NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2018

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. No extra paper may be added to this booklet.
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)

For Markers' USE ONLY

Procedure							**Total**

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

Water sampling is an important tool used to establish whether water is potable. There are a number of techniques to determine whether water is safe to drink.

You are going to investigate the presence of a particular waterborne bacterium known as *Vibrio cholerae* in water samples* taken along a South African river using an indicator.

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

- Four identical test tubes in a test tube rack
- Solution A
- Solution B
- Pipette or dropper
- 5 ml syringe
- 20 ml syringe
- Three "river water samples"* collected from different points along the river. They are clearly marked Sample J, Sample K and Sample L.
- Distilled water in a beaker or cup
- Polystyrene cup or beaker containing tap water for rinsing
- Glass rod or kebab stick for stirring
- Paper towel
- Permanent marker
- Sheet of A4 plain white paper

* The water samples provided in this investigation are **not** real water samples and so contain no real waterborne diseases; they have been prepared to **simulate** contaminated water samples.

PART 1 INVESTIGATION

1.1 Using a marker, label the test tubes 1 to 4.

1.2 Using an appropriate syringe, place 15 ml of distilled water into test tube 1.

1.3 Using a syringe, place 15 ml of **Sample J** into test tube 2.

1.4 Rinse the syringe using the tap water.

1.5 Using a syringe, place 15 ml of **Sample K** into test tube 3.

1.6 Rinse the syringe using the tap water.

1.7 Using a syringe, place 15 ml of **Sample L** into test tube 4.

1.8 Rinse the syringe using the tap water.

1.9 Using an appropriate syringe, draw up 1 ml of Solution B and place on your bench next to Solution A.

CALL THE INVIGILATOR TO ASSESS YOUR WORK

1.10 Add the 1 ml of Solution B to the beaker containing Solution A. Stir using a kebab stick or glass rod. This will activate Solution A. The activated Solution A will be a deep blue-purple colour.

1.11 Using a syringe, add 10 ml of the Activated Solution A to each of the test tubes.

1.12 Place the white piece of paper behind the test tubes to view any colour changes. Stir the solutions in the test tubes using the kebab stick or glass rod provided. Wait five minutes to make your observations.

1.13 In the space below, draw a table of your results and provide a suitable table heading. Record the colour changes (if any) of the water samples in the presence of activated Solution A.

(6)

1.14 Which test tube served as the control in this investigation? What is the purpose of the control in this investigation?

(2)

1.15 Identify ONE controlled or fixed variable relevant to this investigation and explain how this variable was controlled.

(3)

1.16 Was this investigation collecting qualitative or quantitative data? Give a reason for your answer.

(2)

1.17 Write a conclusion to explain the observations in your table. In your answer include comments on whether the water samples are potable.

(3)

1.18 Other than repeating the experiment, suggest any ONE way in which the design of the investigation can be improved.

(1)

1.19 If these were "actual" contaminated water samples, name any precaution that would need to be taken in the laboratory during or after the testing of the water samples.

_____

_____

(1)

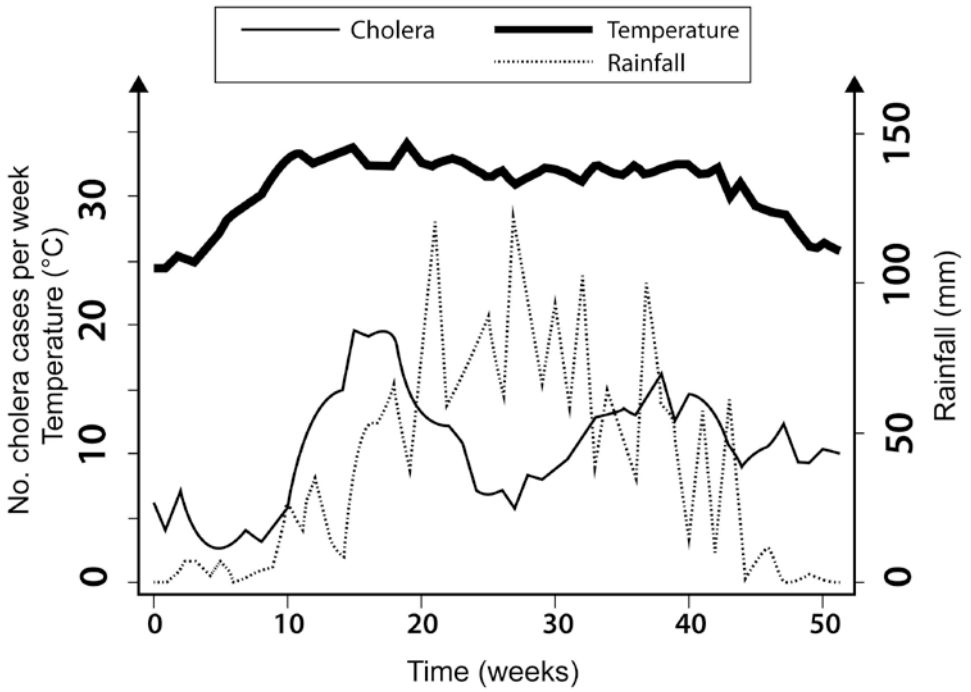
1.20 With reference to the River Map on your Information Sheet and your results, infer from which point Sample L was most likely taken. Justify your answer.

_____

_____

(2)

1.21 There are a number of studies that show that cholera outbreaks are dependent on a variety of seasonal factors. Below is one such study which started in January 2007. Examine the graph and answer the questions that follow.



[Adapted: <https://researchgate.net>]

(a) Name any TWO of the dependent variables in this study.

_____

(2)

(b) To the nearest whole number, how many cholera cases were reported in week 20?

_____

(1)

(c) Describe the relationship between rainfall and the number of cholera cases from week 20 to 40.

_____

_____

_____

(2)

(d) If you lived in the region from which this data was collected, and you had no alternate drinking water other than the river, how could you ensure the water was safe to drink?

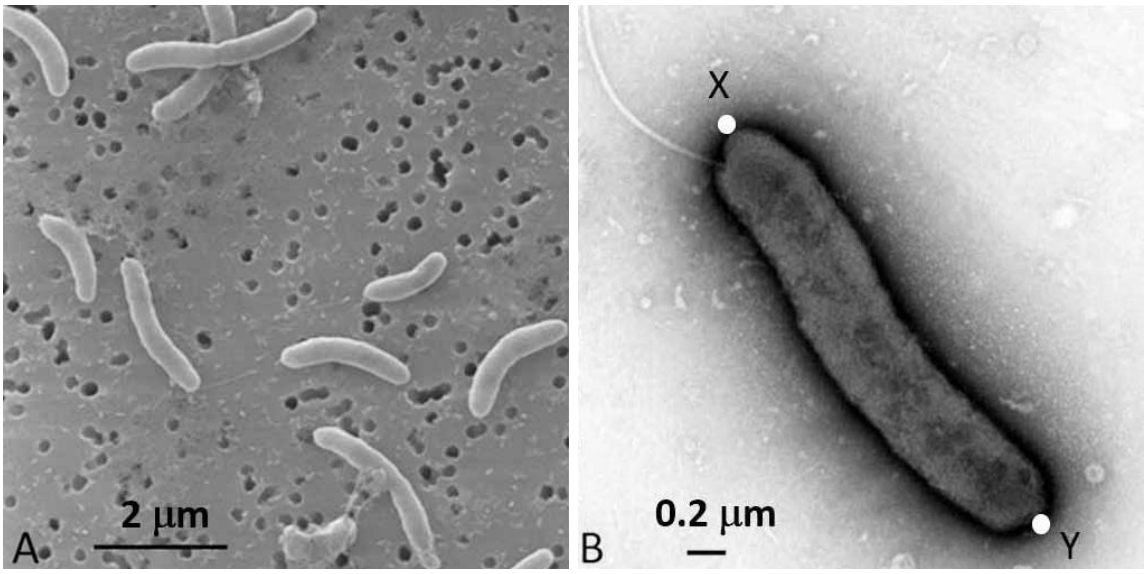
_____

_____

(2)

1.22 An electron micrograph of a newly discovered bacterial species is shown below.

A: Image of 3D surface view of bacteria **B: Image of 2D section of one bacterium**



[Adapted: <http://boucher-lab.squarespace.com>]

(a) Work out the real length of the bacterium in Figure B from point X to point Y. Show all working.

(4)

(b) Is the section of the bacterium in the transmission electron micrograph a transverse/cross or longitudinal section?

_____

(1)
[35]

PART 2 EXPERIMENTAL DESIGN

- Activated Solution A indicator used in Part 1 can detect cholera in water.
- You have been provided with a 500 ml sample of water containing 200 cholera cells per ml.
- Scientists asked the following question: **"Can Activated Solution A detect the presence of the cholera bacterium at concentrations lower than 100 cells/ml?"**
- Design a simple experiment to answer the scientists' question.

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)

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

(8)
[15]

Total: 50 marks

ADDITIONAL PAGE (use only if necessary)