Candidate's Name: ……

Signature: ……..……..

Random No.					Personal No.		

P530/2
BIOLOGY
PRACTICAL
Paper 2
2026
3¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

BIOLOGY PRACTICAL

3 hours 15 minutes

For Scorers' Use Only

Item No.	Code	Weighted Score	Scorers' Initials
1			
2			
Total			

INSTRUCTION TO CANDIDATES:

This examination paper consists of **two** *items. Respond to* **both** *items.*

Write all responses in the spaces provided.

Use sharp **pencils** *for drawings. Coloured pencils should* **not** *be used.*

Show all your working for any calculation.

No *extra paper is allowed. Any work written on additional sheets will* **not** *be scored.*

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Item 1

A researcher at a Ugandan university investigated the factors influencing the survival of rats in grassland and newly metamorphosed common toads that dispersed from an adjacent wetland into the same grassland habitat over a four-months period. During the investigation, the researcher observed that the survival rate of common toads was drastically lower than that of the rats.

The researcher hypothesized that the observed difference in survival rates of the two animals was partly associated with differences in the relative length of their digestive organs and dietary differences.

Field observations showed that both animals fed largely on invertebrates found in the grassland. However, the rats also fed on wild starch-rich tubers similar to specimen **C** whereas the adult common toads remained entirely carnivorous. The tubers similar to specimen **C** contain specialised food-storage structures that can be identified microscopically after staining with a suitable reagent. These observations indicate adaptations to survival.

To further investigate these adaptations, the researcher obtained data from a freshly killed common toad, he recorded it in **table 1** and he intended to collect corresponding data from a freshly killed rat (specimen **E**). However, the investigation was never completed.

Table 1 *Showing length of digestive organs of a toad and a rat.*

Part of digestive system	**Toad**	**Rat**
Stomach *(length in mm)*	48	
Ileum *(length in mm)*	150	
Hind gut *(length in mm)* (*measured from end of small intestine*)	58	

The researcher also made drawings of the measured structures for a toad. To complete the investigation, there is need to compare data for the two animals together with drawings for the rat. You are therefore required to complete the investigation by obtaining data from specimen E together with making drawings.

You are provided with a freshly killed rat labelled **E**,

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Task:

(a) Obtain data from specimen **E** and complete **table 1**.

(*Your responses should include a procedure for carrying out the dissection*)

Procedure

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Drawing

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b) Provide microscopically obtained evidence to support of the nutritional advantage of this food source the rats have over toads in the grassland.

Drawing

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(c) Analyse the findings from this whole investigation (*your data and the researcher's data*), to justify the differences in the survival abilities of the common toad and specimen **E** (rat).

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Item 2

Joan is piloting a project in which she intends to generate and use the gas for study in a school laboratory. She produces the gas by the catalytic breakdown of solution **P** under constant temperature. She was advised to use an enzyme which is obtained from plant extracts.

Joan obtains her enzyme from **extract C** which is obtained by mixing 4 *g* of peeled and crushed Irish potato with 50 cm^3 of distilled water, the mixture is stirred and decanted.

However, she first needs to find out whether the extracts on market labelled as **A** and **B** could produce more gas per unit time than her local **extract C**.
To further increase the rate of gas production, Joan was advised by experts to add an enzyme activator in her set up. Currently there are two types of enzyme activators on the market; **activator X** and **Y,** and she needs to be guided on which one increases gas production in her case.

You are provided with a sample of solutions **P**, enzyme activators **X** & **Y**, enzyme **extracts A** and **B** then specimen **C** from which Joan prepared her enzyme extract **C**. Joan needs guidance on how to select the appropriate materials for her gas production.

Task:

a) Design and carry out an investigation then use your findings to give appropriate advise to Joan in form of a report.

(*Your response should be in form of a scientific report*)

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Uganda Advanced Certificate of Education

P530/2 BIOLOGY

(Practical)

SCORING GUIDE

FOR THE SAMPLE PAPER

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Turn Over

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P530/2 BIOLOGY

Item 1
This item assesses observational investigation skills
(a) Obtain data from specimen E

To obtain the highest achievement, candidate is expected to ;

i.Produce a clear and logical procedure for dissection

- *correct orientation of the specimen;*
- *opening the body cavity to expose internal structures; and systematic*
- *displacement of internal organs to display the required structures.*

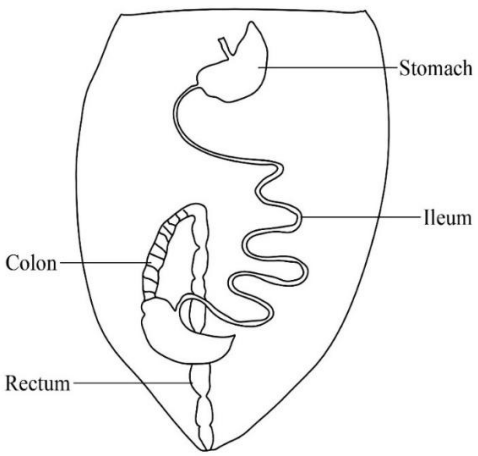
ii. Make a well labelled drawing of structures

iii. Make systematic observations with accurate measurements of external and internal structures;

Responses.
Procedure of dissection

i. Place specimen **E** ventral side uppermost on the dissecting board and pin it through the feet.
ii. Lift the skin at the mid-ventral line and make an incision along this line, extending from the lower jaw to the genitals.
iii. Loosen the skin from the body wall and pin it back on both sides of the specimen.
iv. Make a mid-line incision along the abdomen, cutting from the diaphragm to the pelvic girdle.
v. Pin back the separated body wall to expose the abdominal viscera clearly.
vi. Displace the liver lobes anteriorly to reveal the stomach.
vii. Displace the bulk of the ileum to the left, and the caecum & colon to the lower right, to expose all relevant structures.

A drawing of specimen E showing relevant structures of the gut.



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Measurements

Structure	Toad(mm)	Rat (mm)
Stomach	48	80
Ileum	150	840
Hindgut	58	175

b) Microscopic evidence of the nutritional advantage the rats

A drawing of one cell of specimen C stained with iodine as observed under medium power.

(The diagram shows a plant cell with starch filled structures)

(c) Analysis of the findings to justify the differences in the survival abilities of the common toad and the rat.

Candidates should:

(i) make meaningful comparisons between specimens; and link structural features directly to their adaptive significance for survival in the habitat.

Rats are better adapted to terrestrial habitats than toads because:

- The much longer ileum in rats provides a large surface area for absorbing digested nutrients increasing energy gain
- The longer hindgut allows more time to complete digestion and absorption of nutrients, hence ensuring food availability to the rat.
- The combination of a starch-rich diet enables rats to accumulate larger energy stores allowing them to withstand periods of food shortage better than toads.

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Item 2: SCIENTIFIC INVESTIGATION

This item assesses candidates' ability to plan, conduct, and interpret an investigation, then use results to make justified recommendations

Enzyme Activity Investigation

This item 2 assesses candidates' ability to plan, conduct, and interpret an experiment investigating the effect of enzyme concentration and activators on the rate of gas production.

Aspect	
Aim	An experiment to determine which enzyme extract (A,B or C) and activator (X or Y) combination maximises gas production from breakdown of P and recommend it to Joan
Hypothesis	Extract A produces the highest rate of gas when combined with activator X, because it contains the highest enzyme concentration and activator X provides more favourable conditions for enzyme activity.
Variables	Independent variables: • Concentration of enzyme extracts (solutions A, B and C). • Type of activator (solutions X and Y). Dependent variable: • Volume / rate of gas produced. Controlled variables: • Volume of each solution/extract used. • Temperature of the reaction. • Duration of the experiment.
Risks and Mitigations	Risk 1: Reagents may cause skin burns on contact due to their corrosive nature. • Mitigation: Handle reagents carefully and wear protective gloves throughout. Risk 2: Careless handling of knives may cause injury. • Mitigation: Handle all cutting instruments with care.
Procedure	Effect of enzyme concentration (extracts A, B and C) on gas production: 1) Label three test tubes A, B and C. 2) Add 2 cm^3 of the respective solution (A, B or C) to each labelled test tube. 3) Add 2 cm^3 of solution P to test tube A and record the rate of bubbling. 4) Repeat step 3 for test tubes B and C, recording observations for each.
	Effect of activators (solutions X and Y) on enzyme activity: • Label two test tubes X and Y. • Add 2 cm^3 of solution A to each test tube. • Add 2 drops of solution X to test tube X and 2 drops of solution Y to test tube Y. • Add 2 cm^3 of solution P to each test tube and record the rate of bubbling in each.

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<table>
<tr><td>Results Table</td><td>Results:<table><tr><th>Solution mixture</th><th>Observation</th></tr><tr><td>P + A</td><td>Rapid effervescence</td></tr><tr><td>P + B</td><td>Moderate effervescence</td></tr><tr><td>P + C</td><td>Slow effervescence</td></tr><tr><td>P + A + X</td><td>Rapid effervescence</td></tr><tr><td>P + A + Y</td><td>Slow effervescence</td></tr></table></td></tr>
<tr><td>Explanation</td><td>• Increasing enzyme concentration increases the frequency of enzyme-substrate collisions, leading to the formation of more enzyme-substrate complexes and a higher rate of gas production.
• Activator X enhanced the rate of reaction by modifying the enzyme or substrate to facilitate formation of the enzyme-substrate complex more readily.
• Solution Y inhibited enzyme activity by providing unfavourable conditions for the reaction, thereby reducing the rate of gas production.</td></tr>
<tr><td>Conclusion</td><td>The results confirm that increasing enzyme concentration and the use of activator X both increase the rate of gas production, consistent with the stated hypothesis.

Recommendation: Joan should use extract A (highest enzyme concentration) combined with activator X to achieve the greatest rate of gas production in her project.</td></tr>
</table>

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BIOLOGY
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INSTRUCTIONS
2026

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Uganda Advanced Certificate of Education

BIOLOGY PRACTICAL INSTRUCTIONS

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CONFIDENTIAL

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

INSTRUCTIONS FOR PREPARING SPECIMENS CHEMICALS AND APPARATUS

The head teacher **must** ensure that the teacher responsible for preparing the specimens, chemicals and apparatus hands in his/her procedures together with the trial results properly sealed in a separate envelope and **firmly** fastened (attached) to the candidates' scripts envelope(s).

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1. The description of the specimens, reagents and chemicals specified below does **not** necessarily correspond with the description in the examination paper. Candidates must **not** be informed of the differences.

2. Candidates are **not** allowed to use reference books during the examination.

3. In addition to the fittings and substances ordinarily contained in a Biology laboratory, each candidate will require:

- $20cm^3$ of solution **P**

  (Solution P is prepared by dissolving 8 cm^3 of hydrogen peroxide (100V) in 92cm^3 of water)

- $20cm^3$ of extract **A**

  (Extract **A** *is prepared by dissolving 300 g of peeled, crushed irish potato in 1000cm^3 of distilled water, stirred and decanted)*

- $20cm^3$ of extract **B**

  (Extract **B** *is prepared by dissolving 200g of peeled crushed Irish potato in 1000cm^3 of distilled water, stirred and decanted)*

- $5cm^3$ of distilled water labelled **X**
- $5cm^3$ of 2M HCl labelled **Y**
- Freshly killed rat labelled **E**
- Medium sized irish potato labeled **C**
- 6 test tubes
- $10cm^3$ measuring cylinder
- Knife
- Metre rule
- Mortar & pestle
- Thermometer

Easy access to:

- Heat source.
- Common reagents for food tests
- Weighing balance reading to atleast one decimal point.

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

UGANDA ADVANCED CERTIFICATE OF EDUCATION

2026

REPORT ON BIOLOGY PRACTICAL P530/2

Section I:

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

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

Procedure and results:

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Section II:

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

(a) difficulties due to faulty apparatus,

_____

_____

_____

(b) accidents to apparatus or materials,

_____

_____

_____

(c) physical handicaps of candidates,

_____

_____

_____

(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 experiment, for each session, must be enclosed with the scripts.

Invigilator's Name_____Signature_____

Signature of the teacher responsible for preparing chemicals/specimens _____

Signature of the head teacher _____

Random Number _____

END

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