

Candidate's Name: .....

Signature: .....

| Random No. |  |  |  |  | Personal No. |  |  |
|------------|--|--|--|--|--------------|--|--|
|            |  |  |  |  |              |  |  |

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

P530/3  
BIOLOGY  
Paper 3  
(Practical)  
Nov./Dec. 2024  
3¼ hours



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

BIOLOGY

Paper 3  
(Practical)

3 hours 15 minutes

### INSTRUCTIONS TO CANDIDATES:

*This paper consists of **three** questions.*

*All questions are **compulsory**.*

*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    |                            |
| 2                       | 35    |                            |
| 3                       | 25    |                            |
| Total                   | 100%  |                            |

1. You are provided with specimen X which is freshly killed.  
(a) Examine the head of specimen X and describe the structure and location of the following:

(i) Vibrissae (whiskers). (03 marks)

Many/numerous; thin/slender; stiff; variable length; tapering; dorso-laterally/ventrally/dorsally/laterally positioned; above the eyes/on the cheeks/on the chin/lower jaw; at anterior half; of the head. (03 max)

(ii) Eyes.

(1½ marks)

Paired/two; large/broad; protruding/bulging; oval/round/curved; dorso-laterally located; at anterior half; on either side of the head; in front of the pinnae. (03 max)

(iii) Pinnae.

(03 marks)

Paired/two; large/broad; curved; funnel-shaped; covered with short; scanty; hair dorso-laterally positioned; one on either side of the head; at the posterior end of the head; behind the eyes. (03 max)

- (b) How significant is the location of the following structures in the life of specimen X?

(i) Vibrissae.

(02 marks)

Anteriorly located; on the head for easy detection of obstacles/easy sensitivity to obstacles; OR laterally positioned; on the head for easy determination of the diameter of burrows. (02 marks)



(ii) Eyes.

(1½ marks)

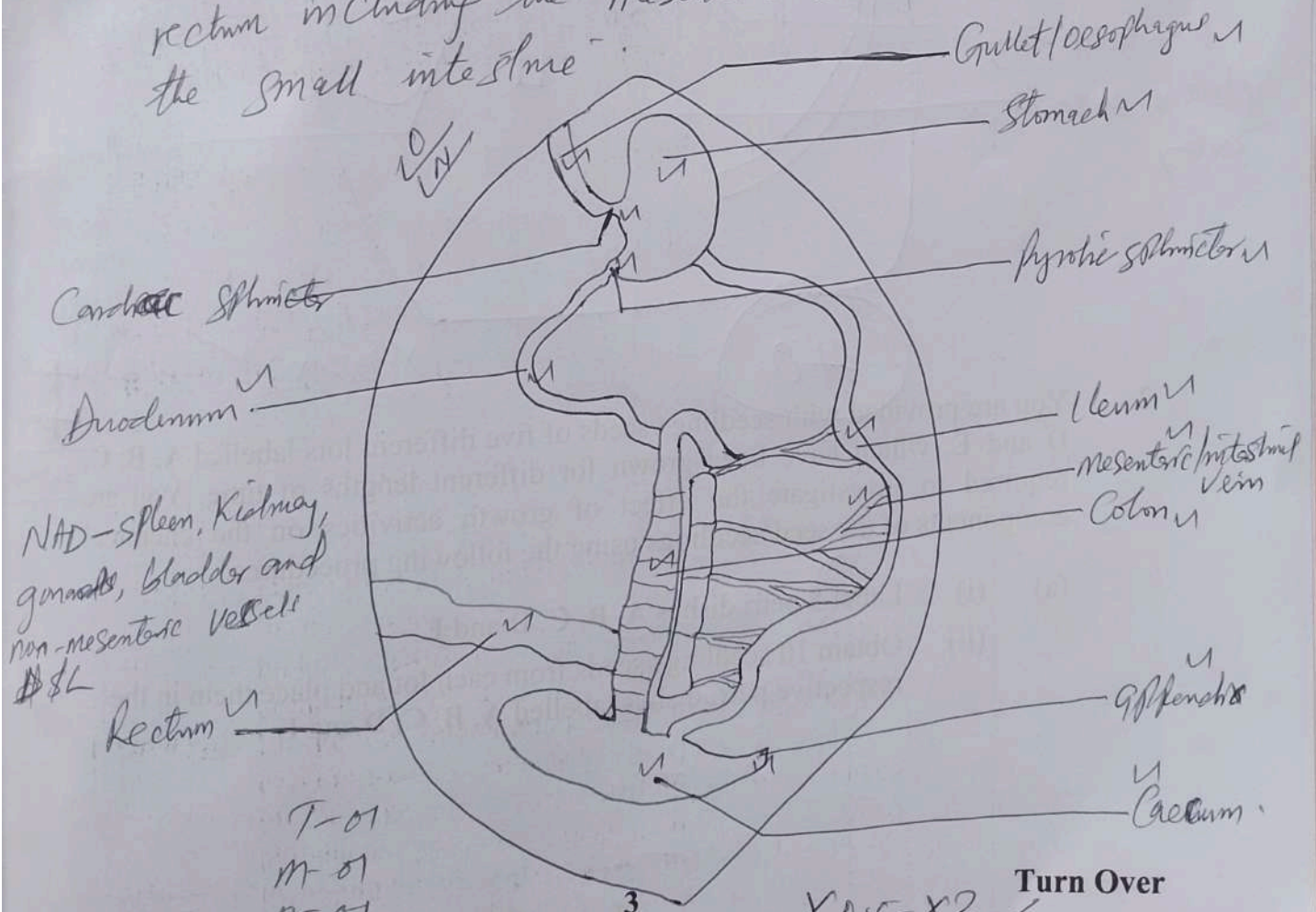
Dorso-laterally positioned for a wide/great  
great field of view;

(02 marks)

- (c) Dissect the abdominal cavity of specimen X to expose the structures in the viscera. Displace the liver lobes anteriorly to expose the underlying structures without displacing the stomach. Cut the rectum at the base, pull it upwards and pin it to the right side of the specimen. Locate the duodenum, caecum and ileum. Displace the duodenum and caecum to the right side of the specimen and the ileum to the left side of the specimen. Draw and label the displayed structures of the alimentary canal of the abdominal cavity up to the pinned rectum including the mesenteric structures attached to the small intestine.

(17 marks)

A drawing showing the structures of the alimentary canal in the abdominal cavity of specimen X upto the pinned rectum including the mesenteric structures attached to the small intestine.



T-01  
M-01  
O-01  
N-01  
D-05½  
L-05½

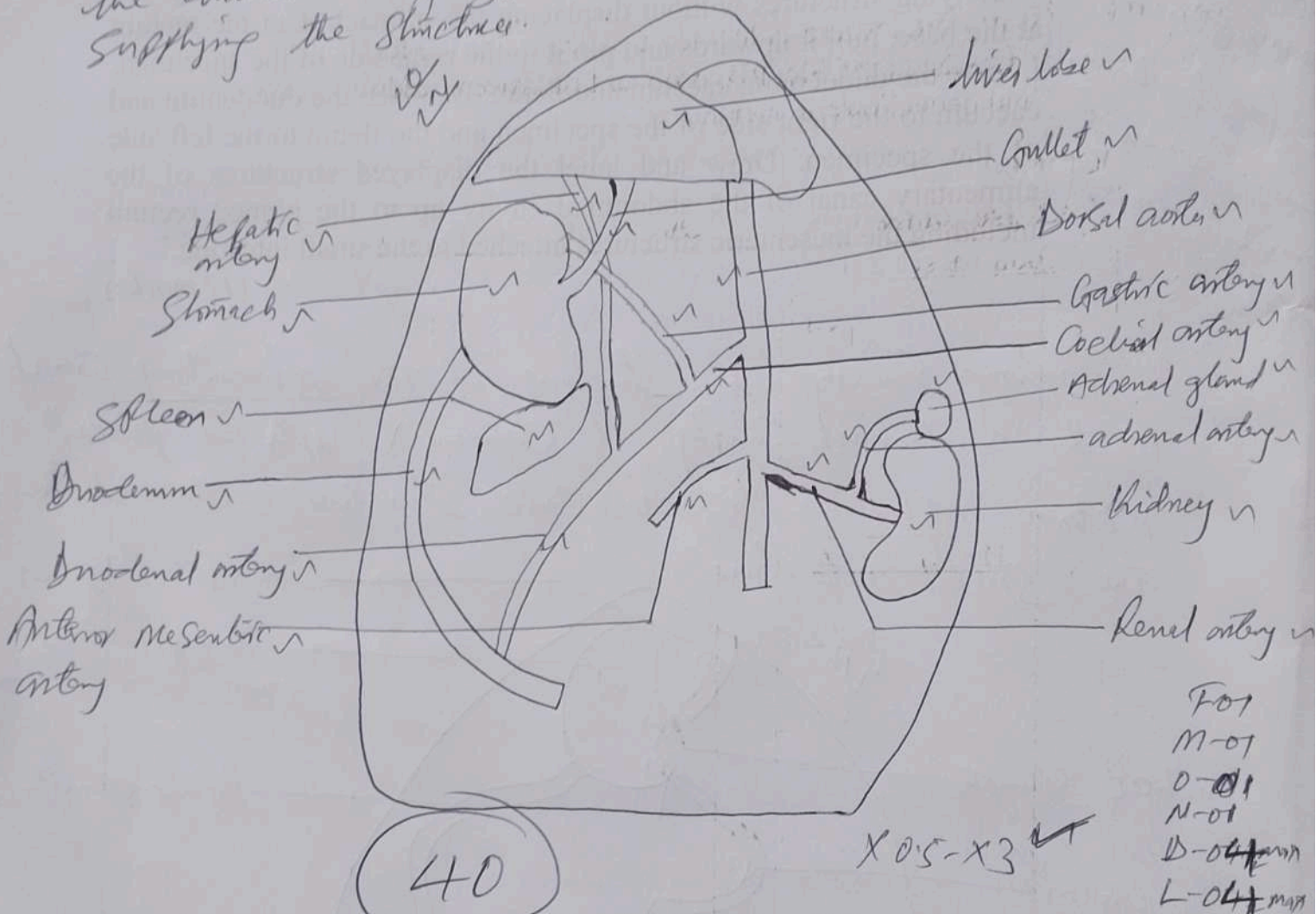
15

NADL - if thoracic and abdominal  
alimentary canal digestive structures DBL.



- (d) With the stomach displaced to the right side of the specimen, draw and label the organs lying between the anteriorly displaced liver lobes and the posterior end of the duodenum. Include the blood vessels that supply the structures displayed. (12 marks)

A drawing showing the organs lying between the anteriorly displaced liver lobes and the posterior end of the duodenum of specimen X including the blood vessels supplying the structures.



2. You are provided with seedlings/seeds of five different lots labelled A, B, C, D and E, which have been grown for different lengths of time. You are required to investigate the effect of growth activities on the chemical components of the seed/seedlings using the following procedures:

- (i) Label 5 petri dishes A, B, C, D and E.
- (ii) Obtain 10 seedlings/seeds from each lot and place them in the respective petri dishes labelled A, B, C, D and E.



- (iii) Using a clean mortar and pestle, thoroughly pound the seedlings from petri dish A. Add 15 cm<sup>3</sup> of distilled water, stir well and decant into a clean boiling tube and label it extract A<sub>1</sub>. Pour the residue into the plastic mug / beaker provided.
- (iv) Repeat the procedures (a)(i) – (iii) using the remaining seed/seedling lots to make corresponding extracts B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub> and E<sub>1</sub>.
- (b) (i) Carry out tests in table 1 to determine the food nutrients in extracts C<sub>1</sub> and D<sub>1</sub>. Record your test procedures, observations and deductions in the table.

Table 1

(14 marks)

| Test procedure  |                | Observations  | Deductions                           |
|---|----------------|---|--------------------------------------|
| <u>Iodine test</u><br>To 1cm <sup>3</sup> of test solution add 1 drop of iodine solution; ✓   | C <sub>1</sub> | Turbid solution; turns to black solution/blue black solution; ✓                                 | Much; ✓ starch present; ✓            |
|   | D <sub>1</sub> | Turbid solution turns to pale blue-black/spears of black solution; ✓                            | Little; ✓ starch present; ✓          |
| <u>Benedict's test</u><br>To 1cm <sup>3</sup> of test solution add 1cm <sup>3</sup> of Benedict's solution; and boil; ✓               | C <sub>1</sub> | Turbid solution turns to pale blue solution; to green solution; ✓                               | Little; ✓ reducing sugars present; ✓ |
|   | D <sub>1</sub> | Turbid solution; turns to pale blue solution; to green solution; to yellow ppt to orange ppt; ✓ | Much; ✓ reducing sugars present; ✓   |
| <u>Biuret test</u><br>To 1cm <sup>3</sup> of test solution add 1cm <sup>3</sup> of NaOH; followed by 3 drops of CuSO <sub>4</sub> ; ✓ | C <sub>1</sub> | Turbid solution turns to pale purple solution; ✓  | Little; ✓ proteins present; ✓        |
|   | D <sub>1</sub> | Turbid solution turns to very pale purple solution; ✓   | Very little; ✓ proteins present; ✓   |

05

06

05½

16½



- (ii) Basing on your results in table 1, name the extract which was obtained from the seedling that had grown for a longer time. (01 mark)

Extract D<sub>1</sub>; ✓ (01 marks)

- (iii) Explain your observations in table 1. (02 marks)

The concentration of starch reduced from C<sub>1</sub> to D<sub>1</sub> and that of reducing sugars increased; b'c D<sub>1</sub> had been germinated for a longer period, resulting into hydrolysis of much starch by enzymes to reducing sugars which are oxidized to provide energy for germination. ✓ (02 marks)

- (c) (i) Obtain five clean test tubes of the same size, label them A<sub>2</sub>, B<sub>2</sub>, C<sub>2</sub>, D<sub>2</sub> and E<sub>2</sub> and place them in a test tube rack.
- (ii) To each of the labelled test tubes A<sub>2</sub>, B<sub>2</sub>, C<sub>2</sub>, D<sub>2</sub> and E<sub>2</sub>, measure and pour 1 cm<sup>3</sup> of solution Q.
- (iii) Add 1 cm<sup>3</sup> of A<sub>1</sub> into the test tube A<sub>2</sub> and immediately start the stop clock.
- (iv) After 30 seconds, using a ruler, measure in centimetres the height of the contents in the test tube A<sub>2</sub>.
- (v) Record your measurement in table 2.
- (vi) Repeat procedures (c)(iii) – (v) using extracts B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub>, E<sub>1</sub> and the corresponding contents of test tube B<sub>2</sub>, C<sub>2</sub>, D<sub>2</sub> and E<sub>2</sub>.

Table 2

(05 marks)

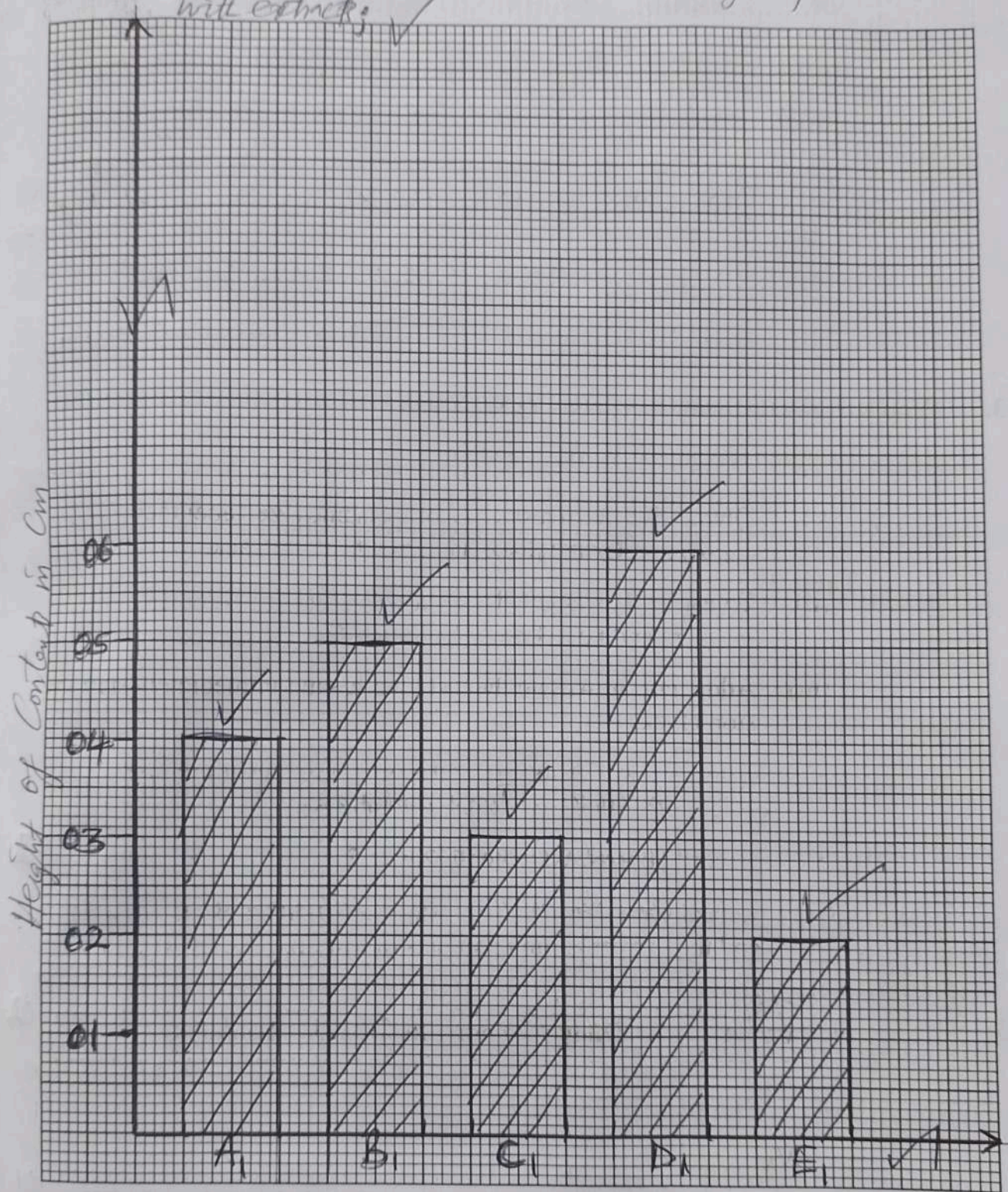
| Extract        | Height of contents after 30 seconds (cm) |
|----------------|--|
| A <sub>1</sub> | 1.5 – 4 ✓                                |
| B <sub>1</sub> | 1.6 – 5 ✓                                |
| C <sub>1</sub> | 1.4 – 3 ✓                                |
| D <sub>1</sub> | 1.9 – 6 ✓                                |
| E <sub>1</sub> | 1.1 – 2 ✓                                |

(05)



- (d) (i) Represent your results in table 2 on a suitable graph. (08 marks)

*A graph showing the relationship between height of contents with extracts;*



*Extracts*



(04 marks)

(ii) Explain the results plotted in (d)(i).

The extract contains Catalase/enzyme/active substance;  
 which determines the rate of decomposition of  $H_2O_2$  to  
 water and oxygen; and this determines the height of  
 contents; as the duration of germination increases,  
 there is increased metabolism; resulting into increased  
 concentration of Catalase/active substance/enzyme;

(04 marks)

3. You are provided with specimens V, W, Y and U.

(a) Examine specimens V, W, Y and U.

(i) Identify **two** distinctive features of the leaves and roots of each of the specimens and record your observations in table 3.

Table 3

(07 marks)

| Specimen | Distinctive Features Observed  |  |
|----------|--|--|
|          | Leaves   | Roots  |
| V        | Short sheath; fleshy/<br>Succulent; hairy; parallel<br>venied; pointed apex;<br>long lamina;                               | Adventitious roots; long;<br>at different nodes;<br>variable length; numerous;<br>fibrous; |
| W        | Fleshy/succulent; parallel<br>venied; thin; scale leaves;<br>closely packed; curved; three;                                | Adventitious roots; fibrous;<br>at base of stem;<br>taproot; variable length;              |
| Y        | Absent;  | Absent;  |
| U        | Inflorescence/longitudinal<br>network venied; stalked/<br>petioled; grooved; hairy;<br>pointed lamina; serrated<br>margin; | long; taproot; numerous;<br>lateral roots of variable<br>length; taproot;                  |

Award only  
the first two.



- (ii) Using the features in table 3, construct a dichotomous key for the identification of specimens V, W, Y and U. (03 marks)

Tied to only the 1st 2 characters

1 (a) Specimens with roots — go to 2; ✓  
 (b) Specimen without roots — Y; ✓  
 2 (a) leaves not veined — U; ✓  
 (b) leaves parallel veined — go to 3; ✓  
 3 (a) Specimen with only fleshy leaves — V; ✓  
 (b) Specimen with both scale and fleshy leaves — W; ✓  
 (03 marks)

- (b) Explain the significance of any **two** common observable features unique to both specimens W and Y. (02 marks)

(i) Both are swollen/thick; to increase surface area for storage of much food; for increased chances of survival of the sprouting plant; ✓

(ii) (02 max)

- (c) (i) Peel off the lower epidermis of a fleshy leaf of specimen W. Place it on a glass slide, add 1 – 2 drops of distilled water and cover with the cover slip. Observe under low power of a light microscope and describe the appearance of the observed structures within the field of view. (03 marks)

Polygonal/rectangular/hexagonal; numerous;  
 elongated/long; thick walled; with round nucleus;  
 They are closely packed side by side; arranged in parallel rows; ✓  
 (03 marks)

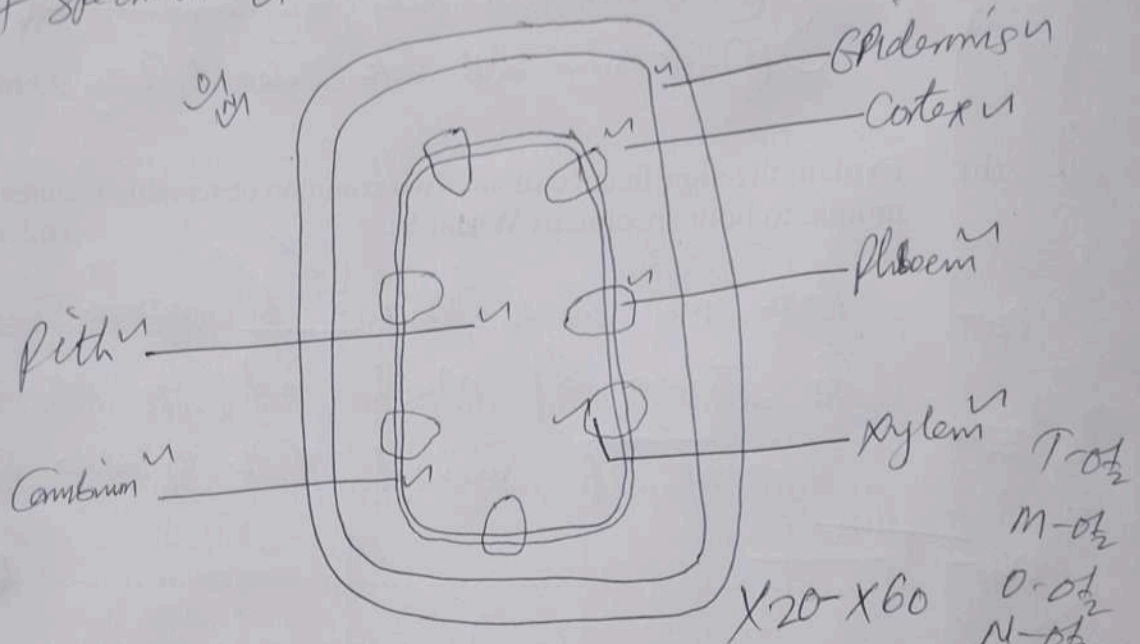


- (ii) Obtain a thin transverse section at the fourth internode towards the apex of specimen U. Place it on a glass slide, add 1 – 2 drops of iodine solution and cover it with a cover slip. Allow it to stand for 3 minutes and observe under low or medium power of a light microscope.

Draw and label the observed structures.

(08 marks)

A drawing of a Transverse section of the internode of specimen U viewed under low power of microscope.



- (iii) State how any **three** observed structures in (c)(ii) are suitable for their functions.

(03 marks)

- Thick epidermis; for increased protection from mechanical damage;
- Numerous parenchyma cells in the cortex/pith; for increased mechanical support when turgid;
- Closely packed parenchyma cells in cortex & pith; for increased mechanical support when turgid;
- Hollow xylem; for easy uninterrupted flow of water & dissolved mineral salts;
- Numerous xylem; to increase surface area for transportation of water and mineral salts;

(03 max)