



# **EXAMINATIONS COUNCIL OF ESOWATINI**

Eswatini General Certificate of Secondary Education

**Biology (6884)**  
**Examination Report for 2023**

**Table of Contents**

| <b><u>Subject Code:</u></b> | <b><u>Name of Component:</u></b> |    |       | <b><u>Page No:</u></b> |
|-----------------------------|----------------------------------|----|-------|------------------------|
| 6884                        | Biology                          | P1 | ..... | 3-10                   |
| 6884                        | Biology                          | P2 | ..... | 11-20                  |
| 6884                        | Biology                          | P3 | ..... | 21-27                  |
| 6884                        | Biology                          | P4 | ..... | 28-31                  |

**EGCSE BIOLOGY****Paper 6884/01****Short Answers****General Comments**

This is a short answer question paper testing knowledge and understanding of biology concepts, with some requiring handling of given information to draw necessary inferences. It is marked out of 40.

The 2023 paper was well balanced as questions came from all sections of the syllabus. The style of setting and the level of difficulty were the same as that in the previous year. However, the performance in 2023 seemed to be better than that of the previous year. There was also a decrease in the number of candidates who left blank spaces.

Even though the performance in 2023 was better than in the previous year, most candidates were still failing to bring out the desired responses, thus scoring lower marks than what was expected. Various factors like incorrect spellings, insufficient use of biology concepts, language barrier and failure to read and understand the question made the candidates fail to perform to their full potential.

**Comments on specific questions****Question 1**

The question was well answered, and a vast majority of candidates were able to match the mitochondria and ribosomes to their functions as required by the question. Some candidates were matching mitochondria with site for photosynthesis instead of site for respiration and this was a common error.

**Expected response:** *mitochondria* → *site for respiration.*

*ribosome* → *site for protein synthesis.*

**Question 2**

The question was well answered by most candidates. Candidates were required to state the class to which arthropod **A** and **B** belong. Common errors included incorrect spelling of crustacean and myriapods and stating the actual names of the given organisms instead of classes e.g. crab and millipede. Spelling does not have to be perfect, but it does have to be unambiguous.

**Expected response:** *A – crustacean.*

*B – myriapod.*

**Question 3**

- (a) The question was fairly answered by most candidates and some wrote incorrect spelling of hepatic e.g. hypotic, hypertic, and this was not awarded credit. The question required candidates to name the blood vessel that transports amino acids from the ileum to the liver. Some candidates lost the mark for writing hepatic vein instead of hepatic portal vein.

**Expected response:** *hepatic portal vein.*

- (b) This question proved to be challenging to most candidates. The candidates were expected to describe what happens to excess amino acids in the liver. Most candidates were able to state the process as deamination but could not describe it. Most candidates had a misconception that the whole amino acid instead of the amino group, is converted to urea. The common incorrect response which was not award credit was “amino acids are deaminated into urea.”

**Expected response:** *deaminated.*

*amino acid/amino group removed from amino acid.*

*amino acid converted to urea and excreted.*

*carboxyl group/remaining part converted to glycogen and stored.*

**Question 4**

- (a) A few candidates were able to interpret the figure correctly. Most candidates appeared to have not understood the question and partial understanding of tropism. Light was excluded as the plant was put in a dark cupboard meaning the shoot was not responding to light. The few candidates that observed that the response was due to gravity did not state that the shoot responded by bending away from gravity and gravitropism alone did not earn credit.

**Expected response:** *negative gravitropism.*

- (b) This question proved to be challenging to most candidates. Candidates were asked to describe how auxins caused the response illustrated in **4(a)**. Most candidates thought the bending of the shoot was due to light, and their description was with reference to phototropism which was wrong. Common incorrect responses included “auxins move to the darker side”, “more growth on the darker side” and “shoot bend towards light” and these were not awarded credit.

**Expected response:** *more auxins collect on lower side of stem.*

*more growth on the lower side of stem.*

*causes upward curvature.*

**Question 5**

- (a) This question was fairly answered. Candidates were expected to label the effector as **F**. Common wrong responses included label lines pointing towards an incorrect label e.g. to pin, to thumb and to the nerves in the muscle.

**Expected response:** labelling line with letter **F** to the muscle.

- (b) The question was well answered, and most candidates were able to correctly arrange the letters **C**, **D** and **E** shown in Fig.5.1.

**Expected order:** **E** → **D** → **C**

**Question 6**

This question was fairly answered by most candidates. Candidates were expected to put a tick for a correct description and a cross for an incorrect description, however some candidates did not read to understand the stem of the question. Most candidates put the ticks for correct descriptions and left empty/blank boxes to indicate wrong descriptions, and this was not awarded a credit. A minority put both a tick and a cross in the same box which was also not awarded credit.

**Expected responses:**

| <b>changes</b>                             | <b>✓ or x?</b> |
|--------------------------------------------|----------------|
| <i>light rays more refracted</i>           | x              |
| <i>ciliary muscles relax</i>               | ✓              |
| <i>lens become thicker and more convex</i> | x              |
| <i>suspensory ligament taut</i>            | ✓              |

**Question 7**

The question was challenging to many candidates, and most were confusing it with asexual reproduction. Most candidates were describing the disadvantages of asexual reproduction instead of disadvantages of self-pollination as required by the question.

**Expected response:** *harmful characteristics of parents may be passed on to/inherited by offspring.*  
*less variation in offspring.*  
*chances of adapting to changing environmental conditions reduced.*

**Question 8**

This question proved to be the most challenging to candidates. The candidates were required to describe some of the changes in the menstrual cycle as illustrated in Fig.8.1 and a majority were not able to interpret the diagram. Most candidates appeared to lack understanding of the menstrual cycle.

- (a) Candidates were expected to describe changes in the follicle and the thickness of the uterine lining between days 2 and 10 as shown in Fig.8.1. Most candidates were able to see that the uterine lining thickens. Some candidates wrote whatever they learnt about the menstrual cycle and all was irrelevant to the question. A minority was describing changes in ovum growth instead of describing changes in follicle growth. Some candidates stated that the changes are due to the presence of hormones like oestrogen and/ or FSH without describing the change itself. Common wrong responses included “ovum grows bigger” and “ovum / follicle thickens”.

**Expected response:** *follicle increases in size.*  
*the lining of the uterus thickens.*

- (b) Candidates were expected to explain why fertilization is unlikely to occur if sexual intercourse occurs on day 26 of the cycle as shown in Fig.8.1. Most candidates seemed to have not understood the diagram, hence their responses were related to menstruation yet on day 26 the diagram did not show any disintegration of walls. The most common misconceptions were that the ovum dies on the day of menstruation, fertilization was unlikely because the follicle / ovum was not matured or because of the occurrence of menstruation.

**Expected response:** *ref. to life span of ovum being 3 days after ovulation / no ovum.*  
*no fusion between sperm and ovum.*

**Question 9**

- (a) The question proved to be challenging to most candidates and many candidates were not able to explain why sickle cell anaemia is given its name. Most candidates could not link the name of the condition to the shape of red blood cells, instead they gave vague responses, for instance, body cells in general assume a sickle shape. Common wrong responses included “red blood cells have sickle cell shape, “anaemic cells are sickle shaped and these were not awarded credit.

**Expected response:** *some red blood cells become sickle shaped.*

- (b) The question proved to be difficult as most candidates had the misconception that sickle shaped red blood cells cannot transport oxygen at all. The question required candidates to suggest why a person with sickle cell anaemia may lack energy. Some candidates were not referring to deformed shape of red blood cells as having reduced oxygen carrying capacity, instead they referred to haemoglobin not being sufficient in the blood thus less oxygen to be used in respiration. A minority was not able to associate lack of energy to reduced oxygen supply and they just gave vague responses such as lack of food / nutrients / iron.

**Expected response:** *reduced oxygen capacity.*

### Question 10

- (a) Candidates were required to name **one** factor that may promote the growth of cancer cells. Most candidates were able to identify smoking and radiation as factors which cause cancer. A common error was incorrect spelling e.g. smocking instead of smoking.

**Expected response:** *carcinogens / smoking / processed foods pollutants / pesticides  
genetic factors  
radiations / X-rays / gamma.*

- (b) The question was well answered by a majority of candidates and a vast majority of candidates were able to state **one** way in which cancer is treated. Some candidates were confusing ways of treating cancer and how to prevent cancer, hence responses including quit smoking and vaccination were common wrong responses. Some of the candidates appeared to lack scientific terminology e.g. burn / kill the cells when referring to chemotherapy, remove cells when referring to surgery, were common wrong responses. Some candidates were wrong spellings e.g. sugary/ segary for surgery.

**Expected response:** *surgery / removal by scalpel or laser.  
chemotherapy / chemical compounds kill the cancer cells.  
radiotherapy / radiations from machines, injections kill cancer cells.*

### Question 11

The question proved to be challenging to most candidates. Candidates were expected to complete the genetic diagram to show the inheritance of coat colour in mice. Many candidates correctly identified F1 phenotype and a minority could not interpret Bb and a few candidates were writing carrier black for the heterozygous genotype which was not awarded credit. The common error was the writing of parental genotypes as gametes e.g. circling each allele or leaving large spaces between the alleles making it gamete notation.

**Expected response:** parental genotype: both Bb.  
offspring phenotype: black, black, black, white.

### Question 12

There were uncertainties in the candidates' responses. Most candidates were able to state the type of variation shown by human blood groups. Some candidates were not able to state a valid reason.

**Expected response:** type of variation – discontinuous.  
reason: discrete groups / categories / no intermediates.  
not affected by the environment / controlled only by genotype.

### Question 13

(a) Candidates were provided with Figure 13.1 which was showing a food web with organisms at different trophic levels. Candidates were required to name the organism that is a tertiary consumer in the diagram. A vast majority of candidates identified the organism as the wild dog and no credit was awarded.

**Expected response:** owl.

(b) The question proved to be challenges to most candidates and many were not able to state the advantage of short food chains in terms of energy efficiency. A large number of candidates were stating that the owl will get more energy in grains, and failed to state that it was because of the shorter food chain between grains and the owl than between grains, grasshoppers and the owl. A majority stated the advantage of the quantity of carbohydrates the owl gets when it eats the grains. A common misconception was that owls find it better to feed on grains than grasshoppers because:

- grains have carbohydrates thus supply more energy to owls
- grains are easy to obtain and difficult to get grasshoppers as they can run away thus owls will lose energy running after them and end up with less energy
- owls are nocturnal, so owls cannot find grasshoppers at night

**Expected response:** short food chain  
more energy available / more energy lost between grains and grasshopper,  
bird and the owl.

(c) The question proved to be challenging to many candidates and quite a number of candidates seemed to be unfamiliar with the concept of biodiversity. There were varied responses listed whatever they learnt about human influences on the environment. They failed to describe the importance of diversity in life in general, hence they gave vague responses such as living organisms



depend on each other, tourist attraction, boosting economy and prevention of extinction. Other common responses were based on the importance of conservation.

**Expected response:** *medicinal purposes;  
ecological roles or explained.*

#### Question 14

- (a) This question proved to be challenging to most candidates. Many candidates seemed to be lacking knowledge of the instrument used in investigating transpiration. There were varied responses including barometer, thermometer, respirometer, hygrometer, triple beam balance etc. Common wrong spellings included photometer, protometer, potrometer and partometer.

**Expected response:** *potometer.*

- (b) A vast majority of candidates were able to describe the effect of temperature on the rate of transpiration. Candidates were expected to state how transpiration rate is affected by temperature. However, some candidates were not able to state that an increase in temperature results in a greater distance moved by the meniscus without showing relationship with transpiration. A minority seemed to have a misconception that it is the transpiration rate that has an effect on temperature.

**Expected response:** *increase in temperature increases the rate of transpiration.*

#### Question 15

Candidates were asked to describe the use of yeast in bread making. A few candidates were able to clearly explain the reaction involved in bread making. Some candidates could not correctly state that yeast as a living organism ferments sugar to produce carbon dioxide and ethanol. Most candidates thought that both ethanol and carbon dioxide make the dough to rise and this was not awarded credit. Common incorrect responses included yeast contains bacteria or contains carbon dioxide / produces lactic acid / ferments the dough / causes the dough to rise / be a raising agent, ethanol makes the dough to rise / is an enzyme that catalyzes the reaction that releases carbon dioxide.

**Expected response:** *yeast ferments sugar / respire anaerobically  
to produce carbon dioxide and ethanol  
carbon dioxide makes the dough to rise / gives the bread a light texture.*

### Question 16

Most candidates were able to state two ways in which high blood pressure can be prevented. Common correct responses included exercise, avoid salty and fatty foods. Some candidates were giving responses like “avoid sugary foods”, stop overthinking”, and “stay calm” and they did not earn credit.

**Expected response:** *less / no fats*  
*less / no salt*  
*exercise*  
*avoid smoking*  
*reduce stress.*

**EGCSE BIOLOGY****Paper 6884/02****Structured Questions****General Comments**

There were 14979 candidates who sat for this component in 2023 compared to 12300 candidates in 2022. The general performance for 2023 was observed to be low compared to the previous year.

Some candidates still were not able to apply the subject knowledge in the context; they could not interpret numerical data. For example, in Question **6(a)** where the candidates were required to explain how the information that was presented in the table proved that region **L** was a collecting duct. Most candidates explained that glucose or urea was not collected. They also failed to state that glucose was absent in **L** because it was all reabsorbed or urea was more concentrated because it was not reabsorbed. Some candidates directly transferred the figures from the table without explaining why region **L** was different from **M** and **N**'s concentrations.

Question **2(a)(ii)** required that candidates applied their knowledge of alcohol being able to dissolve fat layer shown in the structure of the virus. They were expected to remember that proteins denature in extreme values of pH, so alkaline pH of soap would denature the protein coat. Instead, they explained using their knowledge of enzymes in washing powders.

Grammar continued to be a challenge just as in previous years. When required to compare, they failed to use the correct comparative terms e.g. in Question **5(a)(ii)**, they were supposed to explain the immediate effect of exercise on the rate and depth of breathing. The expected words to use were "more oxygen for more respiration to release more energy. A majority used words like "enough, sufficient" oxygen which resulted to a loss of marks. Spelling was still a challenge as some candidates lost marks due to spelling mistakes e.g. construct and contract.

Time allocated for the paper seemed adequate as there were few candidates that left questions unanswered.

Questions that proved to be easy to most candidates were **1**, **2(a)(i)**, **3(a)(i)(ii)**, and **4(a)(ii)** and questions that proved to be challenging were **2(a)(ii)**, **6(a)**, **6(c)(ii)**, **7(a)**, **7(b)**, **7(c)**, **8(a)(i)**, **8(a)(ii)**.

## Comments on Individual Questions

### Question 1

This question was generally well answered.

- (a) This question was well answered by most candidates and candidates were able to identify the *guard cell*. A few candidates wrote stomata, or cell guard and this was not awarded credit.
- (b) The question proved challenging to most candidates. Most candidates were able to identify chloroplasts but did not mention that there should be many chloroplasts for more photosynthesis and this was awarded a credit. Some candidates mentioned only one adaptation instead of two.

**Expected response:** *numerous chloroplasts for more photosynthesis.*  
*palisade layer near the upper epidermis for maximum light absorption.*  
*palisade cells are closely packed to increase surface area for photosynthesis.*

- (c) There were some uncertainties in the responses of candidates. Most candidates were able to correctly describe osmosis. Some wrong responses included that water is absorbed by transpiration pull and transported by osmosis in the xylem vessel.

**Expected response:** *water absorbed by root hair cells from a region of higher water potential in the soil*  
*to a region of lower water potential in root hair cells.*  
*transpiration pull causes water to be transported by the xylem vessel.*  
*water molecules move by cohesive/adhesive/suction/ capillarity forces*  
*which pull up the water in the xylem vessels in a transpiration pull.*

- (d) (i) This question was well answered by most candidates. Candidates were expected to state the limiting factors at **C** and **D** in the graph. A few candidates had incorrect responses including temperature and humidity.

**Expected response:** **C** - carbon dioxide  
**E** - light

- (ii) This question was well answered. Most candidates were able to suggest and explain the relationship between the time of the day and the rate of photosynthesis. Some candidates answered with respect to the sun instead of light intensity and they lost the marks.

**Expected response:** *between B and C - as light intensity increases, so does the rate of photosynthesis*  
*at E - there is no or less light so no or less photosynthesis*

## Question 2

This question was challenging to most candidates

- (a) (i) Most candidates were able to identify the part labelled F in the structure of the virus as *RNA / DNA strand*. Common wrong responses include: chromosomes, flagella, nucleus, genetic material.
- (ii) This question proved to be challenging to most candidates. Candidates were required to explain why washing hands with soap or using alcohol sanitisers is effective in preventing the spread of the virus infection. Stronger responses referred to the structure of the virus. Some candidates were referring action of enzymes in soap being responsible for destroying the virus and this did not earn credit. A common misconception was that alcohol is acidic and the acid destroys the virus.

**Expected response:** *fat layer dissolved by alcohol in sanitizer.*  
*the particle structure of the virus was destroyed.*  
*the soap had a high pH which denatures the protein coat.*

- (iii) Most candidates were able to state **two** structural differences between the virus in the diagram and a bacterial cell.

**Expected response:** *presence of cell wall in bacterial cell.*  
*presence of flagellum in bacteria.*  
*DNA only in bacterium.*

- (b) This question was challenging to a vast majority of candidates. Candidates were expected to describe how vaccine can provide active immunity against a disease-causing virus. Most candidates mentioned vaccination without describing what is contained in the vaccine and how it is introduced into the body. A common response was 'the vaccine produces antibodies / antibiotics / antigens, which was incorrect. Some candidates stated that antibodies are stored as memory cells instead of lymphocytes stored as memory cells which did not earn a mark.

**Expected response:** *a harmless form of pathogen is injected or swallowed as a vaccine. lymphocytes then produce antibodies. antibodies destroy invading pathogens. some of the lymphocytes remain as antibodies in lymph nodes to detect future infections by virus / antigen which offers long term immunity.*

### Question 3

This question was fairly answered, and candidates seemed to have a conceptual understanding of mechanical and chemical digestion.

- (a) (i) There were a lot of uncertainties in the candidates' responses. Candidates were expected to describe and explain the process of starch digestion in the mouth. Some candidates were confusing mechanical digestion and chemical digestion. For example, they defined mechanical digestion stating that large insoluble food pieces are broken down to soluble one, which is a description of chemical digestion. Some candidates wrote the responses for both mechanical and chemical digestion in the answer space for mechanical digestion, hence did not score any mark for chemical digestion. These candidates ended up describing digestion in the stomach or duodenum in the answer space for chemical digestion.

**Expected response:** ***mechanical** - food is chewed by teeth to increase the surface area  
**chemical** - enzyme amylase digests starch to maltose*

- (ii) The question was well answered by most candidates. Candidates were asked to describe how the digested starch from the mouth moves along the oesophagus. Common errors included candidates confusing radial muscles and longitudinal muscles and not mentioning that circular and longitudinal muscles work antagonistically.

**Expected response:** *peristalsis which is due to antagonistic/alternate contraction of the circular and longitudinal muscles.*

- (b) Almost half the candidates were able to explain how enzymes in biological washing powders help to remove blood stains. Some candidates gave a definition of an enzyme and this was not awarded credit. Some candidates appeared to lack knowledge that blood stains contain proteins.

**Expected response:** *protease / lipase digests proteins / fats into amino acids / fatty acids and glycerol into soluble products.*

## Question 4

This question was challenging to most candidates.

- (a) (i) The question required candidates to describe how cells in the tissue fluid get glucose from blood in the capillaries. Most candidates seemed to lack understanding of the process by which substances move out of blood capillaries. Some candidates even mentioned that glucose is moved by osmosis.

**Expected response:** *glucose in plasma passes into tissue fluid.  
from tissue fluid it the passes into cells by diffusion/active transport  
along a concentration gradient.*

- (ii) Most candidates were not able to describe the structural difference between blood vessels **G** and **H**. Most candidates seemed to be confused by the arrows which showed the direction of blood flow. Some of the responses were vague, for example, in **G** blood was going down while in **H** it was going up. Some candidates could not understand that **G** was an artery while **H** was a vein.

**Expected response:** *H has a wider / larger lumen or reverse argument (ORA).  
H has thinner walls / less muscular/ ref. less elastic layer / (ORA).  
H has valves / G has no valves.*

- (b) A vast majority of candidates were not able to fully describe the role of the lymphatic system in the body. Common incorrect responses included lymphatic system function in digestion, secretion of phagocytes.

**Expected response:** *transport tissue fluid.  
produce lymphocytes / antibodies.  
absorption of fatty acids and glycerol.*

- (c) Candidates were required to explain how blood clots formed in the coronary arteries can affect the heart muscle. Most candidates explained the role of platelets in blood clotting and this did not earn credit. Some candidates gave responses about blockage of blood through the structure of the heart instead of blockage of blood in the heart muscles.

**Expected response:** *clots block vessels / arteries / arterioles.  
less blood flows to heart muscles.  
less oxygen/ glucose reaches heart muscles.  
muscle cells cannot respire.  
can cause coronary heart disease/ heart attack.*

## Question 5

The question was challenging to most candidates.

- (a) (i) This question seems to be challenging to most candidates. Most candidates were comparing the rate of breathing against the depth of breathing yet the question required candidates to compare exercise against both the rate of breathing and the depth of breathing. Some lost marks for describing either the rate or depth of breathing instead of both.

**Expected response:** *both increase.*

- (ii) This question was fairly answered by most candidates. Candidates were required to explain the effect of exercise on the rate and depth of breathing. Weak responses did not use the word “more or increase” in reference to oxygen and respiration and no credit was awarded.

**Expected response:** *more oxygen needed by muscles.  
for more energy/ respiration.  
ref. to removal of carbon dioxide.*

- (b) There was some uncertainty in some responses and many candidates seemed to lack understanding of what the question required. Candidates were expected to explain why the rate of breathing does not return to 30 breaths per minute immediately after exercise. Breathing does not return to 30 breaths per minute immediately after exercise. Most common error was the use of incorrect terms including remove/get rid of lactic acid instead of breakdown or oxidized lactic acid and this resulted to a loss of marks.

**Expected response:** *anaerobic respiration took place during the exercise  
creating an oxygen debt.  
more oxygen was supplied to muscles to pay the oxygen debt.  
and oxidize lactic acid.*

- (c) (i) Most candidates were able to correctly outline the route taken by air containing oxygen from the mouth to an alveolus. Some candidates were confusing the trachea and oesophagus.

**Expected response:** *trachea to bronchi to bronchioles.*

- (ii) The question proved to be challenging to most candidates. Some candidates lost marks for writing construct (K construct) instead of contract, others were labelling K and J instead of answering the question. Candidates were expected to state what happens to muscle **K** and pressure at **J** to cause air to be inhaled.

**Expected response:** *K - contracts / flattens  
pressure at J decreases*



**Question 6**

The question proved to be challenging to most candidates.

- (a) Candidates were asked to explain how the information provided in the table confirms that region L is the collecting duct. Most candidates were able to interpret the table but failed to give explanations which resulted to loss of marks. For example, they were able to mention that there was no glucose in region L but failed to explain why.

**Expected response:** *no glucose since it was all reabsorbed.*

*less salts as some were reabsorbed.*

*higher concentration of urea as it is not reabsorbed from the collecting duct.*

- (b) (i) The question was well answered. Candidates were required to explain why the concentration of glucose in the dialysis fluid and in the person's blood is the same. A significant number of candidates were able to state that the *blood will not lose glucose through diffusion or to prevent loss of glucose from the patient's blood.*
- (ii) Some candidates were able to explain why the used dialysis fluid is constantly being replaced with fresh dialysis fluid. Common errors were to state that the fluid was constantly changed to maintain a concentration gradient instead of maintaining a steep concentration gradient.

**Expected response:** *to maintain a steep concentration gradient or to prevent urea from diffusing back to the blood.*

- (c) (i) A vast majority of candidates were able to state the *hypothalamus* as the name of the brain that senses changes in temperature.
- (ii) This question proved to be challenging to many candidates and most candidates failed to interpret the graph. They describe vasoconstriction instead of vasodilation. Stronger responses stated that more blood flows to the skin surface for more heat loss, on the contrary weaker responses only stated that blood flows near the skin surface for heat loss. Candidates should be encouraged to use the correct scientific terms to avoid loss of marks. For example, some candidates lost a mark for stating that blood vessels dilate instead of stating that arterioles dilate.

**Expected response:** *vasodilation / arterioles dilate or widen.*

*more blood flows to the skin surface.*

*more heat loss / radiated.*

## Question 7

Most candidates demonstrated a poor knowledge of the topic on inheritance.

- (a) This question proved to be challenging to most candidates. Candidates were expected to describe the structure of DNA. Many candidates appeared to be unfamiliar with DNA the DNA structure.

**Expected response:** *DNA is a double stranded helix.  
made up of a sequence of nucleotides.  
containing a sugar, phosphate and a base.  
bases pair as AT and CG.*

- (b) The question was challenging to a majority of candidates. Most candidates' responses proved that they lacked conceptual understanding of production of human insulin by genetic engineering. Candidates were required to use the figure provided and describe what is happening at stages **R**, **S** and **T**. Some candidates were confusing the plasmid and nucleus. A few candidates who identified the plasmid at stage **R** failed to state that it was cut by an enzyme. Most candidates were stating that stage **S** is where the insulin gene is inserted into the plasmid using ligase enzyme. A few candidates failed to use the term "recombinant plasmid or recombinant DNA." At stage **T**, most candidates identified this stage as cell division, not mentioning that the cell was reproducing. The most common error was the cell was producing instead of cell reproducing.

**Expected response:** *Stage R - cutting of the plasmid by restriction endonuclease enzyme.  
Stage S - recombinant DNA/plasmid returned to bacterial cell.  
Stage T - bacteria placed in a fermenter tank to reproduce by mitosis.*

- (ii) This question was generally well answered and most candidates mentioned that bacteria reproduce rapidly. The most common errors were using the term 'produce' instead of reproduce, 'bacteria are fast' and 'bacteria are cheap'

**Expected response:** *bacteria reproduce fast.  
no nucleus/enucleated/ genetic material exposed and bacteria are easy to  
manipulate.  
there are no allergens.*

- (c) Most candidates were able to describe the selection and mating of cattle with the desired characteristics. However, candidates omitted the point of selecting offspring with desired characteristics. Very few candidates described cloning.

**Expected response:** *cattle with high meat yield / bigger muscles are selected.  
they are then crossbred.  
offspring with desired characteristics are selected.*

### Question 8

This question was fairly answered by some candidates and they showed excellent understanding of pollution.

- (a) (i) Most candidates were able to describe and explain the harmful effect the air pollution can have on plants. The most common error was answering this question in terms of global warming. Some candidates mentioned that the smoke hindered photosynthesis by covering the sun or closing the stomata. They also failed to state that it is the plant leaves that are damaged not the whole plant.

**Expected response:** *stunted growth.  
release of sulfur dioxide or acid rain.  
soil becomes acidic.*

- (ii) Most candidates were not able to recall ways in which pollution from burning sulfur-containing fuels in a power station could be reduced. The common error was to describe the use on non-renewable resources as a way of reducing the pollution.

**Expected response:** *putting catalytic converters / using low sulfur fuels / fitting power plants with scrubbers*

- (b) (i) This question proved to be challenging to some candidates. Only a few candidates realised that nitrogen / nitrates are needed for protein synthesis and they did not mention that in the absence of nitrates, there would be less protein synthesis leading to stunted growth of plants.

**Expected response:** *stunted growth/weak stem/ lower leaves become yellow and die/ leaf chlorosis / upper leaves turn pale green.  
proteins cannot be synthesised.*

- (ii) This question was well done by most candidates. They were able to recognise that the whole process is about eutrophication. However, some candidates discussed water pollution by nitrates stating that nitrates are poisonous, and others mentioned that algae block the oxygen in the water.

**Expected response:** *eutrophication.*

*nitrates are absorbed by algae.*

*algal bloom / rapid growth of algae occurs due to nitrate increase in the water.*

*this leads to blockage of sunlight to aquatic plants below water surfaces leading to no photosynthesis.*

*aquatic plants die and are decomposed by aerobic bacteria leading to oxygen depletion/ deoxygenated water.*

*death of aquatic organisms/suffocation due to lack of oxygen occur.*

**EGCSE BIOLOGY****Paper 6884/03****Practical Test****General Comments**

Biology Paper 3 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, presenting data in different formats and drawing conclusions from an investigation or a given set of data. It assesses candidates' familiarity with basic laboratory equipment and apparatus as well as manipulative skills. This paper tests if candidates have acquired skills on the scientific method of inquiry including but not limited to designing of investigative experiments and the underlying investigative activities such as controlling variables, ensuring validity and reliability of experimental results, creating 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 2023 paper was no different from previous papers in terms of the difficulty level. It comprised of two compulsory questions with a maximum possible score of 40. Most centres reported that they did not encounter problems in providing the required examination materials. The general performance in the paper was much better than the previous two years particularly for those candidates who had practical experiences. There were instances where the candidate's responses indicated lack of exposure to practical activities. The quality of responses for the 2023 candidature showed a marked improvement from the previous year. The highest score was thirty-eight (38) marks as opposed to the highest score of thirty-five which was attained in the year 2022. In both the years 2022 and 2023, the lowest score has been a zero, but there were fewer candidates attaining a zero in 2023. English expressions showed a remarkable improvement compared to the year 2022.

Question 1 proved to be more challenging for candidates compared to Question 2. It was common for candidates to score a zero in Question 1. Questions that proved to be particularly difficult for candidates were **1 (a)**, **1(c) (i)**, **1 (d)** and **2 (c) (iv)**. Questions that proved to be particularly easy and accessible to a majority of the candidates were **1(b) (i)**, **(ii)** and **(iii)**.

## Comments on individual questions

### Question 1

This question was based on leaf structure and function with investigations on photosynthesis. Candidates were provided with two leaves, a monocotyledon and a dicotyledon, which had been destarched and then exposed to light. They were expected to enumerate visible differences between the two leaves, draw the dicotyledon on a given grid and suggest how they could estimate the total surface area of the leaf. They were further required to describe and explain how the leaf was destarched and how the leaf could be tested for the presence of starch. This culminated to them being required to perform the starch test on the dicotyledonous leaf and finally drawing a conclusion on the basis of the results they had obtained.

- (a) (i) Candidates were expected to describe and explain how they could have destarched the leaf. Noteworthy is that this question was challenging particularly because a majority of candidates simply described how they could have tested the leaf for the presence of starch. They incorrectly stated that they would dip the leaf in boiling water, decolourise it in boiling alcohol, soften it by rinsing it in water, place it on a white tile and then adding iodine solution.

**Expected response:** *cover leaves in aluminium foil for a period of 48 to 72 hours to eliminate light and stop photosynthesis. During this process, the leaves would respire and convert the stored starch in the leaves to glucose for use in respiration.*

- (b) This question required candidates to carefully study the two leaves and then describe two visible differences between them by completing a given table. The question was well answered by a majority of candidates. Common errors included comparing incomparable aspects such as broad leaf against parallel veins. Other commonly used but unacceptable terminology was for the veins to be described as vertical, perpendicular, longitudinal, narrow, small and big. Such descriptions led to loss of marks.

**Expected response:** *leaf A was broader and leaf B was narrower.  
leaf A had networking, reticulate or branched veins while leaf B had parallel veins.  
AVP e.g ref. to observed colours of the leaves provided such as dark green and pale green.*

- (c) (i) The question was well answered, and most were able to correctly place leaf A on the grid provided on the Question Paper and draw the outline of the leaf. Candidates lost the mark by drawing in the midrib and the veins as well as those who drew discontinuous and very untidy outlines. It was expected that candidates *drew a clear outline of the leaf they were provided with.*

- (ii) Candidates were required to explain how they could use the outline they had drawn to calculate the surface area of the leaf they had drawn. Most candidates incorrectly referred to using the formula of either a triangle ( $A = 1/2 BH$ ) or that of a rectangle ( $A = LB$ ) leading to loss of marks. Another common error was for candidates to explain how they could calculate the magnification of their drawing (magnification = length of drawing / length of the leaf). A common misconception was the use of a string that would be moved around the leaf or the outline then measuring the length of the string using a ruler. This would give the perimeter and not the surface area.

**Expected response:** to state that they would *count the number of full squares under their drawing, the number of half squares divided by two and then add the subtotals to come up with the surface area of one side. To capture the surface area of both surfaces, they were expected to multiply the sum by two.*

- (d) About half of the candidates were able to follow the instructions and make good observations. This question required candidates to hold the leaf in hot water using a pair of forceps and immediately observe any changes on the surfaces of the leaf after which they had to describe and explain their observations. Common errors included referring to the leaf as being cooked, soft, chlorophyll being removed and the leaf changing colour to white. Most candidates lost the mark for detailed observation, leading to them leaving out that the surfaces did not release the same quantity of bubbles. It was for this reason that many could not go on to provide an explanation for the observed phenomenon. It was also common for candidates to refer to the formation of water droplets instead of air bubbles.

**Expected response:** description - bubbles were formed, either on one surface of the leaf or on both surfaces in which case one surface produced more bubbles than the other.

explanation – ref. to the effect that the air in airspaces was heated, air molecules gained kinetic energy leading to higher pressure in airspaces that caused the air to escape through the stomata which are more concentrated on one surface of the leaf.

- (e) (i) This question was fairly well performed. Candidates were required to use only the materials they were provided with to investigate if leaf **A** photosynthesised while exposed to light. Despite that the leaf had already been submerged in hot water, most candidates wrongly started their responses by stating that the leaf had to be boiled in water which was then followed by *boiling it in alcohol or ethanol*. Some candidates lost a mark for failure to state that the alcohol had to be

boiling as well. Merely putting the leaf in alcohol would not remove the chlorophyll within the available time. It was expected that the *alcohol was to be boiled using a hot water bath*. Many candidates correctly stated that after boiling in alcohol, the leaf had to be rinsed, but they did not specify how and in what solution it had to be rinsed. Most candidates remembered the *use of a white tile on which to place the leaf before adding iodine solution or drops of the same solution*. Some candidates lost a mark for “adding or covering with iodine” without qualifying that it was in solution form. While some candidates lost a mark for using a white plate instead of a white tile, others lost marks by swapping the use of the reagents alcohol and iodine solution where they boiled the leaf in iodine solution, removed it and then covered it with alcohol. Other common errors included boiling the leaf in a mixture of alcohol and iodine, placing the leaf on a Petri-dish or glassware (unqualified) and provided explanations for each step of the test, but that did not earn them any marks.

- (ii) Candidates were required to describe how they would ensure that the test was carried out safely. Most candidates, however missed the question and stated the results of a positive test for starch, that is, blue / black. A few candidates who mentioned goggles sometimes lost the mark due to wrong spelling which could refer to something else such as “wearing google(s)”. Some candidates mentioned the use of forceps as a safety measure was not acceptable since it was an instruction in the question.

**Expected response:** *boil alcohol using a water bath, to avoid a direct flame near alcohol.  
ref. to the use of protective or safety clothing such as goggles,  
laboratory coat or gloves.*

- (iii) Candidates were required to carry out the test for starch on leaf **A** and then state the result and conclusion. The most common error was that candidates were confusing result and conclusion and this were not awarded credit.

**Expected response:** *result - dark blue or black  
conclusion - the leaf photosynthesised when exposed to light.  
ref. to the presence of starch in the leaves.*

## Question 2

This question was generally well answered, than question 1. Candidates were given a photomicrograph of a longitudinal section of a mammalian kidney and were to answer questions based on the photomicrograph.



- (a) (i) Candidates were expected to make a drawing of the picture of the kidney to test their observation and drawing skills. It was expected that *candidates drew a large and neat diagram with a continuous outline showing three distinct layers being the pelvis area, medulla layer and the cortex layer. The medulla had to show bundles.* Some candidates lost marks for drawing: diagrams that were significantly smaller than the prototype as well as for shading the layers, the longitudinal section of a kidney as they know it from their textbooks, and the structure of the human urinary system as they learnt it and completely ignored the photomicrograph.
- (ii) The question proved to be challenging to most candidates and a majority could not correctly identify the parts they were supposed to label. Candidates were tasked with labelling, using label lines, the medulla as **M** and the first part of the ureter as **U**. The most prevalent errors included labelling directly on the drawing without using label lines and using arrows for label lines. While some candidates correctly labelled with the designated letters, others opted for the words only and yet others fully labelled the diagram.
- (b) (i) Most candidates were able to identify line **X-Y** on the photomicrograph and then measure its length. Some candidates lost the mark for presenting the measurement in centimetres instead of millimetres. Others incorrectly presented the reading as 90.1 mm instead of the expected *91 mm*.
- (ii) Most candidates were able to draw a line in their own drawings in the same position as **X-Y** in the photomicrograph. Some candidates lost the mark either drew the line way above, below the medulla protruding from either one or both sides of their drawings.
- (iii) This question was well answered by a vast majority of candidates. They were expected to measure the line they had drawn in their own drawings. Some candidates lost the mark by either presenting their answer in centimetres or incorrect reading on the ruler such as 110.7 mm for 117 mm.
- (iv) This question, which required candidates to use their measurements to calculate the magnification of their drawing, was fairly well done. A majority of candidates knew the formula for calculating magnification. Common errors that were not awarded credit included mixing up the original and the drawing values in the substitution, not showing the calculation at all and presented only the answer, presenting their answers rounded up to two decimal places instead of one decimal place, presenting their answers without the multiplication sign or writing the small letter x in cursive writing, presenting their answers as an equation such as  $X = 1.2$ . A few candidates gave the units for magnification as mm, and this was not awarded a mark.

(c) In this question, candidates were given a diagram of a set up in which identical pieces of liver and lung were placed in boiling tubes with the same volume of water at equal temperatures. The lung was floating on the water and froth was visible around it while the kidney sank and had no froth. All other variables were controlled.

(i) The question proved to be challenging to most candidates. Candidates were asked to describe **one** observable difference between the two boiling tubes, other than the bubbles, and suggest an explanation for the difference. Comparison skills were wanting as candidates would respond about one boiling tube and not the other. A large number of candidates erroneously referred to enzymes being denatured and optimum temperature and this was not awarded a mark. Candidates are encouraged to read questions carefully to avoid loss of marks, for example, candidates lost a mark for bringing back the aspect of bubbles when the question had eliminated them.

**Expected response:** *observation - kidney sinking and the lung floating.*

*explanation - to relate to the air sacs or alveoli in the lungs that made it less dense than water whereas the kidney has no alveoli and therefore denser than the kidney and water.*

(ii) In this question candidates were required to state variables that were controlled during the investigation. Some candidates who knew about controlled variables were able identify them.

**Expected response:** *a list of variables including temperature of the water, volume of the specimen, type of mammal from which the specimen were taken as well as the duration of the experiment.*

(iii) Candidates were expected to state the role of controlling variables in an investigation.

**Expected response:** to ensure validity and reliability of the data or results.

(iv) Many candidates left the question unattempted. Candidates were expected to refer to the bubbles observed in boiling tube **D** and describe a test and the positive result that would investigate if the gas produced was carbon dioxide or oxygen. The most common error was for candidates to state the tests rather than describe them. Most candidates responded with “lime water and glowing splint” for the tests and “milky and relights” respectively for the positive results and all these did not earn marks. Noteworthy was that some candidates confused the test for oxygen with that for hydrogen. Also a majority of candidates used the lime water test for carbon dioxide with none or minimal referring to the use of sodium hydrogen carbonate solution.

**Expected response:** carbon dioxide - test: bubble the gas through lime water  
positive result: limewater turns milky  
oxygen - test: introduce a glowing splint at the mouth of the boiling  
tube positive result: it relights

**EGCSE BIOLOGY****Paper 6884/04****Alternative to Practical Test****General Comments**

The alternative to Practical paper mainly assesses objective C of the syllabus which focuses on experimental and investigative skills. Candidates should have a practical experience in preparation for this paper.

The paper produced a range of marks. The overall performance of the candidates was more or less comparable to that of the previous year. Candidates should be advised to read questions carefully before writing their responses. It is also important for candidates to understand the differences in the requirements for different command words especially *describe* and *explain*.

Most candidates found question **1(b)** where they were expected to describe visible differences between a dicot and a monocot leaf easy. Question **2(b)** on measurement and magnification was also well attempted by a significant number of candidates with the exception of a few who did not present their answer to one decimal place as per the question. Some of the questions that proved challenging included question **1(c)** where candidates were expected to suggest how they will use a grid to estimate the surface area of a leaf. Question **1(d)(ii)** also was also less popular to a majority of candidates. In question **1(e)** most candidates lost marks as they confused destarching a leaf and testing a leaf for starch.

**Comments on specific comments****Question 1**

- (a)** The question proved to be challenging for most candidates and a majority were confusing destarching a leaf and the procedure for testing a leaf for starch. Candidates were expected to describe and explain how they can destarch a leaf. The explanation for destarching also proved to be challenging for most candidates.

**Expected response:** *place the leaf in darkness for a period of about 48 hours.*

*no photosynthesis during this period and the starch present will be broken down or used up in respiration.*

- (b)** Candidates were expected to complete a table to describe **two** visible differences between two leaves, a dicot and a monocot leaf. Most candidates were able to describe the differences, although some still were having a challenge with comparisons. For instance, they would compare two features at a time when describing a difference between the two leaves and this did not earn credit.

**Expected response:** *leaf A is broad whilst leaf B is narrow.*  
*leaf A has a network of veins whilst leaf B has parallel veins.*

- (c) This question proved to be challenging to most candidates. Candidates were expected to suggest how they could use a grid to calculate the surface area of a leaf. It was common for candidates to confuse surface area with area. Some candidates opted to plot on the grid instead of describing how the grid would be used to calculate the surface area. Some of the responses that were credited were those that made reference to *drawing an outline of the leaf on the grid, counting the number of full squares within the grid and also means of counting incomplete squares within the outline of the leaf*. Candidates were also expected to *multiply the number of squares within the outline by 2* to get the whole surface area of the leaf.
- (d) (i) This question tested candidates familiarity with laboratory equipment. A number of candidates opted for materials that are not necessarily suitable for immersing a leaf safely in very hot water such as spatula. Candidates were expected to choose from equipment such as a *pair forceps, tweezers* etc.
- (ii) This question proved to be one of the most challenging questions to most candidates. Very few candidates were able to obtain maximum marks in this question. Most candidates failed to relate the bubbles appearing on the surface of the leaf to the effect of hot water which resulted in expansion of the gases within the leaf. A common error was to make reference to photosynthesis, denaturing of enzymes and starch leaving the leaf. Candidates were expected to acknowledge that the bubbles were coming out due to the fact that the *air inside the leaf expanded as a result of the hot water and therefore moved out through the stomata. The bubbles were mainly seen on only one side of the leaf because the stomata are more or mainly distributed on the lower side of the leaf*.
- (e) (i) Candidates were expected to describe how they will test a leaf for starch. A significant number of candidates lost marks by describing the process of destarching. Some candidates lost marks by giving incomplete procedure such as “boil the leaf” without stating whether it should be boiled in water or ethanol. Candidates should be reminded that the reagent that is used to test for starch is *iodine solution* not just iodine.

**Expected response:** *dip the leaf in boiling water.*  
*boiling the leaf in ethanol/alcohol.*  
*dipping the leaf in water or rinsing the leaf.*  
*placing the leaf on a white tile and adding drops of iodine solution.*

- (ii) Most candidates were able to correctly state one safety precautions. Some of the expected responses included *ensuring that there is no naked flame near ethanol / using a hot water bath for heating or using safety clothing such as goggles / gloves.*
- (iii) A significant number of candidates were able to explain how they will know whether a leaf has photosynthesised or not. A common error was to omit that if photosynthesis has occurred, there will be starch.

**Expected response:** *if photosynthesis had occurred starch would be present and iodine solution would turn blue-black.*

OR

*if no photosynthesis had occurred no starch would be present iodine. solution would remain brown/yellow.*

## Question 2

- (a) (i) Candidates were expected to make a drawing of the photograph of the kidney. A large number of candidates were not able to produce a neat and a proportional drawing showing sufficient details. Most candidates lost marks because their diagrams were shaded and did not show sufficient details.

**Expected qualities in drawings:** *smooth outline without any shading.  
large diagram with at least 3 distinct layers of tissues  
and also the medulla layer.*

- (ii) Candidates were expected to use label lines to identify the medulla and the first part of the ureter. Some candidates were able to identify the first part of the ureter and some could not identify the proper position of the medulla.
- (b) (i) Most candidates were able to measure the length of the line. The most common error was recording the answer in centimetres (cm) instead of millimetres (mm).
- (ii) A vast majority of candidates were able to draw a line in their drawing in the same position as the one drawn in the photograph of the kidney.
- (iii) Most candidates were able to measure the line accurately with a few who opted to give their values in centimetres instead of millimetres.

- (iv) A majority of candidates were familiar with the formula for calculating magnification however some could not score maximum marks because they failed to round their answers up to one decimal place. Candidates also need to be reminded to include the times (x) symbol in their magnification value.
- (c) Candidates were required to explain, using visible features why a kidney is an organ. Most candidates were able to state that the kidney is made up of several tissues that are grouped together to perform a special function.
- (d) (i) The question was well answered by most candidates. Candidates were required to describe **one** observable difference between boiling tube **C** and **D**. Most candidates were able to describe the observable difference with a few who did not make a comparison in their response. A majority of candidates were able to give acceptable explanations with a few who lost a mark by failing to write a comparative response. Candidates should be encouraged to use comparative words such as heavier, denser etc.

**Expected responses:** *the kidney is sinking whilst the lung is floating.*

*the kidney is dense whilst the lung is less dense.*

*the lungs have more air spaces compared to the kidney.*

- (ii) Most candidates were able to identify the variables that were controlled in this investigation. A few candidates seemed to have not understood the question and the responses were related to the purpose of a control which resulted in loss of marks.

**Expected responses:** *same temperature, same volume of kidney and lung, same volume of water, same size of boiling tubes, same duration and same mammal used.*

- (iii) Generally well answered and most candidates were able to explain that variables are controlled in an investigation *to ensure validity*.
- (iv) Most candidates were not able to describe tests for carbon dioxide and oxygen. A majority of candidates did not pay attention to the command word "*describe*" but instead opted for naming the test for each gas. Most candidates were able to give the positive results for each gas but could not give a good description for each test.

**Expected response:** *carbon dioxide - bubble the gas through lime water and the positive result is a white precipitate or milky.*

*oxygen - insert a glowing splint which will relight if oxygen is present.*