SCORING GUIDE

553/1
BIOLOGY
Paper 1
July / Aug 2024
2 ½ HOURS

KAMTEC EXAMINATIONS BOARD

Uganda Certificate Of Education

BIOLOGY

Paper 1

TIME: 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

This paper consists of **seven** *examination items. It has two sections;* **A** *and* **B**.
Section **A** *has* **three** *compulsory items.*
Section **B** *has two Parts;* **I** *and* **II**. *Answer* **one** *item from each part.*
Answer ***five*** *items in all.*
Any additional item(s) answered will not be scored.

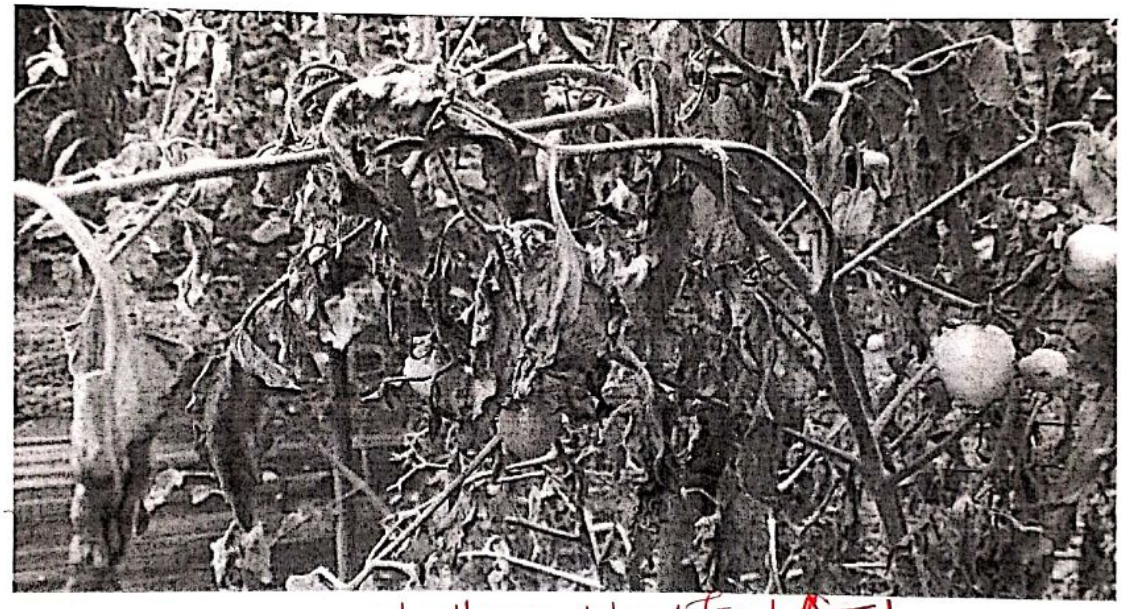
FOR EXAMINER'S USE ONLY			
SECTION	**ITEM**	**SCORE(S)**	**EXAMINER'S SIGNATURE**
A	1	10	
	2	10	
	3	10	
B	4	15	
	5	15	
	6	15	
	7	15	
TOTAL		60	

SECTION A

*Answer **all** the items in this section in the spaces provided.*

Item 1

At the start of the season, the ministry of Agriculture, under the Parish model supplied a new variety of tomato species seeds to people of Yumbe district. The variety was well known for its high productivity and resistance to disease. Mr. Kidega, one of the renown farmers in the area and a beneficiary of the program, prepared his garden, applied fertilisers and planted the seeds. After a month, Kidega observed that most of the tomato plants either drooped their leaves or shed them off during hot days. Some of the tomato plants had yellow leaves. He eventually realised a very poor yield at the end of the season.



Task

(a) Identify the challenge faced by the plants in the garden. (01 scores)

Excessive water loss / tomato plants lost more water than they absorbed from the soil;

(b) Which processes in the tomato plants where affected? Explain how the effect on the processes led to the poor yields observed. (06 scores)

Photosynthesis; much water was lost from the plant, decreasing the rate of photosynthesis since water is a raw material for photosynthesis.

Gaseous exchange; drooping of leaves reduced leaf surface area for gaseous exchange.

Transpiration; some leaves drooped, others fell off, which de4creased the surface area for transpiration

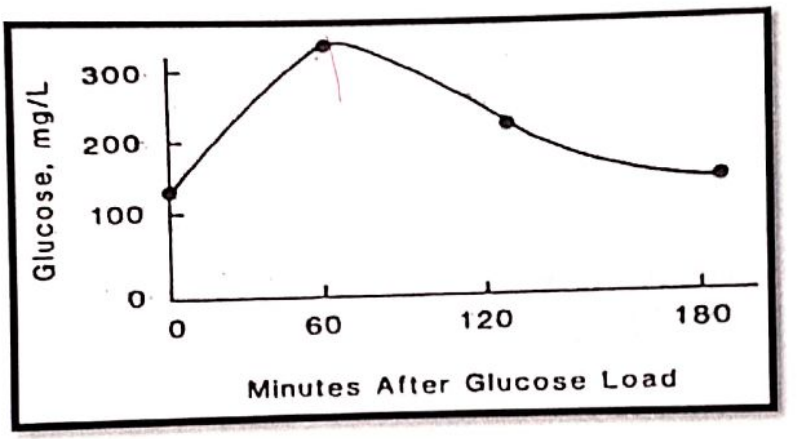
Shedding off leaves also decreased leaf surface area for absorption of sunlight, decreasing the rate of photosynthesis.

(c) How can Mr. Kidega improve his yields of the tomatoes next season? (05 scores)

Watering the plants
Covering the garden with mulches, to keep moisture in the soil
Planting drought resistant tomato variety
Spraying the tomatoes with organic / environmentally friendly pesticides
Research and understand changes in season, to plant the crops at the right time

Item 2

John fell off a tree as he was climbing to get mangoes for his little sister. He was rushed to the hospital for basic treatment. However, since then, John has had a lot of complications. He passes out small volumes of concentrated urine, feels thirsty all the time and has a lot of pain in the lower abdomen. He was then taken to a doctor for medical checkup. The doctor, suspecting a certain condition gave him a glucose rich drink (glucose load) and monitored his blood glucose level as showed in the graph below;



Task

(a) Comment on the variation of glucose in John's blood with time. (02 score)

Glucose concentration in blood increased immediately after taking the glucose drink, and then decreased with time.

(b) Identify the organ(s) that could have been affected in John's body. (02 scores)

Pancreas

~~Kidney~~

Liver

(c) How did the effect on the organ(s) identified in (b) above lead to john's health condition? (04 scores)

Damage on the pancreas; decreased amount of insulin produced which decreased the ability to regulate / lower glucose concentration in blood

Damage on the kidney; decreased reabsorption of glucose from renal fluid in the kidney nephron.

Damage on the liver; reduced glucose metabolism from blood

(d) Suggest possible solutions to John's condition. (03 score)

Getting insulin injection

Kidney dialysis

Reduced glucose intake

Item 3

Kipsang, a long-distance athlete, trains at a high altitude in the mountains and this has increased his performance with time. On day of the race, he had a heavy carbohydrate meal and then started to warm up in preparation for the race. Kipsang competed favourably, but towards the end, he developed muscle cramps and was breathing profusely. He however endured the cramps until he won the race. After the race, his profuse breathing continued, while the muscle cramps progressively receded.

Task

(a) How does training in the high mountains increase Kipsang's performance? (02 scores)

Training at high makes the body to adapt; produces more red blood cells to increase amount of oxygen carried to the tissues; increases lung volume to accommodate more air; increases body metabolism to make more ATP / energy. Also increases muscle tolerance to lactic acid.

(b) Explain how the body utilised the morning meal to enable him win the race. (04 scores)

Starch in the carbohydrate meal was hydrolysed to maltose, catalysed by salivary amylase in the mouth. Food was swallowed, moved through stomach, to duodenum. In the duodenum, pancreatic amylase catalysed hydrolysis of the remaining starch to maltose. In the ileum, maltose was hydrolysed by maltase to glucose; which was absorbed into the blood stream by diffusion, transported to muscle tissues; respired to generate energy which enabled contraction and relaxation of muscles to enable him run very fast and win the race.

(c) Analyse the challenges encountered by his body during the race and how it overcame them. (04 scores)

Insufficient oxygen breathed in during the race; the body overcame this challenge by increasing the breathing rate to supply more oxygen.

Accumulation of lactic acid, causing muscle cramps; this problem was overcome by increased breathing, taking up extra oxygen to oxidise the lactic acid formed

SECTION B

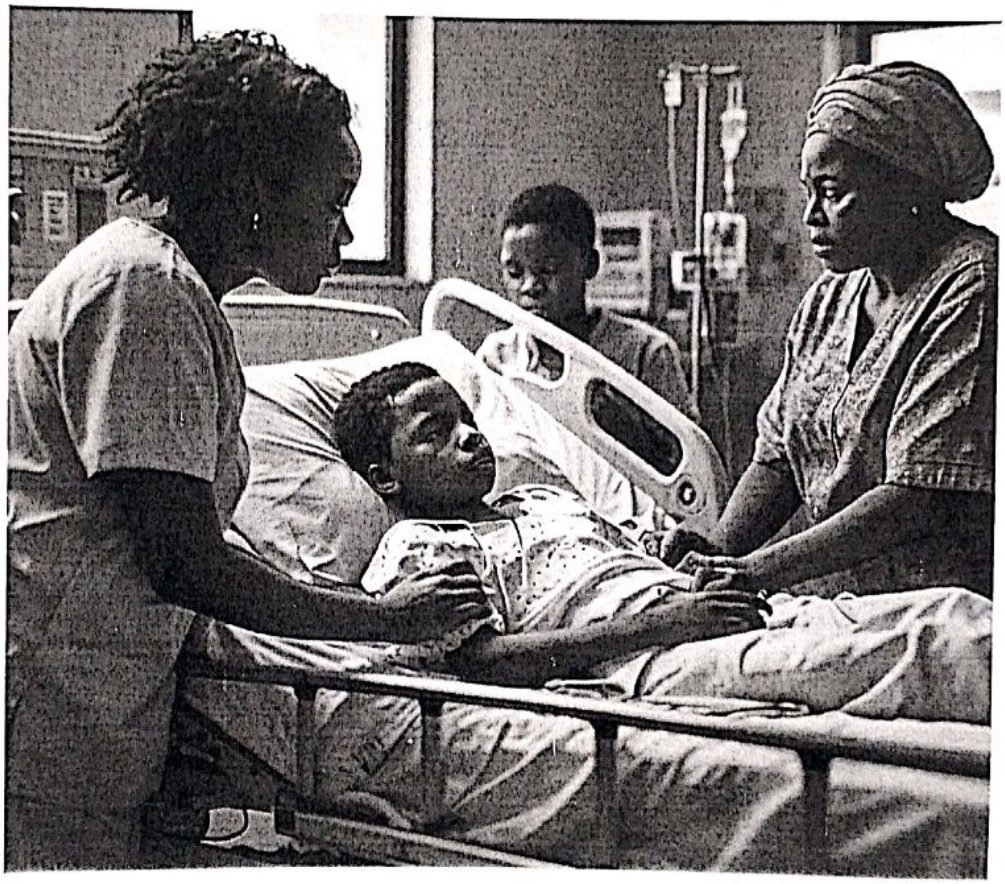
PART I

Answer only **one** *item from this part. Answers should be written in the answer booklet(s) provided.*

Item 4

John, a 10-year-old boy, had an accident as he was moving from school to home on a motor cycle. He had severe bleeding and lost a lot of blood which made him unconscious.

Following close examination, the doctor decided that he needed an immediate blood transfusion. John is of blood group **B** and present at the hospital are John's mother of blood group **A**, his elder sister of blood group **AB** and his younger brother of blood groups **O**.



Task

Work out the possibility of each of John's relatives to successfully transfuse blood to him, and suggest remedies that could save his life. (15 scores)

*John has blood group **B**, implying he has antibody **a** in his blood.*

*John's mother is blood group **A**, implying she has antibody **b** in her blood*

*John's elder sister has blood group **AB**, implying she has no antibodies a and b in her blood.*

*The young brother is blood group **O**, implying he doesn't have antigens **A** and **B**, and has both antibodies **a** and **b**.*

Basing on the compatibility table;

Recipient	Blood donor			
	O	A	B	AB
O	✓	X	X	X
A	✓	✓	X	X
B	✓	X	✓	X
AB	✓	✓	✓	✓

*John can only receive blood from a doner of blood group **O** and blood group **B**, since these do not contain antigen **A**, that would agglutinate with antibody **a** in John's blood.*

John's young brother who is blood group O, can however not donate blood to John, since he is young and below the recommended age to donate blood.

None of the family members is credible to donate blood to John.

Mentioning the antigen and antibody A = 4

Remedies to save John's life

- *Look for a credible doner of blood, with either blood group **O** or **B**, basing on the compatibility table to donate blood to John.*

Possibility of donating B1 = 4

Following advice from the health physician

Explanation B2 = 4

Remedies C = 3.

Item 5

A newly wedded young normal couple gave birth to a child with an abnormal condition. The child experiences recurrent episodes of pain, swollen joints, fatigue, and anemia. She is also weak, fragile and can barely do any work at home. When taken to the hospital, the doctor examined the child and concluded she had sickle cell anaemia. The man has blamed his wife for this misfortune and plans to divorce her for giving birth to such a child.

Task

Help the man understand how this child came about, and suggest measures the couple can employ to ensure they raise up their child together. (15 scores)

The child is a Sickler, a genetic condition that results into formation of abnormal haemoglobin in red blood cells; causing sickling of red blood cells/ red blood cells becoming sickle shaped. The parents must be heterozygous for this condition, though they phenotypically look normal; and the child inherited one recessive allele from the parents.

A = 4

Deny all marks for the inappropriate symbols not defined. Accept undefined symbols

Let Hb^A represent allele for normal haemoglobin B1

Let Hb^S represent allele for abnormal haemoglobin.

Parental ~~genotype~~ phenotype: Career male X Career male B2

Parental genotype: $Hb^A Hb^S$ X $Hb^A Hb^S$ B3

Give [illegible] of the scores to students without processes

Meiosis:

Gametes: Hb^A Hb^S Hb^A Hb^S B4

Max 8. where steps aren't indicated, Give 6

Fertilisation:

Genotypes: $Hb^A Hb^A$ $Hb^A Hb^S$ $Hb^A Hb^S$ $Hb^S Hb^S$ B5

Phenotypes: *Normal* *Carrier* *Career* B6 *Sickler* B7

The child has a genotype of $Hb^S Hb^S$*, which he has inherited from both the parents.*

The parents can take care of their child through;

Regular medical checkup by physician

Feeding the child on a balanced diet. / Foods rich in iron / Iron supplements.

Counselling the child and parental love to make them feel special

Ensuring proper rest by the child

Giving the child foods rich in iron like red Amaranthus and beet root

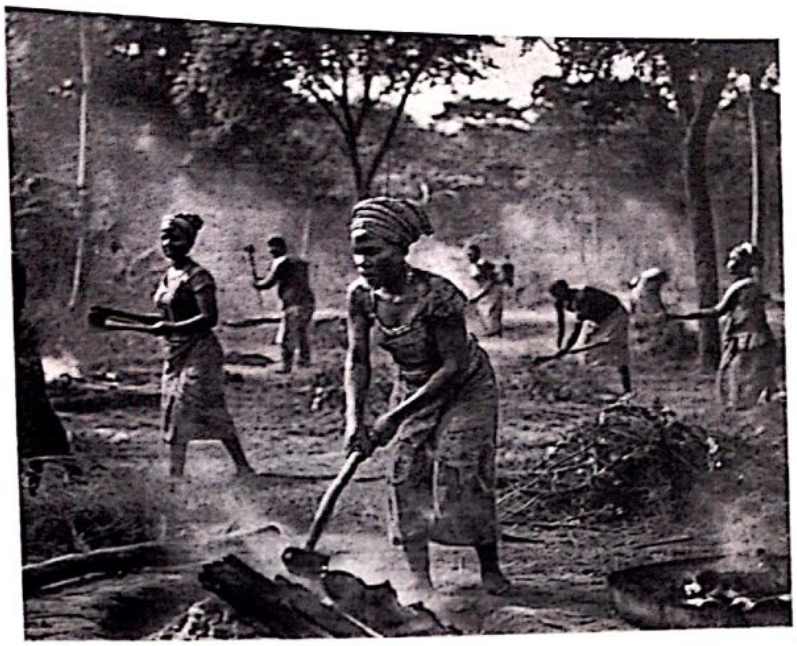
PART II

Answer only one item from this part. Answers should be written in the answer booklet(s) provided.

Item 6

Mabira forest, the largest natural forest in Uganda is a home to a variety of plants, birds, snakes, monkeys, fungi, algae and microscopic organisms like bacteria. Due to its great biodiversity, it attracts tourists from various parts of the country. However, in the recent years, people have cleared a large piece of the forest to plant sugarcane and also to burn charcoal.

 TURN OVER



Task

Explain the possible effects of these human activities on the forest ecosystem and suggest possible measures that can be taken to ensure sustainable use of the natural resource. (15 scores)

Effects of the human activities on the forest ecosystem

Destruction of home for wild animals — run away.

Cutting trees leads to decrease in tree species in the forest | Biodiversity.

Clearing vegetation exposes soil to erosive agents like running water, leading to soil erosion.

Death of wild animals

Reduction in rainfall in the area — leading to drought.

Attacks to humans in the surrounding community by wild animals as they run away from the forest being cut.

Burning charcoal spoils soil by killing soil living organisms

Pollution of air by carbon monoxide from burning charcoal.

Destroying food for wild animals.

Any 5 well explained points A=10

Score the first five points.

Measures to ensure sustainable use of the forest

Government should properly gazette the forest ecosystem to reduce encroachment

Arresting and reprimanding people who indiscriminately cut trees in the forest

Planting new trees, every time a tree is cut

Sensitizing the community about the significance of preserving the forest

Any 5.
The first five correct measu

Employing game rangers to protect the forest and the animals in in.

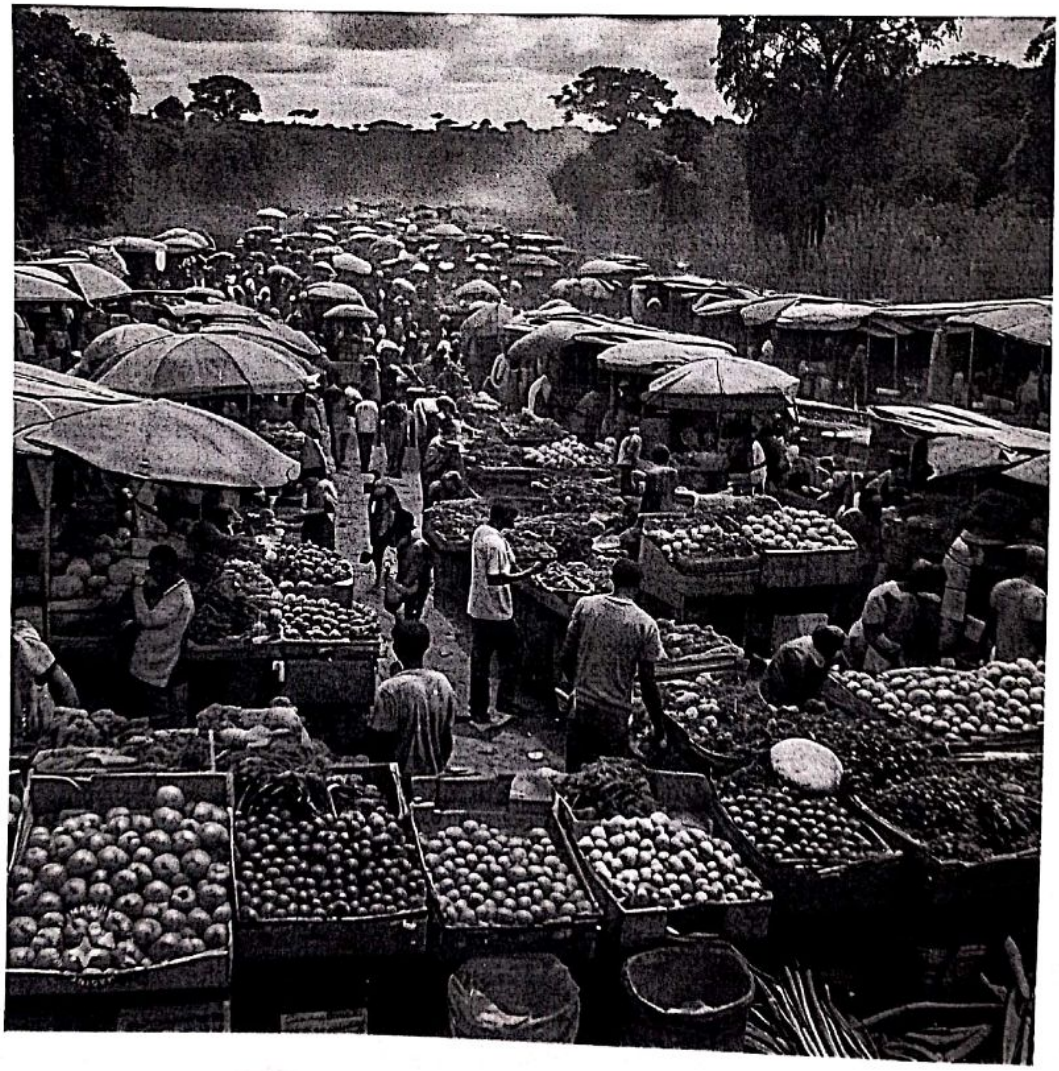
Government should subsidise prices of alternative sources of energy like solar panels and eco-friendly stoves, to reduce charcoal consumption

Relocating and resettling people living very close to the forest to other areas

Encouraging the farmers to practice agroforestry

Item 7

Masendi market, is highly populated and busy market, located near a swamp in a forested area. In the past three weeks, the market has expanded into the swamp and many other stalls have been set up in the newly cleared areas. Within the market, rubbish and fruit remains are scattered all over the market and most vendors are not concerned. The water in the swamp is mainly used for both human consumption and livestock. There has however been reports from the VHT showing high cases of diarrhoea, cholera and malaria.



clearing of swamps | Polythenes | bottle block water passage resulting into flooding.

Task

(a) Analyse the situation in the market and its surrounding and suggest environmental impacts of the human activities around Masendi market.

First, 5 points
A=5

Clearing swamps leads to destruction of home for aquatic animals hence their death

Littering rubbish everywhere in the market, attracts houseflies which spread disease germs causing diseases like diarrhoea and cholera.

Rubbish also produces odour / bad smell which reduces air quality in the area.

Reduction in plant and animal biodiversity due to encroachment on the swamp

Non-biodegradable litter → habitat for mosquitoes
→ affect water infiltration

(b) Help the vendors understand the cause of the problem and how to overcome it.

Cause of the problem

First (3 points)
B=3

Rubbish littered everywhere is breeding ground for houseflies, which spread germs causing cholera and diarrhoea

The malaria is spread by mosquitoes which reside in the swamp, into which the market has expanded.

Drinking water with animals is also an avenue for spread of diarrhoeal diseases

How to overcome the problem

First (7 points)
C=7.

Proper disposal of rubbish to ensure proper sanitation in the market and reduce disease spread.

Proper spacing of stalls to ensure sanitation and proper cleaning of the market.

Planting mosquito repellant plants like lemon grass around the market premises to reduce mosquito infestation.

Using the plant remain in the market to make manure and animal feeds instead of dumping them in the market premises.

Demolishing stalls constructed in the swamp area to prevent encroachment on the swamp and conserve aquatic life.

Sensitising the market vendors about the importance of proper sanitation in the market.

Boiling drinking water to avoid water borne diseases

END