



NATIONAL SENIOR CERTIFICATE EXAMINATION  
NOVEMBER 2013

**LIFE SCIENCES: PAPER III**

**MARKING GUIDELINES**

Time: 1½ hours

50 marks

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**These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting 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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Teachers are asked to complete this grid after the examination.

Criteria		
Correct transfer of solutions	0	1
Correct serial dilution process followed	0	1
Correct observations recorded	0	1
<b>TOTAL</b>	<b>3</b>	

14. If after 30 minutes there is no change, or, no further change, assume that the reaction is complete and continue with your work.

% Yeast solution	Starting time	Time at which colour change occurred	Difference in seconds (or minutes)	(1)
A 50	E.g. 12:45	E.g. 12:47	120	
B 25	E.g. 12:50	E.g. 12:54	240	
C 12,5	E.g. 12:55	E.g. 13:00	300	
D 0	E.g. 13:00	E.g. 13:00	0	

(2)

**Minus a mark if units have been placed in the columns**

Give the table a suitable heading and fill in the time units on the table in the column heading.

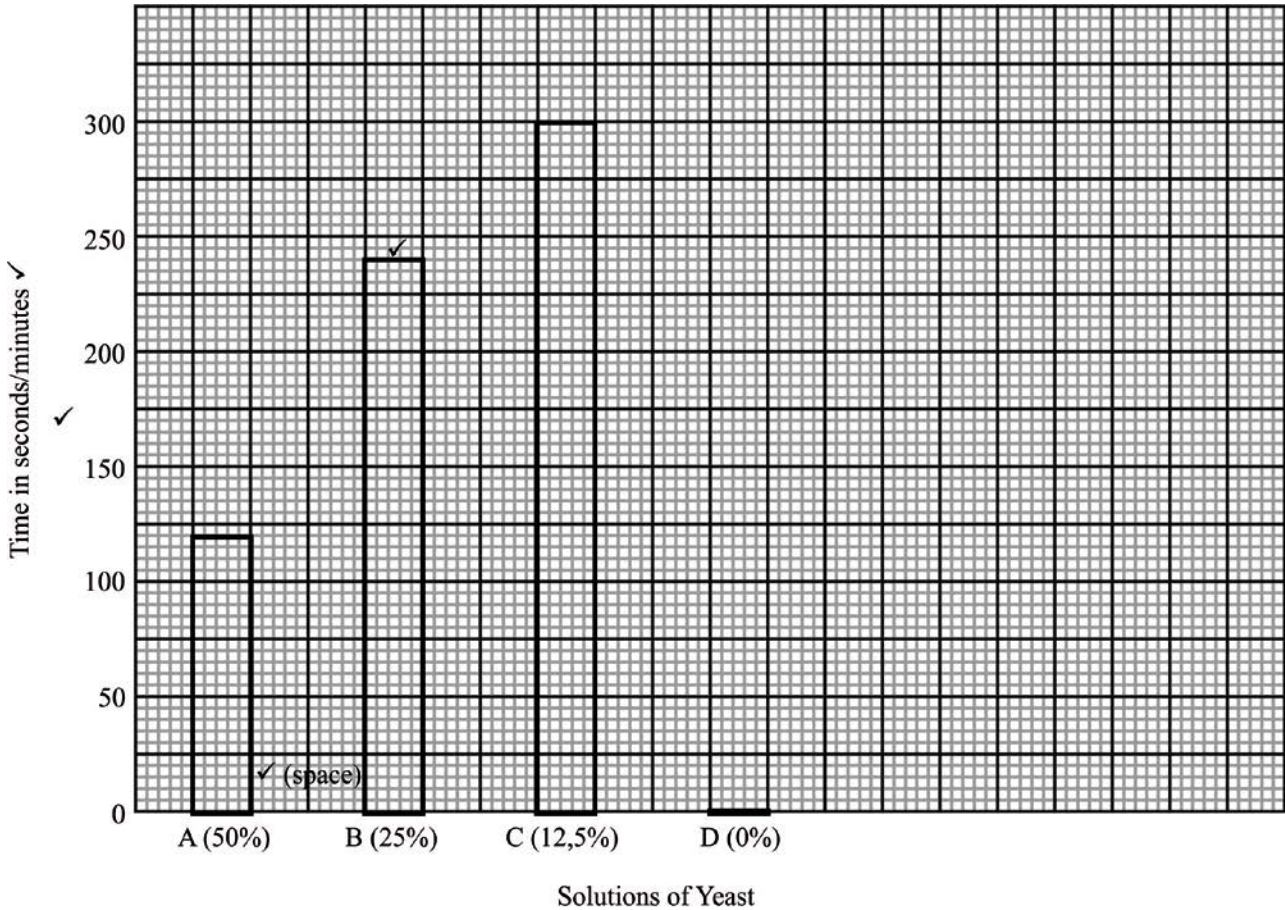
**A table to show how long it takes for O<sub>2</sub> to be used up by yeast cells**

(Any relevant and complete table heading) (2)

15. Calculate the amount of time it took for the colour change to occur for each test tube and write it in the fourth column in your table. (See table for possible answers) (4)

16. Draw a bar graph to show the amount of time it took for oxygen to be used up on the graph grid below. (5)

**Heading – 1 mark    Axes – 1 mark    Scale – 1 mark**  
**Bars spacing – 1 mark    Bars plotting – 1 mark**



Bar graph to show amount of time in seconds for oxygen to decrease as yeast cells reproduce. ✓

17. Now using your findings complete the following:
- 17.1 Which test tube A, B, C or D is the control? **D** (1)

Explain clearly the reason for your answer.

**Test tube D has no yeast, therefore O<sub>2</sub> is not being used up/and methylene blue remains unchanged or other words.**

Comparison but no explanation = (2)

- 17.2 Identify the independent variable.

**Solutions of yeast** (2)

17.3 Identify the dependent variable.

**Time in seconds or Time colour changed in seconds or Time to change colour (2)**

17.4 List TWO controlled variables and clearly describe how you went about controlling them.

- **Amount of distilled water in each test tube – 5 ml – use of syringe**
- **Amount of yeast solution in each test tube – 5 ml – use of syringe**
- **Amount of methylene blue – 4 drops – use of dropper**
- **Any reasonable answer.** (4)

17.5 What conclusion did you reach as a result of your investigation?

- **An increase in the concentration/number of yeast cells causes O<sub>2</sub> in water to decrease more rapidly.**  
**OR**
- **The colour change is quickest in the strongest yeast solution.**  
**OR**
- **Serial dilution referral**  
**OR**
- **Other correct conclusion based on learner's results.** (2)

17.6 How could the design of the investigation given above be improved? Explain ONE improvement you would make to this design.

- **Have 3 test tubes or more for each dilution – take the average**
- **OR**
- **Increase the number of dilutions – for a greater range of results.** ✓
- **OR**
- **Use more accurate way to measure out methylene blue – use syringe – (2 ml)** (2)

17.7 Suggest a reason why there is a blue layer on the surface of the solution in each of the test tubes A, B, C and D.

**Atmospheric oxygen mixes with the surface of the solutions causing them to turn blue.** (2)

18. In which of the test tubes would you most likely expect to find yeast cells as seen below? Give a clear explanation for your answer.

**The answer will depend on their results but it will most likely be: Test tube A where yeast cells are actively dividing and therefore O<sub>2</sub> is used up in the shortest time.** (3)

[37]

You are to design a completely new experiment.

### Helpful Information

There are a number of factors which could affect the rate of growth of a yeast population: the amount of air, nutrients and the pH of the liquid in which they are growing. Yeast grows well in an acidic pH range of 4 to 6 with a temperature of approximately 40 °C. Yeast releases large amounts of carbon dioxide gas during cellular respiration which can be captured and used to inflate a balloon.

1.1 Formulate the hypothesis for the experiment you are designing.

**A change in pH/acidity decreases the growth rate of yeast cells.**

Statement = wording must include 2 variables = (3)

1.2 State the aim of the experiment.

**To show that a change in pH/acidity decreases the growth rate of yeast cells.**

Wording must relate to their hypothesis (2)

1.3 Outline your own method using numbered points or bullet points.

A possible method could be as follows.

- **Label flasks A, B and C.**
- **Place 40 ml of distilled water warmed to a temperature of 40 °C into each flask.**
- **Place 10 ml of yeast solution and glucose solution into each flask.**
- **Add 5 ml of vinegar, pH4, to flask A**
- **Add 5 ml of ammonia, pH9, to flask B.**
- **Do not add anything to flask C.**
- **Place a balloon over the opening of each flask and seal with the masking tape.**
- **Leave the flasks for 20 minutes and observe.**
- **After 20 minutes measure the circumference of each balloon. This indicates the amount of CO<sub>2</sub> that has been released by the yeast cells.**
- **List observations on a table.** (8)

Use the attached rubric for assessment.

Method Rubric Criteria	5	4	3	2	1	0
<b>L</b> Layout – appearance of method.					Layout meets criteria below: Neat and tidy and bulleted/numbered.	Layout is untidy and hard to read. <b>OR</b> Method is not formatted correctly with bullet points or numbers.
<b>A</b> 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 does not relate to the prescribed aim or achieve the desired result. Method given is the same as the given experiment.
<b>M</b> 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 is 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. <b>OR</b> Method a copy of the original given experiment.

[8]

**Total: 50 marks**