



Oxford Cambridge and RSA

Thursday 16 June 2022 – Afternoon

Level 3 Cambridge Technical in Applied Science

05874 Unit 23: Scientific research techniques

Time allowed: 2 hours

C344/2206



You must have:

- your copy of the Pre-release

You can use:

- a scientific or graphical calculator



Please write clearly in black ink.

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. 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 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 **16** pages.

ADVICE

- Read each question carefully before you start your answer.

FOR EXAMINER USE ONLY	
Question No	Mark
1	/5
2	/6
3	/9
4	/20
5	/20
Total	/60

Answer **all** the questions.

- 1 Jamila is a medical student. She wants to find out more about the use of bio-glue in surgery. She reads a variety of information from a range of secondary sources, shown in **Table 1.1**.

Source	Information
A	Scientists develop miraculous 'bio-glue' that sets under UV light and can heal fatal wounds to organs in seconds.
B	<ul style="list-style-type: none"> • Clinically proven in more than 1.25 million cases worldwide since 1998. • More than 300 pre-clinical and clinical papers discussing safety, efficacy, and application techniques. • Simple design allows for unmatched ease of use.
C	Annals of Thoracic Surgery, September 2008 Volume 86, Issue 3, Pages 1055–1056 Bio-glue: A Word of Caution
D	U.S. Food and Drug Administration. Listing of CDRH Humanitarian Device Exemptions: PMA P010003 BioGlue® Surgical Adhesive, CryoLife Inc.
E	Objectives: To determine the feasibility of using serum albumin glutaraldehyde tissue adhesive (bio-glue) to achieve hemostasis and prevent urine leakage during nephron-sparing surgery (NSS).

Table 1.1

Identify which type of source has been used for each piece of information.

Write **A, B, C, D** or **E** in the '**Letter**' column of **Table 1.2** for each source type.

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

Source type	Letter
Government regulations	
Journal (scientific)	
Media	
Published scientific research	
Trade website	

Table 1.2

[5]

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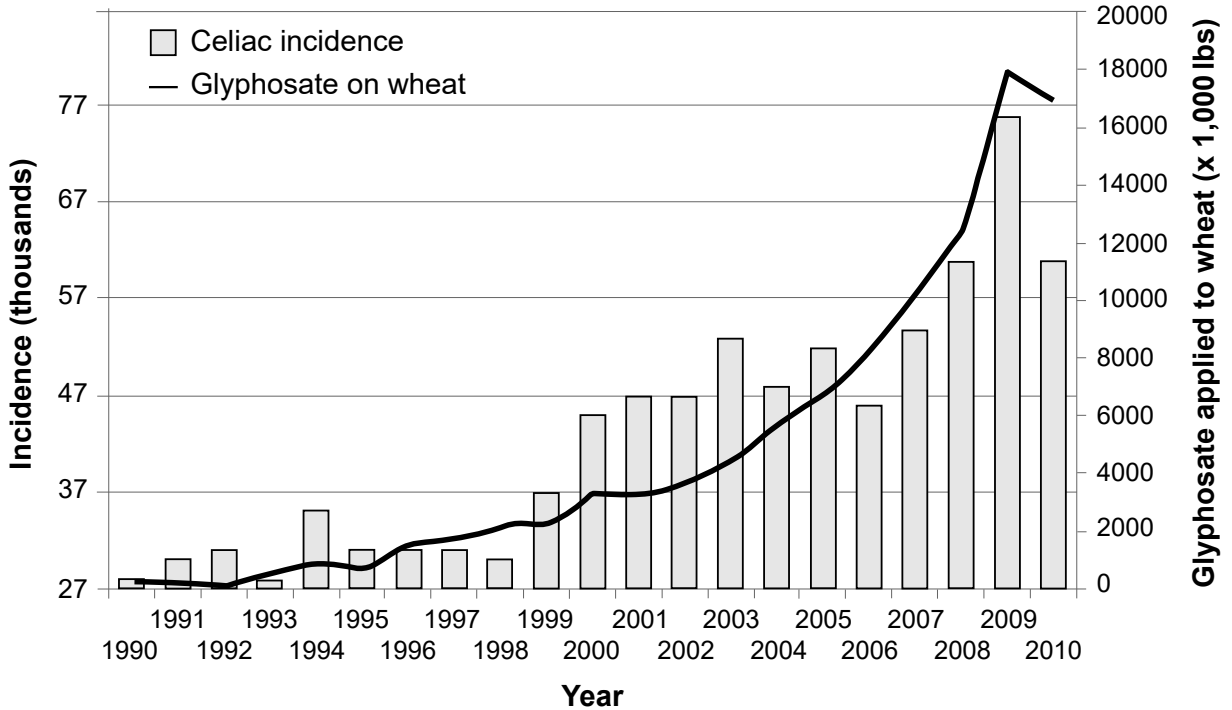
PLEASE DO NOT WRITE ON THIS PAGE

Turn over for the next question

2 Glyphosate is a chemical used by farmers on cereal crops, including wheat, oats and oil seed rape. It is a pre-harvest herbicide, and aids harvesting.

Celiac disease is a lifelong autoimmune disease. The disease is caused by a reaction of the immune system to gluten – a protein found in cereals such as wheat, rye and barley.

A 2013 American study contains the graph shown below.



Key:

Incidence (thousands) = the number of new cases of celiac disease diagnosed in hospital patients.

Glyphosate applied (x 1000 lbs) = the total weight (1000 lbs is approximately 450 kg).

(a) (i) The graph implies that there is a relationship between the weight of glyphosate applied to crops and the incidence of celiac disease.

Write a hypothesis for this relationship.

.....

.....

..... [1]

(ii) Suggest **three** further pieces of information that would increase confidence in this hypothesis.

1

.....

.....

2

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3

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.....

[3]

(b) Explain the choice of graphical techniques used in the graph.

.....

.....

.....

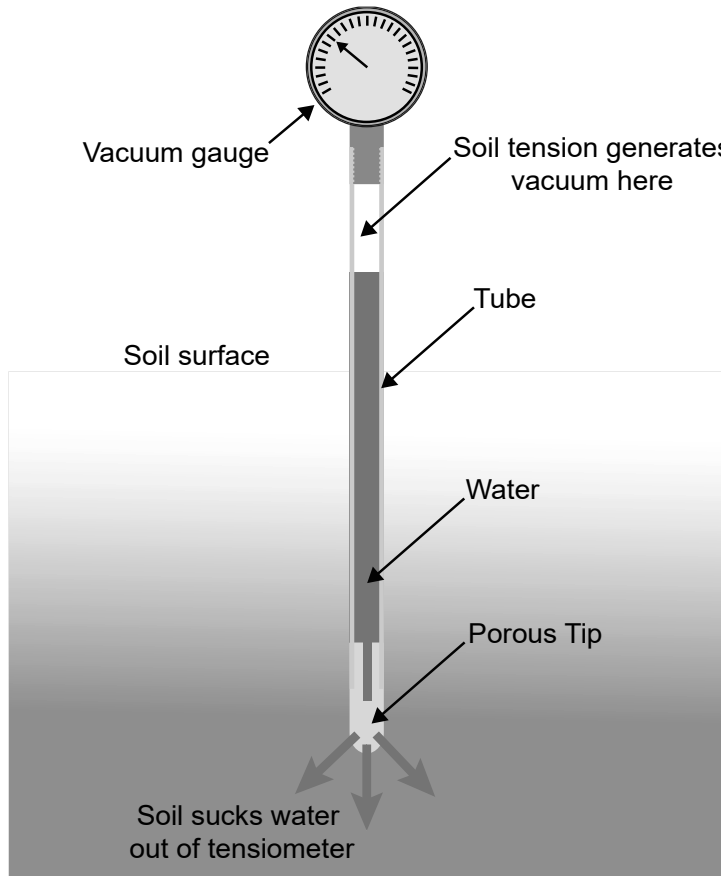
.....

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[2]

3 Heidi is a farmer. She uses an instrument called a tensiometer to monitor the water content of the soil in which her crops grow.

Below is a diagram of a tensiometer.



The tip of the tensiometer is made of porous ceramic.

- Water in the tube passes out of the tip when the soil is dry.
- This creates a vacuum in the space above the water level in the tube.
- This causes the reading on the vacuum gauge to increase.
- This process is reversed as the amount of water in the soil increases.
- In very dry soil the tensiometer stops working as air enters through the porous tip.

(a) Heidi uses the reading on the tensiometer to help her decide when to water her crops.

Give **three** aspects of this test that Heidi should consider **before** deciding it is a suitable analytical technique for her to use.

1

.....

2

.....

3

.....

[3]

(b) The tensiometer comes with a set of protocols (technical instructions) for how to use it correctly and how to interpret the readings on the vacuum gauge.

For example, one of the protocols reads:

‘A gauge reading of between 50 kPa and 60 kPa indicates the optimum condition for plant growth in medium to heavy textured soils.’

Suggest **five** pieces of information that Heidi needs to find out in order to use the tensiometer correctly.

1

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2

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3

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4

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5

.....

[5]

(c) Heidi also needs to consider the risk of damage to the tensiometer.

State **one** risk **and** how it might be avoided.

.....

.....

..... [1]

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

4 Sources A and B consider the effects of different levels of dietary carbohydrates and fats on disease and mortality.

(a) With reference to Source A:

A 'prospective cohort study' is a study that follows, over time, a group of similar individuals, who differ in the factors under study, to determine how those factors affect the rates of a certain outcome.

State how each of the factors, numbered (i) to (iv) below, have been addressed in this study.

(i) the selection of the individuals involved

..... [1]

(ii) the factors being measured

..... [1]

(iii) the timescale **and** follow-up period of data collection

timescale

follow-up period

[2]

(iv) how the statistics produced from the data are used at the end of the study

.....

.....

.....

..... [2]

(b) State the method of data collection in **Source A**, and explain why this method has validity and reliability.

method

.....

explanation

.....

.....

.....

[3]

(c) (i) State **two** conclusions in **Source A** related to higher consumption of carbohydrates.

1

.....

.....

2

.....

.....

[2]

(ii) Identify the contradictory recommendation between **Source A** and **Source B** related to consumption of carbohydrates.

.....

.....

[1]

(d) (i) State **two** conclusions in **Source A** related to higher consumption of saturated fats.

1

2

[2]

(ii) Identify **two** pieces of information that contradict each other in **Source B**, related to consumption of saturated fats.

1

2

[2]

(e) (i) Describe the perspective **and** purpose of **Source B**.

perspective

purpose

[2]

(ii) Identify **two** examples of bias described in **Source B** that led to the initial conclusions about the consumption of saturated fat.

example 1

example 2

[2]

[Total: 20]

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s) – for example, 2 (a)(ii) or 4 (b).

A vertical line on the left side of the page is followed by 25 horizontal dotted lines, providing a ruled area for writing answers.



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