



*Let the mind manage the bod.  
Que l'esprit gère le corps*

**MAURITIUS  
EXAMINATIONS  
SYNDICATE**

**NCE 2023**

# **Science (Biology)**

Subject code: N530

***EXAMINERS' REPORT***

April 2024

## INTRODUCTION

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The NCE Science assessment comprised three 45-minute papers in Biology, Chemistry and Physics. This report will examine the performance of the 2023 cohort in the Biology question paper. It will provide insights into the strengths and weaknesses of candidates, based on the questions set and concepts and skills assessed in last year's question paper. It is intended to be helpful to Educators and students, providing information about the assessment in terms of the objectives of the questions set, the quality of student responses, and will guide future teaching.

The Biology question paper is mainly based on the learning outcomes of the *Science Teaching and Learning Syllabus* set for Grade 9 published by the Mauritius Institute of Education (MIE). It aims to assess the level of attainment of students on the assessment objectives given in Table 1.

**Table 1:** Weighting of the Assessment Objectives

	<b>Assessment Objective</b>	<b>Weighting (%)</b>
<b>AO1</b>	Knowledge with understanding	45 – 50
<b>AO2</b>	Application	25 - 35
<b>AO3</b>	Scientific Inquiry	20 - 25

## GENERAL COMMENTS

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On the whole, candidates performed well in the Science question papers in 2023. 13078 candidates took part in the Science assessment in 2023 among whom 754 were from the Extended Programme. It is noted that the number of students in the Extended Programme opting for Science remains relatively low.

Since the introduction of the NCE assessment, the pass rate in Science has been improving steadily from 79.9% in 2020-2021, 80.3% in 2021-2022 to 88.8% in 2023. Progress in the Biology paper specifically was notable with over 10% of candidates scoring in the range of 45 – 50 marks. A mean score of 29.76 over 50 marks was obtained this year.

The question paper in 2023 was more graded in terms of difficulty level as compared to the 2020-2021 and 2021-2022 question papers. While the items in question 1 – MCQ – over the three NCE sessions are judged to be equally accessible to the majority of candidates, the ensuing questions were more graded in 2023 with questions 2 and 3 assessing mainly knowledge and understanding at a basic level and questions 4, 5 and 6 assessing knowledge with understanding, application and scientific inquiry skills.

A qualitative analysis of candidates' scripts shows that they were comfortable with the objective-type questions, namely the MCQs, matching items and fill-in-the-blanks which mainly assessed knowledge with understanding. This indicates that candidates were able to tackle questions where the answers were already provided within a choice of answers and where they did not have to produce the answers on their own. In this case, there is not enough evidence to say that the basic concepts in Biology at the Grade 9 level have been acquired, particularly when compared to the performance of candidates in questions where knowledge and understanding were assessed through open-ended items.

As noted in the past years' Examiners' reports, language remains a major barrier to the production of high-quality responses from candidates. Often candidates lost marks due to them not being able to express themselves clearly. While language is not penalised during the marking of the Biology question paper, poor command of English is sometimes self-penalising.

## KEY MESSAGES

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Students preparing for the NCE assessment in Biology are advised to:

1. read and understand the questions carefully before answering.
2. pay attention to the words written in bold (eg in the stem of the MCQ items) which should guide them toward the answer.
3. practice the writing of answers particularly those to open-ended questions. Answers should be in clear and concise English.
4. practice the spelling of key biological terms.
5. apply the conceptual knowledge acquired to new scenarios to develop their application and analytical skills.
6. practice biological drawings, calculations and the use of tables and graphs.
7. follow the instructions given for each question when answering.

In addition, Educators are advised to:

1. encourage students to conduct hands-on practical activities, particularly in the chapter Nutrition in Plants;
2. ensure that biological drawing skills are acquired. These are:
  - a. using a sharp pencil.
  - b. Drawing on the left and labelling on the right (for right-handed persons)
  - c. Using the whole space provided to produce large drawings.
  - d. Drawing with accuracy. The drawing should be a clear representation of the specimen/photomicrograph provided.
  - e. Producing clear, continuous and sharp lines.
  - f. No shading or stippling should be done.
  - g. Using parallel lines when labelling.
3. ensure that students are familiar with the reproduction of data from tables or other forms into graphs. Bar charts should be used for discreet data and line graphs for continuous data.
4. ensure that students are familiar with biological calculations, particularly to find the mean and the formula used for the magnification of drawings.

The use of calculators is allowed in the Biology paper. It is recommended that students are familiar with their use and that they bring their calculators for the assessment.

## SPECIFIC COMMENTS

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The 2023 question paper comprised 6 questions. Questions 1, 2 and 3 were based mainly on objective-type items assessing knowledge and understanding. Questions 4, 5 and 6 contained a number of open-ended items assessing candidates' ability to recall knowledge, to apply the biological concepts learnt, as well as to demonstrate the scientific skills they have acquired.

## Question 1

Question 1 comprised 10 Multiple-Choice Questions. The performance of candidates in this question was comparable to that in the previous year. Candidates obtained 8.5 out of 10 marks on average in 2023.

Generally, candidates use pens to respond in the question paper during the assessment. Given that the use of correction fluid is not allowed during the assessment, candidates are advised to use the following steps in case they want to change an answer they have already given in the MCQ.

1. Cross out the letter encircled.
2. Replace their crossed-out answer by encircling a new letter.
3. Indicate, using an arrow, the final answer chosen.

An example is shown below.

Which part of plants <b>absorbs</b> water from the soil?	
<del>A</del>	Flower
<b>B</b>	Stem
<b>C</b>	Branch
<b>D</b>	Root ←

Table 2 provides the answers to the items in Question 1.

**Table 2:** Answer key to the items in Question 1

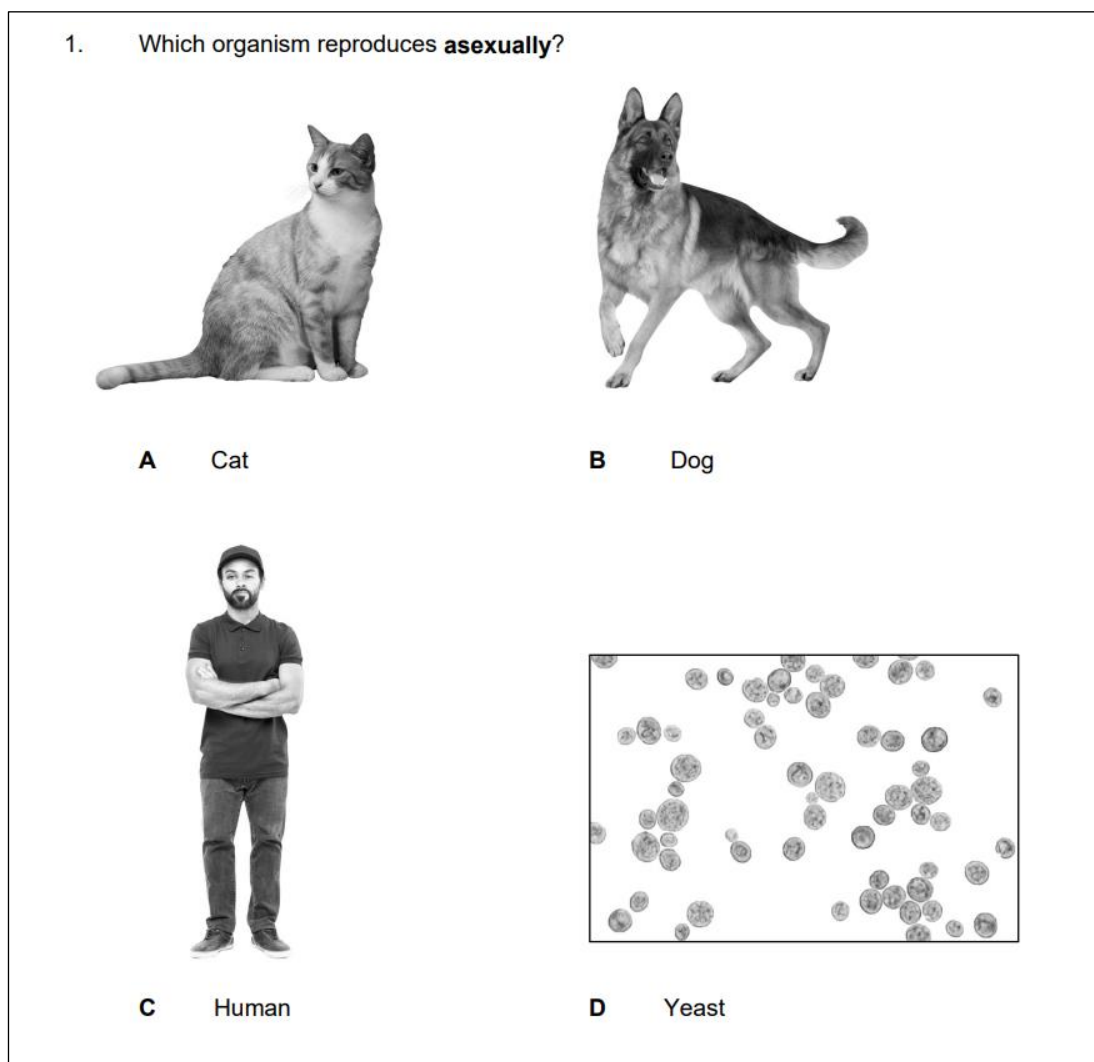
Item Number	Key	Item Number	Key
(1)	<b>D</b>	(6)	<b>B</b>
(2)	<b>D</b>	(7)	<b>C</b>
(3)	<b>A</b>	(8)	<b>C</b>
(4)	<b>D</b>	(9)	<b>B</b>
(5)	<b>C</b>	(10)	<b>C</b>

Performance in items (1), (2), (4), (6), (9) was very good with more than 90% of candidates getting the correct answers.

Educators are reminded that the distractors given in MCQs are plausible ones, that is they are statements that are linked to the concept being assessed. The correct choice of candidates then enables examiners to infer that the learning objective assessed has been acquired and that the answer has not been chosen through elimination or by chance.

### Item (1)

1. Which organism reproduces **asexually**?



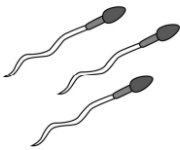
The image shows a multiple-choice question with four options, each with a corresponding photograph:

- A Cat**: A black and white photograph of a tabby cat sitting down.
- B Dog**: A black and white photograph of a German Shepherd dog standing.
- C Human**: A black and white photograph of a man with a beard and a cap, standing with his arms crossed.
- D Yeast**: A black and white photograph showing a cluster of small, round, budding yeast cells.

Candidates readily recognised yeast as the organism which undergoes asexual reproduction. Among the distractors, answer C- *Human* was the most common.

**Item (2)**

Which cells are shown in Fig. 1.1?



**Fig. 1.1: Cells**

- A** Epidermal cells
- B** Muscle cells
- C** Ovum
- D** Sperm cells

Candidates had no difficulty in recognising the sperm cells shown in the figure.

**Item (3)**

Which measure helps in the prevention of the spread of AIDS?

- A** Using condoms
- B** Exercising regularly
- C** Having a diet low in salt
- D** Avoiding smoking cigarettes

The performance of candidates in general was satisfactory, with about 8 out of 10 circling the correct answer, A. However, candidates from the Extended Programme struggled with this item, with only about 4 out of 10 getting the correct answer. This may be explained by the lack of a diagram in this question and candidates having to rely on their ability to read with understanding.

**Item (4)**

Which part of plants **absorbs** water from the soil?

- A** Flower
- B** Stem
- C** Branch
- D** Root

Candidates from both the regular and extended programmes performed very well in this item. Even though no drawing was provided, the concept assessed in this question is one that students have been exposed to since Grade 4 and 5.

### Item (5)

**Fig. 1.2** shows a leaf.

What is structure **X**?

- A** Leaf margin
- B** Lamina
- C** Midrib
- D** Leaf apex



**Fig. 1.2: A leaf**

Performance on item (e) was below expectations. The item assessed knowledge of the midrib of a leaf. The leaf margin and leaf apex were popular wrong answers provided by candidates. It is advised that more time is allotted to the teaching of the structure of the leaf.

### Item (6)

Which organ pumps **blood** around the body?

- A** The brain
- B** The heart
- C** The lung
- D** The kidney

As opposed to item (5), candidates were familiar with the function of the heart in the body. This was also the item in Question 1 where candidate' performed best.

### Item (7)

Which one is a **cardiovascular** disease?

- A** Covid-19
- B** HIV
- C** Stroke
- D** Syphilis



More than 25% of candidates did not get the correct answer for this item. This may be due to not reading with enough attention.

**Item (8)**

Which pigment is responsible for the **red** colour of blood?

- A** Chlorophyll
- B** Calcium
- C** Haemoglobin
- D** Plasma

Item (8) was another item in Question 1 where performance was below expectations. Plasma was the wrong answer chosen by many candidates. This suggests that candidates are familiar with the terms associated with blood but may have difficulty with the functions of the different blood components.

**Item (9)**

Which one of the following is an example of a **human activity** that affects the environment?



**A** Cyclones



**B** Deforestation



**C** Tsunamis




**D** Volcanic eruptions


Performance on this item was very good.

**Item (10)**


Which one of the following is an **endemic** species of Mauritius?




**A** Mongoose



**B** Monkey



**C** Pink pigeon



**D** Rat

The majority of candidates recognised the pink pigeon as being endemic to Mauritius. The three other organisms are all exotic to Mauritius.

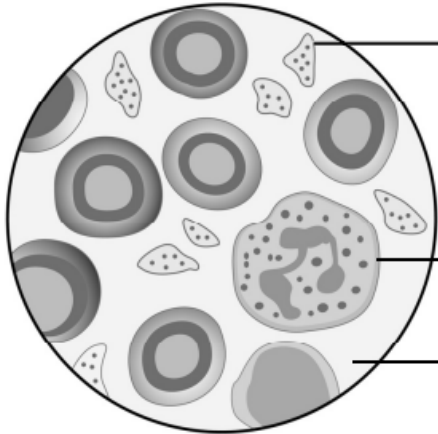
## Question 2

Question 2 carried a total of 8 marks. It assessed candidates' knowledge and understanding on the chapter Blood Circulatory System. The mean mark obtained was 5.47. A better performance could have been expected given that all the items are objective-type and assessed knowledge at the basic level.

### Item 2 (a)

**Fig. 2.1** shows the different parts of a blood sample.  
Label parts **A**, **B** and **C**. Choose from the words given below.

**White blood cell      Red blood cell      Plasma      Platelets**



**A:** .....  
**B:** .....  
**C:** .....




**Fig. 2.1:** Blood sample

Candidates had to label the different components of blood and the options were given for them to choose from. A similar diagram is found in the Grade 9 textbook for the Extended Programme. More than 3 out of 10 candidates did not provide the correct labelling for parts A, B and C.

Based on the performance in this item and that in item (8) of question one, it is suggested that more emphasis be given to this part of the syllabus, that is on the knowledge of blood components and their respective functions.

**Item 2 (b)**


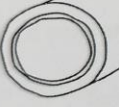

Match each type of blood vessel to its corresponding function.

Type of blood vessel	Function
 Artery	Carries blood to the heart.
 Vein	Allows exchange of substances between blood and cells.
 Capillary	Allows the clotting of blood.
	Carries blood under high pressure.

Question 2(b) was fairly accessible on the whole. The majority of the candidates matched each blood vessel to its correct function in the body.

It is worth noting here that students should be advised to use a ruler when doing the matching exercise. They should also ensure that the matching line is drawn more or less to the centre of the row/box chosen so that there is no ambiguity. Below is an example of a script where the line drawn is unclear.

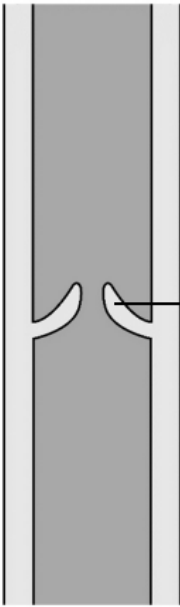
(b) Match each type of blood vessel to its corresponding function.

Type of blood vessel	Function
 Artery	Carries blood to the heart.
 Vein	Allows exchange of substances between blood and cells.
 Capillary	Allows the clotting of blood.
	Carries blood under high pressure.

*Note: In the original image, a blue circle highlights the 'Allows the clotting of blood' function, and a wavy line indicates a handwritten match from the 'Capillary' row to this function.*

**Item 2 (c) (i)**

**Fig. 2.2** shows a vein.  
Name structure **P**.



**P:** .....

**Fig. 2.2:** A vein

[1]

Candidates were expected to label structure P as Valve. Less than half the number of candidates were able to provide the correct answer. Moreover, many spelling mistakes were noted, namely *val* or *valv* given as answers. While spelling mistakes are tolerated as long as the meaning is not in doubt, students should be encouraged to write the words properly. This is particularly relevant to short words such as valve where a spelling mistake can change the meaning of the word altogether.

**Item 2 (c) (ii)**

Which one is the function of structure **P** ?

Tick ( ✓ ) the correct answer.

- It prevents the passage of nutrients.
- It prevents blood from flowing backward.
- It prevents the entry of germs in a wound.

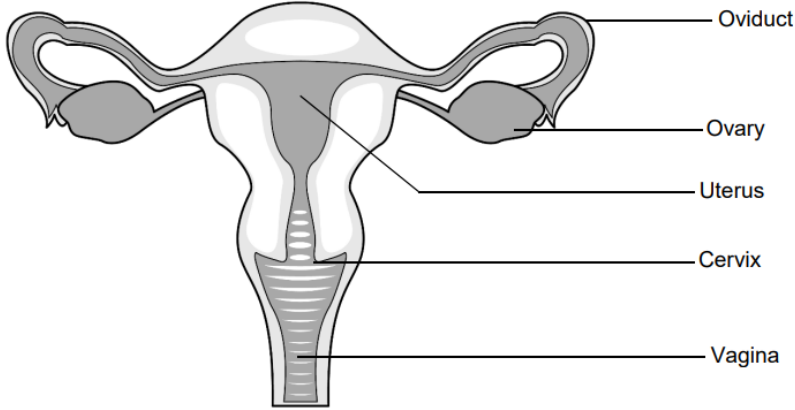
Performance in item (c)(ii) was better than that in item (c)(i). It is expected that students should first know the name of a structure then its function. However, given that options were provided in item (c)(ii) and candidates only had to tick the correct answer, performance was better. The performance in item (c) reinforces the need to ensure that students are not learning and responding to questions in a mechanical way without the learning outcomes having been attained.

### Question 3

Question 3 was over a total of 10 marks on the chapter Reproduction. The mean score was 6.81 which is lower than expected given that the question comprised a fill-in-the-blanks item with words given and labelling again with words given.

#### Item 3 (a)

**Fig. 3.1** shows the female reproductive system.



The diagram illustrates the female reproductive system. It shows a central pear-shaped organ, the uterus, with two fallopian tubes (oviducts) extending from its upper corners to two oval-shaped ovaries. The lower part of the uterus is the cervix, which leads into the vagina. Labels on the right side of the diagram point to the Oviduct, Ovary, Uterus, Cervix, and Vagina.

**Fig. 3.1:** Female reproductive system

Using **Fig 3.1**, fill in the blanks in sentences (i) to (v).

(i) The \_\_\_\_\_ produces eggs.

(ii) Fertilisation takes place in the \_\_\_\_\_ .

(iii) The \_\_\_\_\_ is also known as the birth canal.

(iv) The foetus grows inside the \_\_\_\_\_ .

(v) The \_\_\_\_\_ separates the uterus from the vagina.

[5]

Item (a) comprised 5 sub-parts which were generally well answered by candidates. The item which posed the most difficulty was part (ii). Many students still have the misconception that fertilisation takes place either in the uterus or the vagina.

The correct answers are provided below:

- (i) Ovary
- (ii) Oviduct
- (iii) Vagina
- (iv) Uterus
- (v) Cervix

**Item 3 (b)**

(b) **Fig. 3.2** shows part of the male reproductive system.

Using the words given below, label parts **M – Q** on **Fig. 3.2**.

**Urethra**                      **Scrotum**                      **Testis**  
**Prostate gland**                      **Sperm duct**

The diagram shows a cross-section of the male reproductive system. Labels M through Q are connected to specific parts of the system by lines. M points to the epididymis, N to the vas deferens, O to the urethra, P to the testis, and Q to the scrotum.

**Fig. 3.2: Part of the male reproductive system**

[5]

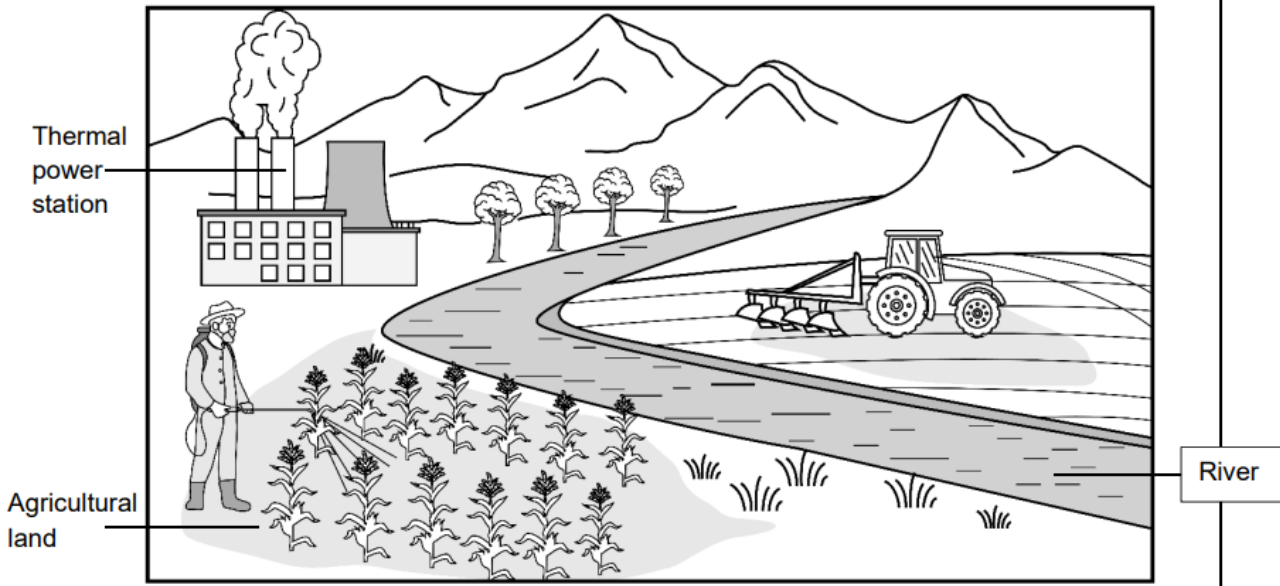
For each of the parts of the male reproductive system, about 6 out of 10 candidates gave the correct answer. Candidates had the most difficulty in labelling the sperm duct for part M. Students are advised to work on activities where they have to label different structures or organs. They should work on writing the terms correctly even when words are not provided.

## Question 4

This question was on a total of 5 marks, with a mean mark of 2.97 obtained. The question comprised 4 open-ended questions in the chapter on Biodiversity. The question was based on a diagram that provided the context upon which the answers had to be formulated. The main difficulty remains that of expressing the answers in correct English.

### Item 4 (a)

**Fig. 4.1** shows several features and activities close to a river.



**Fig. 4.1: An area close to a river**

(a) The biodiversity of this area is being affected by human activities.

Describe biodiversity.

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[1]

In this item, candidates were required to describe the term biodiversity. Though found to be challenging by many – only half of the candidates scored the mark – this item is assessing knowledge. When the command word ‘describe’ is used, a certain level of detail is expected from the candidate and one-word answers or very short phrases will most of the time not convey the understanding of the candidate.



In this particular question, it was expected that the answers of candidates contained three main ideas namely,

- Variety of species
- Number of different species
- Defined area

An example of a simple but correct answer is:

*The variety of species and their respective numbers found in a defined area.*

#### Item 4 (b)

<p>(b) Give one harmful effect of air pollution on the environment caused by the thermal power station.</p> <p>_____</p> <p>_____ [1]</p>
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A range of answers was accepted. The definition of the environment here was taken as comprising the living (plants, animals including humans) and non-living things of the area given in Figure 4.1. As such, the following answers were accepted:

- *Smoke and dust from the factory cause respiratory diseases.*
- *Reduced photosynthesis*
- *Global warming*
- *Causes acid rain*
- *Causes smog*

However, students should be encouraged to describe the effects of the air pollution. The two answer lines provided indicate the level of detail expected from the candidate. For instance, instead of giving *global warming* only, students should be encouraged to give a more complete answer explaining the increase of carbon dioxide gas in the atmosphere which traps heat thus causing global warming.

The attention of students should also be drawn to the important keywords used in such questions. They should understand the requirements of words such as *effects, consequences, measures* or *causes*.

**Item 4 (c)**

(c) Explain how the use of excess fertilisers in the agricultural land affects aquatic life in the river.

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[2]

When the terms 'Explain how' are used, it is expected that candidates go beyond the statement of a fact. Hence, for this question, candidates were expected to explain that excess fertilisers in the water will cause the rapid growth of algae which blocks sunlight from reaching the aquatic plants / the water is deprived of oxygen resulting in the death of the aquatic animals and plants. At least two of the following ideas were required in the answers:

- excess algal growth
- sunlight is blocked
- rapid microbial growth
- oxygen depletion

Few candidates successfully provided a full answer and scored the 2 marks allocated. At least a quarter of the cohort did not score any mark in this item. However, some candidates produced excellent responses. An example is given below:

*Eutrophication will occur in the river, hence many aquatic plants will grow over the water surface, preventing the water from getting sunlight. So oxygen will decrease in the water and aquatic animals will die.*

**Item 4 (d)**

Suggest one measure that can be taken to protect the biodiversity of this area.

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[1]

Performance on this item was good. A variety of answers was expected ranging from measures to prevent air pollution to measures about the practice of sustainable agriculture. Some of the answers accepted were:

- Use of biological control instead of pesticides.
- Use of organic fertilisers or compost.
- Use renewable sources of energy.
- Use of filters in chimneys of factories
- Planting of trees
- Enforcing legislation protecting the environment
- Use of sustainable agricultural practices
- Manual weeding instead of use of pesticides

Students should be encouraged to write about specific measures related to the context given. For instance, only *enforcing laws* is not enough but a full answer should be *enforcing laws to restrict the use of artificial fertilisers* for instance.

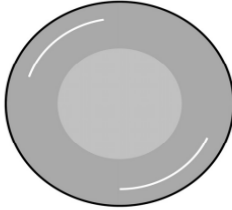
## Question 5

Question 5 was on the topic Blood Circulatory System. More specifically it assessed the learning outcomes related to magnification and pulse. This question also assessed the knowledge of biological calculation, the scientific method and the description of a graph. The total marks available for this question was 10 and the mean mark scored by candidates was 3.35, indicating that the assessment objectives of application and scientific inquiry were not fully acquired.

This question also assessed the acquisition of knowledge but through open-ended items. Candidates found it challenging to express themselves, for instance to define a pulse or to explain why the pulse rate changes after exercising. As stated before, writing the answers to open-ended questions is very important in class.

**Item 5 (a)**

**Fig. 5.1** shows a red blood cell with a magnification of x15000.



**Fig. 5.1:** Red blood cell  
Magnification: x15000

(a) Calculate the actual size in mm of the red blood cell shown in **Fig. 5.1**.  
Show your working.

**Answer:** \_\_\_\_\_ mm [3]

Most candidates found this item out of their reach, with only about 1 out of 10 scoring the 3 marks allotted.

The application of the learning outcome 'calculate magnification of drawings of blood cells' is assessed in this item. Calculation of magnification is also detailed in the Grade 9 textbooks.

Students should understand the reasoning behind the formula:

$$\text{Magnification} = \frac{\text{size of drawing}}{\text{size of original object}}$$

so they can apply it confidently in the given context in the question paper. The marks are allocated as follows:

- 1 mark for the correct measurement of the blood cell given in Figure 5.1
- 1 mark for the conversion of the measurement to mm
- 1 mark for the application of the correct formula.

Though the simplification of the answer in decimal place was desirable, the answer left as a fraction was accepted given that there was no precision as to the format in which the

answer should be provided. Hence, the correct answer was 0.003mm or 47/15000 mm. A tolerance of  $\pm 1$ mm was allowed in the measurement of the red blood cell given.

Some of the issues noted in the scripts of candidates were:

- They redrew a red blood cell and proceeded with the measurement and calculation of magnification.
- They did not convert the diameter into mm.
- The diameter of the red blood cell was wrongly measured.
- They did not know the formula to calculate magnification.

### Item 5 (b)

Red blood cells distribute oxygen throughout the body. Give two ways how they are adapted to carry out this function.

1. \_\_\_\_\_
2. \_\_\_\_\_ [2]

Item 5(b) assessed knowledge and understanding. Though most candidates attempted the question less than 35% could give two correct adaptations of the red blood cells to distribute oxygen. This question only required the candidate to name the adaptation without explaining how it helps the red blood cell to carry oxygen. However, students should be encouraged to not only know the structure of the cell but also how this specific structure helps it. This will support deeper conceptual understanding and thus students will be more comfortable to recall the facts or to apply their knowledge to the context of such questions in the question paper. Some of the correct answers were (the parts in brackets are desired but were not needed in this particular item to score the mark):

- It does not have a nucleus (maximises the space available for carrying oxygen).
- It has a biconcave shape (to increase its surface area).
- It contains hemoglobin (to bind with the oxygen molecules).
- It is flexible/changes its form (thus it can squeeze through the blood vessels).
- It is small in size (thus can easily go through the capillaries).

**Item 5 (c)**

Define a pulse.

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[1]

This item highlighted a possible misconception. A large number of candidates gave the idea of a pulse being a heartbeat or *is like a heartbeat*. Students should be reminded that a pulse arises due to the stretching and relaxation of the artery walls under high blood pressure. Though not in the syllabus, the distinction between a heartbeat and a pulse could be emphasised- simply put, a heartbeat is the contraction of the heart as it sends blood to the lungs and the rest of the body, and is distinct from a pulse.

**Item 5 (d) (i)**

Kevin investigates the effect of exercising on his pulse rate.

He takes his pulse rate at minute 0, that is, before starting to exercise.

(i) Give one reason why he should take his pulse rate before he starts exercising.

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[1]

Item 5 (d) assessed skills developed when a scientific inquiry is conducted. The scientific method – development of a question to investigate, formulation of a hypothesis, the conduct of the experiment – use of controls, observation, data recording and communication and interpretation and conclusion – is an important part of the syllabus. The chapter Scientific Inquiry in the Grade 9 Teaching and Learning Syllabus spells out the learning outcomes that have to be developed. This chapter and the chapter Science, Technology and Society from the Grade 9 syllabus apply to the three Sciences and should not be neglected.

Performance in this part was satisfactory though could have been much better. The idea of comparison was needed and a simple statement such as *to compare the results before and after exercising* was sufficient to score the 1 mark. Ideally answers such as ‘In order

to compare the pulse rate before and after the exercise and hence know the effect of exercising on his pulse rate.' would have been preferable.

**Item 5 (d) (ii)**

(ii) He then monitors his pulse rate for 8 minutes while exercising and 2 minutes after exercising. The results are given in the graph below.

Time / Mins	Pulse rate
0	75
2	100
4	110
6	135
8	140
10	100

Describe the trend shown on the graph. (Use appropriate figures from the graph).

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[2]

Candidates were expected to describe the trend of the graph and not to explain the graph.

In questions requiring a description of a trend, the following are important:

- The trend of the line – e.g; increasing, decreasing, stable, constant etc...
- The degree of the change – e.g; sharp increase, steady decrease, etc...
- Use of relevant figures from the graph

Less than 2 candidates out of 10 were able to successfully describe the trend. An example of a correct answer is:

*As he starts exercising, the pulse rate increases to 140 at 8 minutes then the pulse rate decreases to reach 100 at minute 10.*

Though the degree of the change is not mentioned, this answer scored 2 marks.

### Item 5 (d) (iii)

<p>Give one reason why his pulse rate changes while exercising.</p> <hr/> <hr/> <p>[1]</p>
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About half of the cohort of candidates gave a correct answer. Any one of the following points was required:

- During exercise, the muscles require more oxygen and hence blood is pumped at a higher rate.
- To remove waste (carbon dioxide) from the muscles more rapidly.
- To supply glucose to the muscles at a higher rate

### Question 6

Question 6 assessed the topic Nutrition in Plants, more specifically the learning outcome which emphasised the development of scientific inquiry skills namely, 'conduct simple laboratory experiments to show the importance of these factors to photosynthesis'. The question was over 7 marks and the mean mark scored was only 2.66. The poor performance of candidates in this question highlights the importance of carrying out hands-on experiments and allowing students to observe the experimental setup, collect data and produce their tables and graphs.

It is suggested that students experiment with the different factors affecting photosynthesis. Moreover, they should be able to understand how to measure the effect of these factors – for instance, counting bubbles or the production of starch in the leaves.

The method to test for starch is explicitly provided in the textbook and it is advised that the different steps are carried out in the laboratory even as a demonstration.

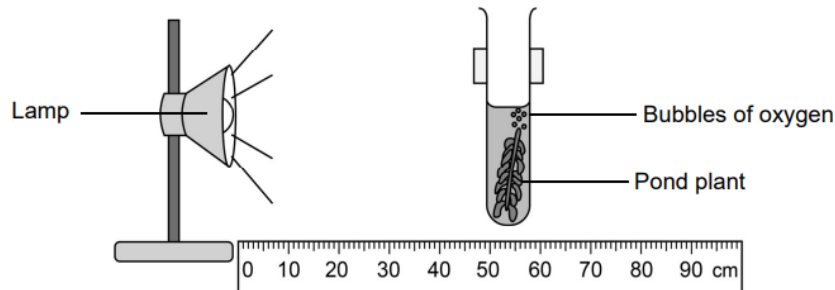
When conducting experiments, students should understand the reason behind each step. For example, they should be able to give the reason why a control is required. They should also be trained on their observational skills, knowing and understanding what has to be observed and what are the relevant data to be collected. Students should also be encouraged to record their data and communicate it clearly.



## Question 6

Sara carries out an experiment to investigate the rate at which the leaves of a pond plant produce bubbles of oxygen when exposed to different intensities of light.

The apparatus used is shown in **Fig. 6.1**.



**Fig. 6.1:** Experimental set up

The investigation is carried out in a dark laboratory. The only source of light is the lamp.

Sara changes the light intensity by placing the lamp at different distances from the plant each time.

She records the number of bubbles of oxygen produced by the plant at each distance.

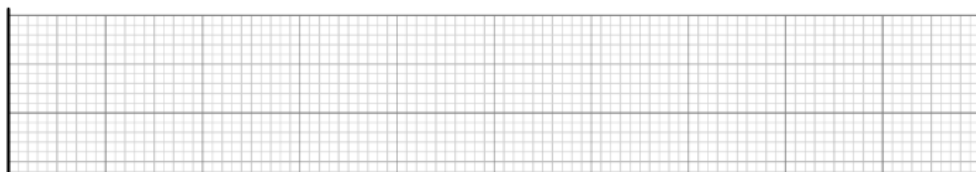
The results are shown in **Table 6.1**.

**Table 6.1**

Distance of lamp from plant / cm	No. of bubbles of oxygen produced per minute
20	29
40	16
60	8
80	3
100	1

### Item 6(a)

(a) Use the data in **Table 6.1** to draw a line graph.



A total of 4 marks were available on this item. 1 out of 10 candidates scored the 4 marks and approximately 3 out of 10 scored zero. The marks were allocated as follows:

- 1 mark for correct labelling of axes
- 1 mark for the correct scale
- 1 mark for the correct plotting of the points
- 1 mark for the drawing of the line joining the points.

Though it was expected that candidates draw the independent variable on X-axis (distance of lamp) and the dependent variable on the Y-axis (number of bubbles), they were not penalised for producing the reverse.

Students should also be reminded not to forget to include the unit for each axis.

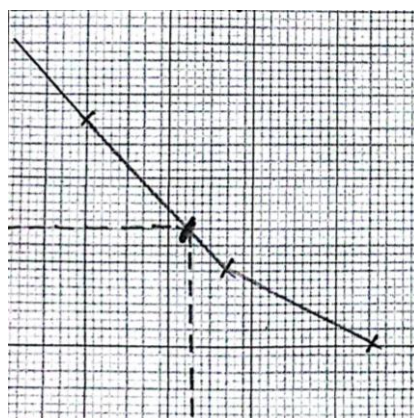
It was also noted that a significant number of candidates drew a bar chart instead of a line graph.

### Item 6 (b)

Use your graph to estimate the distance of the lamp from the plant when 12 bubbles of oxygen are produced per minute.

1. Show on the graph how you obtained your answer. [1]
2. Distance of the lamp: \_\_\_\_\_ [1]

Few candidates were able to show on the graph when 12 bubbles were produced. It was expected that they draw dotted lines to the X and Y axes as follows:



The expected distance of the lamp was 50cm.

### Item 6 (c)

Briefly describe the relationship between light intensity and the rate at which oxygen is produced by the plant.

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[1]

The expected answer was *As the light intensity increases, the number of bubbles of oxygen produced by the plant increases*. The reason why the number of bubbles increases was not required here. A fair number of candidates could answer the question correctly.

### Concluding Remarks

The assessment in Biology is based on the Teaching and Learning syllabus. Educators should be familiar with the document and the learning outcomes. Attention should be paid to the depth of learning and understanding expected as per the learning outcomes. For instance, learning outcomes which are about stating, naming or listing will be assessed mostly through direct knowledge questions, whereas learning outcomes which are about demonstrating or showing an understanding will most often be often through application questions. The importance of the development of scientific inquiry skills cannot be overstated and it was clear from the performance of candidates that they would benefit significantly from carrying out experiments in the laboratory.