



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2013

LIFE SCIENCES: PAPER III

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--

Time: 1½ hours

50 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Write your examination number in the space above.
2. This question paper consists of 8 pages and an Information Sheet of 1 page. Please make sure that your question paper is complete.
3. You are advised to read carefully and spend time planning your work.
4. Perform the tasks with care.
5. Standard time concessions will apply to this examination.
6. Please answer the questions in the spaces provided. Should you need more space please use the back page. **DO NOT** use loose folio paper.
7. The Information Sheet is printed on yellow paper. Please read it carefully before you begin and refer to it during the course of this examination.

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
TOTAL	3	

For Markers USE ONLY

Procedure							Total

You are to investigate the rapid growth rate of yeast cells in milk. This growth is indicated by the reduction in the oxygen found in the solution.

Before you begin your investigation make sure you have the following equipment at your workstation:

- test tube rack
- 4 test tubes of equal size and diameter
- large beaker or similar container large enough to support 4 test tubes
- 3 polystyrene or plastic or paper cups or similar cups of the same size
- permanent marker pen
- access to water of approximately 40 °C
- 50 ml lukewarm water for mixing with yeast
- 50 ml milk at room temperature in a beaker or similar container
- 100 ml distilled water in a beaker or similar container
- teaspoon
- small beaker (at least 100 ml in size) or similar container
- 4 stirring sticks or kebab sticks
- dropper or micropipette
- 10 ml dry yeast in a beaker or similar container
- 5 ml syringe
- 10 ml syringe
- thermometer
- access to a beaker or similar container of methylene blue solution
- clock or other timing device

EXPERIMENT

Follow all instructions carefully as you will be assessed by a teacher.

Remember that your results may not be the same as other candidates, so concentrate only on **your** results.

1. Using the marker pen label the 4 test tubes A, B, C and D and label the polystyrene cups A, B and C.
2. Place a clean stirring stick into each test tube.
3. Using the syringe, place 10 ml distilled water into the polystyrene cups A, B and C.
4. Also using the syringe, place 10 ml distilled water into test tube D.
5. Place a teaspoonful (5 ml) of yeast into the small beaker/container and add 50 ml lukewarm water and stir well.
6. You will add different amounts of yeast solution to each polystyrene cup A, B, and C using a serial dilution technique as follows:
 - Add 10 ml yeast solution to the distilled water in cup A. Stir well. This solution is 50% yeast solution because it has 10 ml distilled water and 10 ml yeast solution.
 - Remove 10 ml yeast and distilled water solution from cup A and add it to cup B. Stir well. This solution contains 25% yeast solution.
 - Remove 10 ml yeast and distilled water solution from cup B and add it to cup C. Stir well. This solution contains 12.5% yeast solution.
 - Remove 10 ml yeast and distilled water solution from cup C and **discard it**.

7. Pour contents of cups A, B and C into test tubes A, B and C respectively.
8. Half fill the large beaker or container with hot water. Check that the temperature is approximately 40 °C. (This hot water is used to speed up the reaction that is to occur in the test tubes and needs to be as close to 40 °C as possible when you start.)
9. Using a dropper, add about 4 drops of methylene blue to each test tube A, B, C and D and stir well.
10. Measure 5 ml milk with a syringe and quickly add to test tube A. Gently, but thoroughly, stir the solution and place the test tube in the beaker of hot water. Note the **starting time** and record it in the table below.
11. Repeat this process (step 10) with each test tube, B, C and D, stirring the solution in each test tube for the same amount of time and record starting times.
12. Observe any colour change, from blue to white, making a note of the time at which each colour change occurred and record it on the table. Remember to give the table a suitable heading.
13. You may continue with the experimental design part of this examination whilst you are waiting for the colour change.
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 for each solution	Time at which colour change occurred	Time taken for colour change () (1)
50			
25			
12,5			
0			

(2)

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

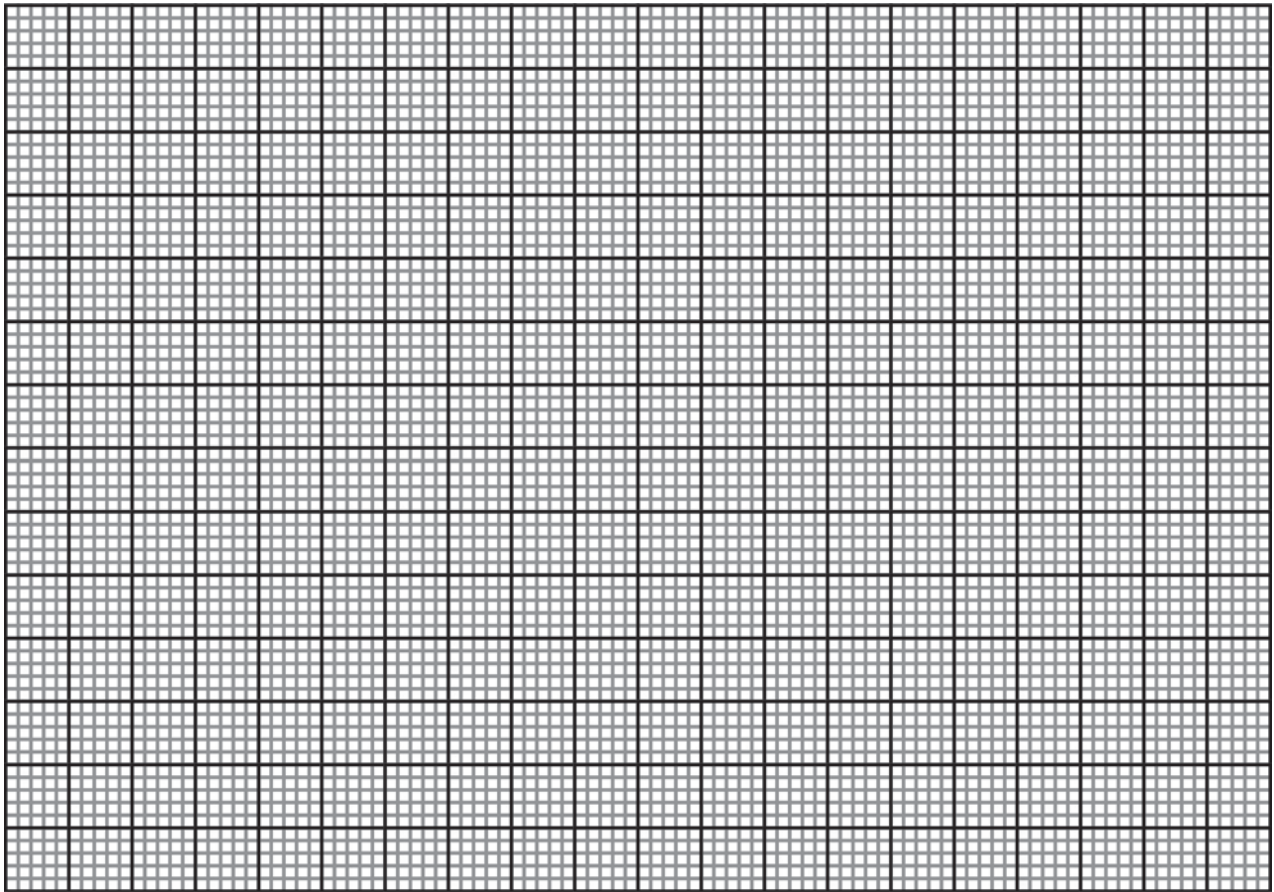
(2)

CALL YOUR TEACHER BEFORE YOU PROCEED ANY FURTHER

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. You may use the space below to show your working.

(4)

16. Draw a bar graph showing the amount of time it took for the oxygen to be used up on the graph grid below. (Please draw this using a pencil.)



(5)

17. Now using your findings complete the following:

17.1 Which test tube A, B, C or D is the control? _____

(1)

Explain clearly the reason for your answer.

(2)

17.2 Identify the independent variable.

(2)

17.3 Identify the dependent variable.

_____ (2)

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

_____ (4)

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

_____ (2)

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

_____ (2)

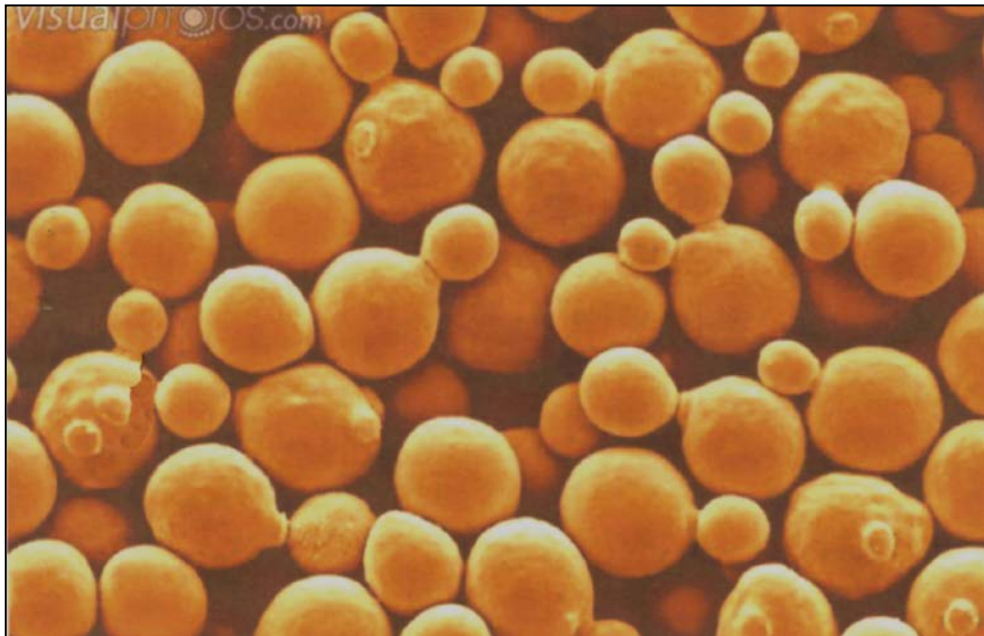
17.7 Suggest a reason why there is a blue layer on the surface of the solution in each of the test tubes A, B, C and D.

_____ (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.

(3)

The scanning electron micrograph below shows yeast cells taken from one of the test tubes in the experiment you have just done. Most of the cells are 'budding'.



[37]

EXPERIMENTAL DESIGN

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.

Design an experiment in which you determine the effect of pH on yeast growth.

You may use the following equipment in your design:

distilled water	a beaker of yeast solution
3 conical flasks	masking tape
3 balloons	a thermometer
a beaker with vinegar – pH4 (an acidic solution)	a syringe
a beaker with weak ammonia – pH9 (alkaline solution)	string
a beaker with glucose solution	ruler
water with a temperature of 40 °C	

You may use other equipment not listed in addition.

You are **not expected** to actually do the experiment.

1.1 Formulate the hypothesis for the experiment you are designing.

(3)

1.2 State the aim of the experiment.

(2)

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

[illegible]

(8)
[13]

Total: 50 marks