OCR
Oxford Cambridge and RSA

Friday 17 January 2025 – Afternoon

Level 3 Cambridge Technical in Applied Science

05874 Unit 23: Scientific research techniques

Time allowed: 2 hours
C344/2501

C344--2501

You must have:
- your copy of the Pre-release

You can use:
- a scientific or graphical calculator
- an HB pencil

05874--23

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. You can use an HB pencil, but only for graphs and diagrams.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If you need extra space use the lined page 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 **16** pages.

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

1 According to a recent business report, the global market for personalised medicine is projected to reach £694 billion by 2031.

Personalised medicine aims to develop treatments for patients based on their unique biological makeup.

The research and development into these treatments is reported in a variety of secondary sources.

Table 1.1 shows different types of secondary sources.

Table 1.1

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

Use **Table 1.1**. to identify which type of source has been used for each piece of information.

Write **one** letter **A**, **B**, **C**, **D**, **E**, or **F** in each row of **Table 1.2**.

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

Table 1.2

	Information	Source type
1	A vaccine unique to a patient's tumour Our teams at The Institute of Cancer Research, London, and The Royal Marsden NHS Foundation Trust tested the treatment, known as RO7198457, in combination with the PD-L1 inhibitor atezolizumab (*Tecentriq*), as part of a large phase I clinical trial involving more than 140 patients.	.....
2		.....
3	The Medicines and Medical Devices Bill introduces new safety measures, increases the professions that can prescribe low-risk medicines and allows hospitals to develop personalised medicines.	.....

[3]

BLANK PAGE

DO NOT WRITE ON THIS PAGE

Turn over for the next question

2 Tyramine is a natural compound found in plants and animals. Mature cheese, e.g. cheddar, contains high levels of tyramine.

A group of scientists are considering carrying out a study to assess the association between sleep quality and tyramine consumption in healthy, young adults.

At a discussion meeting, they start to make planning notes.

- Sleep disturbance can result from inappropriate lifestyles, incorrect dietary habits and/or digestive diseases.
- Insufficient sleep is common and can have severe negative health consequences.
- Tyramine can trigger the release of norepinephrine in the brain.
- Norepinephrine increases alertness, arousal and attention.
- Norepinephrine is released in the part of the brain associated with rapid eye movement (REM) sleep.
- Dreams occur during REM sleep, during which time brain activity is similar to when being awake.
- The Pittsburg Sleep Quality Index (PSQI) questionnaire can be used to assess sleep quality.
- Suggested study subjects - around 500 18-24 year old medical students.

(a) The notes state that the scientists are considering using a particular group of study subjects to answer the research questionnaire.

(i) Suggest **three** reasons why this group is being considered.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(ii) State the **two** factors that must vary in order to achieve an outcome for this proposed research.

Factor 1 .....

.....

Factor 2 .....

.....

[2]

(iii) Write a hypothesis to be tested with reference to **both** factors 1 and 2.

.....

.....

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

(b) Suggest **two** reasons why the scientists will need to carry out a risk assessment for their proposed research.

1 .....

.....

2 .....

.....

[2]

3 Very high levels of nitrate in drinking water can cause serious illness in young children.

To prevent this, UK legislation requires that nitrate levels in drinking water must not exceed 50 mg/l.

A scientist working at a water company uses a spectrophotometer to analyse the concentration of nitrate in water. They use the following procedure:

- prepare a stock solution of 1 g/l nitrate
- use distilled water to make dilutions of the stock solution, giving concentrations of 100, 80, 60, 40, 20 and zero mg/l nitrate
- place a small sample of each concentration into the spectrophotometer
- record the results, as absorbance readings, at 205 nm, for each concentration.

(a) The scientist processes the results obtained to construct a graph.

(i) Complete the sentence:

The scientist produces the graph by plotting ..... on the y-axis

against ..... on the x-axis.

[2]

(ii) After plotting the points, the scientist determines the relationship between the two sets of values.

What **two** steps, using the graph, must they take to find this relationship?

1 .....

2 .....

[2]

(iii) The scientist receives a sample of drinking water, Sample **X**, which contains an unknown concentration of nitrate.

Explain how the scientist uses the spectrophotometer **and** the graph to find the concentration of nitrate in Sample **X**.

.....

.....

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

(b) State **one** procedure the scientist must refer to when preparing the stock standard solution.

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

(c) Explain why the scientist uses distilled water, rather than tap water, to dilute each sample.

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

(d) Suggest why the scientist uses digital media to record their work.

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

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

4 **Sources A** and **B** refer to the use of sodium lauryl sulfate (SLS).

(a) Describe the perspective of:

Source A (article about Truly O2 Skincare products) .....

.....

Source B (Case Study from Impact Analytical) .....

.....

[2]

(b) **Source A** states that SLS is "banned in the EU" but is "extremely common in US cosmetics, shampoos and other beauty products".

(i) Explain why this claim must be checked for reliability.

.....

.....

.....

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

(ii) Suggest **two** reasons why the EU and the US have different regulations for SLS.

1 .....

.....

2 .....

.....

[2]

(c) With reference to the claim made in the **Case Study** in **Source B**:

(i) State the claim that is made, and the evidence that contradicts it.

Claim .....

.....

Evidence .....

.....

[2]

(ii) Explain how primary data obtained by LC-MS analysis in **Source B** was used to evaluate the claim.

.....

.....

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

(iii) Suggest **one** reason why The Honest Company made their claim.

.....

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

(iv) Suggest **two** assumptions the Honest Company may have made in relation to their claim.

1 .....

.....

2 .....

.....

[2]

(d) **Source B** describes a range of analytical options.

(i) State **four** criteria that must be considered when selecting an appropriate analytical technique.

1 .....

2 .....

3 .....

4 .....

[4]

(ii) State **three** procedures or protocols that must be considered when an analytical technique has been selected.

1 .....

2 .....

3 .....

[3]

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]

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use this lined page. You must write the question numbers clearly in the margin.