NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2019

LIFE SCIENCES: PRACTICAL ASSESSMENT TASK

EXAMINATION NUMBER													

Time: 1½ hours 50 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Write your examination number in the blocks above.
2. This Practical Assessment Task consists of 10 pages and a separate yellow Information Sheet of 2 pages (i–ii). Please check that your PAT 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 task with care. You will be assessed on your ability to follow instructions.
5. Standard accommodations will apply to this PAT.
6. Please answer the questions in the spaces provided. Should you need more space for your responses, use the last pages in this question paper ONLY. No extra paper may be added to this booklet.

Invigilators are asked to please complete this after the PAT.

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 PAT: Part 1 –Investigation and Part 2 – Experimental Design.

A pharmaceutical company, along with herpetologists (people who study snakes), have developed a new polyvalent (multipurpose) snake antivenom (PVSA) against 18 species of snake found in Africa. It has the potential to be diluted, thus making more antivenom available in the long run.

You have been asked to test the effectiveness of the new PVSA at a variety of concentrations in order to determine the lowest concentration at which the PVSA is still active.

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

- five identical beakers or containers
- a beaker or container labelled PVSA* (100% concentration)
- pipette or dropper
- 20 ml syringe
- 10 ml syringe
- saline solution in a cup or beaker
- polystyrene cup or beaker containing tap water for rinsing
- ballpoint pen tube or straw or glass tube
- dissecting needle/forceps
- paper towel
- permanent marker
- one A4 sheet of plain white paper
- access to a wall clock or watch
- stirring rod or kebab stick
- one Petri dish with a blue gel infused with a mixture of snake venom**

* The PVSA provided in this investigation is not a real antivenom; it has been prepared to **simulate** antivenom.

** The Petri dish provided in this investigation does not contain any snake venom; it has been prepared to **simulate** snake venom.

Remember
Please read the Information Sheet very carefully before you start and refer to it during your investigation.

PART 1 INVESTIGATION

1.1 Place the Petri dish in the middle of the sheet of white paper.

1.2 Using a marker, make a mark at the "12 o'clock", "3 o'clock", "6 o'clock" and "9 o'clock" positions on the paper. Use the Petri dish as the clock face shown in Figure A on your information sheet. On the paper, write "A", "B", "C" and "D" as shown in Figure A.

1.3 Using the plastic "tube" part of the pen (or glass tube or straw), pierce five holes in the gel as shown in Figure B on your information sheet. If using a pen tube, use the largest (usually the back) end of the tube to make your wells. Your wells need to be 15 mm from the edge of the Petri dish, as shown in Figure B. Make well E in the centre of the Petri dish.

1.4 Use the dissecting needle or forceps to remove the five "plugs" from the five "wells" you have created in 1.3. Place the plugs on the paper towel. These plugs will be discarded.

1.5 Using a ruler, measure the diameter of well E. Record the diameter below.

_____ mm (1)

1.6 Using a marker, label five beakers/containers A, B, C, D and E.

1.7 Using an appropriate syringe, place 40 ml of saline solution into beakers/containers A to D. Rinse the syringe.

1.8 Using an appropriate syringe, place 50 ml of PVSA into container E.

1.9 Using an appropriate syringe, remove 10 ml of PVSA from container E and place in container D. Stir to mix with stirring rod/kebab stick.

1.10 Using the same syringe, remove 10 ml of the solution from container D and place in container C. Stir to mix with stirring rod/kebab stick.

1.11 Using the same syringe, remove 10 ml of the solution from container C and place in container B. Stir to mix with stirring rod/kebab stick.

1.12 Using the same syringe, remove 10 ml of the solution from container B and place in container A. Stir to mix with stirring rod/kebab stick.

1.13 Using the same syringe, remove 10 ml of the solution from container A and place the syringe on the sheet of white paper next to the Petri dish.

CALL THE INVIGILATOR TO ASSESS YOUR WORK

1.14 Using a pipette, place enough of the solution from container A (about 1 to 3 drops) into well A in the Petri dish. Do not overfill or allow the wells to overflow.

1.15 Without rinsing the pipette, repeat step 1.14, placing the solutions from containers B to E into the corresponding wells B to E in the Petri dish.

1.16 Cover the Petri dish with the lid and leave undisturbed for 20 minutes. During this time continue with the rest of the questions from 1.23 onwards.

1.17 At 20 minutes, remove the lid of the Petri dish and record your results in the table below. Calculate the concentration of the PVSA solution of wells B, C and D. Provide a suitable heading for the table.

Heading: _____

_____

Well	**Concentration of PVSA solution (%)**	**Presence of yellow halo* around well at 20 minutes (yes or no)****
A	0,16	
B		
C		
D		
E	100	

**halo: circular zone or ring of a different colour around the well*
***do not record any colour changes after 20 minutes* (5)

1.18 (a) Record the letter of the well with the biggest halo: _____ (1)

(b) Record the diameter of the biggest yellow halo: _____mm (1)

1.19 Identify ONE controlled/fixed variable relevant to this investigation and explain how this variable was controlled.

_____

_____

_____

_____

(3)

1.20 Write a conclusion to explain the observations in your table. In your answer, include a comment about the effectiveness of diluting the PVSA.

_____

_____

_____

_____

(3)

1.21 Instead of only observing the presence/absence of a yellow halo around each well, what could be done instead to make the results more quantitative?

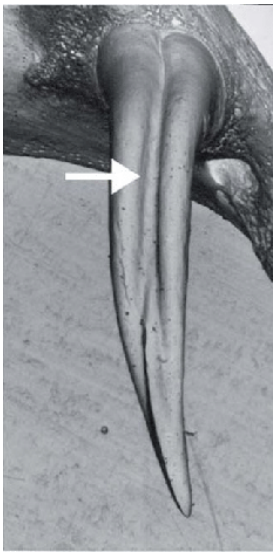
(2)

1.22 If these were "actual" samples of PVSA and snake venom, name any precaution that would need to be taken in the laboratory during the testing of the samples.

(1)

1.23 Below is a scanning (surface) electron micrograph showing the prominent groove (indicated by the horizontal arrow) on the fang of a banded snake (*Bothryum lentiginosum*). In the box below, make a biological drawing of only the fang and label the groove. Your drawing must be larger than the original micrograph.

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

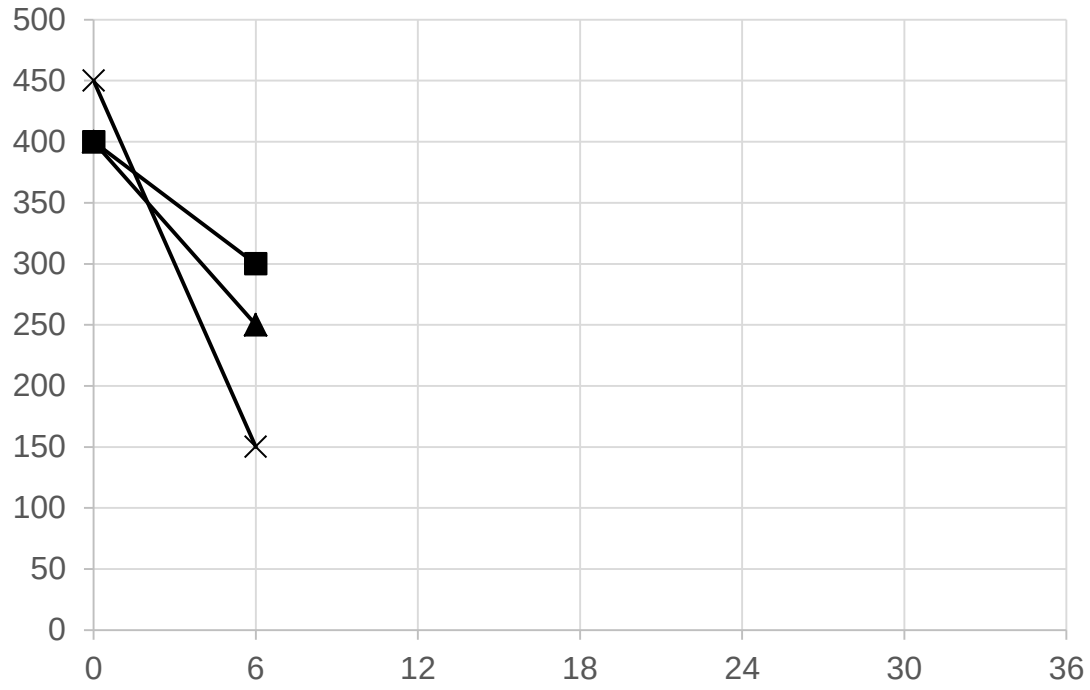


(5)

1.24 A study was conducted in which the time taken for the neutralisation of snake venom was tested for three different universal antisera. The results of the experiment are shown in Table 1.24. Complete plotting the data from the table and draw the graph lines on the incomplete graph below. Add the labels for the axes and provide a key.

Table 1.24: Time taken for neutralisation of snake venom by three universal antisera.

Antiserum name	**Snake venom concentration (μg/L)**					
	0 hrs (start)	**6 hrs**	**12 hrs**	**18 hrs**	**24 hrs**	**36 hrs**
PAN AFRICA CLEAR	400	300	200	100	0	0
PROVALENT	400	250	100	50	25	0
VIPERA	450	150	75	0	0	0



(8)

(a) Which of the three universal antisera had the fastest rate of neutralisation?

_____

(1)

(b) There is an experimental flaw in the design of this study. Identify this flaw using the information from the graph or Table 1.24.

_____

_____

(1)

[35]

PART 2 EXPERIMENTAL DESIGN

You have been provided with four newly developed cobra antisera (W, X, Y and Z). Each of the antisera have the same concentration. You have been asked to design a simple test to see which antiserum can neutralise cobra venom. Also given to you are a few Petri dishes containing a blue gel infused with cobra venom. The blue gel will produce a yellow halo upon neutralisation with antiserum.

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

(3)

2.2 State the independent variable used in this experiment.

(2)

2.3 State the dependent variable used in this experiment.

(2)

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

(8)
[15]
Total: 50 marks

ADDITIONAL PAGES (use only if necessary)

