NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION – MARCH 2019

LIFE SCIENCES: PAPER III

EXAMINATION NUMBER

Time: 1½ hours 50 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Write your examination number in the blocks above.
2. This question paper consists of 11 pages and a yellow Information Sheet of 2 pages (i–ii). Please check that your question paper 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 tasks with care. You will be assessed on your ability to follow instructions.
5. Standard accommodations will apply to this examination.
6. Please answer the questions in the spaces provided. Should you need more space for your responses, use ONLY the last page in this question paper. No extra paper may be added to this booklet – it will not be marked.
7. The Information Sheet is printed on separate yellow paper. Please read it **carefully** before you begin and **refer to it during the course of the examination**.

Invigilators are asked to please complete this after the examination.

CRITERIA		
Following instructions	0	1
Procedural skills	0	1
Manipulative skills	0	1
TOTAL		**3**

(3)

For Markers' USE ONLY

Procedure							**Total**

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Please read the Information Sheet very carefully before you start. There are two parts to this question paper: Part 1 – the Investigation and Part 2 – an Experimental design.

Breastfeeding is the optimal method of infant nutrition. However, if the mother consumes alcohol, it passes into her bloodstream and into her breast milk. Alcohol levels in the breast milk are similar to the blood alcohol levels of the mother at the time of feeding. Alcohol leaves the body as it is metabolised. A breastfeeding infant is exposed to a very small amount of the alcohol the mother drinks. Alcohol is not stored in the breast milk for long, and so it becomes safe to breastfeed about 2 hours after an alcoholic beverage is consumed. A new colour test has been developed for mothers to see if their breast milk contains alcohol, so that they can make responsible decisions about the consumption of alcohol and still breastfeed their babies.

You will perform an investigation to work out the sensitivity of a colour test to alcohol in breast milk.

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

- Five 50 ml beakers
- Test tube rack with five identical test tubes
- Sample of breast milk* containing 1 alcohol unit
- Alcohol detection solution (ADS) in a dropper bottle
- 3 ml or 5 ml syringe
- 20 ml syringe
- Distilled water in a beaker or cup
- Polystyrene cup or beaker containing 100 ml tap water for rinsing
- Glass rod or kebab stick for stirring
- Paper towel
- Permanent marker
- Sheet of A4 plain white paper

*The breast milk samples provided in this investigation do not contain real breast milk; they have been prepared to **simulate** breast milk that contains alcohol.

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PART 1 INVESTIGATION

1.1 Using a marker, label your **beakers A** to **E**.

1.2 Also label the five **test tubes 1** to **5**.

1.3 Using a syringe, place 18 ml distilled water into **beakers B** to **E**.

1.4 Using a syringe, place 20 ml of breast milk into **beaker A**.

1.5 Rinse the syringe using the tap water on your bench.

1.6 Using a small syringe, transfer 2 ml of the breast milk from **beaker A** into **beaker B**.

1.7 Swirl the contents of beaker B.

1.8 Using a small syringe, transfer 2 ml of the diluted breast milk from **beaker B** into **beaker C**.

1.9 Swirl the contents of beaker C.

1.10 Using a small syringe, transfer 2 ml of the diluted breast milk from **beaker C** into **beaker D**.

1.11 Swirl the contents of beaker D.

1.12 Using a small syringe, transfer 2 ml of the diluted breast milk from **beaker D** into **beaker E**.

1.13 Swirl the contents of beaker E.

1.14 Using a small syringe, remove 2 ml of the solution in beaker E and place the syringe on your bench.

1.15 You have just performed a ten-fold serial dilution of the breast milk.

1.16 Transfer, using a large syringe, 10 ml of breast milk from beaker A into test tube 1.

1.17 Rinse the syringe using the tap water on your bench.

1.18 Repeat steps 1.16 to 1.17, transferring 10 ml from each of the beakers B to E into test tubes 2 to 5, respectively.

1.19 Using the dropper, add 5 drops of Alcohol Detector Solution to each test tube. DO NOT stir.

CALL THE INVIGILATOR TO ASSESS YOUR WORK

1.20 Using the kebab stick, stir the solutions in the test tubes in the following order: Test tube E, D, C, B, A (most dilute to most concentrated).

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1.21 Complete the table below by recording the colour changes (if any) of the diluted breast milk samples. Provide a meaningful table heading.

Test tube	Concentration of breast milk (alcohol units)	Colour change of Alcohol Detection Solution
1	1	
2	0,1	
3		
4		
5		

(6)

1.22 Identify the independent variable in this investigation.

(1)

1.23 Identify TWO controlled or fixed variables relevant to this investigation and explain how each variable was controlled.

(4)

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1.24 Write a conclusion to explain the observations in your table. Comment on the **sensitivity** of the indicator in detecting different concentrations of alcohol.

(3)

1.25 Suggest any TWO ways in which the design of the investigation can be improved.

(2)

1.26 Below is an extract from a dictionary.

Ethics in science

1. pertaining to or dealing with morals or the principles of morality; pertaining to right and wrong in conduct.
2. being in accordance with the rules or standards for right conduct or practice, especially the standards of a profession, e.g. it was not considered **ethical** for physicians to advertise their services.

[Adapted: <http://www.dictionary.com>]

With reference to the above definitions and your results, comment on the ethics of making a commercial colour alcohol test available to breastfeeding mothers.

(2)

1.27 There are a number of charts that women can use to schedule their occasional alcohol consumption around breastfeeding. Below is a portion of one such chart. Examine the chart and answer the questions that follow.

Chart showing the time from the start of the first drink until clearance of alcohol from breast milk for women of various body weights.

Mother's weight kg	**Clearance time for different no. of drinks* (Hours : Minutes)**					
	1	**2**	**3**	**4**	**5**	**6**
47,6	2:39	5:19	7:58	10:38	13:18	15:57
49,9	2:36	5:12	7:49	10:25	13:01	15:38
52,2	2:33	5:06	7:39	10:12	12:46	15:19
54,4	2:30	5:00	7:30	10:00	12:31	15:01
56,7	2:27	4:54	7:22	9:49	12:16	14:44
59,0	2:24	4:49	7:13	9:38	12:03	14:27
61,2	2:21	4:43	7:05	9:27	11:49	14:11
63,5	2:19	4:38	6:58	9:17	11:37	13:56
65,8	2:16	4:33	6:50	9:07	11:24	13:41
68,0	2:14	4:29	6:43	8:58	11:12	13:27
70,3	2:12	4:24	6:36	8:48	11:01	13:13

[Adapted: <https://www.beststart.org/resources/alc_reduction/pdf/brstfd_alc_deskref_eng.pdf> (2005)]

*1 drink = 1 standard can of beer (5% alcohol); 1 standard glass of wine (11% alcohol) or one standard tot of spirits (40% alcohol)

(a) Make a generalisation about the weight of a breastfeeding mother and the time required to metabolise consumed alcohol.

_____

_____

_____

(2)

(b) At what time could a 63,5 kg woman who drank 2 beers consider breastfeeding her baby if she started drinking at 8 p.m. (20:00)? Show all working.

(3)

(c) What is the dependent variable in the chart?

_____

(2)

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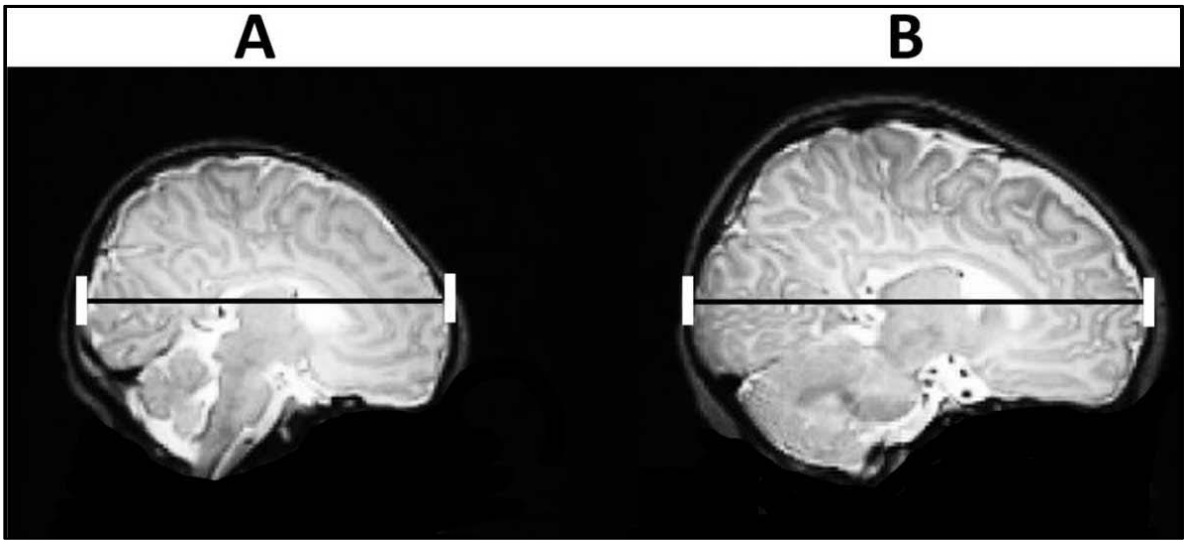
1.28 Consumption of alcohol during pregnancy is not recommended, as it can lead to Foetal Alcohol Syndrome (FAS). The images below are of a child's brain after prenatal exposure to alcohol (A) and a child's brain never exposed to alcohol (B). Both children are 3 months old.



[Adapted: <https://www.livescience.com/47298-babies-amazing-brain-growth.html> (2014)]

(a) Measure the marked lines on each of the brains. Record the measurements below:

A: _____ B: _____

(2)

(b) Using the measurements from 1.28 (a) above, calculate how many times larger brain B is than brain A. Round your answer to ONE decimal place. Show all working.

(2)

(c) In obtaining the brain images, scientists took digital images of the brains using an MRI machine. Are the images of the brains above longitudinal or transverse sections?

_____

(1)

(d) Using the images on page ii of the Information Sheet, describe one visible difference between a FAS brain and the brain of a normal individual.

_____

_____

_____

_____

(2)
[35]

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PART 2 EXPERIMENTAL DESIGN

A breastfeeding mother consumes three glasses of wine with her supper at 19:00. She provides you with samples of breast milk every two hours thereafter until 03:00 the next morning. She would like you to analyse the samples for the presence of alcohol and determine when the alcohol can no longer be detected in her breast milk by the alcohol detection solution (ADS).

Design a simple experiment to assist this mother in providing breast milk free of alcohol to her child.

2.1 Formulate a hypothesis for this experiment that you are designing.

_____

_____

_____

(3)

2.2 State the aim of this experiment.

_____

_____

_____

(2)

2.3 State the independent variable used in this experiment.

_____

_____

_____

(2)

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2.4 Outline your method in the simplest way, using numbered points.

(8)
[15]

Total: 50 marks

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ADDITIONAL PAGE (use only if necessary)

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