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**TOTAL
MARKS**

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NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2022

LIFE SCIENCES: PRACTICAL ASSESSMENT TASK

EXAMINATION NUMBER

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Time: 1½ hours

50 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Write your examination number in the blocks above.
2. This Practical Assessment Task consists of 11 pages and a separate yellow Information Sheet of 2 pages (i–ii). Please check that your PAT is complete.
3. You have ten minutes reading time before you begin. You are advised to read carefully and spend time planning your work.
4. Perform the task with care. You will be assessed on your ability to follow instructions.
5. Standard accommodations will apply to this PAT.
6. Please answer the questions in the spaces provided. Should you need more space for your responses, use ONLY pages 10–11 in this question paper. No extra paper may be added to this booklet.

Invigilators must please complete this after the PAT.

CRITERIA		
Following instructions	0	1
Procedural skills	0	1
Manipulative skills	0	1
TOTAL		(3)

FOR MARKERS' USE ONLY

	Skills	Part 1	Part 2	Total	Initials
Marker					
Internal Moderator					
IEB Moderator					

Please read the Information Sheet very carefully before you start and refer to it during your investigation.

There are two parts to this PAT:

Part 1 – Investigation

Part 2 – Experimental Design

A food technologist needs to determine the caffeine content of beverages. The test involves adding an activator solution to a mixture of caffeine-testing solution and then to the beverage to be tested. The height of the foam is proportional to the amount of caffeine present.

Before you begin your investigation, please make sure that you have the following equipment and solutions at your workstation:

- Four test tubes in a test tube rack
- A beaker or container containing distilled water (labelled 'dH₂O')
- An empty beaker or glass container
- Kebab stick or stirring rod
- 20 ml syringe
- 50 ml syringe
- 5 ml syringe
- Measuring spoon
- A beaker or container containing the caffeine test powder (labelled 'CTP')
- A beaker or container containing the activator solution (labelled 'AS')
- Polystyrene cup or beaker containing tap water for rinsing (labelled 'R')
- One A4 sheet of plain white paper
- Paper towel
- Permanent marker
- Ruler

Access to a beaker/container containing:

- coffee (labelled 'coffee')
- black tea (labelled 'black tea')
- green tea (labelled 'green tea')
- rooibos tea (labelled 'rooibos tea')

Remember

Please read the Information Sheet very carefully before you start and refer to it during your investigation.

At the end of the PAT, leave your workstation neat, as the invigilator will assess parts of the PAT once you have left the venue.

PART 1 INVESTIGATION

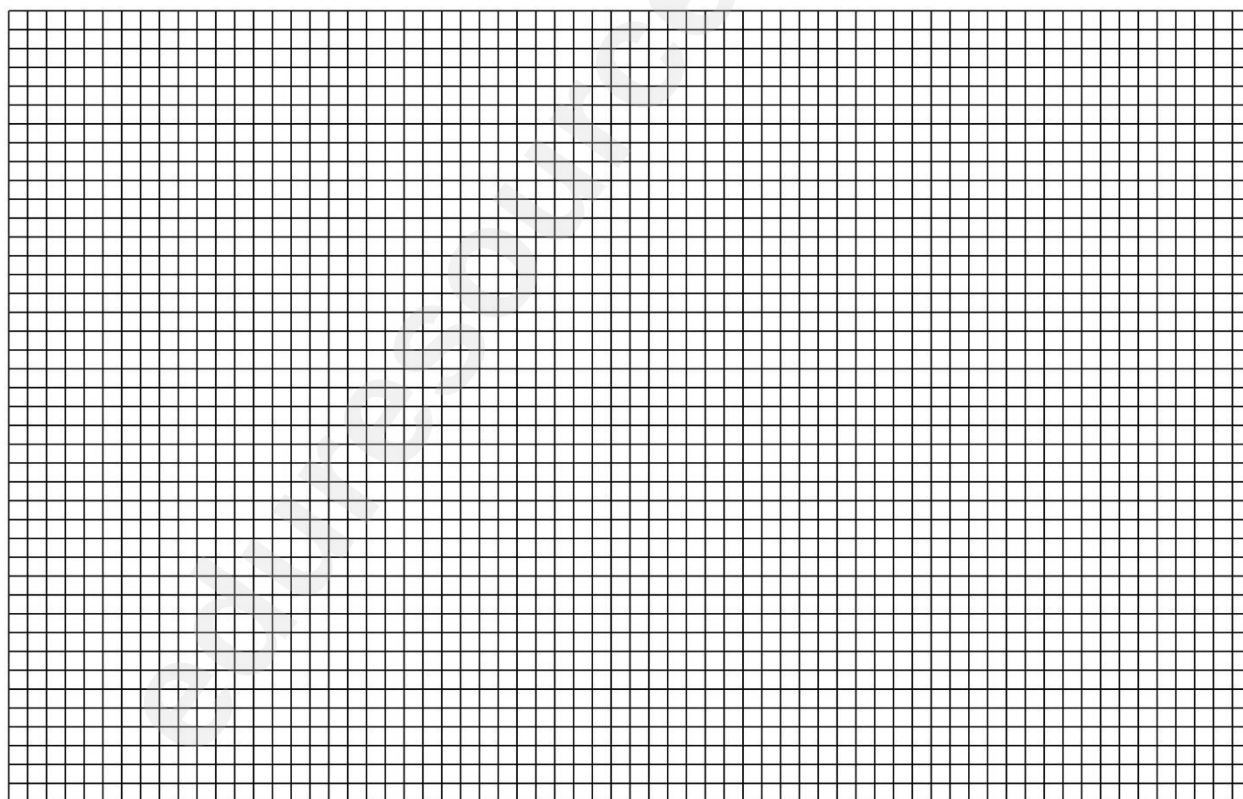
- 1.1 Using a marker, label the test tubes **A**, **B**, **C** and **D**.
- 1.2 Using a marker, label the empty beaker CTS (caffeine testing solution). Using the measuring spoon, measure 5 ml of CTP into the empty beaker.
- 1.3 Using an appropriate syringe, place 100 ml of distilled water into the beaker. Using the kebab stick or stirring rod, stir until almost completely dissolved. Rinse the kebab stick in the rinsing water.
- 1.4 Using an appropriate syringe and ensuring that no cross-contamination of liquids occurs, add the following to the relevant test tubes:
 - 20 ml of **coffee** into test tube **A**
 - 20 ml of **black tea** into test tube **B**
 - 20 ml of **green tea** into test tube **C**
 - 20 ml of **rooibos tea** into test tube **D**
- 1.5 Using an appropriate syringe, add 5 ml of the CTS you made in step 1.2–1.3 to each of the test tubes. Stir the contents of each test tube gently with a kebab stick. Ensure that no cross-contamination of liquids occurs.
- 1.6 Rinse the syringe in the rinsing water.
- 1.7 Read this entire step before commencing:
 - Using the same syringe, add 5 ml of **AS** into test tube **A**.
 - Stir the liquid gently with a kebab stick while counting to 10 in your head (approximately 10 seconds).
 - Immediately have your marker ready and mark the tube at the highest point of the foam at 10 seconds.
 - If the liquid overflows, make a mark just below the rim of the test tube.
- 1.8 Repeat step 1.7 for each test tube in turn, marking the tubes at the highest point of the foam at 10 seconds.
- 1.9 Using a ruler, measure the distance from the surface of the liquid to the mark you have made, in millimetres (mm). Record this measurement, which indicates the height of the foam, in the table on the next page.

- 1.10 Complete the table below by adding in the names of the beverages and the height of the foam (if any). Provide a heading for the table.

Beverage	Height of foam (mm)

(4)

- 1.11 Draw a bar graph of the amount of caffeine in each liquid. NOTE: 1 millimetre of foam is equivalent to 1 μg of caffeine per beverage. No heading is required.



(6)

- 1.12 Based on your results, which liquid (A, B, C or D) contains the most caffeine?

(1)

- 1.13 Bearing in mind that $1 \text{ mg} = 1000 \text{ } \mu\text{g}$, explain how your results for coffee and tea compare with the table on page (i) of the Information Sheet.

(2)

- 1.14 How could you make sure the results of this investigation are reliable?

(2)

- 1.15 Identify ONE controlled/fixed variable relevant to this investigation and explain how you controlled this variable.

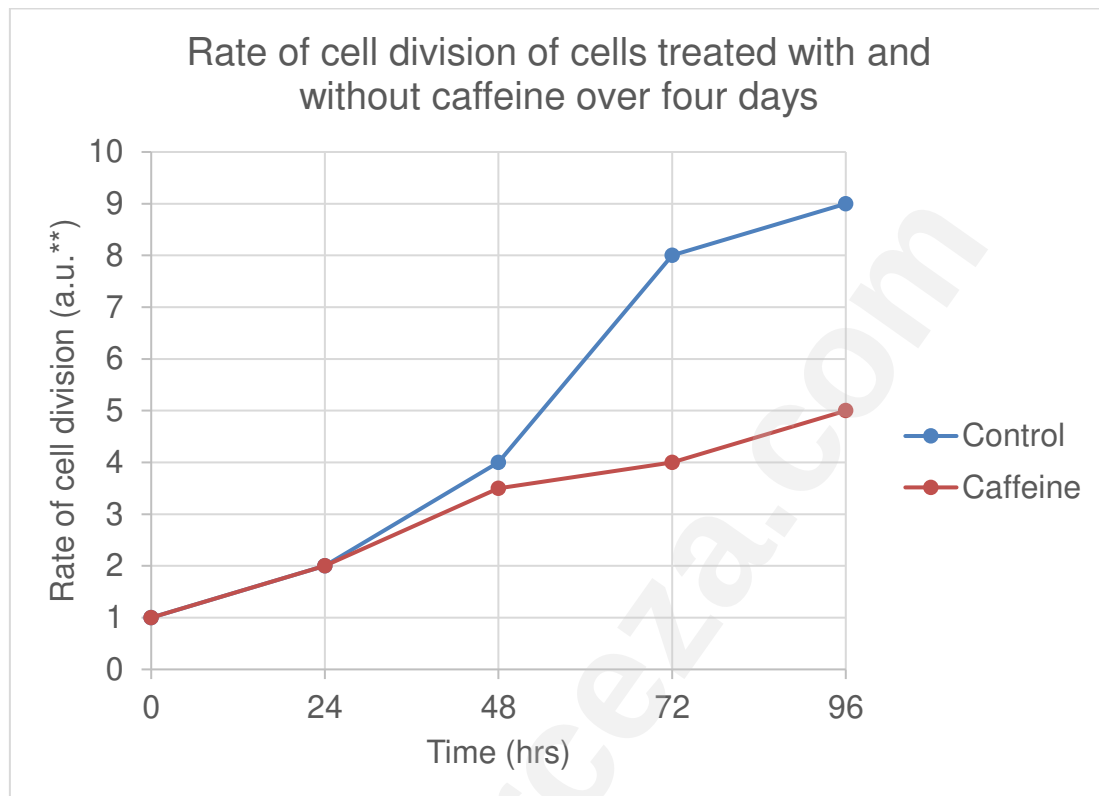
(3)

- 1.16 Describe how you avoided cross-contamination in both steps 1.4 AND 1.5.

(2)

**LEAVE THE TEST TUBES NEATLY IN THE RACK ON YOUR DESK FOR
ASSESSMENT AFTER THE PAT.**

- 1.17 An oncologist* was studying the effects of caffeine on the rate of cell division in cancerous cells. Below is the data she collected over four days.



[Adapted: https://www.researchgate.net/figure/The-effect-of-caffeine-on-cisplatin-mediated-cell-growth-inhibition-in-both-HTB182-and_fig4_275835408]

*Oncologist: doctor qualified to diagnose and treat cancer

** a.u. = arbitrary units

- 1.17.1 Name the dependent variable.

(2)

- 1.17.2 This experiment had a control. What is the purpose of a control in an experiment?

(2)

- 1.17.3 Explain what the control was in this experiment.

(1)

1.17.4 Write a suitable conclusion for this experiment.

(2)

1.17.5 In the space below, draw a table of results from all the data in the graph. No heading is required.

(5)
[35]

PART 2 EXPERIMENTAL DESIGN

A barista has prepared three cups of coffee for you, each from beans roasted differently: dark roast, medium roast and light roast. He asks you the following question:

Which roast (dark, medium or light) has the most caffeine?

Design a simple experiment to answer this question. Make use of caffeine test powder (CTP) in your design.

2.1 Give an aim for the experiment that you are designing.

(2)

2.2 State the independent variable in this experiment.

(2)

2.3 State the dependent variable in this experiment.

(2)

2.4 Give a reason why this experiment will produce quantitative results.

(1)

This image shows a blank sheet of white paper with horizontal ruling lines. A diagonal watermark, "eduresourceza.com", is visible across the page. The watermark is light gray and slanted from the bottom-left towards the top-right. There are approximately 20 horizontal lines spaced evenly down the page.

(8)
[15]

**REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE
ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.**

[illegible]

[illegible]