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NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2022

LIFE SCIENCES: PRACTICAL ASSESSMENT TASK (PAT)

MARKING GUIDELINES

Time: 1½ hours

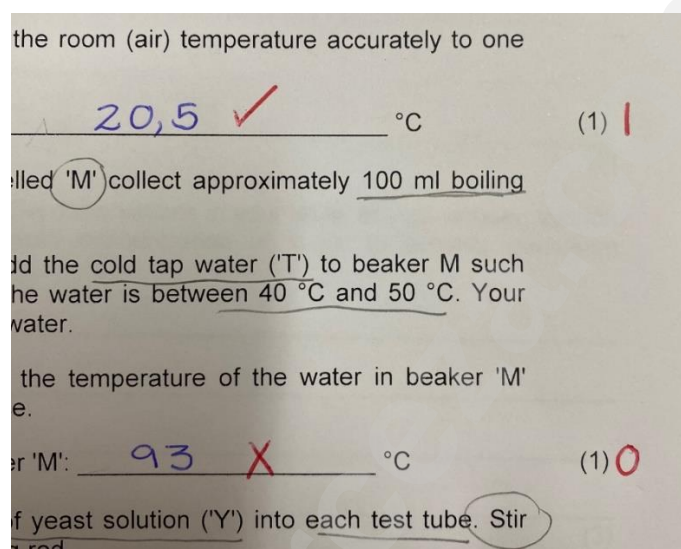
50 marks

These marking guidelines are prepared to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

General instructions

1. Mark scripts in red pen.
2. Place the tick (✓) where the mark is allocated, NOT at the end of the answer/sentence/line. Make a cross (✗) if incorrect.
3. Write the subtotal for each question in red pen next to the bracketed () mark allocation. If the mark is zero, please write "0".
4. Please do NOT circle any marks when marking, e.g. ①
5. For an example see image below:



6. Remember to look at additional pages 10–11 for answers, mark them, and carry the mark forward to the particular question.
7. Answers must be read in their entirety. Alternative or equivalent wording that correctly expresses the concept or the meaning of the concept must be accepted.
8. Write the skills mark and the subtotals for Part 1 and Part 2 into the blocks as shown below. Calculate the total and initial next to it.

Example:

Invigilators must please complete this after the PAT.

CRITERIA		
Following instructions	0	①
Procedural skills	①	1
Manipulative skills	0	①
TOTAL	2	(3)

FOR MARKERS' USE ONLY

	Skills	Part 1	Part 2	Total	Initials
Marker	2	21	12	35	PMG
Internal Moderator					
IEB Moderator					

9. Should you moderate a script in a cluster (external), use PENCIL and record marks on the front cover of the script in the 'Internal Moderator' row.
10. Please place the FINAL mark in the box at the top of the answer script (TOTAL MARKS) in RED pen (as shown in the image below).



11. When returning scripts, exclude all loose pieces of paper (e.g., information sheets).
12. However, place the skills mark sheets in a separate envelope.

PART 1 INVESTIGATION

Following instructions: four test tubes, labelled A, B, C & D, in a rack ✓

Procedural skills: Approximately 25 ml of liquid in each test tube ✓ (every candidate should be awarded this mark due to the variation in the overflow).

Manipulative skills: Lines marked on each test tube ✓

(3)

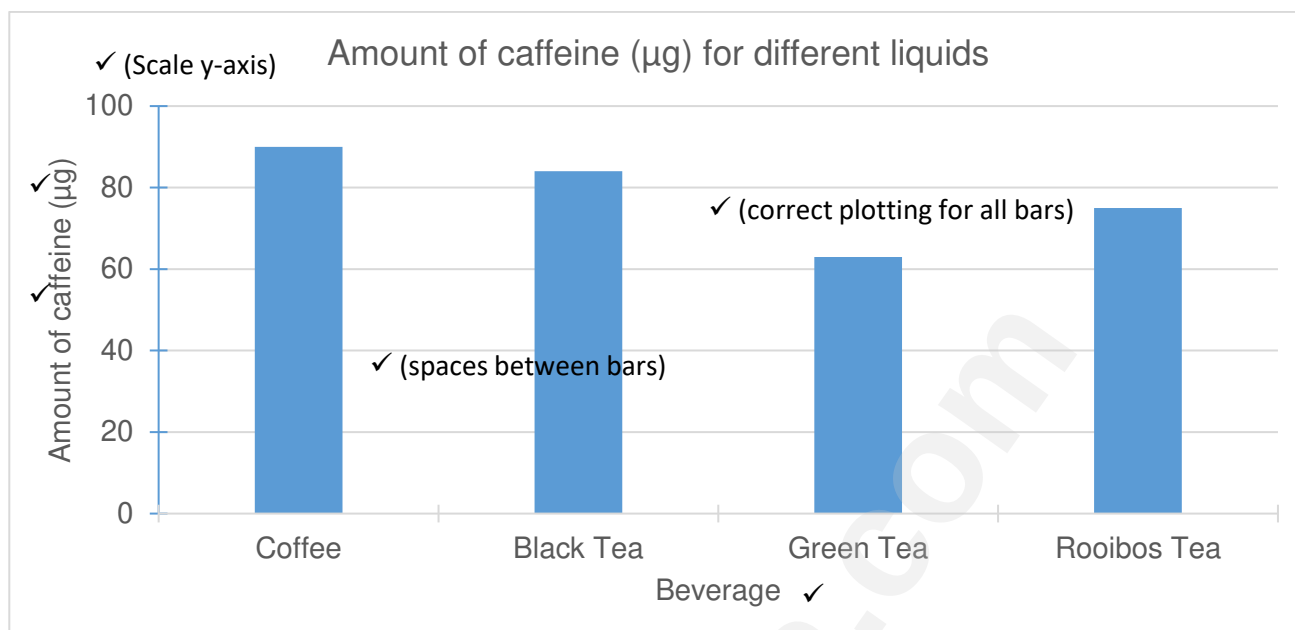
1.10 Table showing the height of the foam ✓ for (four different) beverage(s). ✓

Beverage	Height of foam (mm)
Coffee	90
Black tea	84
Green tea	63
Rooibos tea	75
✓ (liquids listed in any order, not just 'A', 'B' etc.)	✓ (values* in mm and no units in table) *within a range of between 5 mm-120 mm; the values in the table are an example only with no definite trend

(4)

1.11 Graph

Note: Bars should be plotted according to the values given by the candidate in the table in Question 1.10 by the candidate (heading not required – no mark).



(6)

Explanation of the marks awarded for graph:

- X axis label – Beverage with coffee, black tea, green tea, rooibos tea labels OR Beverage with A, B, C, D labels OR other evidence of key linking Beverage and the respective bar (1 mark)
- Y-axis label and unit – (amount of) caffeine in μg (2 marks)
- Scale y-axis – appropriate and proportional scale with regular intervals (1 mark)
- Spaces between bars of equal width (does not have to be equal to space between y-axis and first bar plotted; first bar may be plotted against the y-axis) (1 mark)
- Correct plotting for **ALL FOUR** bars according to values in the candidate's table (1 mark)

If line graph/histogram drawn: do not award mark for spaces between bars

No heading was required, but because of best practice the marking guidelines includes a suitable heading.

1.12 Based on candidate's result (mark in conjunction with the candidate's results): can be A, B, C or D / coffee, black tea, green tea, or rooibos tea ✓

Note: Look at the highest value(s) the candidate provided in the table in Question 1.10. Award a mark for any liquid(s) with the highest (equal) value(s).

(1)

1.13 Comparison of candidate's result with the table on page (i) of Information Sheet: Any one of the following **explanations**:

- results of caffeine content for coffee and tea are much less than/more than/ the same as the published caffeine quantities ✓ (mg quantities can be quoted from the table and compared with graph μg quantities / ratios or averages of coffee : tea / understanding of volume differences also acceptable ✓)
First mark is awarded for comparison of caffeine content from candidate's results vs table on information sheet; second mark is awarded for referencing values/providing evidence.
- results of caffeine content cannot be found ✓ on the published caffeine quantities (e.g., green tea and rooibos tea are not specified on the table.) ✓

(2)

- 1.14 Repeat the experiment ✓ (with a second batch of liquids). Compare the results to previous results / if same/similar results, ✓ then reliable.
NOTE: Do NOT accept 'calculate average' nor 'add a control'. (2)
- 1.15 Any ONE, explained:
- Volume/quantity/amount of CTS ✓ (not just 'CTS solution'), 5 ml added to each/all samples/test tubes ✓ using a syringe ✓
 - Volume/quantity/amount of liquid/beverage ✓ (20 ml) added to all test tubes ✓ using a syringe ✓
 - Volume/amount of AS ✓ (5 ml) added to each test tube ✓ using a syringe ✓
 - Size of test tube: ✓ checked/measured ✓ that each tube had the same diameter and/or height ✓ (relevant in this case because measuring the height of the foam)
 - Time/Pace of stirring with kebab stick: ✓ the liquid in the test tubes was stirred at the same pace or for the same amount of time, ✓ e.g., 10 seconds ✓
- NOTE: Do not award marks for the environment or temperature, as these were not controlled by the candidate.
If candidate identifies more than one variable, then only the first one is marked. (3)
- 1.16 Cross contamination is avoided in:
Step 1.4 by rinsing the syringe thoroughly in the rinsing water between using the syringe in different beverages; ✓
Step 1.5 by rinsing/wiping the kebab stick thoroughly between stirring of the different solutions. ✓
OR: Rinsing kebab stick and syringe ✓ between use with different beverages/solutions ✓ (2)
- 1.17 1.17.1 Rate ✓ of cell division ✓ (2)
- 1.17.2 For a comparison ✓ to the experiment without the effect of the independent variable. ✓ OR
Purpose of control is to observe if the effect ✓ in an experiment is due to the independent variable only ✓ OR
To compare results ✓ with an experiment with no caffeine ✓ (2)
- 1.17.3 Rate of cell division without caffeine OR
Rate of cell division in untreated cells OR
Rate of cell division in a person not consuming caffeine. ✓ (1)
- 1.17.4 Conclusion: Caffeine reduces the rate of cancerous cell division ✓ over 4 days / 96 hours / or any reference to time in a range after 24 hours to 96 hours ✓ OR
There is a reduction in the rate of cell division with caffeine ✓ by 4 a.u. ✓ at 96 hours OR
There is a reduction in the rate of cell division with caffeine ✓ with any reference to data showing a reduction in a range of 0,5 – 4 a.u. ✓
Converse is also correct:
No caffeine increases the rate of cancerous cell division ✓ over 4 days / 96 hours / or any reference to time in a range after 24 hours to 96 hours ✓ OR

There is an increase in the rate of cell division without caffeine ✓ by 4 a.u. ✓ at 96 hours OR

There is an increase in the rate of cell division without caffeine ✓ with any reference to data showing an increase in a range of 0,5 – 4 a.u. ✓

(2)

1.17.5 Table showing rate of cell division over four days for cells treated with and without caffeine (*Preferred layout*)

Time (hrs)* ✓	Rate of cell division (a.u.)✓	
	Control	Caffeine
0	1	1
24	2	2
48	4	3,5
72	8	4
96	9	5

Column headings ✓

✓✓ all correct values

If one incorrect value,
only one mark awarded
(✓)

If more than one
incorrect value, no
marks awarded

*Time must be on the left-hand column.

ALTERNATIVELY, candidates may present the table in a different format as shown below (*less-preferred layout*):

Time (hrs)✓**	0	24	48	72	96
Rate of cell division (a.u.) for control***	1	2	4	8	9
Rate of cell division (a.u.) with caffeine***	1	2	3,5	4	5

**Time must be on the top row

***In this table format, one mark is awarded for rate of cell division in both rows, ✓ and one mark for 'control' and 'with caffeine'✓ included in the row headings.

All correct values (✓✓)

If one incorrect value, only one mark awarded (✓)

If more than one incorrect value, no marks awarded.

(5)

[35]

PART 2

- 2.1 To determine the caffeine content (height of foam) ✓ in three differently roasted coffee beans / dark, medium and light roast beans ✓
OR To determine which roast ✓ has the most caffeine ✓
NOTE: if candidates simply rewrite the question (e.g. Which roast has the most caffeine?), max 1 mark. (2)
- 2.2 The three ✓ bean types ✓ OR
The types of coffee ✓ dark/medium/light ✓ OR
The different ✓ roasted beans ✓ OR
The three ✓ roasted coffees ✓ (2)
- 2.3 Amount/quantity ✓ of caffeine ✓ OR
caffeine ✓ content ✓ OR
height ✓ of foam ✓ (2)
- 2.4 Measuring/collecting a value/number (millimetres) ✓ OR
Measuring/observing height of foam ✓ OR
Measuring amount of caffeine ✓ (1)
- 2.5 Sample method:
1. Using a marker, label three test tubes 1, 2 and 3 (or dark, medium and light).
 2. Using a syringe, measure 20 ml of each coffee into the respective test tubes, rinsing the syringe between transfers.
 3. Using a measuring spoon, add 5 ml of caffeine testing powder (CTP) to a beaker labelled CTS.
 4. Using a syringe, add 100 ml distilled water into the beaker CTS and stir using a kebab stick/stirring rod until dissolved.
 5. Add 5 ml CTS to each tube. Stir using a kebab stick.
 6. Using a syringe, add 5 ml AS into tube 1. Stir using a kebab stick. Immediately mark the tube at the highest point of the foam at 10 seconds, using a marker.
 7. Repeat steps 5 and 6 for tubes 2 and 3.
 8. Using a ruler, measure the millimetre distance from the surface of the liquid to the mark made in step 6 (height of the foam) and record in a table.
 9. Optional: Calculate the height difference to determine the caffeine content for each coffee.

NOTE: *do not penalise candidates for adding an additional control or having replicates/repeating the experiment for reliability.*

Layout (L): neat (orderly, easy to follow), numbered (if not numbered, then no marks) ✓

Aim (A): (A1) must use three coffee samples (dark, medium and light roast) ✓
(A2) must use CTS and AS and measure the height of the foam ✓

Method (M):

- Original – look for use of three coffee solutions (no other varieties of beverages such as tea) ✓
- Equipment – look for correct use of ALL of the following: syringe, ruler/measuring cylinder and marker/marketing device ✓
- Measuring – same amount of coffee, CTS and AS added to all three tubes ✓
- Valid – order allows for achievable, valid result; must measure the height of the foam or calculate height of foam to get caffeine content in the coffees ✓
- Measurable results – recording of height of foam / caffeine content ✓

The rubric has been interpreted in this way for this experimental design. Please do NOT attach a copy of the rubric. Use the following key when marking where L = layout, A = aim and M = method.

e.g.
 L ✓
 A x✓
 M x✓xxx
 1 2 3 4 5
 OR
 L ✓
 A ✓✓
 M ✓✓✓✓✓
 OECVR

Do NOT place **any other** ticks in the method.

You may circle or underline elements in the candidate's method to indicate that a mark will be awarded or highlight a sentence or phrase when an element is missing from the method.

It is helpful if an indication is made as to why a mark is not awarded for a particular element of the method (next to the cross), for example:

L	✓	
A1	x	used beverages from original investigation (teas)
A2	✓	
M	x	did not use 3 coffees
	✓	
	x	same amount coffee was not used
	x	height of coffee foams not measured
	x	no recording of height of foam

(8)
[15]

METHOD RUBRIC

Method Rubric Criteria	5	4	3	2	1	0
L Layout – appearance of method					Layout meets criteria below: neat, tidy and numbered.	Layout is untidy and hard to read. OR Method is not formatted correctly with numbers.
A Aim – Method relates to prescribed experiment.				Method clearly tests an aim that relates to the prescribed experiment and achieves the required result.	Method relates to the prescribed aim but is a little confusing and does not achieve the required result.	Method neither relates to the prescribed aim nor achieves the desired result. Method given is the same as the experiment given.
M Method – This needs to be appropriate and relevant to the aim, clearly logical and sequential. If apparatus is given in the examination paper, the method should resemble the one given in the marking guidelines.	All 5 criteria given below are met: 1. An original experiment provided. 2. Equipment is appropriate and used correctly. 3. Measuring of solutions, reagents and marking of equipment are explained and this assists in the control of variables. 4. Instructions are scientifically valid and ordered. 5. Instructions are complete to produce measurable results that are recorded.	An original experiment provided. Plus 3 of 5 criteria are met.	An original experiment provided. Plus 2 of 5 criteria are met.	An original experiment provided. Plus 1 of 5 criteria is met.	An original experiment provided.	None of the 5 criteria are met. OR Method a copy of the original, given experiment.

Total: 50 marks