source A** which shows an international community of scientists.

.....

..... **[1]**

(ii) State **two** reasons why an international community of scientists working together is important in new discoveries.

1 .....

2 ..... **[2]**

(c) Describe the role of the computational physicist in the investigation in **Source A**.

.....

..... **[1]**

2 **(a)** The new ice in **Source A** and **Source B** is a non-crystalline solid which does not obey the Third Law of Thermodynamics.

What is a scientific law?

.....

..... **[1]**

(b) Describe how a scientific theory is different to a scientific law.

.....

..... **[1]**

(c) **Source B** describes how scientists examined the new ice with X-rays to understand it.

What conclusion did the scientists make about the new ice from the X-ray analysis?

.....

..... **[1]**

(d) **Source B** contains a section at the end which is subtitled 'Ice cold fact file'.

Identify **two** reasons why the author of **Source B** has included this section in the article.

1 .....

.....

2 .....

..... **[2]**

3 Scientists in **Source B** have a hypothesis that the new ice may exist inside the icy moons of planets like Jupiter.

(a) Give **one** piece of evidence from **Source B** which supports the scientists' hypothesis.

.....

..... **[1]**

(b) Further scientific development might involve collecting samples of the ice on the moons of Jupiter. This might enable scientists to test their hypothesis.

Outline **two implications or limitations** of this further scientific development and how these might be overcome.

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..... **[4]**

4 You have been asked to recommend some scientific articles for sixth form science students.

The articles should be:

- valid
- effective at providing accurate information
- engaging for the students

Discuss whether **Source A** and **Source B** would be appropriate articles for the student. In your answer you **must** write about:

- The ways that **Source A** and **Source B** are appropriate articles for the students.
- The ways that **Source A** and **Source B** are not appropriate articles for the students.
- Whether you would recommend **Source A** and **Source B** to the students **and** your reasons.

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..... **[9]**

Section B (Non pre-release)

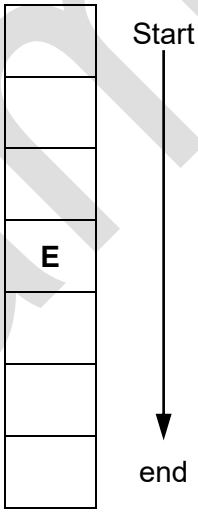
5 Battery technology in electric cars has developed from scientists using the scientific method to conduct research.

(a) The table shows the seven steps of the Scientific Method.

The steps are **not** in the correct order.

	Action
A	Formulating a hypothesis and making predictions
B	Drawing conclusions
C	Defining the problem
D	Communicating results to others
E	Performing experiments
F	Research
G	Analysing data

Write the letters in the boxes to show the **correct** order of the steps.
One has been done for you.



[2]

(b) What is the difference between a hypothesis and a prediction?

.....

..... **[1]**

(c) The scientific method is a non-linear process.

Explain this statement.

.....

.....

.....

..... **[2]**

(d) Mining the various metals needed for lithium-ion batteries requires vast resources. 2 273 000 litres of water is required to mine one tonne of Lithium. Pure lithium metal is then extracted by electrolysis.

An environmental analysis of lithium mining in a country in South America has been linked to destruction of habitats, and increased levels of drought in nature reserves. This analysis also shows that it costs more to recycle lithium-ion batteries than to mine for more lithium and make new ones. Approximately 5% of lithium-ion batteries are recycled globally, with the rest going to landfill.

Explain why it is important for scientists to continue to develop battery technology.

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..... **[3]**

6 The table shows data on the total number of new cars sold and number of new electric cars sold in the UK between 2018 and 2022.

Year	Total number of new cars sold in the UK	Number of new electric cars sold in the UK	Percentage of new cars sold in UK that were electric cars (%)
2018	2 370 000	15 500	0.00654%
2019	2 310 000	37 900	0.0164%
2020	1 630 000	108 200	6.64%
2021	1 650 000	190 700	11.6%
2022	1 610 000	267 200	

(a) Calculate the percentage of new cars sold that were electric cars in 2022**.**

Percentage = ... % **[1]**

(b) The total number of new cars sold in the UK has decreased over time from 2018 to 2022.

(i) Calculate the percentage decrease in new car sales from 2018 to 2022

Percentage decrease = ... % **[2]**

(ii) A scientist has made a prediction from the data in the table that, in 2039, all new cars sold in the UK will be electric cars.

Explain the reasons for this prediction, including any assumptions you have made.

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.....**[3]**

(iii) Identify the most appropriate graphical form for the data in Table 1.

.....

..... **[1]**

(iv) State **one** advantage and **one** disadvantage of representing the data in this way.

Advantage .....

.....

Disadvantage .....

..... **[2]**

7 John needs a new car and is investigating whether to buy an electric car.

John lives in a rural area.

John drives 10 000 miles a year. On average people in the UK drive 7 400 miles per year.

The table shows information about average-size electric, petrol and diesel cars.

Criteria	Average-size car		
	Electric car	Petrol car	Diesel car
Cost to buy new	£40 000	£26 000	£30 000
Ownership costs over 3-year period (Running, maintenance, insurance)	£13 000	£18 000	£16 000
Cost per 10 000 miles	£398	£1 500	£1 125
% Efficiency	80%	20%	25%
Time taken to refill / recharge	12 hours at home (30 minutes - fast charge station)	5 minutes	5 minutes
Filling /charging stations	Very few Uneven distribution around country	Many Distributed evenly around country	Many Distributed evenly around country
How many miles on a full tank / charge	250	400	400
Carbon Dioxide (CO_2) emissions	No CO_2	High CO_2	Low CO_2
Noise	Very quiet	Noisy	Very noisy

Discuss how beneficial an electric car would be for John.

In your answer you **must** write about:

- any **benefits** of an electric car
- any **disadvantages** of an electric car
- **how beneficial overall** an electric car would be for John **and** the reasons why.

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..... **[6]**

END OF QUESTION PAPER

This is sample assessment material for our specification. It is to help show how the live assessment materials will look. During the lifetime of the qualification you might see small adjustments to the assessment materials. This is part of continuous improvement, designed to help you and your students. We recommend you look at the most recent set of past papers where available.

Level 3 Cambridge Advanced National (AAQ) in Applied Science (Extended Certificate)

Unit F181: Science in society

SAMPLE ASSESSMENT MATERIAL

MARK SCHEME

This document has **10** pages.

MARKING INSTRUCTIONS

Crossed-out answers

If a student has crossed out an answer and written a clear alternative, do **not** mark the crossed-out answer.

If a student has crossed out an answer and **not** written a clear alternative, give the student the benefit of the doubt and mark the crossed-out answer if it's readable.

Multiple choice question answers

When a multiple choice question has only one correct answer and a student has written two or more answers (even if one of these answers is correct), you should **not** award a mark.

When a student writes more than one answer

1. Questions that ask for a set number (including 1) of short answers or points

If a question asks for a set number of short answers or points (e.g. **two** reasons for something), mark only the **first set number** of answers/points.

First mark the answers/points against any printed numbers on the answer lines, marking the **first** answer/point written against each printed number. **Then**, if students have not followed the printed numbers, mark the answers/points from left to right on each line and **then** line by line until the set number of answers/points have been marked. Do **not** mark the remaining answers/points.

2. Questions that ask for a single developed answer

If a student has written two or more answers to a question that only requires a single (developed) answer, and has **not** crossed out unintended answers, mark only the first answer.

3. Contradictory answers in points-based questions

When a student has written contradictory answers, do **not** award any marks, even if one of the answers is correct.

Levels of Response marking

1. To determine the level start at the highest level and work down until you reach the level that best describes the answer
2. To determine the mark within the level, consider the following:

Quality of the answer	**Award mark**
Consistently meets the criteria for this level	At the top of the level (6 and 9 mark questions)
Meets the criteria but with some inconsistency	At the middle of the level (9 mark questions)
On the borderline of this level and the one below	At the bottom of the level (6 and 9 mark questions)

MARK SCHEME

1 (a) (i)	
Max mark	2
Answer	To validate a piece of academic work (1) To ensure the quality of published research (1)
Guidance	1 mark for each correct answer

1 (a) (ii)	
Max mark	2
Answer	He is an expert in the same discipline of science / he is the same type of scientist (1) He was not involved in the original study (1)
Guidance	1 mark for each correct answer

1 (b) (i)	
Max mark	1
Answer	(Source A has) quotes from scientists in Stockholm, Innsbruck, and New York / quotes from scientists from different parts of the world (1)
Guidance	Answer must not just be a direct quote from the source

1 (b) (ii)	
Max mark	2
Answer	Any **two** from: • share research (1) • share resources (1) • learn from others' expertise (1) • better funding / grants available (1) • diversity ensures open-mindedness (1)
Guidance	

1 (c)	
Max mark	1
Answer	To create a virtual model/simulations to help explain the structure of the ice (1)
Guidance	Answer should relate to the ice Answer must not just be a direct quote from the source

2 (a)	
Max mark	1
Answer	Any **one** from: • a statement / equation that describes / predicts what happens to a natural phenomenon (1) • provides a description of a directly observable phenomenon (1) • provides a description about how some aspect of the natural world behaves under stated circumstances (1)
Guidance	Allow other acceptable wording

2 (b)	
Max mark	1
Answer	(A scientific theory) explains why something happens, but a law is a statement that describes or predicts what happens (1)
Guidance	Allow other acceptable wording

2 (c)	
Max mark	1
Answer	Molecules (of the ice) did not have an organised structure (1)
Guidance	Allow alternative correct answers Answer must not just be a direct quote from the source

2 (d)	
Max mark	2
Answer	Any **two** from: • Supports the information in the source (1) • Explains some of the background (1) • Provides concise factual information (1) • Newsround is targeted at young audiences who may prefer bite-sized information (1)
Guidance	

3 (a)	
Max mark	1
Answer	Forces on the moons are the same as the scientists created (1)
Guidance	Allow other acceptable wording

3 (b)	
Max mark	4
Answer	Any **two** pairs from: • Using polluting fuel to get there (1), so using solar panels/sustainable fuels will help to overcome this (1) • Collecting samples might disturb any living organisms on the moon (1), so minimising time on the surface of the moon/designing robotic machinery that can safely collect samples (1) • Raise funding for the scientific development (1) so employ interdisciplinary development teams (1) • Not being able to send humans to the moon of Jupiter (1), so increasing development of technologies may help to achieve this. (1)
Guidance	One mark for each implication/limitation One mark for how each of these might be overcome Allow alternative correct answers.

4	
Max mark	9
Levels of Response	**Level 3 (high) 7-9 marks** A **thorough** discussion which shows **detailed** evaluation, which includes: • a **range** of points from **both** sides of the argument • a **detailed** analysis in the context of the question • a **clear** conclusion(s) with **detailed** reasons/justifications • **consistent** use of appropriate subject terminology. **Level 2 (mid) 4-6 marks** An **adequate** discussion which shows **sound** evaluation, which includes: • **some** points from **both** sides of the argument • **some** analysis in the context of the question • an **adequate** conclusion(s) with **relevant** reasons/justifications • **some** use of appropriate subject terminology. **Level 1 (low) 1-3 marks** A **basic** discussion which shows **limited** evaluation, which includes: • a **few** points from the argument • a **limited** analysis in the context of the question • a **brief** conclusion(s) with **limited** reasons/justifications • use of appropriate subject terminology is **limited**. **0 marks** Answer is **not** worthy of credit.
Indicative content	Answers can include some of the following: The ways that **Source A** and **Source B** are appropriate articles for the students:

	• Source A is valid because it is recent, refers to other scientists (including some not involved in the study – so not biased), includes a reference, includes some numerical data. • Source A is written by a scientist whose qualifications we know about (PhD in physics) • Source A is from a scientific website aimed at people interested in science. • Language in Source A has some scientific terms (such as amorphous and supercooled) but is not too complex for sixth form science students – there is bit of sensationalised language (such as 'water is weird') which will keep the students engaged. • Source B is recent and refers to scientists who do not all agree so not one-sided. • Source B is written by BBC Newsround which a respected source that should have checked the information prior to publication. • Language in Source B is easy for students to read as it is aimed at children. There is some sensationalised language (such as 'really cool'). • Source B is structured with headings in chunks so will keep students reading. • Source B has a fact file aimed at children which explains some of the background science. The ways that **Source A** and **Source B** are not appropriate articles for the students: • Source A has a large amount of solid text which may put off students from reading it. • Source A is unlikely to have been peer reviewed (although based on a report that has). • Source B has no references, so we don't know where the information came from. • Source B is aimed at younger children so may be too simplistic and exaggerated to engage children. Whether you would recommend **Source A** and/or **Source B** to the students **and** your reasons: • Source A can be recommended as it is valid due to it being current, from a scientific source, author has scientific qualifications, more scientific language appropriate for the students. • Source B could be recommended as it is an easy read in simple language but not as scientific. It may not be as valid as Source A as we do not know whether it is written by someone with scientific qualifications, its source is a newspaper, written more for public (younger children rather than someone studying science at sixth form level). **Credit other relevant conclusions, points and examples.**
Guidance	

5 (a)	
Max mark	2
Answer	**C** **F** **A** **(E)** **G** **B** **D**
Guidance	1 mark for correct sequence before E 1 mark for correct sequence after E

5 (b)	
Max mark	1
Answer	A hypothesis is an idea or explanation for something that may be true, and a prediction is a statement about what you think will happen when this idea is tested in a practical investigation (1)
Guidance	Answer must refer to both definitions for the mark Allow alternative wording

5 (c)	
Max mark	2
Answer	(It is a non-linear process because) Any **two** from: • Not all the steps of the scientific method always need to be followed, e.g. the problem may already have been defined (1) • The problem may already have been defined, but the experiment is building on a body of evidence or looking to challenge existing evidence (1) • Iterative and cyclical nature of science research (1) • Role of serendipity and intuition in discovery (1) • Inductive reasoning that leads to hypotheses (1) • Each point in the scientific process can lead to a variety of different next steps (1) • It may not always involve performing experiments (1) • Scientific investigations often use multiple methods or may take characteristics from more than one method to collect the data (1) • Results may lead to additional experiments for confirmation or because the results show something not anticipated (1)
Guidance	Answer must include both definitions for the mark Allow alternative wording

5 (d)	
Max mark	3
Answer	Any **three** from: • So that scientists can find different metals that require less water/fewer metals/precious metals to reduce impact of mining/drought (1) • Reducing impact of mining/drought will help to protect biodiversity (1) • Reducing impact of mining/drought will help to protect people living in affected areas (1) • So that scientists don't have to use electrolysis for extraction which requires a lot of energy, and potentially increasing CO_2 emissions (1) • So that scientists can help to reduce emissions during production of the batteries (1) • So that scientists can help to reduce costs for consumers to allow more people to support the environment (1) • So that scientists can find materials that are easier to recycle / reuse, so that less goes to landfill, which has environmental implications (1)
Guidance	Answer must refer to at least two different ideas supported by explanation Allow any other appropriate moral, ethical, environmental and/or social reasoning

6 (a)	
Max mark	1
Answer	267 200 / 1610 000 x 100 = 16.6% (1)
Guidance	1 mark

6 (b) (i)	
Max mark	2
Answer	2 370 000 – 1 610 000 = 760 000 760 000 / 2 370 000 x 100 = 32.1(%)
Guidance	2 marks for a correct answer. 1 mark for each step in the calculation.

6 (b) (ii)	
Max mark	3
Answer	• Percentage of new electric cars in past 3 years has gone up by 5% on average / year for past 3 years (1) • Assume similar rate of progression as trend for past 3 years (1) • Assume that the number of cars stays same as it has for past 3 years (1)
Guidance	Allow any other correctly reasoned statements.

6 (b) (iii)	
Max mark	1
Answer	Any **one** from: • Compound bar chart (1) • Line graph (1)
Guidance	Allow any other suitable type of graph

6 (b) (iv)	
Max mark	2
Answer	Any **one** from (advantage): • Visual representation of proportion / Allows you to see trend clearly (bar chart) (1) • May help to make predictions based on trend line (line graph) (1) Any **one** from (disadvantage): • Difficult to see proportion within compound bar chart for first few years considering difference in magnitudes (bar chart) (1) • Difficult to see trend as a proportion when two separate lines (line graph) (1)
Guidance	Allow any other suitable advantage or disadvantage for the chosen type of graph

7	
Max mark	6
Levels of Response	**Level 3 (high) 5-6 marks** A **thorough** analysis, which includes: • identification of a **range** of characteristics or elements • **detailed** knowledge and understanding in the context of the question • **clear** explanation • **consistent** use of appropriate subject terminology. **Level 2 (mid) 3-4 marks** An **adequate** analysis, which includes: • identification of **some** characteristics or elements • **sound** knowledge and understanding in the context of the question • **adequate** explanation • **some** use of appropriate subject terminology. **Level 1 (low) 1-2 marks** A **basic** analysis, which includes: • identification of **at least one** characteristic or element • **limited** knowledge and understanding in the context of the question • **basic** explanation • use of appropriate subject terminology is **limited**. **0 marks** Answer is **not** worthy of credit.

Indicative content	Answers can include some of the following: Comparisons to petrol and diesel cars: • Electric cars are more expensive to buy new • Electric cars are cheaper to run and maintain over a three-year period • It would take at least 9 years before the lower ownership costs compensate for the higher cost to buy new • The more miles you do in an electric car the more money you save as costs per mile are much cheaper • Electric cars are much more efficient which is why they are cheaper to run • Electric cars take much longer to charge than filling a petrol or diesel • Charging stations are harder to find • Electric cars need to be charged more often than petrol and diesel cars need filling as a full charge doesn't cover as many miles • Electric cars are better for the environment as they do not give off carbon dioxide emissions • Electric cars are quieter to run – can have disadvantage because pedestrians cannot hear them coming but also advantage of reducing noise pollution in heavy traffic areas • Worth buying an electric car for all its advantages if you drive a lot of miles and are planning to keep the car for at least 9 years **Credit other relevant analysis, points and examples.**
Guidance	

Oxford Cambridge and RSA

Level 3 Cambridge Advanced National (AAQ) in Applied Science (Extended Certificate)

H151 Unit F181: Science in society

Sample Assessment Material (SAM)

Pre-release material

For issue on or after: xxxxx

To prepare candidates for the examination taken on xxxx

INSTRUCTIONS

- Do **not** take this insert into the exam.
- Do **not** take any notes into the exam.
- Please contact OCR Copyright should you wish to re-use this document.

INFORMATION

- A clean copy of this pre-release will be given to you with the question paper.
- This document has **5** pages.

Pending Copyright - Science News article

Source A

Adapted from 'Water is weird. A new type of ice could help us understand why'
The unusual amorphous ice has a density close to that of liquid water. (By: Emily Conover, Science News https://www.sciencenews.org/article/water-ice-amorphous-physics-chemistry)

Ice cubes float in water because they're less dense than the liquid. But a newfound type of ice has a density nearly equal to what's in your water glass, researchers report in the Feb. 3 *Science*. If you could plop this ice in your cup without it melting immediately, it would bob around, neither floating nor sinking.

The new ice is a special type called an amorphous ice. That means the water molecules within it aren't arranged in a neat pattern, as in normal, crystalline ice. Other types of amorphous ice are already known, but they have densities either lower or higher than water's density under standard conditions. Some scientists hope this newly made amorphous ice could help solve the scientific mysteries that swirl around water.

To generate the new ice, scientists used a surprisingly simple technique. Called ball milling, it involves shaking a container of ice and stainless-steel balls, cooled to 77 kelvins (nearly –200 °Celsius). The researchers were motivated by curiosity; they didn't expect the technique to produce a new amorphous ice. "It was a sort of Friday-afternoon idea we had, to just give it a go and see what happens," says physical chemist Christoph Salzmann of University College London.

An analysis of how X-rays scattered from the frosty stuff suggested they'd created an amorphous ice. And computer simulations that mimicked the effects of ball milling revealed that a disordered structure could be produced by layers of ice sliding past one another in random directions, in response to the forces exerted by the balls.

"You have to be open, as a scientist, for the unexpected," says chemical physicist Anders Nilsson of Stockholm University, who was not involved with the research. The ball milling technique, he says, "was quite innovative to do."

Since the material was made by mashing up normal ice, its relationship to liquid water is unknown. It's unclear whether it can be produced directly, by cooling liquid water. Not all amorphous ices share this connection with their liquid state.

If the new ice does have this link to the liquid, the ice might help scientists better understand water's quirks. Water is puzzling because it flouts the norms for liquids. For example, whereas most liquids become denser upon cooling, water gets denser as it gets closer to 4 °C, but becomes less dense as it is cooled further.

Many scientists suspect water's weirdness is connected to its behaviour as a supercooled liquid. Pure water can remain a liquid at temperatures well below freezing. Under such conditions, liquid water is thought to exist in two different phases, a high-density liquid and a low-density one, and that dual nature could explain water's behaviour under more typical conditions. But much remains uncertain about that idea.

Salzmann and colleagues suggest that the new ice could be a special form of water called a glass. Glasses can be made by cooling a liquid quickly enough that the molecules can't rearrange into a crystal structure. The glass in a windowpane is an example of this kind of material, made by cooling molten silica sand, but other substances can form glasses, too.

If the new ice is a glass state of water, scientists would need to work out how it fits into that dual-liquid picture. And that could help scientists tease out what's really going on at difficult-to-study supercooled conditions.

But some researchers are sceptical that the new material has any connection to the weird physics of liquid water. Physical chemist Thomas Loerting, of the University of Innsbruck in Austria, was not involved with the research, and thinks that the ice is “closely related to very small, distorted ice crystals,” rather than the liquid form of water.

Still, earlier computer simulations have suggested that water could form glasses of a range of densities close to liquid water, says computational physicist Nicolas Giovambattista of Brooklyn College of the City University of New York. Those simulations produced structures similar to the ones seen in the computer simulation of ball milling ice, says Giovambattista, who was not involved with the new research. “It opens doors for new questions. It’s new, so what is it?”

Source B

Adapted from 'Scientists discover new type of ice by accident' (By BBC Newsround https://www.bbc.co.uk/newsround/64523827)

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