

COORDINATED GUIDE

553/3
'O' LEVEL
BIOLOGY
PRACTICAL



MARKING
GUIDE 2023

1. You are provided with solutions X and Y. Use them to carry out the experiment below and record your observation and deduction in the table below.

TABLE I

(09 marks)

a)	TEST	OBSERVATION	DEDUCTION
	(i) Protein X	<i>Turbid solution turned to a colourless solution and to a purple / violet solution / precipitate</i>	<i>Proteins present</i>
<i>Accept colourless state Rej. colour without state</i>	(ii) Reducing sugars Y	<i>Colourless solution turned to a blue solution to a green solution to a yellow precipitate to a orange precipitate.</i>	<i>Reducing sugars present</i> <i>Rej. Colour without state</i>

- Immerse the visking tube provided into water and gently rub it between your fingers to open it.
- Tie one open end of the visking tube
- Measure 5cm³ of X and 5cm³ of Y.
- Pour both contents X and Y into the visking tube and tie up the remaining open end and wash the outside surface of the visking tube.
- Measure 20cm³ of distilled water and pour it into a boiling tube.
- Submerge the prepared visking tube into the boiling tube and leave it to stand for 15 minutes. (*Meanwhile, continue with other work*).
- After 15 minutes remove the visking tube and carry out the following tests of the content in the boiling tube and record your observation and deductions. (06 marks)

TABLE II

b)	TEST	OBSERVATION	DEDUCTION
(i)	<i>Protein test on content in the boiling tube</i>	<i>Colourless solution remained a colourless solution and turned to a blue precipitate</i> <i>(Not applicable)</i>	<i>Proteins absent.</i>

(ii) Reducing sugar test on content in boiling tube.	Colourless solution turned to a blue solution to a green solution to a yellow precipitate and an orange precipitate.	Reducing sugars present
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04

- (c) (i) Explain your observations in table II above. (03 marks)

~~Proteins absent because they have large particles which could not pass through the pores of the visking tube while~~ Reducing sugars ~~were present since they were small molecules~~ and passed through the pores of the visking tube by diffusion.

- (ii) Identify the nature of the visking tube, stating a reason to support your answer. (02 marks)

Partially permeable / selectively permeable
Semi permeable membrane since it allowed small molecules of reducing sugars to pass through ~~and the large protein molecules did not pass through~~.

- (d) What biological process is investigated in the experiment? (01 mark)

Diffusion / diffusion in liquids.

Ref facilitated diffusion

- (e) State any **one** factors of the process investigated in the experiment above. (02 marks)

- Size of the particles affects diffusion size of molecules
- ~~Concentration of the substance affects the diffusion~~

Ref size alone

2. You are provided with plant organs A and B. Examine them carefully and use them to answer the questions that follow:

Specimen A - Mature Aloe vera leaf

Specimen B - Mature Amaranthus leaf.

- (a) (i) Using observable features, suggest the characteristics which identify the specimens to belong to the same plant group of organs. (02 marks)

- Lamina, ✓ (Any 2)
- Petiole, ✓ / leaf stalks
- Leaf base
- (any 2) i.e. mark the first 2(two) answers

Accept
Leaf stalk because
a leaf stalk is a
sheathed stalk.

- (b) (i) Describe the venation of specimen B. (03 marks)

- Many/numerous veins
- Joined veins
- Network veins / Reticulate veins
- Different sized veins

Accept
tapering for
reducing towards
the margin

- Originate from the midrib
- Reducing / narrowing towards the margin

- (ii) Using observable features, state any four(4) differences between specimens A and B. (04 marks)

Specimen A	Specimen B
- Parallel veins / venations	- Network veins / reticulate veins
- Thorny leaf margin	- Entire leaf margin
- Short petiole	- Long petiole
- Narrow lamina	- Broad lamina
- Thick lamina / succulent lamina	- Thin lamina
- Short petiole	- Long petiole
- Leaf sheathed petiole	- Leaf stalked petiole
- unHairy lamina	- Hairy lamina

Accept
spiny margin

Rg margin
not thorny or
spiny

(Any first 4)

- (c) (i) Using observable features, explain how specimen B is adapted for survival in its habitat. (03 marks)

- Thin lamina shortening the penetration of sunlight during photosynthesis
- Thin lamina to shorten the diffusion distance ~~for sunlight~~ carbon dioxide during photosynthesis
- Green lamina indicating the presence of chlorophyll for trapping sunlight energy during photosynthesis.

(Any first 3)

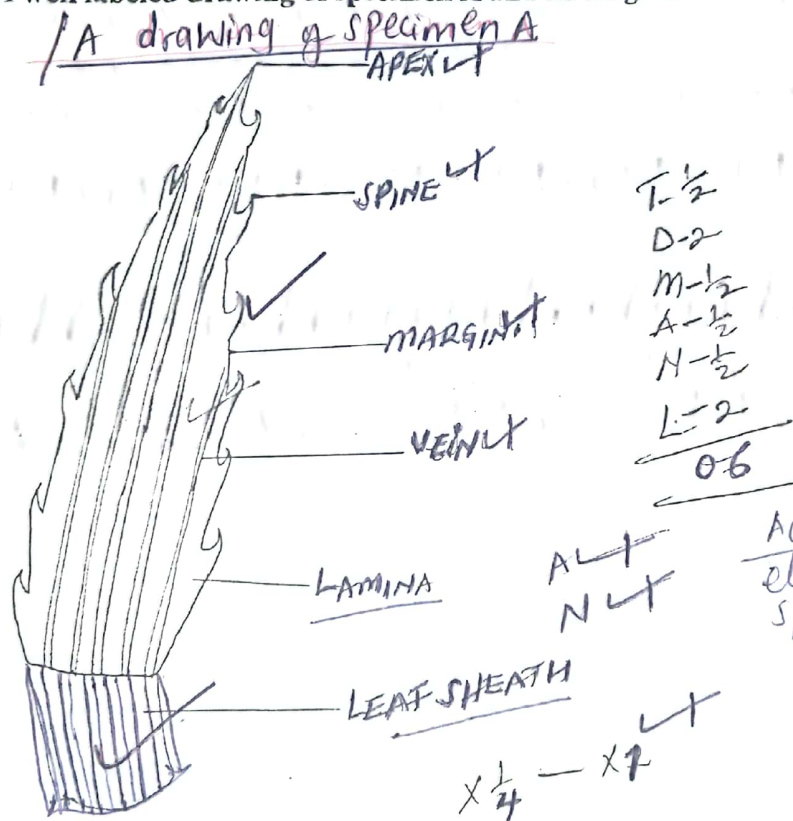
- Numerous / many veins ^{increase surface area} for transporting water and mineral salts during photosynthesis.
- Broad lamina increases surface area for trapping sunlight during photosynthesis.

(ii) Using observable features, suggest two(2) advantages of specimen A over specimen B. (02 marks)

- Sharp spines ^{/thorns} along the margin / sharp spiny margin ^{thorny} for protection unlike B with out thorns
- Thick / succulent / fleshy lamina for water storage in the habitat unlike B which has a thin lamina

(d) In the space provided, make a well labeled drawing of specimen A and indicate your magnification. (06 marks)

A well labeled drawing of specimen A and its magnification.



Drawing points

- ▢ Tapering lamina with spiny (curved) margin
- ▢ Short petiole with stripes / veins and separated from the lamina.
- ▢ Grooved petiole / sheath with a depression.
- ▢ - well drawn spine / thorn curving upward.

20 marks

3. You are provided with specimens P and Q which belong to the same animal group. Examine them carefully and use them to answer the questions that follow:

Specimen P - Mature cockroach
Specimen Q - Soldier termite

- (a) Identify the taxonomic class to which both organisms belong stating two(2) reasons to support your answer. (03 marks)

Identity

Class insecta *Rej. Wrong spellings.*
Insect

Reasons

- 3 pairs of jointed legs / limbs / ~~appendages~~ / legs *(Any first 2)*
- 3 thoracic segments
- 3 main body divisions / 3 main body parts / 3 body divisions

- (b) Using observable features on the head only, state any three(3) differences between specimens P and Q. (03 marks)

Specimen P - <i>cockroach</i>	Specimen Q - <i>Termite</i>
- Long antennae	- Short antennae
- Sharp serrated mandibles / <i>serrated mandibles</i>	- Sharp pointed mandibles / <i>curved mandibles</i> <i>Any 3</i>
- Triangular shaped head	- Oblong shaped head
- 2 or a pair of comma shaped eyes / eyes	- Lacks eyes
- <i>flat on the ventral side.</i>	- <i>grooved on the ventral side</i>

- (c) Using observable features of the thorax only, explain how specimen P is adapted for survival in its habitat. (04 marks)

- *Jointed* ~~Hard~~ legs for flexibility to move in the habitat
- Hard / stiff outer wings for protection in the habitat
- Folded membranous inner wing to increase surface area for flight
- Dull coloured outer wings for camouflaging during protection
- Hard cuticle for protection in the habitat
- Waxy cuticle to prevent water losses from the organism.

ReJ
- Other parts not located on the thorax

(Any first 4)

(d) Explain the ecological importances of specimen Q to the environment.

(04 marks)

- mixes soil ^{litter} improving soil fertility
- Cuts down ^{litter} / wastes into small particles improving soil fertility
- Eaten by other organism like birds for food
- When it dies, it decomposes to form manure / organic matter in the soil improving soil fertility.
- It aerates the soil ^{during burrowing or making tunnels} ~~allowing gaseous exchange~~
- creates tunnel allowing water infiltration / water drainage in the soil.

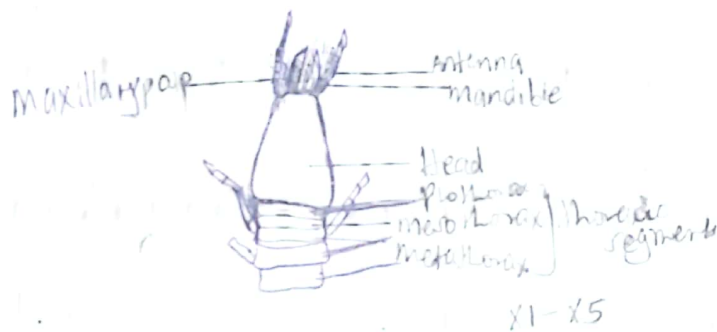
Rej
- cutting down plants its not ecological

(Any first 4)

(e) In the space provided make a well labeled drawing of the dorsal view of only the head joined with the thorax of specimen Q and indicate your magnification.

(06 marks)

A well labeled drawing of the dorsal view of both the head and thorax only of specimen Q.



T-1/2
D-2
M-3
A-4
H-2
K-2 (Any 4)

06

Rej
- Accuracy when the head is drawn with grooves

Rej
if origin of the legs is shown and with wings
- More than 3 thoracic segments

Rej.

Head with grooves it

becomes a ventral view

curved pointed

Drawing points

Well drawn

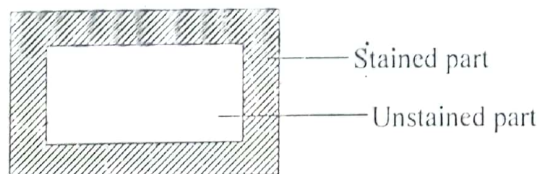
- Oblong shaped head without grooves
- 3 thoracic segments narrow than the head but first thoracic segment longer.
- 2 antennae and sharp mandibles at the top of the head but mandibles shorter than antennae
- curved pointed mandibles

20 marks



1. You are provided with specimen **K** which is a plant organ and solution **Z** which is a common laboratory reagent. Use them to carry out the experiment below and answer the questions that follow:

- Peel specimen **K** and cut it to obtain two cubes K_1 and K_2 .
- Using a razor blade, trim two(2) cubes.
- Trim cube K_1 in the dimension of 5mm x 5mm x 5mm.
- Trim cube K_2 in the dimensions of 10mm x 10mm x 10mm.
- Measure 20cm³ of solution **Z** and pour it into the boiling tubes(1) and (2) respectively.
- Drop both cubes K_1 and K_2 simultaneously into each of the boiling tubes and wait for 15 minutes. MEANWHILE CONTINUE WITH OTHER WORK
- After 15 minutes, remove both cubes K_1 and K_2 from the solution **Z** and dry them with the filter paper.
- Then cut each cube vertically into two(2) equal halves using a razor blade.
- Measure the distance penetrated by solution **Z** into each cube K_1 and K_2 as shown below:



From the experiments above, calculate the volume, surface area, surface area to volume ratio and the average distance moved by solution **Z** into cube K_1 and K_2 and fill the results in the table below: (10 marks)

(a)

$$\text{Volume} = L \times W \times H \text{ cm}^3 \quad 5 \times 5 \times 5 \text{ mm}^3$$

$$\text{S.A} = 2(l \times w) + 2(w \times h) + 2(l \times h) \text{ cm}^2 \quad 150 \text{ mm}^2$$

$$\text{Average distance moved} = \frac{L + W + L + W}{4}$$

(10 marks)

Cubes	Volume (mm ³)	Surface area (mm ²)	Surface area to volume ratio	Average distance moved by solution
K ₁	125 ✓	150 ✓	$\frac{150}{125} = 1.2$ ✓	$\frac{2.1 + 1.7 + 2.3 + 2}{4} = 2.0$ ✓ <i>+0.5/-0.5</i>
K ₂	1000 ✓	600 ✓	$\frac{600}{1000} = 0.6$ ✓	$\frac{1.0 + 1.3 + 0.8 + 1.2}{4} = 1.0$ ✓ <i>+0.5/-0.5</i>

- (b) From your results in the table above, explain the differences in the distance moved by the solution Z into each of the cubes K₁ and K₂. (04 marks)

acc: entered
 The small cube (K₁) has a large surface area to volume ratio; enabling faster penetration of solution Z; while cube K₂ is large and has a small surface area to volume ratio; hence slow diffusion of solution Z; and solution Z less penetrated into K₂. *deeper*

- (c) Explain how the large cube would overcome its disadvantage. (02 marks)

~~The large cube would develop a circulatory system, to supply the substances to all the parts;~~

The large cube would be given more time to allow the solution/molecules or Z to penetrate deeper into the cube

- (d) Identify the biological process investigated in the experiment. (01 mark)

diffusion

- (e) Suggest any other three(3) factors that may affect the process investigated above. (03 marks)

- Temperature of the substance
- Size of the molecules / particles */ Density of molecules*
- Time allowed for diffusion
- Concentration of the substance */ gradient*

2. You are provided with specimens M and N which are plant organs. Examine them carefully and use them to answer the questions that follow:

- (a) Identify the plant divisions to which each specimen belongs. (02 marks)

Specimen M : Mature yellow *axils* plant → *spermatophyta*

Specimen N : Mature fern plant → *pteridophyta* / *Filicinophyta*

- (b) Using observable features, state any four(4) differences between specimens M and specimens N. (04 marks)

Specimen M	Specimen N
- Lacks ^{Has} flowers / fruits	- Lacks flowers / fruits
- Lacks sori	- Has sori
- Has leaves	- Has fronds
- Has a tap root system / ^{tap root}	- Has a fibrous root system / ^{adventitious root system}
- Lacks a Rhizome / ^{Hairy plant}	- Has a rhizome / ^{starchy stem} (Any 4)

- (c) Using observable features, explain the advantages of specimen N over specimen M. (04 marks)

- N has swollen rhizome / stem for food storage unlike M ^{used by the plant during drought}
- N has large fronds to increase surface area for photosynthesis unlike M
- N has many adventitious roots to increase water absorption unlike M ^{Ref}
- N has many adventitious roots for firm anchorage into the ground ^{reproduction alone}
- ^{a lot many} many sori for asexual reproduction faster than M

- (d) Explain the adaptations of specimen M for survival in its habitat. (04 marks)

- ^{Many leaves increase surface area for sunlight absorption} Many leaves increase surface area for sunlight absorption
- Brightly coloured flowers to attract insects for pollination during sexual reproduction.

- ^{Many} Green coloured leaf ~~lamina~~ ^{leaf} indicating the presence of chlorophyll for trapping sunlight during photosynthesis

- Thin lamina to reduce the diffusion distance for ~~carbon dioxide~~ ^{penetration / absorption} and sunlight during photosynthesis.

accept many leaflets - * Many ^{leaves} leafless to increase surface area for trapping sunlight during photosynthesis.

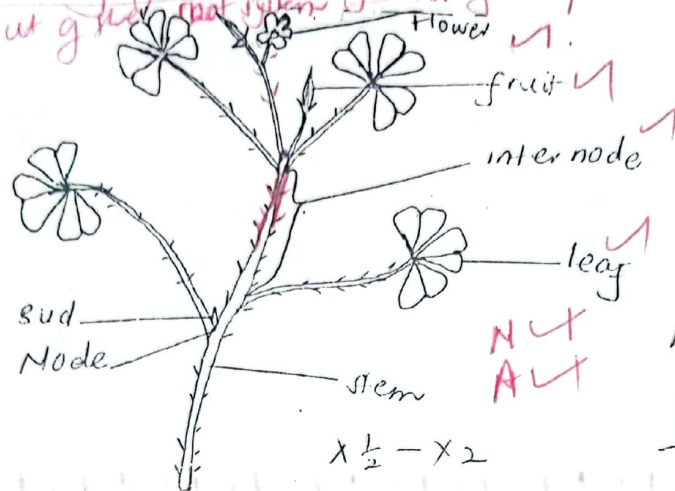
- Has fruits with sutures which burst open to promote seed dispersal. / ^{lines of weakness} self dispersal

- Long tap root for firm anchorage / deep penetration to absorb water and minerals.

- Hairy plant / leaves and stem to reduce water loss by transpiration / reduce water loss

- (c) Cut off the roots from specimen M and make a well labeled drawing of the remaining part and indicate your magnification. (06 marks)

A drawing of the shoot system of M / A drawing of specimen M with out g roots



7-1/2
D-2
M-1/2
N-1/2
L-2
06

rej
* A complete specimen with labels.

* Drawing with roots But roots not labeled mark the labels

* Drawing with boundary - Don't mark outside work

Well drawn

- Leaf with a long leaf stalk attached to the stem
- ~~Long~~ hairy stem
- Elongated fruit or flower attached on a long stalk.

any 2

3. You are provide with a freshly killed animal specimen X. Examine it carefully and use it to answer the questions that follow;

- (a) (i) Using observable features, suggest the phylum for the specimen stating three reasons to support your answer. (04 marks)

Phylum

Arthropoda rej. Wrong spellings

Reasons

- Segmented body
- Jointed legs / limbs / appendages
- Exoskeleton / outside

Accept outer / external skeleton

- (ii) Identify the habitat for the organism. (01 mark)
Crevices / cracks of walls / wood

Dark warm places

Accept cracks crevices.

Reg dirty places

(b) Explain how the features listed below make the organism become adapted for survival in its colony.

i) Body shape.

(1) mark

Dorsal ventrally flattened body shape to fit / fix in the crevices / cracks of wood. / *spaces*

ii) Antennae

(12 marks)

- Long antennae to increase surface area for sensitivity

around the organ
segmental / Jointed antennae / segmented antennae for flexibility during sensitivity

Acc. Long and segmented to increase surface area for sensing around the bodies

iii) Outer wings

(12 marks)

- Dull coloured outer wings for camouflaging during projection

- Hard outer wings / stiff outer wings for protection in the colony

*ALL = camouflage
Not to be seen*

iv) Hind legs.

(12 marks)

- Spiny hind legs for protection in the colony

- Jointed legs / limbs for flexibility to locomote in the colony

(can be) Pointed claws for gripping on rough surfaces

- Smooth glandular pads / arolium for attachment and movement on smooth surface.

Long legs for leaping over long distance

(c) (i) Suggest the mode of feeding for the organism X.

(1) mark

Cutting / biting / cutting and biting.

(ii) Explain how the organism X is adapted for the mode of feeding stated in (c) (i) above.

(1) mark

receptacles for cutting

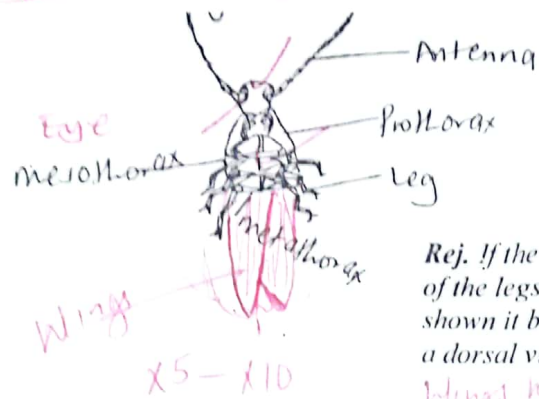
Sharp serrated mandibles for cutting and biting food when feeding / masticating

(d) In the space provided, make a well labeled drawing of the ventral view of specimen X without the abdomen and indicate your magnification.

(16 marks)

A drawing of the ventral view of specimen X showing the head and thorax only / a drawing of the ventral view of the head and thorax without the abdomen.

A well labeled drawing of the ventral view of X without the abdomen



T - $\frac{1}{2}$
D - 2 (any 2)
M - $\frac{1}{2}$
A - $\frac{1}{2}$
N - $\frac{1}{2}$
L - 02 (any 4)
Total = 6

Rej. If the origin of the legs is not shown it becomes a dorsal view

Wings must have veins

Drawing Points

- Triangular shaped, head with long antennae
- 3 thoracic segments showing the origin of the legs
- 2 comma shaped eyes showing the origin of the long antennae

END