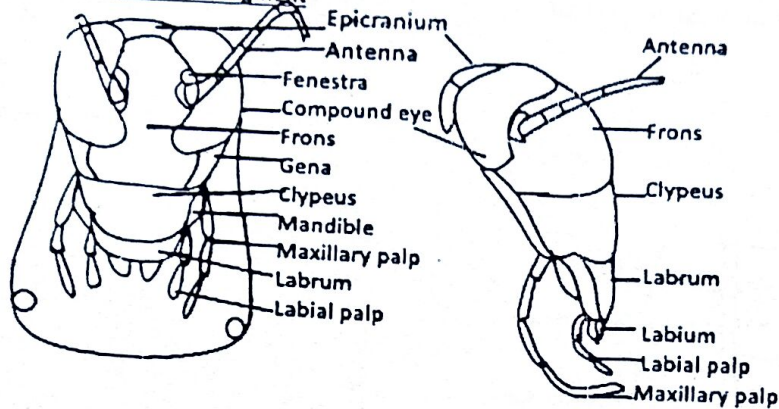
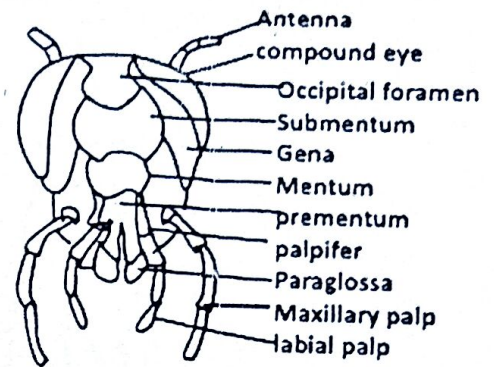


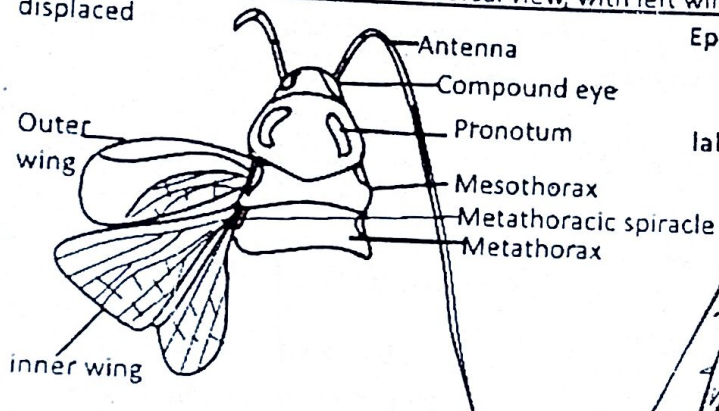
Drawing of anterior view of the Head plus the first thoracic segment Drawing of lateral view



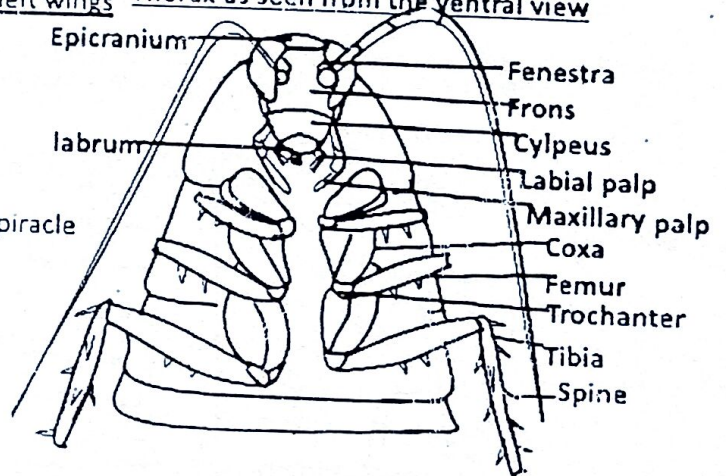
Drawing of the posterior/ventral view of the Head



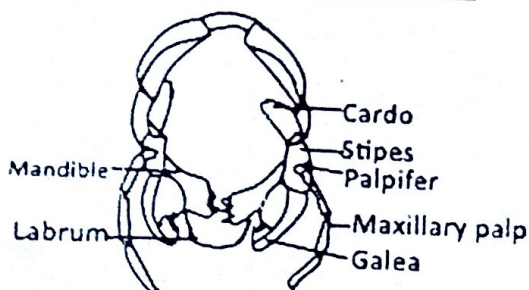
Drawing of the structures on the dorsal view, with left wings displaced



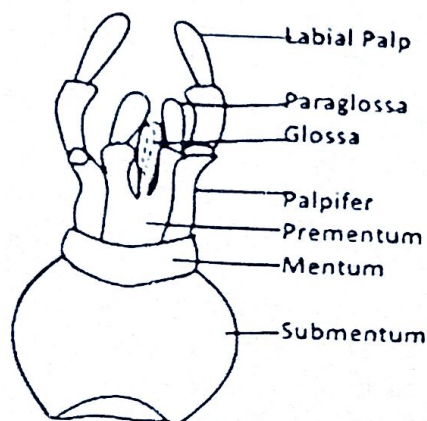
Drawing showing structures on the head and Thorax as seen from the ventral view



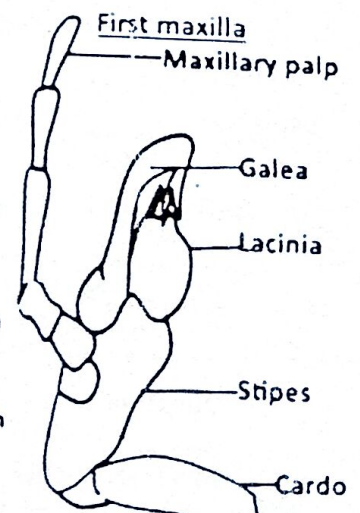
Drawing showing posterior view of the head with labium/second maxilla removed



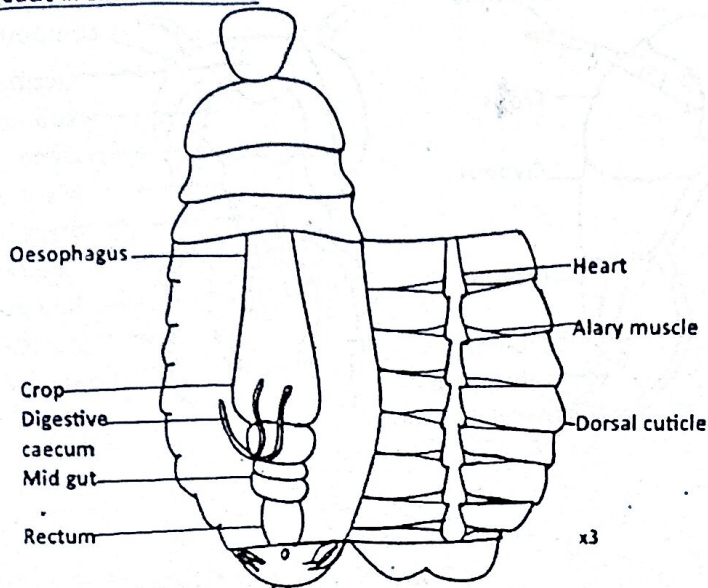
Second maxilla
Drawing showing labium



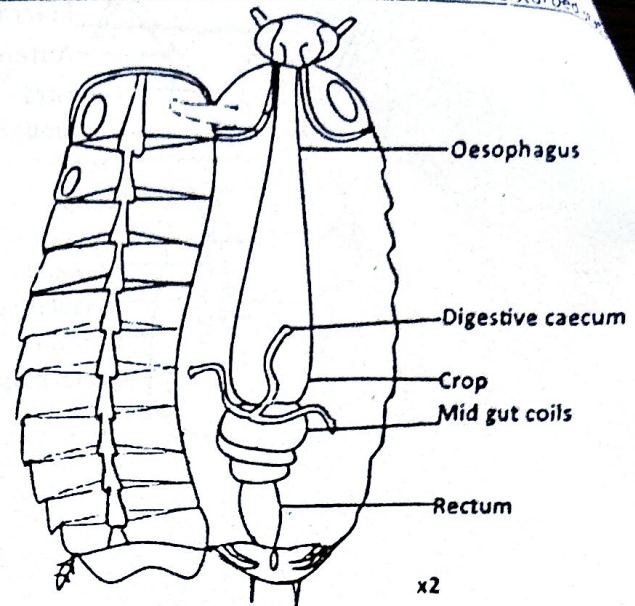
First maxilla
Drawing showing labium



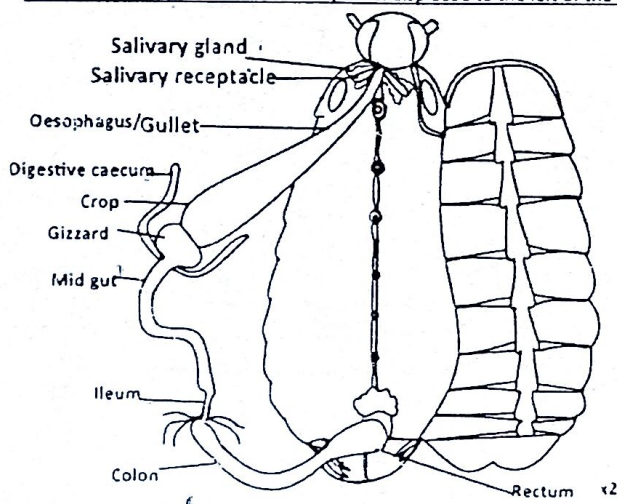
Drawing showing abdominal structures on ventral cuticle and dorsal cuticle in undisturbed state



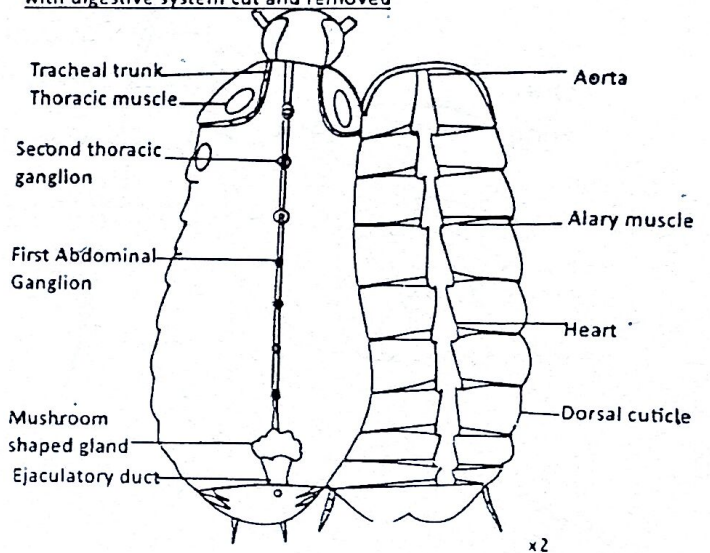
Drawing showing alimentary canal of a cockroach in undisturbed state



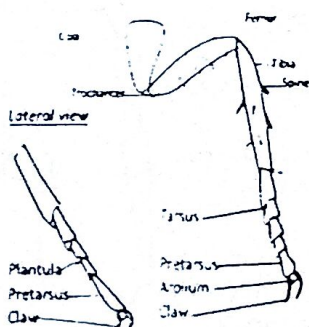
Drawing showing digestive system and structures on the ventral and dorsal cuticle of a cockroach with alimentary canal displaced to the left of the animal



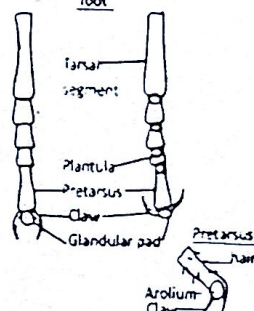
Drawing showing structures on the ventral and dorsal cuticle of a cockroach with digestive system cut and removed



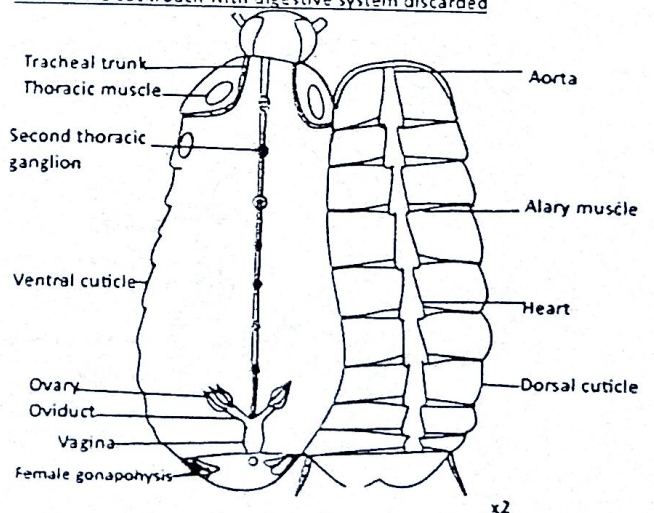
Drawing showing structure of hind foot of a cockroach



Dorsal view and Ventral view of the foot



Drawing showing structures on the ventral cuticle and circulatory system of a female cockroach with digestive system discarded



Question 1

Specimen Z-cockroach

Question 2

Solution Q - 35cm³ of 342.3 in 1Litre

Solution S-1% H₂O₂

P-LARGE Irish potato

R-2 beans soaked in wet cotton wool for 48hours

Question 3

Inflorescence of

Specimen H-bidens pilosa

Specimen I -bougainvillea

Specimen J-lantana camera

Question 3

You are provided with specimens H, I, and J which are plant organs.

(a) State the phylum of the plants from which the specimens were obtained.

(01 mark)

Angiospermophyta/tracheophyta/angiospermatophyta/spermatophyta

b) (i) Examine the flowers or florets of each specimen, and state three structural descriptive features as indicated in Table 3. (7½ marks)

Table 3

Flowers or florets of specimen	Symmetry	Corolla	calyx	Bracts
H Bidens pilosa inflorescence	<i>Actinomorphic/ radial/regular Or Zygomorphic;</i>	<i>Small; fused; net veined; open at apex tubular at the base ,broad at the apex</i>	<i>Free; slender; small; thin; pointed/Tapering</i>	<i>NO BRACTS</i>
J Lantana inflorescence	<i>Actinomorphic;</i>	<i>4/5 fused; small ;tubular smooth; broad at apex</i>	<i>Fused; small; short;</i>	
I -Bougainvilleae inflorescence	<i>Actinomorphic;</i>	<i>5; fused ;small ;net veined</i>	<i>No calyx/absent</i>	<i>Large /broad; veined; thin; smooth;</i>

(ii) For each specimen, name the outermost part of the flower or floret and give one descriptive feature of it. (05 marks)

specimen	Descriptive features
H-sepal;	<i>Free; slender; small; thin; pointed; dull coloured;</i>
J-sepal ;	<i>Fused;short;small;dull coloured;</i>
I-petal;	<i>Five;fused;small;net veined;brightly coloured;</i>

Examine specimens H, I and J provided and answer the questions that follow;

A (i). Describe the structure of specimens **H** and **J**

(4mks)

Specimen H -Bidens

Numerous; crowded; unstalked florets; of two types; ray florets at the periphery; surrounding; closely packed tubular/ inner disc florets; which are arranged *in the circular pattern around the centre with the mature/older tubular* florets at higher level; younger tubular florets at lower level and found in the centre.

All the florets are attached at expanded tip/ apex of the peduncle; and are surrounded by numerous bracts;

Specimen J-Lantana

Numerous; *unstalked; bisexual; actinomorphic; florets/flowers* attached on a expanded tip/apex of peduncle at almost the same or different points. *The inner/younger florets are arranged around the centre and closely packed while the older florets are found at the peripheral of the expanded apex of peduncle. All florets are enclosed by dull coloured; oblong/ovate; hairy; tapering; thick; free; parallel veined; bracts.*

Specimen I-bougainvillea inflorescence

Three; stalked; bisexual florets; separately attached/fused at the midrib/ main vein; at the base on the upper/ inner surface; of the bracts;

All the pedicels of the three florets; fuse at the base; forming a common peduncle/main axis;

(ii) How does each specimen benefit from its structural uniqueness as described in a(i) above
Specimen H

- Closely packed florets ensures firmness/ florets support each other/ eases or increased chance of being pollinated;
- Florets surrounded by involucre of bracts/ outer florets surround inner florets for protection;
- Tubular florets, inner parts protected;

Specimen I=Bougainvillea

- Each floret on its own bract reduces competition;
- EACH florets attached by stalk fused to midrib to absorb water/ nutrients;
- Florets on inner/ upper surface of the bracts for protection;
- Each floret at the midrib of the bract for firm support
- At the base of the midrib for firm support

(ii) Repeat the procedure in b(i) above for a floret from the periphery of **specimen H**.

Give one outstanding difference and two similarities in the structure of the two florets. (03 marks)

Inner floret	Floret from periphery
Fully fused corolla/ corolla uniform size or narrow all through.	Partially fused corolla/ broad corolla at tip
Narrow petals	Broad/open petals at the apex which are tubular at the base.
Have stamens	Lacks stamens

Ray/ligulate floret	Tubular/Disc floret
• Open corolla towards apex/tubular at the base only	Tubular corolla
• Zygomorphic/irregular	Actinomorphic /regular
• Style/stigma/ovary/anthers absent	Style/stigma/ovary/anthers present
• Corolla white in colour	Corolla yellow in colour

Similarities

- Forked/ divided stigma; inferior ovary
- Fused anthers
- Fused corolla
- Hairy calyx

ii) State one advantage of specimen J over specimen H in reproduction.

(02mks)

(b) Pick one flower from each inflorescence and examine it using a hand lens. Describe the structure of each flower with respect to the specified parts as indicated in Table 2 (15marks)

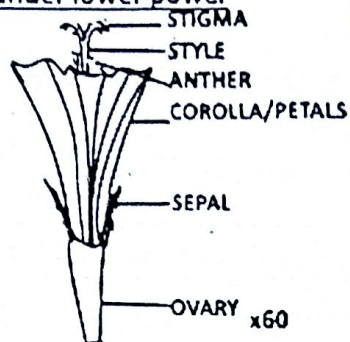
	STAMENS/ANDROECIUM	GYNOECIUM/PISTIL/CARPELS
I- Bougainvillea	<i>Long; slender; free; smooth; filaments and bilobed ;circular anthers ;brightly coloured</i>	<i>Elongated; Superior; ovary with short; style and elongated ;hairy stigma;</i>
H- Bidens	It has five stamens with fused, bilobed; elongated/long anthers and thin/slender short; filaments	Pistil with long/elongated inferior ovary and two/forked fused; hairy; stigma
Specimen J- lantana camera	<i>Four Stamens with large; bilobed; elongated; ovoid shaped anthers attached to a short; thin; fused with petals filaments.</i>	<i>The florets have a syncarpous pistil that consists of bilobed/bilocular/bicarpel; knob-like; obliquely attached stigma to broad base; superior; ovary by a short; thin; style</i>

Using the descriptive features in the table. State how the structure of each flower is adapted to the reproductive life of the plant of each specimen

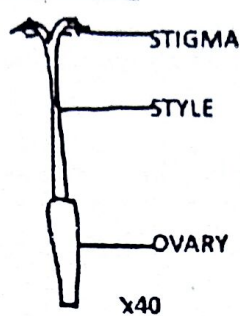
Specimen H=Bidens

- Has both stamens and pistil/carpel therefore pollen produced by stamen and deposited easily on stigma
 - Two stigmas heads/forked feathery stigma to capture /trap /avail large surface area for pollen
 - Large anther heads to produce large quantities of pollen to increase chances of pollination
- c) Draw and label flower from specimen H

Drawing of tubular floret of *Biden pilosa* observed under lower power



Drawing of gynoecium of *biden pilosa* under lower power



(d) (i) What is the structural limitation for the mode of pollination for florets of specimens H, J and I? (1 ½ marks)

They have small petals; hence inconspicuous; and can not be easily seen by/attract insects for pollination;

(iii) How has specimen H overcome the limitation in (d)(i)?

(01mark)

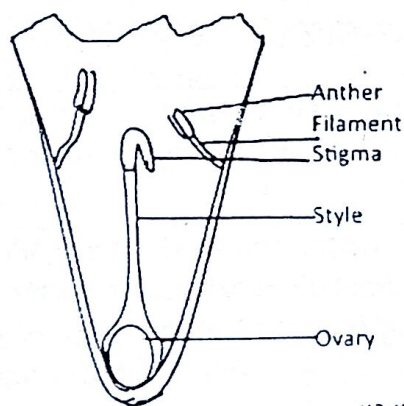
Broad brightly coloured bract; that makes it conspicuous/easily attract insect pollinators;

(e) Obtain a floret from specimen J (*LANTANA*) and cut it longitudinally.

(i) Draw one half of the floret and label the essential parts.

(06 marks)

A Drawing of the longitudinal section/one half showing the essential/reproductive parts of specimen M



T 0.5
M 0.5
O 0.5
N 0.5
D 02.5
L 02.5
07

x3-x5

(ii) How is the floret of specimen J adapted to its type of pollination?

(01mark)

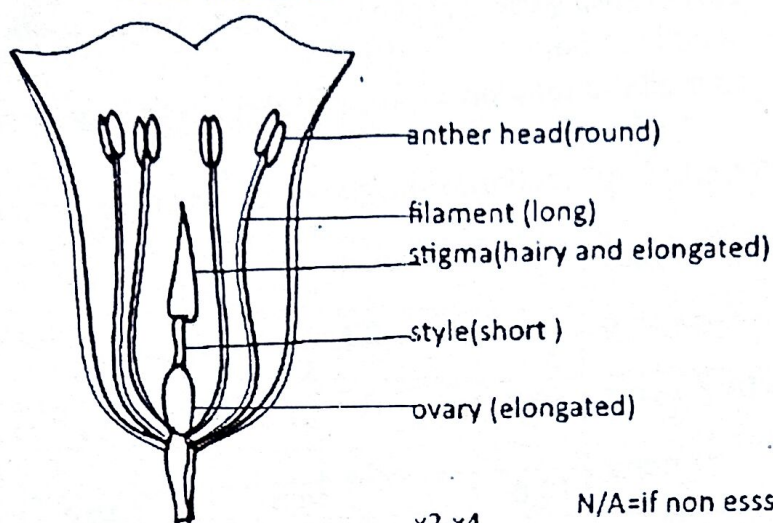
Has both stamens and pistil/bisexual/hermaphrodite to allow self pollination;

Anthers above/higher than the stigma for self pollination;

iii) Remove one floret from specimen j. Cut it symmetrically into two halves .observe the internal structures using a hand lens.

Draw one half of the floret and label only the essential reproductive floral structures.

Drawing of longitudinal section of specimen F showing essential reproductive structure
floral structures



x2-x4

N/A=if non essential parts drawn
and labelled

Question 2

Solution Q - 35cm³ of 342.3 in 1Litre

Solution S-1% H₂O₂

P-LARGE Irish potato

R-2 beans soaked in wet cotton wool for 48hours

FOOD TESTS AND ENZYME ACTIVITY

	STARCH	R/S	PROTEIN	CATALASE
BEAN	BLACK SPECKS	PALE BLUE	PALE PURPLE	MODERATE BUBBLES
IRISH	BLACK	PALE BLUE	INTENSE PURPLE	VERY MANY BUBBLES
	FILTER PAPER RISING			
BEAN	LONGER TIME TAKEN			
IRISH	SHORTER TIME TAKEN			

FILTER PAPER RISING

b) Prepare solutions 1-5 by mixing solutions Q and water as follows;

i) Label tubes 1-5 and add Q into the tubes as indicated in table 1.

ii) Make up the contents of each tube to 10cm³ by adding water. Record the volume of water added into each tube in table 1 below.

(02½marks)

TABLE: 1

TUBES	1	2	3	4	5
Q/ cm ³	10.0	7.5	5.0	3.0	0.5
Water / cm ³	0.0	2.5	5.0	7.0	9.5

c) Carry out the procedures below:-

- i) Cut five cylinders of length 6 cm from plant material **P** provided. Chop the first cylinder into ten smaller pieces of uniform size and transfer the pieces into solution -1
- ii) Repeat the above procedure using the remaining cylinders and solutions **2, 3, 4** and **5**
- iii) Leave the set up to stand for **1 hour**.
- iv) After **40 MINUTES**, pour all the solution from **test tube 1** into a small measuring cylinder and record the volume in **table 2**
- v) Repeat the above procedure for solutions from the remaining tubes. Tabulate your results as follows:

TABLE 2

solutions	1	2	3	4	5
Final volume(V_2) / cm^3	10.6 > 10	10.3 > 10	10.2 > 10	10.0 $\Rightarrow$ 10	9.6 / < 10
Initial volume(V_1) / cm^3	10.0	10.0	10.0	10.0	10.0
Change in volume ($V_2 - V_1$) cm^3	+0.5	+0.3	+0.2	0.0	-0.4
Physical conditions of cylinder	Very soft; flabby/flexibility /flexible; reduced size/shrunken; smooth texture	flabby/flexibility /flexible; reduced size/shrunken ; smooth texture	Almost similar as before	Almost similar as before	Hard;rigid;swollen /increased in size 'rough texture

(06 marks)

- d) Giving explanations based on the results in table 2,
- i) Arrange solutions 1-5 in order of increasing osmotic potential

Order 5,4,3,2, and 1

(01mark)

Explanation

Solution 1 highest Volume of water added; meaning solution 1 was the most hypertonic; ;followed by 2 ; 3 ; 4; and solution 5; which lost water; meaning its most hypertonic

(02½marks)

- ii) Suggest the solution(s) with most predictable results

Solution (s)

Solution 1 and 5

(01mark)

Explanation

Solution 1 was most concentrated /had much C_2 ; therefore absorbs most water from cell sap of the potato cylinder; while solution 5 was most dilute and loses water to the cell sap of the potato cylinder

(02marks)

- e) Explain the results in tube with solution 2

solution 2 is hypertonic to the cell sap of potato tissue; therefore net movement of water molecules is into solution 2 ;by osmosis; causing the volume of the external solution to increase;

(04 marks)

- a) Complete the table by working out the initial length: final length ratio for each piece.

Table 1

Molarity of sucrose solution	Initial length (cm)	Final length (cm)	initial length: final length ratio
0.0M(distilled water)	3.0	3.2 > 3.0	0.94
0.1M	3.0	3.1 > 3.0	0.97
0.25M	3.0	3.0 $\leq \geq$	1.0
0.5M	3.0	2.9 < 3.0	1.03
0.75M	3.0	2.6 < 3.0	1.15
1.0M	3.0	2.5	1.2

f) Explain two limitations of this experiment as a method of determining osmotic changes in plant tissues (04 marks)

- initial concentration of solutions C_1 and C_2 may be incorrect; causing incorrect concentration of solutions prepared thus leading to inaccurate results;
- material P used may not be of suitable variety or poorly stored; and the cylinders obtained not osmotically active leading to inaccurate results;

Dilute Solution

- Turgidity provides support to herbaceous plant/no-woody plants /non woody parts of woody
- Turgidity causes opening of the stomata for gaseous exchange
- Turgidity ensures that petals of flowers are open for pollination
- Turgidity allows for water storage .

Concentrated Solution

- Plasmolysis results into wilting/dropping/infolding of leaves to reduce surface area for transpiration
- Plasmolysis causes closing of the stomata leading to reduced water loss through transpiration

The importance of the above characteristics of the cylinders in different concentration are;

- Turgidity gives support to herbaceous plants causing them to be upright for photosynthesis.
- Turgidity enables plant to store water in order to survive adverse environmental conditions
- Turgid guard cells cause stomatal opening to allow gaseous exchange
- Turgid leaf lamina keeps lamina flat to absorb sunlight for photosynthesis

Advantage

- Flabby tissues allows dormancy of the stem tuber hence survival of adverse environmental conditions
- Flabby nature leads to wilting of plant leaves to reduce water loss.

Disadvantage

Flabby tissues lead to wilting which reduces surface area of the leaf surface hence reduction of photosynthesis

COCKROACH DISSECTION

Question 1

You are provided with specimen K. Examine it carefully and answer the questions that follow:

a) Place the specimen ventral side upper most spread out the wing and then examine the anterior wing and posterior wing using a hand lens.

i) Give four structural differences observed between anterior wing and posterior wing.

(04 marks)

ii) Explain one way the structures of the anterior and posterior wing relate to their function.

(04marks)

ii) Cut off the left hind limb and the outline the adaptations of the structures anterior to the foot of the hind limb that enables the animal to efficiently locomote.

(04 marks)

b) Place the specimen dorsal side uppermost; open up the abdomen cavity by cutting along the left lateral side. Displace the alimentary canal to the left. Immerse the specimen in water fully. Draw and label all the buoyant internal structures visible in the specimen.

(15 marks)

c) By further dissection, Dissect the specimen by cutting along the right lateral side of the thoracic region to expose only the structures attached on the ventral cuticle. Draw and label the exposed structures with the alimentary canal discarded.

(10 marks)

Question 2

You are provided with specimen Y, which is freshly killed.

(a) Cut off appendages at their proximal ends, remove all the wings including the tegmina. Describe the structure of the animal's body.

(10 marks)

(b)i) Lay the animal dorsal side upper most, cut off the elytra and the wings close to their bases. Lift the 10th abdominal tergum. Draw and label the visible structures on the ventral cuticle when the tergum is displaced.

(04 marks)

(ii) State the sex of the specimen. Describe the external structures used for determining the sex. (02 marks)

c) Cut of the limbs and wings of the specimen. Place the specimen with dorsal side uppermost. Dissect the specimen by cutting along the left lateral line of the thorax and the anterior half of the abdomen. Displace the loosen portion of the dorsal cuticle and pin it. Without displacing any structures, draw and label the visible structures.

(15 marks)

Question 3

(a) You are provided with a freshly killed cockroach, labeled specimen Q. lay the animal ventral side uppermost. Observe the structures posterior to the point of attachment to the cercus.

i) Count and record the number of abdominal segments visible in this region. (01 mark)

ii) Draw and label

(04 marks)

(b) Lay the animal dorsal side upper most. Cut through the left lateral side of the abdomen and thorax, leaving the anterior most segment of the animal intact. Lift the dorsal cuticle and displace it to one side of the specimen. Cover the dissection with water and clear away the fat bodies and displace the alimentary canal to the right of the specimen. Draw and label the exposed structures on both cuticles.

(18 marks)

Question 4

You are provided with a freshly killed cockroach.

(a) Cut off the antenna from its base:

(i) Measure and record the length of the antenna and the rest of the body. (02 marks)

(ii) What is the significance of the ratio in promoting the survival of the animal (02 marks)

(b) Examine the antenna and describe its structural features. (05 marks)

(c) Explain three ways the antenna is suited to its functions. (03 marks)

(d) Identify the sex of the cockroach, and draw and label those external features which you used to determine the sex of the cockroach. (4 marks)

(e) Remove the wings of the specimen. Pin down the specimen with the dorsal side upper most. Lift the free edge of the tergum in the middle of the right lateral side of abdomen. Cut the anterior edge of the terga and remove all the terga except those posterior to the middle of the abdomen. Avoid damaging the organs.

(i) List all the visible organs after removing the terga. (4marks)

(ii) Make a fully labeled drawing of the digestive system (8 marks)

(f) Cut off the tegmina, posterior wings, antennae and limbs, Place the specimen dorsal side upper most, cut through its right lateral side and dissect to expose the structures with in the abdominal and thoracic regions. Displace the salivary glands to the right of the specimen. Displace the alimentary canal to the left. Remove all unnecessary tissue to display the alimentary canal and the structures on the ventral cuticle. Draw and label structures exposed in your dissection.

(18 marks)

Question 5.

(a)i) Using a hand lens examine the compound eye, fenestra, antennary pit and antenna. Describe their structural features. (06 marks)

(ii) Examine the head region, search for the mouth parts, describe their relative positions and associated structural features. (06 marks)

b) Using a low power microscope, examine the ventral view of the pretarsus.

(i) Describe the structure of the pretarsus (03 marks)

(ii) Draw and label (04 marks)

(c) Place the animal ventral side upper most. Draw and label the posterior end of the abdomen together with its associated structures. (03 marks)

(d) Place the specimen dorsal side upper most, cut through the left hand edge of the exoskeleton of the abdomen and dissect to expose the structures with in the abdominal cavity. Displace the alimentary canal to the left of the animal. Remove the unnecessary tissue display all the parts of the alimentary canal and structures on the dorsal cuticle. Draw and label. (18 marks)

No. / No. of test tubes used for each experiment (22)
 or
 Catalase in parts of Cockroach (22)

No

using mortar & pestle, cut out cubes as shown below

cube 1 $2\text{cm} \times 2\text{cm} \times 2\text{cm}$

Cube 2 $1\text{cm} \times 1\text{cm} \times 1\text{cm}$

Cube 3 $0.5\text{cm} \times 0.5\text{cm} \times 0.5\text{cm}$

crushed beans.

Procedure
 ① Use a mortar & pestle — Crush cube 1 into a paste + 10cm^3 of distilled water, let it stand & decant some solution into a very clean test tube. Repeat procedure 1 for cube 2, cube 3 & beans. Dip one filter paper measuring $0.5\text{cm} \times 0.5\text{cm}$ into each decanted solution. for some time

Pour 8cm^3 of X (H₂O₂) into three + 4 test tubes labelled 1, 2, 3, 4 resp.

② (a) Remove the filter paper one at a time into the decanted solution & dip it into solution X as it starts a stop clock. Record your observations as the paper moves upwards & time taken for paper to reach the surface in table below.

TI	obs.	Time taken
1		
2		
3		
4		

③ explain the time recorded for test tube 2 & 3. ④ with reason state the nature of extract B. ⑤ state properties of extract B. ⑥ state aim of expt.