

## Friday 17 January 2020 – Afternoon Level 3 Cambridge Technical in Applied Science

**05874** Unit 23: Scientific research techniques

**Time allowed: 2 hours**

**C344/2001**



**You must have:**

- a ruler (cm/mm)
- a clean copy of the Pre-release (inside this document)

**You can use:**

- a scientific or graphical calculator

Please write clearly in black ink.

Centre number

Candidate number

First name(s) \_\_\_\_\_

Last name \_\_\_\_\_

Date of birth

### 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.

### INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [ ].
- This document has **16** pages.

### ADVICE

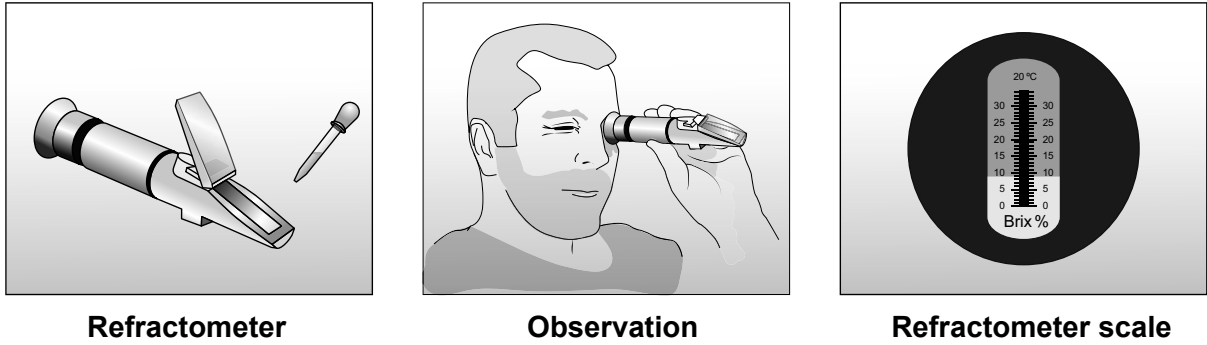
- Read each question carefully before you start your answer.

| FOR EXAMINER USE ONLY |            |
|-----------------------|------------|
| Question No           | Mark       |
| 1                     | /10        |
| 2                     | /7         |
| 3                     | /3         |
| 4                     | /20        |
| 5                     | /20        |
| <b>Total</b>          | <b>/60</b> |

Answer **all** the questions.

- 1 Howard is a fruit farmer. He uses a refractometer to carry out a Brix test. This analytical technique monitors the ripeness of his crop.

He places a drop of juice from a piece of fruit in the refractometer. He then observes the reading on the refractometer scale (**Fig. 1.1**).



**Fig. 1.1**

To determine the quality of the fruit, he compares the reading against a table of data (**Table 1.1**).

| Fruit      | Poor | Average | Good | Excellent |
|------------|------|---------|------|-----------|
| Apple      | 6    | 10      | 14   | 18        |
| Pear       | 6    | 10      | 12   | 14        |
| Raspberry  | 6    | 10      | 14   | 16        |
| Strawberry | 6    | 8       | 12   | 14        |
| Tomato     | 4    | 6       | 8    | 12        |

**Table 1.1**

- (a) Give **five** aspects of this test that Howard would consider before deciding it is a suitable analytical technique for him to use.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

5 .....

.....

- (b) In addition to using the refractometer, Howard wants to gather feedback on the quality of his fruit.

He constructs a table of the five points he needs to consider when planning how he will do this.

Complete **Table 1.2** by giving **one** suggestion for each point.

|          | <b>Point to be considered</b>          | <b>Suggestion</b> |
|----------|--|-------------------|
| <b>1</b> | <b>Source</b> of feedback              |                   |
| <b>2</b> | <b>Form</b> of feedback                |                   |
| <b>3</b> | <b>Method</b> of gathering feedback    |                   |
| <b>4</b> | <b>Objective</b> of gathering feedback |                   |
| <b>5</b> | How to <b>evaluate</b> feedback        |                   |

**Table 1.2**

**[5]**

2 Adiponectin is a hormone released by fat cells in animals, including humans.

A 2004 study concluded:

Increased coffee consumption is associated with increased adiponectin levels in Japanese males.

*European Journal of Nutrition*

A 2007 study concluded:

Mice genetically engineered to have high levels of adiponectin do not develop type 2 diabetes.

*Journal of Clinical Investigation*

(a) Write a hypothesis based on a combination of these two conclusions, and state **three** assumptions you have made.

Hypothesis: .....  
.....  
.....

Assumptions:

- 1 .....  
.....  
.....
- 2 .....  
.....  
.....
- 3 .....  
.....  
.....

[5]

**(b)** Adiponectin levels are determined by analysing blood samples.

The Health and Safety Executive (HSE) advises:

All blood should be considered potentially infectious.

Precautions are needed when taking samples.

Describe **two** precautions to be taken.

1 .....

.....

.....

2 .....

.....

.....

**[2]**

3 The following abstract about a research study appeared in an education journal.

**ABSTRACT**

The article describes how children’s understanding of science concepts can be assessed by interviewing [them]. Data from interviews are analysed using categories and criteria that have been chosen to indicate not only the extent of a child’s knowledge, but also aspects of its ‘quality’. Methods of interviewing and analysis are described. The report is part of a continuing study of [methods of assessing] meaningful learning in science in English and Malaysian schools.

Azian Abdullah and Jon Scaife

*School Science Review*, June 1987, 78 (285)

(a) State the scope of the research.

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

(b) Suggest the outcome that must be achieved to answer the research focus.

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

(c) Suggest what the researchers should do to ensure the accuracy of the outcome.

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

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

4 (a) Refer to **Source A**.

Describe **four** properties of neonicotinoids (neonics) that have made them useful to farmers.

1 .....

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2 .....

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3 .....

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4 .....

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[4]

**(b)** Compare sources **A** and **B** in relation to **legislation, bias** and **regulation**.

Use information from the source material to justify your answer.

Legislation .....

.....

Bias .....

.....

.....

.....

.....

.....

.....

Regulation .....

.....

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.....

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.....

.....

**[6]**



(c) **Source B** refers to the Centre for Ecology and Hydrology (CEH). The CEH has been commissioned by the government to conduct large-scale field trials in the UK.

The CEH will be working to an agreed research brief to determine the effects of neonics on bees in the UK.

It is anticipated that completion of this research brief will result in a list of recommendations to the government.

(i) Suggest a likely hypothesis to be tested by the CEH.

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

(ii) Suggest **four** recommendations that the CEH could make following the results of their research.

1 .....

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2 .....

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3 .....

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4 .....

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[4]

- (d) (i) The analysis of pesticide residues is carried out in accordance with Standard Analytical Practices.

State **two** reasons why.

Give an explanation for each reason.

Reason 1 .....

Explanation .....

.....

Reason 2 .....

Explanation .....

.....

**[4]**

- (ii) Which laboratory technique can be used to analyse pesticide residues?

Put a tick (✓) in the box next to the correct answer.

microscopy

titration

gas chromatography

gel electrophoresis

**[1]**









**ADDITIONAL ANSWER SPACE**

If additional answer space is required, you should use the following lined pages. The question numbers must be clearly shown in the margins – for example, 2(b) or 4(b).

A large rectangular area containing 25 horizontal dotted lines for writing answers. A solid vertical line is on the left side of the page.



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