Candidate's Name: .....

Signature: …….....

Random No.						Personal No.		

(*Do not write your School/ Centre Name or Number anywhere on this Booklet*.)

553/1
BIOLOGY
Paper 1
2024
2½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

BIOLOGY

Paper 1
Theory

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.

 Turn Over

SECTION A

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

Item 1.

Mr. Nsamba's cassava garden was invaded by the neighbour's goats at the time of tuber formation. The owner of the goats has refused to compensate Mr. Nsamba, and Mr. Nsamba is worried that the yields will be poor.

Fig. 1 shows Mr. Nsamba in his garden which was invaded by the neighbour's goats.

Task

(a) Identify the plant structures affected by the goats.

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(b) Explain how the goats affected the processes in the cassava plants.

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(c) Why should Mr. Nsamba be compensated even if the cassava plants were able to grow again?

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Item 2.

John was suspended from school as a result of drinking alcohol. He engages in heavy drinking of alcohol in the nearby trading centre. One day, as John approached a swamp on his way home staggering from drinking alcohol at 6:00 pm, he encountered a snake. His heart started beating faster and his breathing rate increased. He tried to pick a nearby stick but he could not get hold of it on several attempts, so the snake escaped.

Fig. 2 shows John walking home from drinking alcohol.

Task

(a) Describe how John's body coordinated to bring about his reactions from the time he encountered the snake up to when his rate of breathing increased.

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_____

(b) What are the likely effects of John's lifestyle as described in the scenario?

(c) Suggest ways in which John can change his lifestyle.

Item 3.

Mrs. Kasuru had been taking her baby boy for routine immunization and the nurses kept on plotting the baby's weight as a growth curve on the immunization card. On one of the visits, the nurses got concerned and referred the baby to the doctor, who diagnosed the baby with a genetic inherited disease. Mrs. Kasuru could not understand how her baby got the disease since both her and the father of the baby look healthy and normal. The doctor explained to her that the baby's condition was because of genetic disease.

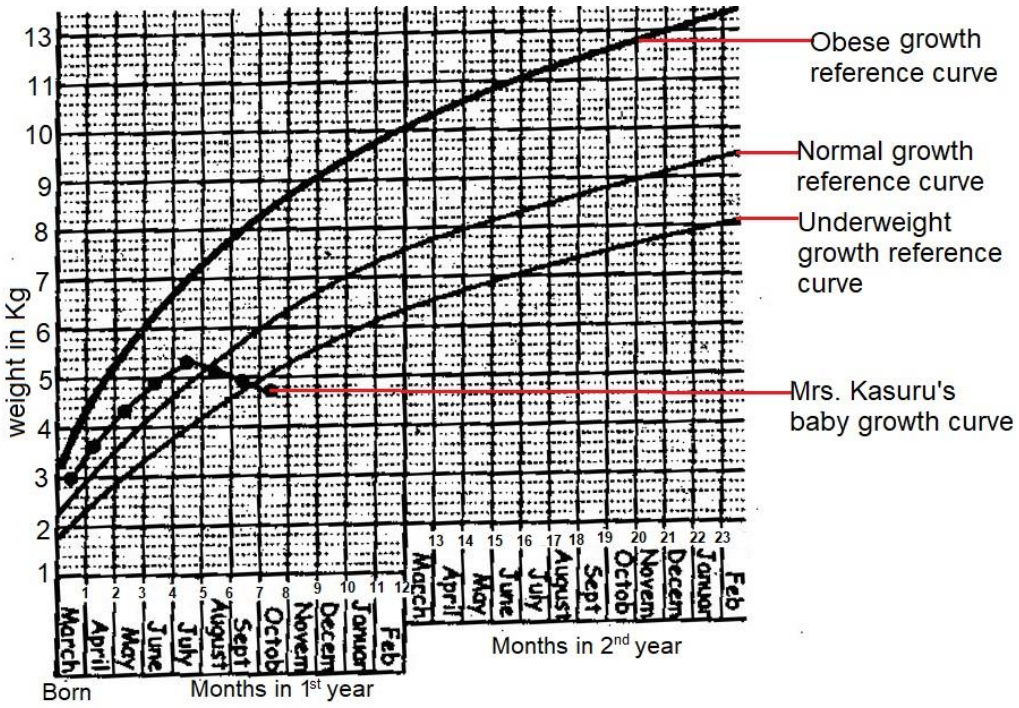

Fig. 3 shows growth curve of Mrs. Kasuru's baby.

Task

(a) Identify the genetic disease and show how it was genetically passed on to the baby.

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(b) Describe the likely appearance of Mrs. Kasuru's baby boy.

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(c) Suggest how the family can manage their baby's condition.

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SECTION B

Part I

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

Item 4.

In a village in western Uganda, swamps have been cleared for cattle farmlands and sand mining. The area environment officer organized a radio talk show on sustainable use of natural resources in swamps. Unfortunately, Mary a resident of the area only heard the concluding statement, "*From the presentation, I kindly request everybody to use our natural resources sustainably*."

Task

Explain to Mary the environmental problems being addressed by the environment officer and how they can be solved. Explain why the village should conserve the natural resources in the swamps.

Item 5.

As a result of a civil war in one of the countries neighbouring Uganda, many people entered Uganda as refugees. The local authority decided to settle the refugees on a piece of land, part of which was covered by a forest reserve next to a swamp. Several challenges arose in the community.

Task

Explain to the community how the environmental challenges came about. Advise them on how to minimize effects of the challenges and show the value of conserving the environment in the area.

Part II

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

Item 6.

Two Ugandan Towns **A** and **B** each have industries that release carbon dioxide gas, smoke and dust. The levels of air pollution in the two towns are as shown in table **1**.

Table **1**: levels of air pollution in two towns **A** and **B**.

Town	**Level of air pollution (units)**
A	30
B	70

(According to **American Lung Association**, 2023, *the normal range of air pollution is 0 – 50 units*).

Samuel was living in town **A**. He used to jog everyday, and would experience normal changes in his body during and after jogging.
When he shifted to town **B**, he continued with his usual routine of jogging. However, he started experiencing complications such as difficulty in breathing, chest pain and coughing.

Task

Explain to Samuel his experiences while living in town **A** and the new ones encountered in town **B**. Advise Samuel on how to manage the challenges experienced in town **B**.

Item 7.

In preparation for an inter-house competition, Chesang, a 40 kg female athlete ate a meal containing 470 g of carbohydrates in the morning. She believes the meal will help her perform better during the competition. However, her young brother does not seem to understand how the meal will contribute to Chesang's success.
Chesang finally won the competition but experienced muscle cramps. She rested for 20 minutes, returned home walking but the brother wondered how she still had the strength to walk home after the competition.
[*The recommended daily carbohydrate intake of a 40* kg *female athlete is* (*280 – 480* g)]

Task

Explain to Chesang' s brother the processes that the meal she ate went through to enable her win the race, be able to come back home and how her body regained the normal state.

END

553/1
BIOLOGY
Paper 1
2024

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

BIOLOGY

Paper 1
Theory

SCORING GUIDE

Section A

1 a) Leaves, and Stems.

b) Photosynthesis. The cassava leaves eaten by the goats are the sites for photosynthesis prevents the manufacturing of food. Removal of leaves removes sites for entry of carbon dioxide gas which is a raw material for photosynthesis. The breaking of stems prevents transportation of another raw material for photosynthesis, water molecules, from soil to the point of food manufacturing, hence photosynthesis will not take place.

Transpiration. The rate of transpiration will greatly reduce since there are few/no leaves available which are sites for transpiration. The broken stem will cut off transpiration pull.

Translocation. The eaten stem barks and/or broken stems destroys the phloem tissues, hindering/preventing the movement of manufactured food from the sites of manufacture to parts where they are needed for respiration/growth/storage.

c) Food that should have been stored in the root tubers are instead used to facilitate growth of new plant parts. This consequently affects both the size and quality of root tubers leading to poor yields hence a need to compensate Mr. Nsamba..

The roles of the affected processes are;

- Photosynthesis makes food, stored in tubers, hence increasing the quality and quantity of yields.
- Transpiration allows movement of water up the plant, which is a raw material for photosynthesis.
- Translocation permits movement of food from sites of manufacture to other parts e.g. for growth, storage etc.

2. (a) The image of the snake was formed at the retina, impulses were sent to John's brain for interpretation. Impulse were sent to various structures e.g. adrenal glands, that released adrenaline hormone transported in blood to the heart causing the heart beat to increase. The adrenaline hormone also stimulated the intercostal muscles to increase the rate of breathing.

(b) The likely effects of John's lifestyle are;

- Mental illness/ disorder.
- Poor relationship with others.
- Increased crime / reckless behavior and isolation.
- Depression and anxiety.
- Organ failure e.g. malfunctioning liver.
- Infections and diseases e.g. breast/throat/colon/lung cancer, liver cirrhosis, stroke, high blood pressure, diabetes, chronic bronchitis etc.
- Inability to sustain financial needs.
- Poor memory.
- Bad company.

(c) John can change his lifestyle in the following ways;

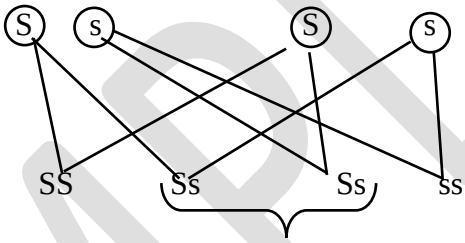
- Withdraw from bad peer group.
- Get professional help from a counsellor.
- Stop going to places where he is tempted to drink.
- Practice healthy habits to replace drinking and smoking.
- Go for rehabilitation.

3 a) Both parents are heterozygous.
Let S represent the allele for normal RBC shape.
Let s represent the allele for sickle cell shaped RBC.

Parental Phenotypes: Normal male Normal female
Parental genotypes: Ss X Ss

Meiosis

Gametes



Random fertilization:

Offspring genotypes: SS Ss Ss ss

Offspring phenotypes: Normal Carriers Sickler

There is ¼ chance of producing a child suffering from sickle cell disease. Hence the baby inherited a sickle cell gene from each of the parents. The parents look worried because they are both carriers, and carriers appear normal and do not show any physical symptom.b. the likely physical appearance of Mrs. Kasuru's baby boy

b)

- Loss of weight / muscle wasting.
- Retarded growth / stunted growth.
- Difficulty in vision.
- Swellings of hands / feet.
- Frequent fatigue.
- Reduced immunity / frequently falling sick.

c) How the family can manage their baby's condition

- Blood transfusion.
- Frequent and rapid rehydration of the baby.
- Regular checkup and medication.
- Timely treating of any infection.
- Preventing and treating stroke.
- Proper nutrition.

SECTION B

Part I

4. Flooding; leads to destruction of vegetation due to water logging which prevents roots from absorbing enough oxygen or cover vegetation cutting off photosynthesis.

Silting of swamp channels / rivers as a result of destruction of swamps; This affects aquatic animals by making water turbid, hindering visibility. It may also lead to death of animals.

Destruction of natural habitats of animals e.g. frogs, snakes etc. the dangerous animals may attach human / other organisms' settlements.

Sand mining creates deep stagnant water pools which can be risky to humans and other animals. The pools can also act as a breeding ground for vectors.

How to sustainably use the swamps

- Controlled sand mining.
- Controlled harvesting of raw materials from swamps e.g. papyrus.
- Planting trees in swamps to protect them from soil mass flow.
- Use alternative lands / areas to graze livestock.
- Desilting swamp channels.

Benefits / advantages of conserving natural resources in swamps

- Provides a good natural habitat for aquatic animals e.g. snakes, frogs etc.
- The swamp is a water catchment area; hence prevent flooding in settlement areas. It also maintains a stable water table for lakes.
- The swamps protect lakes and rivers from silting by filtering water before joining the main stream / water bodies.
- Availability of raw materials like papyrus, reeds etc. for crafts and constructions etc.
- Swamps provide water for home and industrial use.
- The fish and other animals in the swamp are sources of food to man and other animals.

5 *Environmental challenges in the community*

- Outbreak of diseases due to congestion / overcrowding / water born diseases.
- Encroachment of natural habitats for animals, which leads to attack by wild animals.
- Deforestation; in an attempt of getting firewood and wood for construction.
- Destruction of natural habitats for settlement and farming.
- Swamp reclamation / drainage for farming and settlement.
- Hunting of wild animals for food.
- Loss of biodiversity.
- Poor disposal of wastes.

How to minimize the effects of the challenge

- Afforestation / planting of trees which mature in a short time.
- Use alternative construction materials.
- Use alternative source of fuel other than firewood.
- Practice wetland edge cultivation.
- Sort domestic wastes into biodegradable and non-biodegradable for recycling.
- Have controlled hunting of wild animals.

Values / benefits of conserving the environment

- Forests are habitats for wild animals which are sources of food.
- Swamps provide raw materials like sand for construction, clay and papyrus for crafts.
- Forests release oxygen which is used by animals for respiration.
- Trees / forests trap / absorb carbon dioxide from the atmosphere hence reducing pollution and global warming.
- Swamps act as water catchment areas.

Part II

6

Experiences in town A.

- Increased body metabolism to especially generate sufficient energy required in jogging.
- Increased heart beat to circulate sufficient blood around the body to facilitate faster metabolism/respiration of food to supply energy.
- Increased breathing rate to ensure quick supply of oxygen to respiring tissues and remove accumulated carbon dioxide.
- Accumulation of lactic acid in the body as a result of vigorous exercise, which resulted into anaerobic respiration in the body.
- Sweating so as to remove excess heat generated during the exercise.

New experiences in town B

- Reduce oxygen intake presented difficulty in breathing due to too much carbon dioxide in air / pollution.
- Lung irritations causing coughing due to in halation of dust from polluted environment.
- Lung infections / diseases like emphysema presented with chest pain as a result of increased inhalation of polluted air.

Advise to manage challenges experienced in town B

- Go for medication to treat the respiratory complications.
- Change residence from town B to a less polluted area.
- Eat a balanced diet to boost the body's immunity to have self defense.
- Perform other physical activities that may not require exposure to polluted environment.
- Wear a mask, especially when not engaged in jogging since he is living in a polluted area.

7 *Processes are*; digestion, absorption, assimilation and respiration

Carbohydrates were digested in the mouth by salivary amylase, and in the duodenum by pancreatic amylase to maltose. Maltose was digested in the ileum to glucose molecules by maltase.

The glucose produced was absorbed in the walls of ileum/villi and transported in the bloodstream to the respiring tissues/body muscles.

The glucose was broken down during respiration to provide energy/ATP, water and carbon dioxide gas were produced in the process. The produced energy was used by Chesang's body/muscles to run and win the race.

Changes / challenges experienced by Chesang's body were;

- Accumulation of lactic acid in the muscles.
- Increased oxygen demand.
- Increased energy demand.
- Excess heat in the tissue/cells.
- Increased amount of carbon dioxide.

How Chesang came back home and her body remained in normal state.

- Excess carbohydrates stored as glycogen is converted to glucose which was respired hence providing Chesang energy to go back home.
- Deep breathing enabled her take excess oxygen to breakdown the accumulated lactic acid. Also to expel carbon dioxide from the body.
- Increased sweating to remove excess heat.
- Increased heart beat to transport the required materials and products to target organs.

Candidates Name: …….....

Signature: ….....

Random No.						Personal No.		

(*Do not write your School/ Centre Name or Number anywhere on this Booklet.*)

553/2&3
BIOLOGY
Paper 2
2024
2½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

BIOLOGY

Paper 2&3
Practical

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of **two** examination *items. Answer* **all** *the items in the spaces provided.*

Drawings should be made in the spaces provided. Use **sharp pencils** *for your drawings. Coloured pencils or crayons should* **not** *be used.*

No additional sheets of writing paper are to be inserted in the booklet.

Work on additional sheets will **not** *be scored.*

 Turn Over

Item1.

Mary's 5-year-old baby frequently falls sick and has to visit the hospital regularly. The doctor told her that the frequent sickness is as a result of feeding. Mary feeds her baby on food nutrients; **A** and **B** plus food supplement containing mineral salts, fats and roughages. Mary is wondering what could be missing in her baby's food.

Task:

Carry out investigations on the food samples **A** and **B** and use your findings to advise Mary accordingly.

Item 2.

Biteke Secondary School had some classroom blocks constructed using wood. After One year the head teacher realised that the poles in S1 classroom block were partly destroyed with holes in them. The school had spent a lot of money on the classroom block and did not have any money to construct another one.

Specimens **X** and **Y** were some of the most common organisms that S.1 students collected from their classrooms.

Task:

(a) (i) How do the features on the organisms enable the organism to enter and survive in the classroom?

(ii) Explain to the head teacher which organism was able to cause such serious damage to the classroom block.

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(b) Draw and label the head of specimen **X**.

END

553/2&3 Inst. Sch.
BIOLOGY
PRACTICAL
INSTRUCTIONS
2024

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

BIOLOGY PRACTICAL INSTRUCTIONS

553/2&3 Inst. Sch.

CONFIDENTIAL

This information is given only to facilitate preparation of examination.

Great care should be taken that the informaton given below does not reach the candidates either directly or indirectly.

INSTRUCTIONS FOR PREPARING SPECIMENS AND APPARATUS:

The teacher responsible for preparing specimens must ensure that candidates are provided with correct specimens and other materials as specified in these instructions. Specimens and solutions which have been assigned codes should be presented to candidates using those **codes only** and not any other identity. The head teacher **must** ensure that the teacher responsible for preparing the specimens hands in his/her trial results for the physiology/biochemistry question, properly sealed in a separate envelope and **firmly** fastened (attached) to the candidates' script envelope(s).

Each candidate should be provided with;

25 cm^3 of solution **A** (*is prepared by crushing* 125 g *of peeled fresh cassava, into paste, add* 500 ml *of water, mix and decant the solution then dilute it to* 1000 ml *using distilled water*).

25 cm^3 of solution **B** (*is prepared by soaking* 125 g *of beans in water for* 24 *hours, poundthe beans into paste and mix with* 500 ml *of distilled water. Decant the solution and dilute to* 1000 ml *using distilled water*).

Freshly killed housefly, labelled specimen **Y.**

Freshly killed worker termite, labelled specimen **X.**

Access to:

Reagents for food tests.

2 Beakers.

Hand lens.

Source of heat.

6 Test tubes.

Test tube holder.

Test tube rack.

Droppers.

A thermometer.

This information MUST be completed and returned in a separate envelope firmly attached to the script enelope(s).

UGANDA CERTIFICATE OF EDUCATION

2024

REPORT ON BIOLOGY PRACTICAL 553/2&3

Section I:

Any information which the teacher responsible for preparing the specimens and apparatus thinks may be useful to the examiners should be given on this sheet. The teacher must try the physiology/ biochemistry question and submit his/her results in the space provided below to guide the examiners about the specimens, apparatus, and concentrations of the chemicals used.

NB: Teachers who **DO NOT** submit their trial results will be held responsible for their candidates' performance.

Results:

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Section II:

The invigilator in consultation with the teacher responsible for preparing the specimens should give details below of any difficulties experienced by particular candidates, giving their names and personal numbers. This should include reference to:

(a) Candidates who were unable to use specimens,

_____

_____

_____

(b) Insufficiency of specimens or shared specimens,

_____

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_____

(c) Substituted specimens,

_____

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_____

(d) Any other information.

_____

_____

_____

Other cases of hardship e.g. illness, disability, should be reported directly to UNEB in the normal way.

A plan of work benches, giving details by personal numbers of the places occupied by the candidates for each session, must be enclosed with the scripts.

DO NOT STAMP ANYWHERE ON THIS DOCUMENT.

Invigilator's Name_____Signature_____

Signature of the teacher responsible for preparing specimen _____

Signature of the head teacher _____

Random Number _____

END

553/2
BIOLOGY
Paper 2
2024

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

BIOLOGY

Paper 2
Practical

SCORING GUIDE

EXPECTED RESPONSES 553/2

Qn. 1

Aim: To investigate the nutrients present in the food samples **A** and **B.**

Hypothesis: Frequent sickness of Mary's child is due to absence of required nutrients in food samples **A** and **B**.

List of Apparatus, reagents, solutions and Materials used:

- Solutions A and B.
- Iodine solution.
- Benedict's solution.
- Dilute hydrochloric acid.
- Dilute Sodium hydroxide.
- DCPIP.
- Copper(II) sulphate solution.
- Heat source.
- Test tubes and droppers.

Procedure, Observations/ data presentation

Procedure	**Sample**	**Observations**	**Deductions**
To 1 cm^3 of food sample add 2 drops of Iodine solution	A	Cloudy/turbid/milky solution turns black/ blue-black	Starch present
	B	Cloudy/turbid/milky solution turns black/blue-black	Starch present
To 1 cm^3 of food sample add 1 cm^3 of Benedict's solution and boil	A	Cloudy/turbid/milky solution turns blue and the blue colour persists.	Reducing sugars absent
	B	Cloudy/turbid/milky solution turns blue and the blue colour persists.	Reducing sugars absent
To 1 cm^3 of food sample add 1 cm^3 of dil $HCl_{(aq)}$ and boil, cool under tap water. Add 1 cm^3 dil $NaOH_{(aq)}$ followed by	A	Cloudy/turbid/milky solution turns blue and the blue colour persists.	Non reducing sugars absent
	B	Cloudy/turbid/milky solution turns blue and the blue colour persists.	Non reducing sugars absent

2 cm^3 of Benedict's solution and boil.			
To 1 cm^3 of food sample add 1 cm^3 of dil $NaOH_{(aq)}$ followed by 4 drops of $CuSo_{4(aq}$	A	Cloudy/turbid/milky solution turns blue and the blue colour persists.	Proteins absent
	B	Cloudy/turbid/milky solution turns blue and then purple.	Proteins present
To 1 cm^3 of DCPIP add the food sample dropwise until in excess	A	Deep blue colour was discharged (*if the cassava was very fresh from the garden*) **OR**	Vitamin C present
		Deep blue colour persists (*if the cassava not very fresh e.g. from market)*	Vitamin C absent
	B	Deep blue colour persists	Vitamin C absent

Conclusion / Nutrients present in the baby's food are:

Option **1**: Starch (carbohydrate), Proteins, and Vitamin C.

Option **2**: Starch (carbohydrate), proteins.

Recommendations and Advice

Option **1:** the child's food has all the required nutrients. The sickness is not due to the current food nutrients provided. The child may be sick due to other causes, hence take the child for further examination by medical personnel.

Option **2**: the child's food is lacking vitamin C, hence the frequent sickness is possibly deficiency of vitamin C. Provide the child with foods rich in Vitamin C e.g. oranges, mangoes, passion etc. so as to boost the child's immunity.

Qn. 2

a)

i) Organism Y sensed the location of the classroom and possible food source using its compound eyes and antennae respectively. It used its wings to fly and entered the classroom. It survives by using its proboscis to feed on liquid food available in the classroom.
Organism X sensed the location of food/wood in the classroom block using its antennae. It used its mandibles to dig barrows to access the classroom block and feed on the wood.

ii) Organism X is responsible for the damage caused.
Because it has hard and strong pair of mandibles that are capable of cutting the timber/wood in the classroom block. It can feed on solid materials such as wood

b) *A drawing of the head of specimen X*