NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2017

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 10 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 the last page in this question paper ONLY. Anything extra included with this booklet as you have received 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
Test-tube contents	0	1
Recording	0	1
TOTAL		**(3)**

(3)

For Markers' USE ONLY

Procedure							**Total**

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 – Experimental design.

Diabetics use the levels of sugar in the blood or urine as an indicator of the state of their insulin 'load'. High sugar levels indicate that they need to administer or inject more insulin. Various techniques to measure the presence of glucose in a sample of urine are available to sufferers of diabetes.

You are going to investigate the presence of sugar in different samples of urine* using an indicator.

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

- four identical test tubes in a test-tube rack
- 50 ml distilled water
- two empty polystyrene or plastic cups
- 200 ml of tap water in a cup (for cleaning)
- permanent marking pen
- 10 ml syringe
- 3 ml syringe
- 5 ml measuring spoon
- access to indicator X
- access to indicator Y
- thermometer
- 250 ml beaker or container to hold boiling water
- three 'urine samples'* collected from different individuals just before this investigation began. They are clearly marked Sample A, Sample B and Sample C.
- access to boiling water in a kettle or urn
- wall clock or timing device
- A4 sheet of white paper

*the samples provided in this investigation are **not** real urine; they have been prepared to **simulate** real urine.

PART 1 INVESTIGATION

1.1 Label the empty test tubes A to D using the marking pen.

1.2 Into test tube A, using a syringe, add 20 ml of Sample A.

1.3 **Clean** your 20 ml syringe using the tap water you have on your bench.

1.4 Into test tube B, using the cleaned syringe, add 20 ml of Sample B.

1.5 **Clean** your syringe using the tap water you have on your bench.

1.6 Into test tube C, using the cleaned syringe, add 20 ml of Sample C.

1.7 Into test tube D, using a clean syringe, add 20 ml of distilled water.

1.8 Using the 3 ml syringe, add 3 ml of Indicator X to each test tube, A to D. **CALL THE INVIGILATOR**

1.9 Record the temperature of the contents of test tube A here. Do this whilst the invigilator observes you recording the temperature. _____ (1)

1.10 Gently swirl the test tubes and keep note of the initial colour in each test-tube.

1.11 Place the four marked test tubes in the empty 250 ml beaker or container.

1.12 Collect approximately 150 ml of **BOILING WATER** from the urn or kettle in a plastic measuring jug provided and **immediately** add to the beaker or container holding the four test tubes.

> **NOTE:** the boiling water acts as a water bath for the test tubes. The heat from the water will allow the indicator to react with the samples in the test tubes to indicate the glucose concentration.

1.13 Wait five minutes and keep note of the colour changes in the test-tube contents AFTER heating.

1.14 In the space below, draw up a suitable table, with a meaningful table heading. In the table, record your observations of content colour both BEFORE and AFTER heating.

(6)

1.15 Identify the independent variable in this investigation.

(2)

1.16 Identify the dependent variable in this investigation.

(2)

1.17 What is the purpose of the distilled water in test-tube D?

(2)

1.18 Identify TWO controlled or fixed variables in this investigation and state how these variables were controlled.

(4)

1.19 Write a conclusion to explain your observations in your table regarding the sugar content of the samples of 'urine'. Your conclusion needs to include information on all FOUR test-tubes AND needs to relate to the health of the individual who could produce such a sample of 'urine'.

(4)

1.20 With reference to the Information Sheet, suggest a possible reason for the presence of glucose in the urine of an individual.

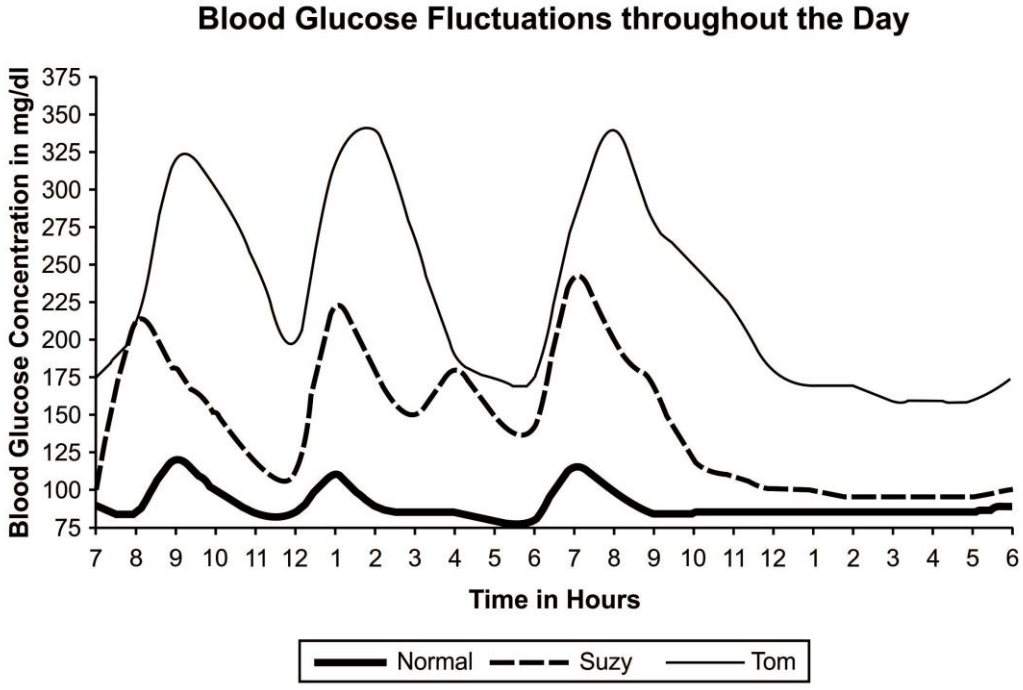
_____

_____

_____

_____ (2)

1.21 Blood glucose concentration is a far more reliable indication of an individual's health than measuring the glucose levels found in urine. Below is a graph indicating the changes in two different people's blood glucose levels over a 23-hour period. Examine this graph and answer the questions that follow.



[Source: <http://www.phlaunt.com/diabetes/43067769.php>]

1.21.1 According to the above graph, who is most likely to be suffering from diabetes?

_____ (1)

1.21.2 What is the maximum blood glucose concentration/level recorded on the graph above?

_____ (1)

1.21.3 One of the individuals in the graph had an afternoon sugar snack. Who had the snack and how do you know this?

_____

_____

_____

_____ (2)

1.21.4 Was **qualitative** or **quantitative** data collected in order to plot this graph? Explain.

_____

_____

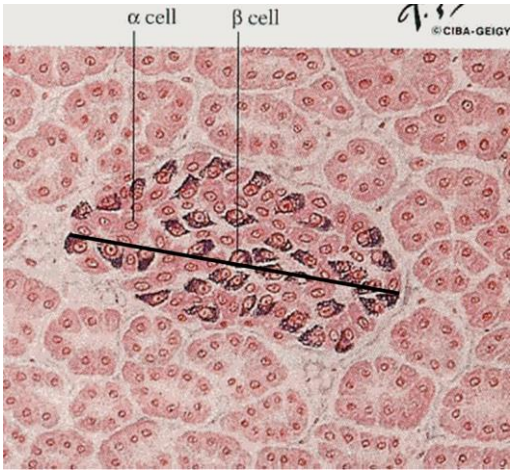
_____

_____ (2)

1.22 A micrograph of a portion of human pancreas shown below gives details of the Beta (β) cells found in the pancreas that produce the hormone insulin. These Beta (β) cells are found grouped or clustered in a group of cells within the pancreatic tissue (shown as darkened) called an Islet of Langerhans.

This micrograph has been magnified 300x. Calculate the **real length** of this single Islet of Langerhans, using the line drawn on the micrograph as your magnified length of the structure.

Show all working out of the real size in the space given alongside the micrograph.



[Source: Ciba-Geigy]

(3)

PART 2 EXPERIMENTAL DESIGN

The indicator used to detect the simple reducing sugar glucose in the previous investigation is called Benedict's solution. In the presence of glucose concentrations above 30 mg/litre, a brick-red/orange colour is detected. Benedict's is not effective when used on sugars such as lactose (sugar in milk) or sucrose (cane sugar).

Design a simple experiment to demonstrate the above information.

Use laboratory equipment and chemicals that you would find in the school laboratory.

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 investigation.

(2)

2.4 Outline your own method below using numbered points.

(8)

Total: 50 marks

ADDITIONAL PAGE (use only if necessary)