NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2014

LIFE SCIENCES: PAPER III

MARKING GUIDELINES

Time: 1½ hours 50 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

Invigilators are asked to please complete this after the examination.

CRITERIA		
Following instructions	0	1
Test tube contents	0	1
Manipulation	0	1
TOTAL		**3**

(3)

PART 1 INVESTIGATION

10. In the space below, construct a suitable table with an appropriate heading and record both the results of temperature readings and the colour changes of litmus that you observed in all three test tubes. (6)

Table to show colour changes of paper (pH) and temperature of three solutions in test tubes A to C
(relevant and complete heading for the **two marks**)

Table layout
(need to record colour change and temperature for all three test tubes)

Test tube	Colour change of litmus paper		Temperature (^{o}C)
	Red/pink litmus	Blue litmus	
A	Remains red/pink	Turns red/pink	23*
B	Turns blue	Stays blue	23*
C	Stays red/pink	Stays blue	23*

*In all should be room temperature – around 22 – 24 ^{o}C

NOTE: Minus a single mark if unit for temperature has not been placed in the column heading

11. As a result of your investigation to this point, which solution is an acid and which solution is alkaline and which is neutral? (2)

A = acid B = alkaline C = neutral (max 2)

CALL THE INVIGILATOR BEFORE PROCEEDING FURTHER

12. Which test tube represents the stomach contents? Explain a reason from your observations. (3)

A acid pH blue litmus goes pink or red/pink stays red/pink.

13. Now take the coated and uncoated asprin (out of foil) and add them to test tube marked A at the same time. Observe carefully what happens for three minutes. **Do not stir.**

Step 13: Uncoated tablet in A dissolves. Coated tablet does not dissolve in test tube A (2)

14. After three minutes pour out the liquid into an empty cup or beaker. Remove the **coated** tablet using a spatula or forceps or teaspoon or kebab stick and immediately drop it into test tube B. **Do not stir.**

15. Leave for 10 minutes. In this time proceed with the rest of the investigation. Observe what happens.

16. Describe your observations of step 15 in the space below. (3)

Step 15: In test tube B the (coated tablet fizzes and the) coating comes off (1)

17. What is the dependent variable in this investigation? (2)

Dissolving of tablets/Ecotrin and Disprin

18. This investigation simulates a process in the human digestive system. Why is it not necessary to put an uncoated tablet into test tube B? (2)

Uncoated tablet will dissolve in the stomach and will not reach the small intestine undissolved

19. Give ONE controlled variable that was important for the fairness/success of this investigation. State clearly how you went about controlling this. (2)

- **Same volume of solution – measured with a syringe**
- **No stirring movement of liquid/tablet/solution**
- **Same temperature – measure with a thermometer**

20. In what way does moving the coated tablet from test tube A into test tube B simulate the process occurring naturally in humans? (2)

Tablet reaches stomach/acidic first in its passage through human gut; so acidic environment in A and then intestine/alkaline in B.

21. What conclusion did you reach as a result of your investigation? (2)

The coating of the aspirin does not dissolve off in an acid medium but does in an alkaline medium/or low pH prevents the dissolving of the enteric coat/the enteric coating allows for a slower release/protects the stomach wall from effects of aspirin

22. Comment fully on why it is valuable and extremely important for scientists to be able to carry out simulations, such as the one described above, that involve using drugs designed for humans use. (3)

Can do important safety checks in a controlled environment/can readily repeat trials for reliability not harming (humans or animals), etc. repeating pre-clinical trials/drugs could cause damage to organs, e.g. aspirin causes ulcer.

23. Describe ONE way in which this investigation could be improved to be a more realistic match of this process in humans. (2)

Adjust/match the pH values to those matching pH in the body organs
Use a temperature of 37 ^{o}C human body temperature
Time the tablets spend in each part of digestive system is different to time in test tube A and B.
(Any one description)

24. Below is a section through the small intestine seen under a microscope.

Refer to the Information Sheet to see where this section (marked S) is taken from.

Calculate the actual size in the body of the line marked X – Y on the slide below. Your answer needs to be expressed in mm.

24.1 Measurement with a ruler

Examiner will check on final image from typeset copy (94 mm)

24.2 Calculation of actual size:
Measured length of X – Y = _____ mm
Actual size = measured length in mm/magnification of slide

Answer: _____mm (4)

25. Identify the type of section shown in the micrograph above. (1)

Cross section/transverse section

PART 2 EXPERIMENTAL DESIGN

You are to design a completely new experiment.

Helpful information
There are a number of factors which could affect the rate of release of medication into the body. (Temperature, surface area and concentration are just some of these). For rapid relief of heartburn (excessive stomach acid) antacids are often taken

Design a simple experiment where you investigate the effect of surface area of antacid medication on rapidly neutralising excess acid in the stomach.

You could use the following equipment in your design; other equipment available in a school laboratory could also be used.
(Do not actually perform this experiment.)

- distilled water
- test tubes
- an empty ice cream container or similar container
- tablets of an antacid, e.g. Rennie
- a beaker of acid solution (pH 3) similar to stomach acid
- water at a temperature of 40 ^{o}C
- pestle and mortar
- spoon
- syringe
- timer
- pH indicator (universal indicator – accurately measures a range of pH values) or litmus paper

1.1 Formulate a hypothesis for this experiment that you are designing. (3)

The greater the surface area of antacid added, the sooner the pH of a solution is made more alkaline OR similar hypothesis.

Statement

1.2. State the aim of the experiment. (2)

To investigate the effect of surface area of antacid on the neutralisation/ removal of excess stomach acid.

1.3 Outline your own method using numbered points (an example of a method).

Take two identical test tubes.
Mark them A and B with a marking pen.
Using a syringe, place 40 ml of a weak acid solution into each test tube.
Using pH indicator paper/litmus paper determine/confirm the pH of the solution in each test tube.
Take a whole Rennie/antacid tablet and grind in a pestle and mortar and place in test tube A.
Take a second whole Rennie/antacid tablet and place in test tube B.
Test the pH value of the solutions at different time intervals using a timing device. Determine/confirm in which test tube the pH is neutralised first.

The candidate can refer to the time taken.
NOTE: The candidate might indicate the need to possibly add more of the antacid to the test tubes to reach neutralisation.
Record findings in a suitable table.
Repeat the experiment to check for reliability.

Use the attached rubric for assessment for Question 1.3.

Method Rubric Criteria	**5**	**4**	**3**	**2**	**1**	**0**
L Layout – appearance of method.					Layout meets criteria below: Neat and tidy and bulleted/numbered.	Layout is untidy and hard to read. **OR** Method is not formatted correctly with bullet points or numbers.
A Aim – Method relates to prescribed experiment.				Method clearly tests an aim that relates to the prescribed experiment and achieves the required result.	Method relates to the prescribed aim given, but is a little confusing and does not achieve the required result.	Method does not relate to the prescribed aim or achieve the desired result. Method given is the same as the given experiment.
M Method – This needs to be appropriate and relevant to the aim, clearly logical and sequential. If apparatus is given in the examination paper the method should resemble the one given in the marking guidelines.	All 5 criteria given below are met: 1. An original experiment provided. 2. Equipment is appropriate and used correctly. 3. Measuring of solutions, reagents and marking of equipment is explained and this assists in the control of variables. 4. Instructions are scientifically valid and ordered. 5. Instructions are complete to produce measurable results that are recorded.	An original experiment provided. Plus 3 of 5 criteria are met.	An original experiment provided. Plus 2 of 5 criteria are met.	An original experiment provided. Plus 1 of 5 criteria is met.	An original experiment provided.	None of the 5 criteria are met. **OR** Method a copy of the original given experiment.

[8]

Total: 50 marks