

Monday 9 June 2025 – Afternoon

Level 3 Cambridge Technical in Applied Science

05874 Unit 23: Scientific research techniques

Time allowed: 2 hours

C344/2506

You must have:

- your copy of the Pre-release

You can use:

- a scientific or graphical calculator



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

Centre number

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Candidate number

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First name(s)

Last name

Date of birth

D	D	M	M	Y	Y	Y	Y
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INSTRUCTIONS

- Use black ink.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- At the end of the exam, hand in your pre-release notes with your exam paper.
- Use the pre-release to answer Questions **4** and **5**.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [].
- This document has **20** pages.

ADVICE

- Read each question carefully before you start your answer.

BLANK PAGE

DO NOT WRITE ON THIS PAGE

Section A

- 1 Green hydrogen is produced by passing electricity, generated from renewable sources, through water.

Due to large reductions in the costs of the equipment needed for these processes, the cost of green hydrogen is expected to fall steeply by 2030. Hydrogen can be mixed with natural gas (a fossil fuel) and so contribute to reductions in emissions of carbon dioxide.

The development of green hydrogen policies and technologies is reported in a variety of secondary sources.

The table shows different types of secondary sources.

Source types	Letter
Media	A
Government	B
Published scientific research	C
Trade website	D
Journal (scientific)	E
Scientific research institution	F

Use the table to identify which source type has been used for each piece of information.

Write **one** letter **A, B, C, D, E, or F** in each row of the table below.

You may use each letter once, more than once or not at all.

Information	Source type
© hydrogeninsight.com, Hydrogen Insight. Item removed due to third party copyright restrictions. Link to material - www.hydrogeninsight.com/innovation/dutch-start-up-bags-40m-of-eu-funds-to-bring-hybri	
© sciencedirect.com, ScienceDirect. Item removed due to third party copyright restrictions. Link to material - www.sciencedirect.com/science/article/pii/S2589299120300537	
UK hydrogen strategy This strategy sets out the approach to developing a thriving low carbon hydrogen sector in the UK to meet our increased ambition for 10GW of low carbon hydrogen production capacity by 2030.	
© commission.europa.eu, European Commission. Item removed due to third party copyright restrictions. Link to material - joint-research-centre.ec.europa.eu/scientific-activities-z/hydrogen-electrolysers-and-ft	

[4]

- 2 Glaucoma is caused when pressure builds up inside the eye. This excess intraocular pressure (IOP) can damage the optic nerve that connects the eye to the brain. If left untreated it can cause permanent blindness.

The use of tonometry is shown in the image. It is a test to measure the pressure inside a patient's eye. It is used to screen for glaucoma.



Normal IOP is in the range 10–21 mm Hg. Part of the procedure for one type of tonometry test involves placing a mixture of chemicals in the patient's eye.

An optician follows a checklist to prepare a patient for a tonometry test.

Checklist:

1. Explain the procedure to the patient. It is important that the patient fully understands what you are going to do.
2. Check for allergies and explain the (minimal) risks.
3. Make sure that the patient does not have any tight clothing around the neck, which could increase IOP.
4. Ask the patient to remove any hats. Look for anything else that may obstruct the tonometer e.g. drooping eyelids, overgrowing eyebrows, facial hair etc.
5. Adjust the patient's chair and slit lamp height.
6. Put drops of the mixture of anaesthetic* and fluorescein** into the patient's eyes – make sure you tell the patient it stings and it is yellow!
7. Note how many drops of the mixture are used, the date and time it is used and the expiry date of the mixture, on the patient's record card.
8. Ask the patient to place their chin on the chin rest of the tonometer, forehead against the bar. Remind them to keep still, keep their teeth together, and try not to hold their breath.

* for pain relief

** a brightly coloured yellow dye that stains the eye.

(a) The optician checks whether the patient has allergies. This check is part of the optician's health and safety procedure and it also provides information for their risk assessment.

(i) Identify **two** other items in the checklist that the optician uses to ensure the health and safety **of the patient**.

- 1
- 2 [2]

(ii) Identify **two** other items in the optician's checklist that also inform their risk assessment.

- 1
- 2 [2]

(b) Describe **two** items in the optician's checklist that are designed to ensure the accuracy of the measurement.

- 1
- 2 [2]

(c) The optician refers to COSHH regulations for guidance on the safe storage of the mixture of anaesthetic and fluorescein.

(i) Complete the sentence:

COSHH provides guidance on the Control of Substances that are to Health. [1]

(ii) Suggest **two** areas of guidance, other than safe storage of substances, the optician may find in the COSHH regulations.

- 1
- 2 [2]

- 3 Your chronotype (CT) is the natural inclination of your body to sleep at a certain time.

The Morningness–Eveningness Questionnaire (MEQ) is widely used to measure a person’s CT. A number of studies have reported that the MEQ has a good reliability and validity.

However, criticisms about the length (19 items) of the MEQ, and concerns about its structure have led to the development of a reduced 5-item version of the questionnaire, called rMEQ.

A group of scientists investigated the reliability and validity of rMEQ.

Abstract

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- (a) Sources of information can be evaluated for their:

- A** – academic rigour
- B** – reliability
- C** – relevance
- D** – perspective

The following questions use quotations from the abstract.

- (i) Which letter (**A**, **B**, **C** or **D**) is most applicable to:

“individuals aged 16 – 26”

.....

Explain your answer.

.....

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

(ii) Which letter (**A**, **B**, **C** or **D**) is most applicable to:

“1000 randomly selected... (response rate = 71%)”

.....

Explain your answer.

.....
 [2]

(iii) Which letter (**A**, **B**, **C** or **D**) is most applicable to:

“...rMEQ can be used to estimate CT ...caution should be taken when interpreting the results”

.....

Explain your answer.

.....
 [2]

(b) The scientists claim:

“... the prevalence of sleep difficulties is high amongst young adults.”

Suggest what further evidence could be provided to support this claim.

.....
 [1]

Section B

4 Questions 4 and 5 relate to the pre-release material you have studied and your secondary research.

(a) Gathering feedback is an important aspect of scientific research.

Four ways of gathering feedback are:

- A – interviews
- B – conversations
- C – surveys
- D – focus groups

(i) **Source A** refers to ‘white Caucasian men aged 55 to 69 years old’ as the target group for the BARCODE 1 study.

Which of the statements given below explains why this group is **not** an example of **D**, a focus group?

Put a tick (✓) in **one** box.

there are too many participants

☐

the age range is too wide

☐

there is no discussion between participants

☐

the trial is no longer recruiting patients

☐

[1]

(ii) **Source A** also refers to ‘complete the questionnaire’.

Which letter (**A**, **B**, **C** or **D**) is most applicable to this reference?

.....

[1]

(b) **Source A** refers to a clinical trial called the BARCODE 1 study.

This study uses a range of investigative measures and analytical techniques to assess a person’s **risk of developing** prostate cancer.

Identify **one** measure or technique used in this way in the BARCODE 1 study.

..... [1]

(c) Three objectives of feedback are:

E – clarity

F – objectivity

G – inspiration

(i) **Source A** refers to 'identify people who have an increased risk of developing prostate cancer'.

Which letter (**E**, **F** or **G**) is most applicable to this reference?

.....

Explain your answer.

.....

..... [2]

(ii) It could be concluded that the data in **Source B, Table 4** are a form of objective feedback (**F**).

Suggest **one** way in which the data support this conclusion and **one** way in which the data do **not** support this conclusion.

support the conclusion

.....

.....

do **not** support the conclusion

.....

.....

[2]

(d) **Source B** refers to:

‘two....widely used methods for measuring cancer-specific health-related quality of life’

(i) State the names of these two methods.

1

.....

2

.....

[1]

(ii) State the scope and expected outcome of **Source B**.

scope

.....

outcome

.....

[2]

(iii) Explain how the data in **Table 4** assures the validity of the outcome.

.....

.....

[2]

(e) Use the information in **Source B**, **Table 4** to answer the following questions.

(i) How many psychometric properties are used to evaluate:

Reliability

Validity

Responsiveness

[2]

(ii) Which psychometric property of ‘Reliability’ was evaluated in 15 articles?

.....

[1]

- (iii) How many articles were used in the evaluation of the psychometric property 'Resp'?

Show your working.

..... [2]

- (iv) Using an example of any psychometric property in **Table 4**, explain why the number of articles evaluated for the psychometric property you have chosen is also recorded as a percentage.

Clearly identify the example you have chosen.

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

- (v) Explain why the % **data** for 'Resp' appears to be incomplete.

..... [1]

5 Write a report on your own research related to the pre-release material, including the following:

- the area of focus you have chosen;
- the findings from your research;
- evaluation of your research with reference to:
 - method(s) chosen
 - evidence generated
 - source material(s) used
- conclusions and implications of your findings;
- areas where further research may be required.

[20]

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END OF QUESTION PAPER

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