NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020

LIFE SCIENCES: PRACTICAL ASSESSMENT TASK

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.

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PART 1 INVESTIGATION

Following instructions: four test tubes labelled 1 to 4 ✓

Procedural skills: Level of solutions NOT the same in each tube ✓

Manipulative skills: All test tubes are either blue or blue/green before the addition of the yeast solution ✓ (3)

1.6 Room temperature: reasonable temperature given to one decimal place. ✓ Educator should measure the temperature of the room. (1)

1.9 Temperature of water: between 40 and 50 °C, recorded to one decimal place ✓ (1)

1.12 Heading: Table showing the **presence of blue colour** of the bromothymol blue for the different **sugar concentrations** (%) in the fermentation of yeast. ✓

Tube	**Final volume (ml)**	**Final concentration of sugar in solution (%)**	**Presence of blue colour after 10 minutes (+ or -)**
1	20	0	+ ✓
2	30 ✓	0,6	- ✓
3	25	0,4	+/-
4	21 ✓	0,1	+/-

(5)

1.13 Conclusion:
The concentration of sugar ✓ for the optimum fermentation is between 0,4% and 0,6% ✓ where the blue colour disappeared ✓;
Accept: no conclusion can be drawn ✓ due to the variables not being controlled/incorrectly controlled variables ✓ therefore no pattern can be determined from colour changes ✓ (3)

1.14 (a) Identification of the variable: Total volume was not the same in all the tubes. ✓ (1)

(b) Add different volumes of distilled water ✓ to each test tube to the same final volume, ✓ e.g. 10 ml to Tube 1; 5 ml to Tube 3 and 9 ml to Tube 4 (using a syringe). (1)

1.15 Making data more quantitative – any one of the following:

- time taken for blue colour to disappear ✓

Also accept:

- Number of CO_2 bubbles produced per minute (or other time frame) ✓
- Rate of disappearance of glucose/appearance of ethanol ✓
- Volume of CO_2 produced ✓ (1)

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1.16 Hazard identification: Any one of the following
- hot/boiling water ✓ – used gloves or tongs to handle ✓
- glassware could break ✓ – if break dispose of safely ✓
- yeast – is a living organism ✓ and should be disposed of safely (treated with bleach/sodium hypochlorite, etc.) ✓
- rinse hands with water ✓ if accidently spill bromothymol blue ✓ (2)

1.18 Measurements – check final printed copy.

(a) A = 27✓ mm (accepted range ± 1 mm) (1)

(b) B = 48✓ mm (accepted range ± 1 mm) (1)

1.19 Calculation of actual length of yeast cell in mm.
Check final printed copy.
Actual length = measured length/Magnification
Actual length = 27 (± 1 mm) / 5000 ✓ = 0,0054 ✓✓ mm
(Accept 0,0050–0,0056 mm)
(Accept 5–5,6 µm) (3)

1.20 Largest is yeast ✓ (1)

1.21 (a) Trend of graph X:
As the sugar concentration decreases, ✓ the ethanol concentration increases. ✓ (2)

(b) Concentration of ethanol at 20 hours (check final printed copy)
4.5 ✓ %✓ (2)

(c) Calculation of the decrease in sugar concentration per hour between 4 and 8 hours (check final printed copy) (3)
(1,4 – 1,2)✓ / (8 – 4) ✓ = 0,2 / 4 = 0,05 ✓ % per hour

(d) Heading for graph Y. (3)
Graph showing mass of CO_2 ✓ given off over time ✓ for different sugars. ✓

(e) Time at which CO_2 is 5,5 g (check final printed copy)
250 minutes ✓ (accept 220–250 mins) (1)

[35]

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PART B

2.1 Aim: To determine if the type of carbohydrate/sugar (maltose/glucose/ sucrose) ✓ used, affects the fermentation rate/time taken to lose blue colour)/colour change ✓ (2)

> ***NOTE to markers***: this is a typical example where the hypothesis is overarching, and the aim is more specific in terms of the dependent variable:
> Hypothesis: "rate of fermentation" and Aim: "time taken to lose blue colour". Both dependent variables are acceptable at school level.
>
> Reason: One can have numerous Aims to determine if the hypothesis is correct
> e.g. Aim 1: time taken for blue colour to disappear; Aim 2: number of CO_2 bubbles given off in a given amount of time; Aim 3: amount of ethanol produced → all point to the overarching fermentation rate/time.

2.2 Different types ✓ of sugar/carbohydrate✓/(maltose, glucose, sucrose) ✓✓ (2)

2.3 Any one of the following:
- concentration of sugars ✓
- temperature at which the experiment takes place ✓
- amount/volume/concentration of yeast solution used ✓
- amount/volume of bromothymol blue used ✓ (1)

2.4 Time taken ✓ for blue colour to disappear ✓/ time taken ✓ for colour change ✓/ fermentation✓ rate ✓ (2)

2.5 Sample method:
(a) Label three test tubes 1–3 using a marker.
(b) Label three beakers as follows: maltose, glucose and sucrose.
(c) Prepare three sugar solutions by measuring 5 ml (or g) of maltose, glucose and sucrose and placing in the three beakers.
(d) Using a syringe, add 100 ml of distilled water to each beaker and stir until the sugar has dissolved.
(e) Using a syringe, place 10 ml of maltose solution in test tube 1, 10 ml of glucose solution in test tube 2 and 10 ml of sucrose solution in test tube 3 (rinse syringe between transfers).
(f) Using a dropper, place 10 drops/5 ml of bromothymol blue into each tube.
(g) Place 5 ml of yeast solution in test tube 1 and start timing using a timer/stopwatch/watch/clock.
(h) As soon as the solution has no more observable blue colour, stop timing.
(i) Calculate and record the fermentation time for the maltose.
(j) Repeat steps (g) to (i) for test tubes 2 and 3 to calculate the fermentation time for glucose and sucrose respectively.

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NOTE: *do not penalise candidates for adding a control. Also, either steps (c)–(e) can be followed or some indication that same quantity of equal concentration of three sugars were placed into each of the beakers/tubes.*

Layout (L): neat, numbered (if not numbered, then no marks) ✓
Aim (A): must use of three sugar solutions (e.g. maltose, glucose and sucrose solutions) ✓
must time the change of colour (using bromothymol blue) from blue to colourless ✓

Method (M):

- Original – look for use of maltose, glucose and sucrose; if mention a dilution or different volume of sugar or different concentrations then no marks awarded. ✓
- Equipment – looking for a syringe used correctly; must make use of a timing device for each test tube ✓
- Measuring – equal volumes of maltose/glucose/sucrose, yeast and bromothymol blue added to each tube ✓ (temperature, although valid here, is not critical to the outcome so no marks awarded for this).
- Valid – order allows for achievable result; same concentrations of sugars made/used; sensible volumes used for test tubes e.g. no more than 40 ml; candidates must use beakers/test tubes with appropriate volumes. ✓
- Measurable results – recording of time taken for loss of blue colour. ✓ (8)

[15]

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METHOD RUBRIC

Method Rubric Criteria	5	4	3	2	1	0
L Layout – appearance of method					Layout meets criteria below: neat and tidy and bulleted/numbered.	Layout is untidy and hard to read. **OR** Method is not formatted correctly with bullet points or 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 given, 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 given experiment.
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

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