

EXAMINATIONS COUNCIL OF ESWATINI

EGCSE

EXAMINATION REPORT

FOR

BIOLOGY (6884)

YEAR

2022

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EGCSE BIOLOGY

Paper 6884/01

Short Answers

General Comments

This is a short answer question paper which aims at testing knowledge with understanding and handling information. It is marked out of 40.

The questions in the 2022 paper were balanced as they came from all four sections of the syllabus.

The 2022 paper was somehow of the same difficulty when compared with the 2021 paper. However, the overall performance in 2022 was very low than that of the 2021 paper. Most candidates had difficulty in answering all questions as most left blank spaces. Those who attempted all the questions failed to bring out the desired responses.

Questions 9, 10 and 12 proved to be easy as more candidates scored full marks.

Questions 1, 2(a), 4(a), 6(b), 8, 13, 15, 16 and 18 proved to be more challenging as a number of candidates scored no marks. The low performance may be attributed to various factors which included the following:

- Unpreparedness of candidates
- Lack of biology concepts
- Language barrier
- Spelling mistakes

Comments on individual questions**Question 1**

This question was not accessible to a majority of candidates.

- (a)** This question required candidates to state a visible feature that identified the given cell (bacterial cell) as a prokaryote. However, a majority of candidates identified a feature of bacterial cell which some prokaryotes do not possess. Some common incorrect responses included 'a strand of DNA' and 'flagella'.

Expected response: *absence of nucleus/naked DNA/DNA not enclosed in a membrane;*

- (b) Several candidates missed this part of the question and left it unanswered. Those who attempted it labelled the cytoplasm, DNA or the flagella as the part that is found in plant cells but not in animal cells. Some candidates used Fig.2.1 to label the part requested in question 1(b).

Expected response: a label line to the cell wall with the letter A

Question 2

- (a) This question was not accessible to a majority of the candidates as they failed to give the level of organization of a leaf. It seemed candidates were not familiar with levels of organisation. The candidates named the process of photosynthesis as a level, while some gave responses like level 1, 2 or 3 and others would write upper or lower level. On the contrary, those who got the level of organization correct, lost marks by stating that it is made of different cells rather than group of tissues.

Expected response: level: organ;

reason: made of different tissues

- (b) This question required candidates to state the name of gas B, which enters a leaf at night for respiration. It was accessible to most candidates. However, some candidates missed the part on respiration, hence gave carbon dioxide as a response thus lost the mark.

Expected response: oxygen

Question 3

This question was generally well attempted by candidates. However, some mistook salts for nutrients. The most common incorrect responses were 'salts give us energy' or 'salts kill bacteria or salts neutralise the acid that causes diarrhea

Expected response: to replace salts lost in diarrhoea

Question 4

- (a) The question required candidates to name the structure labelled C in the wind pollinated flower. Most candidates failed to score marks as they gave the anther as their response. Very few gave the correct answer.

Expected response: stigma

(b) Candidates were expected to explain advantages of cross-pollination in plants.

Most candidates were able to score 1 mark on this question as most stated that cross pollination results in variation. A few described advantages of asexual reproduction, while some gave responses based on dispersal so lost the marks.

Expected response: *to increase variation; due to genetic mixing
leading to natural selection/greater ability to adapt/ more resistance to diseases*

Question 5

The question required candidates to explain, in terms of the lock and key hypothesis. A number of candidates were able to state that higher temperatures denature enzymes, but failed to relate effect of temperature to enzyme activity in terms of 'lock and key'. Quite a number of candidates could not identify a lock or a key between an enzyme and a substrate. Some lost marks for stating that enzymes get killed or become inactive.

Expected response: *active site of enzyme gets denatured; so substrate no longer fits on active site/ fat molecule not complementary to shape of active site/ no enzyme-substrate complex formed.*

Question 6

The question required students to display their knowledge of temperature regulation. A majority of candidates were not able to score full marks on this question.

(a) Candidates were expected to state the role of part **D** (receptor cells) in temperature regulation. Many candidates identified **D** as a sweat gland so stated their role of as to produce sweat. Some gave the function of a skin such as to detect pain, pressure and temperature hence lost the mark because question was specifically on temperature regulation.

Expected response: *to detect temperature changes/ to send nerve impulses to the brain*

(b) Candidates were expected to describe what will occur in the part labelled **E**. A majority of candidates identified part **E** as a capillary, instead of identifying it as an arteriole which resulted to a loss of marks. Some used incorrect statements like 'arteriole contracts/become smaller' or 'moves away from skin surface' and so lost a mark.

Expected response: *vasoconstriction/ arteriole will constrict/ diameter of arteriole reduced
reducing blood flow towards the skin*

Question 7

This question required candidates to show the inheritance of colour using a genetic diagram. A majority of candidates were able to score full marks. However, a number of candidates used wrong parental genotypes (BB and bb) so lost all 3 marks. A few used their own key instead of key given by examiner, so lost the all the marks.

| | | | |
|---------------------------|---------------------------|------------------|-------------------------------|
| Expected response: | <i>Parents phenotype</i> | <i>brown fur</i> | <i>white fur</i> |
| | Parents genotype | Bb | x bb |
| | <i>Gametes</i> | B b | x b b (each letter encircled) |
| | <i>Offspring genotype</i> | Bb | Bb bb bb |

Question 8

Many candidates failed this question on DNA.

- (a) They could not give observable features of the given structure. The most common wrong response was chromosomes.

Expected response: *made of nucleotides/ contains nitrogenous bases/ has a sugar-phosphate backbone/ is double stranded*

- (b) Almost all candidates could not correctly identify structure **F**, instead gave nucleotide/ phosphate/ pentagon/guanine so lost the mark.

Expected response: *sugar*

- (c) Many candidates could not name base **H**.

Expected response: *cytosine*

Question 9

This was the most accessible question to candidates. Most were able to correctly state the function of a condom. A few candidates lost a mark for poor use of scientific terminology e.g. to prevent transfer of diseases/ to prevent mixing of blood.

Expected response: *prevents spread of sexually transmitted infections or prevents pregnancy*

Question 10

Candidates were expected to name the hormone, site of production and the target organ. The question was well answered by most candidates. However, a few gave wrong spellings like FHS, LSH thus lost the marks.

Expected response: *corpus luteum*

LH/FSH/luteinizing/follicle stimulating hormone

uterus

Question 11

Candidates were expected to interpret a flow diagram showing the flow of energy in a typical ecosystem. Most candidates failed to correctly interpret the flow diagram

(a) Many candidates were able to identify the box containing the largest amount of living matter.

Correct response: **J**

(b) Very few correctly identified the group of organisms represented by box **M**. A majority identifying it as omnivores which earned them zero marks.

Correct response: *decomposers;*

(c) Candidates were expected to identify a box representing secondary consumers on the flow diagram. Most candidates wrongly identified it as **K** so lost a mark.

Expected response: **L**

Question 12

The question was accessible to most candidates as they were able to write the equation correctly. However, a few candidates included energy as a product of photosynthesis, while some failed to balance the equation. Some wrote a word equation, while others gave an equation for respiration. As a result, they could not score all 2 marks.

Expected response: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

Question 13

Candidates failed to state a condition caused by gene mutation in humans. Responses related to causes of gene mutations such as exposure to radiation/ faulty DNA were common and no mark was awarded for this. A majority of candidates named Down's syndrome as the required condition in this question thus lost a mark since it is caused by a chromosome mutation.

Expected response: *albinism/ haemophilia/ sickle cell anaemia/ cystic fibrosis*

Question 14

(a) This question was generally fairly done by most candidates. A few candidates correctly named the blood vessel transporting nutrients from the villi to the liver.

Expected response: *hepatic portal vein*

(b) Many candidates were able to describe the role of bile in emulsification but could not score the second mark due to failure to state its composition. The most common wrong responses included: to kill bacteria, to neutralize acid in the stomach, to emulsify fats into fatty acids and glycerol.

Expected response: *bile is alkaline; to neutralise acidic chyme*

OR

bile has bile salts; for fat emulsification

Question 15

Generally, this was a challenging question. Candidates would compare **P** and **N** structurally (e.g. coiled, straight), some would compare in terms of oxygen content, while some would write about only one part and do not compare with the other.

Expected responses: *N has nutrients/named + P no nutrients*

N has less nitrogenous waste/urea + P has more

N has more salts + P has more salts

Question 16

Most candidates failed to unpack the question sequentially, hence lost the marks. A few candidates correctly stated the condition of the diaphragm during exhalation but could not get the other mark which was based on the effect of the bulging of the diaphragm. Other candidates failed to describe exhalation in terms of the diaphragm only but instead described the sequence of events using intercostal muscles and ribcage.

Expected response: *diaphragm relaxes/bulges up/become dome shaped*

so that volume of thoracic cavity decreases and pressure in lungs increase

Question 17

This question was fairly attempted by most candidates. It required candidates to state **two** natural processes that remove nitrogen from the atmosphere. However, a few candidates wrote incorrect spellings e.g. lighting, lightening and thus lost the mark. Some would give the name the bacteria instead of stating the name of the process.

Expected response: *lightning*
nitrogen fixation

Question 18

The question was challenging to most candidates. They were required to state the role of the dense network of blood capillaries. A majority of the candidates made reference to increased surface area for gaseous exchange, so lost the mark.

Expected response: *to maintain a steep concentration gradient of gases or to provide a good supply of blood for transport of gases*

EGCSE BIOLOGY

Paper 6884/02

Structured Questions

General Comments

The 2022 candidature was lower (about 12300) compared to 2021 where there were about 20 000 candidates.

Generally, the 2022 performance was poor, but a bit better than the 2021, as there were a few candidates that scored 70 and above yet there were none in the 2021 examination.

Questions 3 (a), 4 (a), 6 (b) (ii) 7(b) (i), (ii) and 8 (b) proved to be very challenging as most candidates scored less than half of the given marks.

On another note, **Question 1, 2 (a) (i) and (b)** seemed to be easy as more candidates scored more than half the given marks.

Many candidates left a lot of questions unanswered, making it difficult to know if time for the paper was inadequate or the questions seemed difficult for them to respond correctly to. Some were seen to be unable to use the scientific terminology to explain or describe scientific concepts for example in **Question 8(b)**, most candidates used their general knowledge to try to explain how ARV resistance develops. Also, in **Question 2(a) (i)** instead of weakened pathogen being injected during vaccination, candidates would say the vaccine contains the disease. Lymphocytes were also referred to soldiers by some candidates, and instead of lymphocytes remaining in lymph nodes as memory cells, they were said to 'keep memory of the disease so that on re-infection the disease is remembered.

Grammar continues to remain a challenge like in the previous years, spelling was also a challenge which made some to lose marks, for example in **Question 3(a)(i)** where they wrote spectrum, septic instead of septum.

Comments on Individual Questions**Question 1**

This question was fairly done with most candidates obtaining more than half the marks especially in **1(a) and (b)**. However, **(c) and (d)** proved to be quite challenging.

- (a) It was an easy question which required candidates to interpret the graph. Some candidates failed to select the food samples required, instead they selected fibre not beans and in (ii) they wrote fats instead of beef. Some also gave the function of the nutrients instead of stating that the food contains the nutrient. In a (ii) some lost marks for not stating that beef contains a lot of fats.

Expected response: (i) *beans have fibre*
(ii) *beef has high fat content*

- (b) It was a fair question, a majority of candidates were able to state the one aspect of a healthy lifestyle.

Expected response: *exercise/avoid smoking/avoid stress/avoid fatty diet*

- (c) This question was challenging. Most candidates could not properly describe the process of peristalsis. Some candidates scored half the marks, others were able to state the names of the muscles.

Expected response: *wavelike motion of food along the oesophagus/ movement of food along the oesophagus due to alternate contraction and relaxation of the longitudinal and circular muscles which are antagonistic contraction of circular muscles behind the bolus or contraction of longitudinal muscles Infront of the bolus*

- (d) This question was a challenge to most candidates. They were unable to state the disadvantage of excess fluoride in water. Some of the wrong responses included tooth decay, eutrophication etc. fluoride in water.

Expected response: *fluorosis, yellowing/ allergies*

Question 2

The question did not seem to be difficult yet most candidates were able to score 5 out of 10.

- (a) (i) The absorption of water from the soil was well answered by most candidates, although some only scored 1 mark for osmosis.

Expected response: *osmosis*
due to water potential gradient/higher water potential in soil than in plant/higher concentration gradient/ higher concentration of water molecules through partially permeable /cell membrane

- (ii) The question required candidates to describe transport of water up the stem. Most candidates scored only a mark in the question for stating that water moves up the stem in xylem vessels but failed to describe further.

Expected response: *water moves up the stem in xylem vessels high water potential in roots than leaves
suction force/transpiration pull
ref. to adhesion/cohesion forces*

- (b) This question was easy but proved to be tricky for most candidates. They answered the question by simply stating that transpiration is the loss of water from leaves to the atmosphere, and this did not earn them any mark.

Expected response: *evaporation of water/loss of water vapour through stomata*

- (c) This was a challenging question to most candidates as they able to score 1 mark out of 3. They concentrated more on describing global warming without the implications of cutting down trees on global warming.

Expected response: *less photosynthesis/reduced carbon sinks
reduces carbon dioxide removal from the atmosphere/ increased concentration of carbon dioxide
higher heat retention/ increased temperature/causes enhanced greenhouse effect*

Question 3

This question was difficult for most candidates. Most scored less than half of the marks. Some were scoring zero.

- (a) (i) Most candidates were able to identify part **A**. However, some were writing wrong spellings e.g., spectrum, septum, septic. Other common wrong response was identifying **A** as a valve, ventricle or cardiac muscle.

Expected response: *septum*

- (ii) Performance in this question was average. Some candidates were able to score 2 out of 3 marks. Some candidates were not answering the question, instead of describing the structure. Others identified the structure as an artery hence described the structure as such. Some were giving incomplete description such as thin instead of thin walled. Other misconceptions were that the structure is one cell thick, has a thin cell wall.

Expected response: *wide/large lumen*
less elastic fibre
has valves

- (iii) This proved to be a very difficult question as most of the candidates got zero. They just described incomplete blood pathway e.g., the blood in **C** is from the heart to the lungs, in **D** the blood is from the heart to the rest of the body. Others were only able to identify the circuit as pulmonary circuit for **C** and systemic circuit for **D** which was not required. Those candidates that were able to identify the differences could not compare, they would just write that in **C** blood is at low pressure without describing the blood pressure in **D**.

Expected response: *C low pressure+ D high pressure*
C shorter distance/ fewer organs supplied

- (iv) This question required candidates to explain how digested food from blood vessel **E** reaches the body. This proved to be a very difficult question for a majority of candidates as they did not score any mark. A few candidates only scored 1 mark for only mentioning arteries. Most candidates only discussed the absorption of nutrients in the villus and transporting of absorbed nutrients to the liver by the hepatic portal vein.

Expected response: *blood from the aorta/ artery/ arteriole gets to capillary*
digested food leak from thin capillary walls
into tissue fluid
and then diffuses into cells

- (b) (i) The performance was average in this question. Some candidates were able to score 2 marks out of 3. A majority of the candidates were only able to describe without explaining. They were describing the graph at each stage instead of explaining why the pulse rate increased. Those that knew what was happening still could not get all the marks due to failure to use the word “more” in reference to oxygen, glucose and energy. Very few candidates were able to explain that the pulse rate increased since the heart was pumping blood faster.

Expected response: *increase in pulse rate*
faster blood supply
more glucose/oxygen
higher respiration/more energy

- (ii) Most candidates seemed to understand what the question required. However, they failed to give complete responses to score the full marks e.g., there was presence of lactic acid without stating that it would be broken down, refer to oxygen debt without stating that it would be repaid, oxygen was lost or used during the exercise, and that anaerobic respiration occurred before or after the exercise not during.

Expected response: *more/faster oxygen supply to muscle
to pay oxygen debt
ref. to anaerobic respiration during exercise
to oxidize lactic acid*

Question 4

This question was challenging with a majority of candidates scoring half the marks. Most candidates seemed not to understand the difference between a pathogen and a disease. Others confused antibiotics and antibodies, and some did not show the understanding of the functions of the different types of white blood cells. Also, some had limited understanding between passive and active immunity.

- (a) (i) Most candidates did not score full marks in this question due to failure to explain fully how vaccination provides active immunity. Common misconceptions included that: a weakened form of the disease is injected into the body, the vaccine comes with antibodies, it's the antibodies that remain in the body.as memory cells.

Expected response: *weakened/attenuated /dead pathogen/antigen injected into the body
lymphocytes in the body produce antibodies that destroy pathogens
lymphocytes remain as memory cells in the lymph nodes antibodies
bound to pathogens mark them for phagocytosis*

- (ii) This part was poorly done. Most candidates scored 1 out of 2 marks. They did not mention that in passive immunity the body does not make its own antibodies

Expected response: *antibodies not made in the body in passive immunity
but injected in serum from a donor or passed from mother to child during
breastfeeding or pregnancy
no memory cells are formed*

- (b) (i) Most candidates scored 1 out of 2 marks even in this question because they either did not mention the or its function.

Expected response: *phagocytes engulf and digest pathogens*

- (ii) Candidates were expected to explain how tissue rejection is prevented. The candidates were mentioning that the people should have matching blood groups to prevent tissue rejection. Some could not mention immune suppressants or explain why organs need to match.

Expected response: *use of immune suppressant drugs to stop/suppress lymphocytes from producing antibodies OR
tissue typing/ matching tissue to be used
so that antibodies could recognize the matching tissue as their own;*

Question 5

The question was challenging to most students.

- (a) Candidates were expected to name the chemical in the sprays that kills the weeds. A majority of the candidates were giving the brand names or name of the herbicides such as round up, clear out etc which resulted to a loss of a mark.

Expected response: *auxin/synthetic plant growth hormone*

- (b) Candidates did not do well even on this part of the question and they show limited understanding of the mechanism. They only mentioned 2 points, that is, fast growth and exhaustion of food reserves

Expected response: *auxins are absorbed through leaves/stomata
translocated by phloem vessels
resulting in increased respiration rate/ metabolism
then use up /exhaust food reserves*

- (c) Most candidates failed to state at least one undesirable effect on the balance in the ecosystem of using weedkillers. Common incorrect responses included: the chemicals killed innocent species, cause eutrophication, cause extinction of species.

Expected response: *kill untargeted species
leached/washed into water bodies and poison and kill aquatic organisms*

- (d) (i) Most candidates did not score full marks on this question.as they were not able to recognize that the question was about active transport. They often referred to the oxidation of magnesium which was incorrect.

Expected response: *less magnesium absorbed
due to less respiration/less energy
for active transport*

- (ii) This question was challenging. Most candidates did not know the function of magnesium, but they knew the deficiency of magnesium ions and they based their responses on the deficiency symptoms of magnesium. A few candidates gave incorrect responses such as to *make green colour, make chloroplast*.

Expected response: *making chlorophyll, fast growth for photosynthesis*

Question 6

This question was very challenging to a majority of candidates.

They failed to obtain above average marks allocated. Most candidates gave opposite responses to the expected ones.

- (a) (i) This question was challenging. Most candidates scored zero. They had no idea on percentage calculations.

Expected response: $4.3 - 2.4 = 1.9$
 $1.9 / 2.4 \times 100\%$
 79.2%

- (ii) This question was also not done properly and most candidates scored out of 3. They confused pupil reflex with accommodation.

Expected response: *receptors/cones
in fovea/yellow spot/retina
ref. to sensory neuron---relay neurone-----motor neurone
nerve impulses reaching iris muscle
circular muscles relax + radial muscles contract
pupil dilates/ gets bigger in diameter*

- (b) (i) Most candidates were able to correctly define homeostasis. Those who did not get the mark gave responses such as maintenance of internal constant environment while others made reference to maintaining body temperature.

Expected response: *maintenance of a constant internal environment*

- (ii) The question was fairly attempted, most scored 2 out of 3. They wrote the mechanism of regulating glucose level instead of answering the question in terms of **F** and **H**.

Most identified organ **F** as the liver instead of pancreas. A common misconception was that insulin converts excess glucose to glycogen, instead of the liver converting excess glucose to glycogen.

Expected response: *glucose level rises above normal
detected by pancreas **F**
insulin **H** secreted
liver stimulated to change excess glucose to
glycogen/increased oxidation of glucose*

- (c) This question proved to be challenging to candidates. Candidates confused events in the endocrine with those in the nervous system. They also mentioned nerve impulses instead of electrical impulses in nervous system.

Expected response: *fast in nervous+ slow in endocrine
short lived in nervous + long lasting in endocrine
electrical impulses in nervous + chemical in endocrine
messages via neurons in nervous + messages in blood
localized in nervous + widespread in blood*

Question 7

This question proved to be difficult to most candidates. It tested candidates understanding of biotechnology and genetic engineering.

- (a) (i) Candidates were expected to state the term used to describe a set of chromosomes in the donor nucleus. A majority of them could not differentiate between haploid and diploid nucleus.

Expected response: *diploid*

- (ii) The question expected candidates to identify the type of cell division. Most candidates could not make a difference between mitosis and meiosis. Some made spelling mistakes which made it difficult to see whether its mitosis or meiosis.

Expected response: *mitosis*

- (iii) This question was fairly done as most were able to identify cow **J** however some could not give the correct explanation

Expected response: cow **J** since all genetic material/DNA are purely from **J**,
nucleus from cow **L** was removed

- (iv) This question was challenging. Most candidates gave general differences between asexual and sexual reproduction.

Correct answer no fertilization occurs/ no fusion of gametes;

- (b) (i) This question required candidates to explain why bacteria are used in genetic engineering. Candidates fairly answered the question, however, some candidates described production of insulin. A few candidates wrote 'produce' for 'reproduction.'

Expected response: they reproduce fast
there are plasmids used in genetic engineering/are easily manipulated/no
nucleus
they are small and take up less space
ref. to no ethical concerns

- (ii) Candidates were expected to show in-depth understanding of the advantages and disadvantages of GMOs. Most candidates did not score marks in this part of the question. A few made reference to cloning instead of GMOs. Most gave advantages of sexual and asexual reproduction which were not in question.

Expected response:

Advantages: production of human medicines
production of herbicides resistance in crops
insect resistance in crops
additional nutrients in crops
increase yields

Disadvantages: environmental safety
compromised food safety
reduce biodiversity
ethical/moral objections

Question 8

This question tested candidates understanding of variation and natural selection, however, it was not well done by most candidates. A majority of the candidates scored only 1 or 2 marks out of 6.

- (a) (i)** Some candidates were able to correctly state the correct type of variation. Others wrote other unrelated terms associated with inheritance such as genotype, natural or gave the wrong type of variation, discontinuous.

Expected response: *continuous*

- (ii)** Most candidates had an idea that nutrition or disease could be the environmental factor, however, they described the factor instead of stating it e.g. lack of food. Others referred to environmental factors such as temperature, climate, drought. poverty etc.

Expected response: *nutrition or disease*

- (b)** This question proved to be a difficult question for most candidates, as most scored 1 out of 4. They were only able to refer to defaulting in taking medication. They did not understand that the question was on natural selection. Some were writing about the development of antibiotic resistance in bacteria.

Expected response: *mutation*

leads to variation

It could be due to defaulting medication

some strains of virus survive

and invade white blood cells

where they reproduce

passing their resistant alleles/ genes to their offspring;

mutants will no longer be affected by ARVs

EGCSE BIOLOGY

Paper 6884/03

Practical Test

General Comments

This Paper is a practical paper designed to test Assessment Objective C which aims at assessing the candidates' attainment in investigative skills and the scientific method of inquiry. The nature of the paper demands that candidates are exposed to practical activities and the science process skills including observation, drawing and making conclusions. It assesses candidates' familiarity with basic laboratory equipment and apparatus as well as manipulative skills. This paper tests if candidates have acquired adequate training on the scientific method of inquiry including but not limited to designing of investigative experiments and the basic principles such as; underlying investigative activities such as controlling variables, ensuring validity and reliability of experimental data, making and recording experimental data, data presentation skills as well as drawing conclusions from experimental data. Furthermore, it assesses candidates' ability to evaluate and improve methods used in investigative processes.

The 2022 paper was no different from previous papers in terms of difficulty level. It comprised two compulsory questions with a maximum possible score of 40. Most centres reported that they had no problems providing the required examination materials. The general performance in the paper was, however, worse than that of the 2021 paper. This was evidenced in a lower mean score in the overall performance. While the highest score attained in the 2021 paper was 37, the 2022 paper had a lower highest score of 35 with fewer candidates attaining above 30 marks. The lowest score was a 1 in 2021 while 2022 the lowest score was a 0. It is suspected that the candidates were less prepared compared to the previous year's cohort. It is worth noting that the level of English was better in 2021 compared to 2022 this was noted in the way the learners expressed their responses. Most used a direct translation from Siswati to English leading to clouding of concepts and loss of marks. Centres are encouraged to enforce use of English both spoken and written.

Although the questions were both intended to be accessible and well discriminating between different grade levels, the performance in **Question 1** was much poorer than that for **Question 2**. Questions that proved to be particularly difficult for candidates were **1 (a)(ii), 1 (b), 1(c), 1 (e), 2 (a) (v) and 2 (a) (vii)**. Questions that proved to be particularly easy for the candidates were **1(d) and 2(a)(i)**.

Comments on individual questions

Question 1

This question was based on investigating the effect of surface area on the rate of diffusion of reducing sugar using different sizes of an apple and Benedict's solution. The apple was cut into two halves. One half was kept in a Petri dish with the cut surface in water while the other half was used to cut out three equal pieces of 1cm^3 . One piece was put into a boiling tube labelled **A**, one piece was cut out into four equal pieces and put into a boiling tube labelled **B** while the last piece was crushed to small pieces and put into a boiling tube labelled **C**. Equal volumes of water were added into the three boiling tubes covering the samples of apple after which the boiling tubes were shaken for about three seconds and about ten drops of Benedict's solution added into each boiling tube. The tubes were placed at the same time into a hot water bath and observations made within a period of two minutes.

- (a) (i) Candidates were expected to describe the observations made in the different boiling tubes. It was expected that candidates observed that *there was colour change in the boiling tubes from blue to green to yellow to orange and finally brick red at different rates where test tube A would show only up to the green-yellow colour, B the yellow-orange colour and C the orange-brick red colour within the first two minutes*. A majority of candidates were able to observe the colour change. A common error made by candidates was to provide explanations for the observed changes instead of just the observations. Some candidates lost marks for not being able to state that the changes occurred at different rates with boiling tube **C** being the fastest, **B** being moderately fast and boiling tube **A** being the slowest to show the changes.
- (ii) This question was low scoring. Candidates were expected to explain the observations made in each of the three boiling tubes **A**, **B** and **C**. Most candidates lost these marks by duplicating the observations they had made in (i) without providing the explanations why there was a colour change and why the change occurred at different rates culminating in the end results being different. It was expected that candidates would refer to the presence of reducing sugar as the main cause of the colour change of benedict's solution and then relate the different rates of the colour change to differences in the surface area. In boiling tube **A**, there was the least surface area and boiling tube **C** had the largest surface area. It was common for candidates who realised that the concept of surface area was at play to erroneously state that the larger the particle size such as **A**, the larger the surface area yet the contrast is true. *Boiling tube C was fastest to show*

the colour change because the apple piece had been crushed into smaller pieces thus increasing the surface area for glucose to diffuse and collide with the Benedict's solution. There were a few instances where candidates thought the investigation was on osmosis.

- (b) The question was the most challenging in the paper. Candidates were expected to suggest an aim of the investigation. Only about 10% correctly articulated the aim of the investigation as *“investigating the effect of surface area on the rate of diffusion or reaction”*. An overwhelming majority incorrectly stated that the aim of the investigation was to test for the presence of reducing sugars or glucose in apples. Other incorrect responses included testing for proteins and vitamin C while a few stated the test for starch as the aim of the investigation. This showed lack of exposure to practical work.
- (c) The question was the second most challenging question. It required candidates to state why it was not necessary to add Benedict's solution at the same time in the three boiling tubes. *The expected response was to the effect that the reaction of Benedict's solution with reducing sugars would not occur until the boiling tubes were placed in the hot water bath.* Some candidates incorrectly stated that they would need to be three people doing the investigation to be able to add the Benedict's solution at the same time into the three boiling tubes since one person only has two hands and there were three boiling tubes.
- (d) For this question, candidates were expected to identify and state any two variables that were controlled during the investigation. Most candidates were able to identify these variables which included, but not limited to *volume of water added into the boiling tubes, temperature, size of specimen (apple), pH, time for heating and the type of specimen (apple) used.* This question was the most well scored question in the paper.
- (e) This question required candidates to state an advantage of using a hot water bath to heat the boiling tubes over direct heating using a Bunsen burner. The question was challenging to many candidates. Most stated that the Bunsen burner would crack the boiling tubes. The expected responses were *to provide even distribution of heat, to avoid spillage, to ensure safety of other candidates, as a control measure to ensure that all boiling tubes were subjected to the same temperature.* Common errors included ensuring an optimum temperature for enzyme activity so that they were not denatured.

- (f) This question required candidates describe how they would test a crushed apple in water for the presence of vitamin C. A majority of candidates correctly stated the procedure as *addition of DCPIP into the boiling tube with the crushed apple and a colour change from blue to colourless would occur if the test was positive*. Those who lost the mark provided a wrong spelling such as DTPIP. Common errors included the use of iodine solution or lower cased DCPIP.
- (g) (i) In this question, candidates were required to take the other half of the apple from the Petri dish, draw a large diagram of the cut surface and label only the ovary as **S**. Very few candidates scored full marks. The expected response was for candidates to *draw a large realistic diagram, covering at least half of the provided space and showing the outer covering, the fleshy layer, the ovary as well as a cavity with or without seeds in the inner core*. Common errors that led to loss of marks included shading and untidiness where the outline was either jagged or discontinuous. Some candidates labelled all parts of the fruit while others, wrote the full name ovary instead of the “**S**”. A number of candidates labelled the seeds as the ovary. Candidates also lost marks for using arrows instead of label lines.
- (ii) This question required candidates to state a visible features of an apple that are indicators of the seeds being animal dispersed. A lot of candidates apparently missed the “visible” part of the question and stated features of an apple as they know them. These included such features as sweet taste apples as good sources of vitamin C. The expected responses were *a reference to bright or attractive colours, succulent, hard and indigestible seeds which are enclosed within the fruit*.

Question 2

This question was generally better scoring than question 1. Candidates were asked set-up an experiment on yeast respiration where the gas produced was bubbled through lime water using a delivery tube.

- (a) (i) In this question, candidates were expected to count and state the number of bubbles of gas produced in one minute. Most candidates scored the mark although there were a few that recorded zero bubbles while others recorded over a hundred bubbles. The *acceptable range was 15 or 70 bubbles in the two minutes*.

- (ii) Candidates were required to use their answer in (i) to calculate the rate of bubble production per second and state the unit of measurement in their response. Some candidates correctly *divided the number of bubbles by 60 seconds and gave the unit as bubbles per second* scoring two marks in the process. A common error was for candidates to multiply the number of bubbles per minute by 60 seconds. Others incorrectly subtracted the 60 seconds from the number of bubbles while others erred by dividing 60 seconds by the number of bubbles. A lot of candidates lost a mark through failure to attach a unit to their answers yet it was a requirement. A few candidates calculated correctly but failed to present their numerical values to two decimal places preferring to use three or more while others simply failed to round up correctly.
- (iii) This was a fairly well-done question. Candidates were required to explain why the apparatus was left in the water bath for three minutes before counting the number of bubbles produced. It was expected that candidates would correctly articulate the concept of *acclimatisation in which the contents of the boiling tube were given time to take up the temperature of the water bath*. Candidates also correctly referred to giving sometime for the yeast/glucose mixture to start fermenting so that bubbles were formed. A lot of candidates stated that this was aimed at providing the enzymes with an optimum temperature.
- (iv) Candidates were expected to describe and explain the change observed in the limewater during the experiment. However, as already highlighted in Question 1 (a), candidates had a challenge distinguishing between the terms describe and explain. While others provided only the description, others provided the explanation without a description leading to loss of marks. Candidates were expected to realise that the *limewater changed from colourless to milky due to anaerobic respiration/fermentation that released carbon dioxide which reacted with the calcium hydroxide to form calcium carbonate or a white precipitate*. A common error was to refer to the precipitate as a white emulsion. It was also very common for candidates to incorrectly state that the yeast was fermenting while it was acceptable for candidates to state that the yeast was feeding on the glucose and releasing carbon dioxide and ethanol. A number of candidates also wrongly stated that the yeast contained or produced the carbon dioxide which was responsible for the colour change in the lime water.
- (v) Candidates were expected to suggest an effect on the rate of bubble production, of leaving the set-up at the same temperature for 24 hours. *It was expected that candidates would recognize that the glucose would be used up leading to the production of bubbles ceasing. Another reason would be for the environment becoming toxic to the yeast as accumulation of carbon dioxide*

would render the medium acidic thus denaturing enzymes. This would lead to the rate of bubble production decreasing to a point where no bubbles were produced. Common errors included that the yeast/ enzymes would be used up. Others missed the point on the temperature of water being kept constant and stated that the water would become cold, and the enzymes would be inactive resulting in a reduced rate of bubble production. Some candidates erroneously felt that there would be a continuous increase in the rate of bubble production as the reaction would be given enough time to occur. In most cases, the decrease in the number of bubbles was mentioned without an explanation leading to loss of marks. Most candidates incorrectly referred to enzymes instead of rate of bubble production.

- (vi) Candidates were required to suggest a change to the experimental procedure that would result in an increase in the rate of reaction other than altering the temperature. *Expected responses included increasing surface area for the yeast, adding more yeast or adding more glucose to increase the concentration of the glucose solution.* A common error was for candidate to suggest either an increase in the temperature or an increase in the volume of the glucose solution. It was also common for candidates to suggest a repeat of the investigation with more observers.
- (vii) This question was fairly well done. Candidates were expected to describe a modification they would make to the experimental procedure to determine whether glucose was necessary for the observed change in the limewater. *The expected response was that two set-ups be made where one boiling tube would contain the glucose solution as the control and the other without glucose such as water and yeast. Furthermore, they were expected to state how variables would be controlled, how data would be collected and how they would arrive at the conclusion on whether or not glucose was necessary for the change.* Although a majority of candidates were able to speculate the idea of leaving out the glucose, but using any other solution such as protein solution, water or sucrose solution, they lost a mark for stating how they would arrive at a conclusion.
- (b) (i) In this question, candidates were provided with experimental data for an investigation which was similar to the one performed in (a). It was noted that graphic skills were poorer on this paper as few candidates managed to score all the marks allocated to the question with a majority scoring three marks. Candidates were *expected to correctly orient axis, correctly label the axis, present a large and consistent scale, correctly plot all points and neatly join the points.* Many candidates lost a mark by using brackets to separate the quantity and units when labelling axis instead of

the solidus line. Others lost a mark by failing to plot point (0,0) while others failed to choose a suitable scale opting to use the numbers as they appear in the data table. Most of those who copied the values from the table copied directly with 75 coming being followed by 54. Joining the points was a challenge particularly for those who had a wrong orientation of the axis. A few candidates plotted the points and left them without joining leading to loss of marks. Extending lines after the last point led to loss of marks. There were rare cases where candidates drew either bar charts or histograms and consequently lost marks.

- (ii) Candidates did fairly well in this question in which they were expected to use their graph to estimate the rate of bubble production at 40 °C. A lot of candidates were able to extrapolate this value with ease. The question required that the working be shown hence a mark was lost if there was no evidence of how the value was derived from the graph. If the graph was correctly plotted and points drawn from point to point, *the correct value was 60 bubbles per minute.*
- (iii) This question required candidates to describe the trend shown by the graph they had drawn alongside the data in the table. Most candidates sailed well with the question. *The expected responses were to the effect that the rate of bubble production increased with increase in temperature from 0 to 45 °C, then a decline in the rate of bubble production beyond 45 °C.* A mark was awarded for learners who qualified their responses using from the graph e.g. slow increase in the rate of bubble production between 0 °C and 15 °C, fast increase in the rate between 15 °C and 45 °C. It was also expected that candidates would realise that the highest rate was at 45 °C, which therefore could be the optimum temperature. Common errors were for candidates to incorrectly refer to enzymes and enzyme activity without refereeing to the rate of bubble production as per the dictates of the question.
- (d) This was another fairly done question. It required candidates to state the independent variable in the investigation. Quite a number of candidates correctly referred to *temperature*. It was common, however, for candidates to write a description such as optimum temperature.

EGCSE BIOLOGY

Paper 6884/04

Alternative to Practical Test

General Comments

The Alternative to Practical paper assesses mainly experimental skills and candidates are expected to demonstrate that they have practical experience in their responses.

The level of difficulty of the paper was almost comparable to that of the previous paper and it produced a range of marks. A significant number of candidates however found the paper challenging. Some candidates displayed challenges with the use of language and understanding of command words such as describe and explain. Candidates should be advised to carefully read the given procedure in a practical investigation before attempting to answer the questions. It was worth noting that a majority of candidates were lacking practical experience and as a result they were not familiar with some of the practical procedures they were asked about in this paper.

Questions 1(b), (c), 2 (a) (i) and (vi) proved to be challenging whilst **Questions 1 (d), 2(b) (i) and (iii)** proved to be easy for most candidates. Candidates should be encouraged to match their responses with the number of marks available for each part of a question.

Comments on individual questions**Question 1**

- (a)** This question proved to be challenging for a number of candidates. Candidates were expected to explain the differences in the time taken for colour change in the different boiling tubes. The most common mistake was to take the data as it is from the table and writing it in words e.g. boiling tube **A** took 38 seconds whilst boiling tube **B** took 28 seconds instead of giving an explanation. Some candidates confused “boiling tubes” with boiling. Another common misconception was to associate small pieces of apples with small surface area likewise, big pieces of apples with big surface area. Candidates were also expected to appreciate that *the change in colour occurred at different rates with the crushed pieces changing the fastest while the whole piece took more time to change*. Candidates had to explain that *the one that took less time to change was because of an increased surface area for diffusion to occur*. Credit was also given to candidates that acknowledged that *the change in the different boiling tubes indicated the presence of reducing sugars in the apples*.

- (b) Very few candidates scored a mark in this question as they were unable to suggest a suitable aim of the investigation. Reading carefully, the whole procedure given about the investigation could have benefitted the candidates in answering this question. A common mistake was to suggest that the aim of the investigation was to find out the presence of reducing sugars in apples.

Expected response: *the aim of the investigation was to investigate the effect of surface area on the rate of diffusion*

- (c) This proved to be one of the demanding questions. Very few candidates were able to recall that Benedict's solution will only react when heated. Some of the mistakes came from the fact that some candidates confused "boiling tubes" for boiling. The candidates' understanding was that the contents of the boiling tubes were already boiling even before they could be placed in a hot water-bath, which was incorrect.

Expected response: *Benedict's solution reacts when heated*

- (d) This question was accessible to most candidates as they were able to identify variables that were controlled in the investigation. Candidates were expected to identify **two** variables from the given procedure not to suggest their own.

Expected response: *same volume of water/Benedict's solution*
same size of apple
time for sample in water/ heating in water bath

- (e) Very few candidates were able state the advantage of heating the sample in a water-bath. Most candidates focused on the heating rather than the " heating in a water-bath".

Expected response: *to avoid spillage*
even distribution of heat
gently heating
allow the samples to be heated at the same temperature

- (f) Most candidates were able to describe how they will test the apple for vitamin C. However, some candidates lost marks by failing to write the abbreviation, DCPIP in full. Candidates who also wrote that the blue colour will be decolourised in the presence of vitamin C were also awarded a mark.

Expected response: *add drops of DCPIP into solution from test-tube;*
blue colour decolourised by presence of vitamin C;

- (g) (i) Very few candidates were able to score all the points in this question. Candidates lost marks by shading their drawing which is not allowed. Candidates are to be reminded that the drawings should be large, realistic, have a clear outline and should not be shaded. Labelling the remains of the style and the ovary proved very challenging for many candidates. The fruit stalk was incorrectly labelled as the remains of the style whilst the flesh was incorrectly labelled as the ovary. The ovary of an apple is the small non fleshy core of the apple where the seeds are found. The remains of the style should have been labelled on the base of the fruit.

Expected response: *large + neat diagram covering at least half the space provided*
two seeds shown + fruit stalk
correct position for the ovary labelled R
correct position of the remains of the style as S

- (ii) Very few candidates were able to correctly state the features of an apple that shows that its seeds are dispersed by animals.

Expected response: *fleshy, seeds indigestible*

Question 2

- (a) (i) Many candidates found this question challenging. Marks were lost by failing to show the working and by not leaving their answer to two decimal places.

Expected working: $33/60 = 0.55$ bubbles per second

- (ii) Although some candidates were able to come up with acceptable responses, it was worth noting that a significant number of candidates found the concept of acclimatisation challenging.

Accepted responses: *those to the effect of giving enough time for the yeast to respire*

- (iii) A fairly well done question by a significant number of candidates. A majority of candidates were able to describe that the colour change and source of carbon dioxide. Candidates that were fully credited were those who further explained that the carbon dioxide came from the process of anaerobic respiration.

Expected response: *changes from colourless to milky*
caused by the presence carbon dioxide
produced during anaerobic respiration of yeast

(iv) Most candidates were able to state that the number of bubbles will be fewer or no bubbles will show up when the set-up is left for 24 hours. Candidates were then expected to *explain that the bubbles will be fewer because most of the glucose would have been used up or finished.*

(v) This question was fairly done. Most candidates were able to suggest a change to the method that would increase the rate of the reaction.

Expected response: *increase concentration of reactants.*

(vi) This question proved to be demanding for most candidates. Candidates were expected to modify the already given investigation. It was evident that most candidates did not read the question thoroughly and hence opted to write about the test for glucose in their responses which was not acceptable. Candidates should be reminded that when designing or modifying an investigation they should do the following:

- Identify the independent variable and explain how this variable will be manipulated, in this question it will be: *have two setups, one with glucose and the other without;*
- Identify the dependent variable and describe how it will be measured in this case it will include: *counting the number of bubbles released per second or observing if there is any colour change in the limewater.*
- Candidates should also identify the factors which need to be kept constant, in this question it could be: *keep the set-ups at the same temperature/ same volume of reactants/ keep them for the same duration.*
- Candidates also need to be able to write how they will conclude their investigation e.g. *if limewater changes milky it means glucose is necessary.* Candidates are to be reminded on how to phrase a conclusion in an experimental design? Most candidates tend to write the results they expect as their conclusion instead of writing about what the outcome will mean.
- Reference to repeating the investigation was also awarded.

(b) (i) Candidates were asked to plot a graph using the information given in the table. Most candidates were able to produce excellent graphs which gained full marks. Generally, the axes were correctly oriented and labelled with units. The labels and units for the axes should be taken directly from the headings on the table of results. There were some candidates who lost some marks by failing to produce an even scale and drawing bar graphs instead of a line graph. Some candidates also lost a mark by writing the units in brackets instead of using the solidus as used in the table.

Expected graph: *axis correctly oriented*
axis correctly labelled with units
scale even starting with a zero + occupying at least half the space
all points correctly plotted
all points neatly joined

- (ii) Most candidates were able to extrapolate the rate of bubble production at 40°C correctly although some lost a mark by failing to read their scales appropriately. Candidates are to be reminded that they need to show on the graph how they arrived to their answer.
- (iii) This question was fairly done by most candidates. A significant number of candidates lost a mark by wrong interpretation of the graph at 45 °C, instead of stating that it is the optimum temperature, a significant number wrote that the number of bubbles declines. Some candidates also lost some marks by not qualifying “high temperature” e.g. at high temperature the number of bubbles decreases.

Expected response: *an increase in temperature increases the number bubbles released between 0 °C and 45 °C, there was a slow increase between 0°C and 15 °C whilst there was a fast increase between 15 °C and 45 °C. 45 °C is the optimum temperature and beyond 45 °C the number of bubbles produced drops*

- (c) Candidates responses to this question were incorrect. Candidates are to be reminded that an independent variable is the variable you manipulate/ what you will change whilst the dependent variable is what you will measure.

Expected responses: *dependent variable: rate of bubble production*
independent variable: temperature