

P530/3 Inst.Sch.
BIOLOGY
PRACTICAL
INSTRUCTIONS
Nov./Dec. 2023



UGANDA NATIONAL EXAMINATIONS BOARD
Uganda Advanced Certificate of Education
BIOLOGY PRACTICAL INSTRUCTIONS

P530/3 Inst. Sch.

November/December, 2023

CONFIDENTIAL

This information is given only to facilitate preparation of examination.

Great care should be taken that the information 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** must 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 the following:

A freshly killed rat, labelled X.
20 cm³ of 20 volumes hydrogen peroxide, labelled solution Q.
2 M hydrochloric acid solution, labelled solution P.
2 M sodium hydroxide solution, labelled solution R.
Medium sized Irish potato, labelled S.
6 cm³ of 0.6 M commercial sucrose solution, labelled solution T.
Bread mould, labelled E.
Lichen, labelled F.
Whole fern plant, labelled G.
Dissecting kit, pins, board and cotton wool.
Stop clock.
4 plastic beakers (100 cm³ - 250 cm³).
Thermometer.
Ruler (15 cm – 30 cm long).
6 test tubes.
10 ml measuring cylinder.
50 ml measuring cylinder.
2 Droppers.
Labels.
Mortar and pestle.
Knife.
Filter paper.
Glass rod.
Hand lens.
Light microscope, slides and cover slips.
Razor blade.
A piece of thread (1.5 m long).
A petri dish.

Access to:

- Distilled water.
- Reagents for carrying out food tests.
- Source of heat.
- Hot water/water bath.

Candidate's Name: **I AM MUZAFALU**

Signature: **0777396759** WhatsApp

Random No.	Personal No.

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

P530/3
BIOLOGY
(Practical)
Paper 3
Nov./Dec. 2023
3½ hours



UGANDA NATIONAL EXAMINATIONS BOARD
Uganda Advanced Certificate of Education

BIOLOGY
(PRACTICAL)

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of three questions.

Answer all the questions.

Write the answers in the spaces provided. No additional sheets of paper should be inserted in this booklet.

You are not allowed to start working within the first 15 minutes. You are advised to use this time to read through the paper and ensure that you have all the apparatus, chemicals and specimens you require.

For Examiners' Use Only		
Question	Marks	Examiner's Signature & No
1	40	Muzafalu
2	35	Muzafalu
3	25	Muzafalu
Total	100	0777396759 WhatsApp

1. You are provided with a freshly killed specimen X.

(a) (i) Giving three reasons, state the class to which it belongs. (04 marks)

Class Mammalia; ✓

Reasons

Pinna / pinnae / External ear lobe; ✓

Hairs / Fur / Hairy body; ✓

Award
only the
first 3 reasons
External genitalia; ✓ 04 max

Nipples / Teats; ✓

(ii) Open the mouth of specimen X and examine the teeth. What special teeth adaptations do you observe? (04 marks)

Sharp / pointed incisor teeth; ✓ for easy cutting of food; ✓

Long / elongated incisor teeth; ✓ for deep cutting of food; ✓

Ridged Molar teeth; ✓ to increase surface area for chewing food; ✓

Large molar teeth; ✓ to provide large surface area for grinding food; ✓

04 marks

08

- (iii) View the head of specimen X from the dorsal side and state how the features are suitable for environmental perception.

(0.5 marks)

- Long vibrissae / elongated vibrissae / whiskers ✓
to increase surface area for easy sensitivity at long distances. ✓
- Vibrissae / whiskers of varying lengths / short and long vibrissae; to increase SA for detection. ✓
- Stiff vibrissae / whiskers for increased sensitivity. ✓
- Large / enlarged eyes; to provide a wide field of view. ✓
- Large pinnae / pinnæ / external ear lobe; to provide a large surface area for collection of sound waves. ✓
- Funnel shaped pinna / pinnæ / external ear lobes to increase surface area to concentration of sound waves. ✓ 0.5 max

- (b) (i) Dissect specimen X to open the abdominal cavity. Carefully disentangle the alimentary canal without causing much bleeding. Ligature the hepatic portal vein to prevent much bleeding. Stretch out the full length of the alimentary canal from the cardiac end of the stomach to the posterior end of the colon.

Measure the length of each portion of the alimentary canal as indicated in table 1, record your results in the table and complete the table.

↓ % Considering lower lengths only
eg

Table 1

(06 marks)

Portion (along outer part)	Length (mm)	Percentage length of each section
stomach	30 - 80; ✓	3.44; ✓ $\frac{30 \times 100}{872}$
duodenum	80 - 150; ✓	9.17; ✓
ileum	680 - 1030; ✓	77.98; ✓
caecum & appendix	50 - 90; ✓	5.73; ✓
colon	32 - 75; ✓	3.66; ✓
full length	872 - 1425; ✓	99.98 \approx 100; ✓

06

- (ii) What is the significance of the observed differences in the length and shape of the different portions of the alimentary canal?

Stomach

(2 1/2 marks)

C-shaped / Curve / Bean shaped; it increases surface area for digestion of food; it is short / shorter; for quick passage of food; it

02 1/2

Duodenum

(02 marks)

Long / longer; it provides large surface area for digestion of food; it and absorption of food; it

02

Ileum

(02 marks)

Longest / long; it provides large surface area for digestion and absorption of food; it

02

Caecum and appendix

(02 marks)

C-shaped / Curve-shaped; it for temporary storage of undigested food; it is short; for quick passage of food materials; it

02

Colon

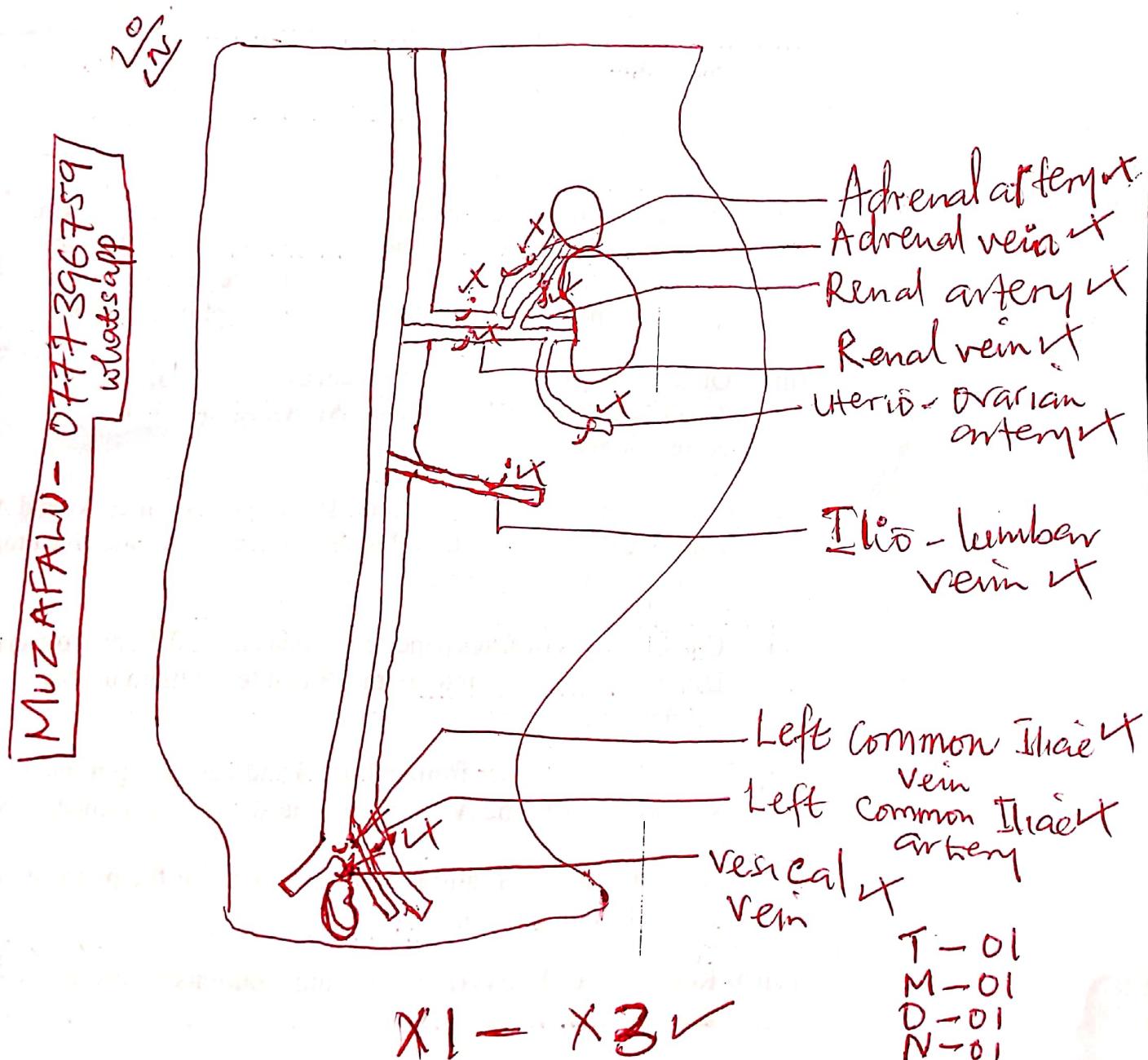
Short / shorter; it for quick passage of food; it and temporary storage of food; it

01 1/2

- (c) Proceed with the dissection by removing the unnecessary structures in order to display the major blood vessels of the left side of the abdominal cavity.

Draw and label the major blood vessels displayed. (12 marks)

A drawing of major blood vessels of the left side of the abdominal cavity of Specimen X; ✓



2. You are provided with solutions; P, Q, R and specimen S. Solutions P and R provide different pH media.

- (a) (i) Label four beakers; A₁, A₂, A₃ and A₄, and prepare their corresponding solutions as shown in table 2.

Table 2

Solution (cm ³)	Volume of solution Q (cm ³)	Volume of water added (cm ³)
A ₁	7	7
A ₂	4	8
A ₃	5	30
A ₄	1	11

- (ii) Cut a cube from specimen S measuring 3 cm × 3 cm × 3 cm. Chop the cube into smaller pieces and crush them into a paste using a mortar. Add 10 cm³ of distilled water and decant the extract of specimen S in a petri dish and label it extract S.
- (iii) Obtain six test tubes and label them as A₁, A₂, A₃, A₄, A₅ and A₆. Pour 10 cm³ of the solutions A₁, A₂, A₃ and A₄ into the corresponding test tubes.
- (iv) Pour 10 cm³ of solution A₃ into each of the test tubes A₅ and A₆. Add five drops of solution P to the content of A₅ and five drops of solution R to the content of A₆.
- (v) Cut six pieces of filter paper each measuring 0.5 cm × 0.5 cm. Dip the filter papers into extract S and leave them to stay in the extract for five minutes.
- (vi) Pick one filter paper from extract S and gently dip it into the solution in test tube A₁, and start the stop clock immediately.
- (vii) Record your observations and time taken for the paper to rise to the surface in table 3.
- (viii) Repeat procedure (vi) - (vii) using solutions in test tubes; A₂, A₃, A₄, A₅ and A₆.

Table 3

(11 marks)

Test Tube	Content	Observations	Time taken for paper to return to surface (seconds)
A ₁	Solution A ₁ + filter paper	Very rapid/very many bubbles/effervesces; filter paper rises very rapidly; it	3-15; ✓
A ₂	Solution A ₂ + filter paper	Rapid/many bubbles/effervesces; Filter paper rises rapidly/fastly; it	4-16; ✓
A ₃	Solution A ₃ + filter paper	Moderate bubbles/effervesces; Filter paper rises moderately; it	7-24; ✓
A ₄	Solution A ₄ + filter paper	Few bubbles/effervesces; Filter paper rises slowly; it	13-35; ✓
A ₅	Solution A ₃ + P + filter paper	Very few/No bubbles; filter rises slowly and dark or did not rise; it	infinity/∞; ✓
A ₆	Solution A ₃ + R + filter paper	Moderate/many bubbles; filter paper rises dark moderately; it	10-26; ✓

12

- (b) Explain the results in the following test tubes.

(i) A₁

(03 marks)

Solution S / Extract S contain an active substance / enzyme / ~~Catalase~~ → Catalase;

Highest Concentration of Substrate O₂ / Hydrogen peroxide; provide highest chances of collision between Substrate O₂ / Hydrogen peroxide with Catalase / enzyme; Very rapid decomposition, breakdown of Substrate O₂ / Hydrogen peroxide by catalase / active substance / enzyme;

OH_{max}

(03 marks)

(ii) A₃

Moderate Concentration of Substrate Q/
Hydrogen peroxide ✓ providing moderate
chances of Collision between Substrate
molecules and enzyme / Catalase molecules ✓
Moderate decomposition / breakdown /
enzyme activity ✓ 03

(03 marks)

(iii) A₄

Low Concentration of Substrate Q/
Hydrogen peroxide; ✓ providing few chances
of Collision between Substrate Q and
enzyme molecules / catalase; ✓ 03

Low decomposition of Substrate Q/
Hydrogen peroxide by Catalase / enzyme; ✓

(iv) A₅

(03 marks)

Substance P provided unfavourable
medium / unsuitable medium / pH; ✓ ND / low
breakdown / decomposition of substrate Q / Hydrogen
peroxide / ~~not enough~~ low enzyme
activity; ✓ 02

(v) A₆

(03 marks)

Substance R provided slightly favourable/
favourable / optimum pH; ✓ for slow / rapid /
Moderate decomposition / breakdown of
substrate Q / Hydrogen peroxide /
enzyme activity; ✓ 02

~~10~~

- (c) (i) Explain the significance of the reactions in the experiment to multicellular organisms. (05 marks)

Hydrogen peroxide is a toxic by-product of metabolism which is harmful and broken down/decomposed by catalase to harmless products water and oxygen which protects/prevents the cells from death. Multicellular organisms are able to regulate the cell pH medium which enables cells to function properly.

05 max

- (ii) How were errors minimised during the experiment? (03 marks)

- Usage of equal size of filter paper to ensure equal concentration of enzyme molecules from extract S₁
- Usage of equal same volume of test tubes to provide equal surface area for enzyme activity
- Soaking of filter at for the same period of time to ensure same concentration of enzyme molecules from extract S₁
- Usage of same volume of test tubes A₁ to A₄ to ensure same concentration of substrate Q₁

Turn Over

09

3. You are provided with specimens; E, F and G.

- (a) Mount a small portion of specimen E in a drop of water and observe under low power of a light microscope.

- (i) Giving two reasons, state the division to which specimen E belongs. (03 marks)

Division Zygomyces / zygomycete ✓

Reasons Rhizoids ✓

Sporangia ✓ 03

Sporangiophore ✓

Award the first two reasons ✓

- (ii) From your observations, state how the features of specimen E ensures its survival in the habitat. (04 marks)

- Long sporangiophore, it to hold the sporangia at high height to increase chances of spore dispersal
- Thin/slender Rhizoids, for easy penetration into substratum increasing surface area for absorption of food
- Numerous sporangia, to provide large surface for storage/production of numerous spores increasing chance of colonisation
- Numerous spores, increasing chance of easy propagation/colonisation/dispersal
- Numerous Rhizoids, for easy penetration into the substratum to increase surface area for firm anchorage

05

- (b) (i) Using a hand lens, examine the upper surface of the pinna of specimen G. Describe the role of the observable structures in the survival of the organism. (04 marks)

- Numerous sori, for storage/production

of many spores, 03

- Many veins, to provide support

- Large pinnae, to provide large surface area for increase rate of transpiration

10

II

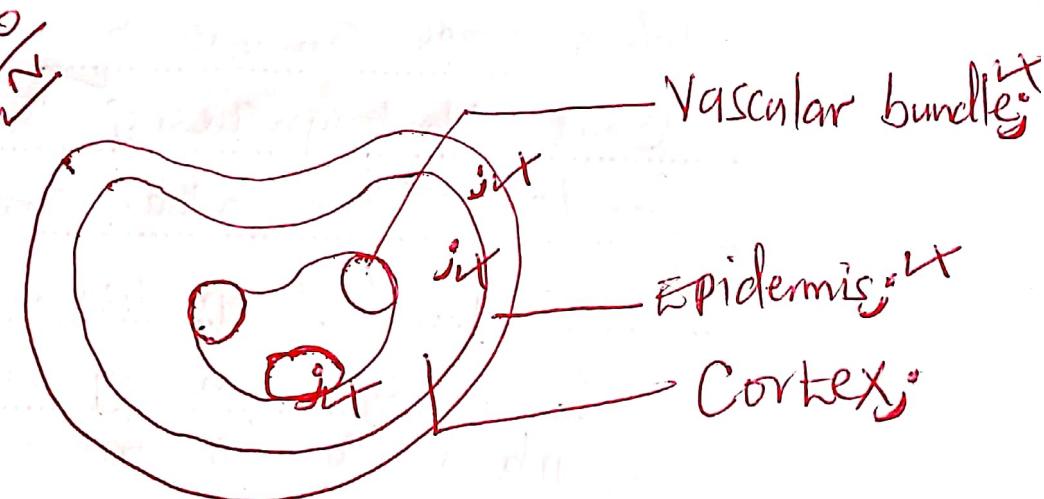
~~area~~

60

- (ii) Cut a thin transverse section of the rachis of specimen G.
Observe under low power of a light microscope. Draw and label the tissue plan observed. (07 marks)

Answer

A drawing of transverse section of the rachis of tissue plan of Specimen G Under low power.



X30-X100

T	-01
M	-01
D	-01
N	-01
D	-01½
L	-01½

OF

~~OF~~

(c) Use a hand lens to examine specimen F.

(04 marks)

(i) Describe the structure of specimen F.

..... Flattened body; ✓

..... Undifferentiated body;

..... Broad / Large body;

..... Thin / slender body;

04

(ii) Explain the ecological significance of specimen F. (03 marks)

..... F contain Chlorophyll pigment; ✓

..... which traps Sunlight to enable it carry

..... Out Photosynthesis thus Making
..... food; ✓ for other organisms.

..... During photosynthesis, it detoxifies

..... the ecosystem by absorbing

..... Carbon dioxide from the atmosphere; ✓

03 max

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