Q.1) Defined entomology and write it detail economic importance of insects.

→ Entomology :-

Entomology is the branch of zoological Science which deals with the scientific study of insects is called as the entomology.

Economic importance of insects :-

* Useful insects

- Pollination :-

Insects help flowers make fruits and seeds.

Ex :- Honey Bee.

- products :-

Some insects give useful products like silk & honey.

Ex :- Silkworm.

- pest Control :-

Some insects eat harmful insects

Ex :- Ladybird Beetle.

- Decomposition :-

They help break dead plants and animals and improve soil.

Ex :- Dung Beetle.

Page No.
Date

a) Harmful Insects

- Crop damage :-
  Some insects destroy crops
  Ex :- Locust

- Spread diseases :-
  Some insects spread disease
  Ex :- Mosquito spreads malaria.

- Damage stored grains :-
  Ex :- Rice weevil

- Damage wood and clothes :-
  Ex :- Termite.

Q. 2) Defined insects write in Greek about history of entomology in India.

→ Insect :-
Insect are the create arthropods in which body is divide into 3 regions head, thorax, and abdomen and having 3 pairs of legs 1 pairs of antenna and 2 pairs of wings.

Greek Origin [word Meaning]
The word entomology Comes from Greek words
"Entomon" - Meaning insect
"logos" - Meaning ~~Study of insects~~ of Science

Page No.
Date

Basic feature of insects :-

- Body divide into three parts : head, thorax, & abdomen
- Three pairs of legs (6 legs)
- Usually one pair of antennae.
- Most insects have one or two pairs of wings.
- They have Compound eyes.

* History of Entomology in India

Entomology in india developed mainly during the 19th & 20th centuries especially with the growth of agriculture.

Importance

2) Early period (Before 1900)
- Insect study started during British rule in India
- many scientists studied insects affecting crop and forests

3) Establishment of Agricultural Research
- In 1905, the Imperial Agricultural Research institute was established at pusa.
- This institute later become Indian Agricultural entomologist of India in 1903.
- He worked on insect pests of crops.

3) Important Scientist :-
- Harold Maxwell - Leftoy become the first Imperial entomologist of India in 1903.
- He worked on insect pest of crops.

4) Development after independence (1947)
- Many agricultural universities started entomology departments.
- Research on pest control and beneficial insects increased.

5) Modern period
- Today entomology helps in crop protection pest management: biological control and biodiversity ~~studies~~ in in india.

Q. 3) In list different institute ~~of~~ which are related to entomology in india

→ ① Indian Agricultural Research Institute (IARI)

- New Delhi

- one of the leading agricultural research institute in india with a strong Division of entomology.

② Indian Council of Agricultural Research [ICAR] New Delhi

- Apex body that Coordinates agricultural research including entomology and pest mangement.

④ National Bureau of Agricultural insect Resource [NBAIR). Bengaluru.

- Focused on identification, conservation and utilization of insect resources.

⑤ Central Institute for Cotton Research [CICR]

- conduct research on cotton pests and their management.

⑥ Central Rice Research Institute (CRR) Cuttack

- Studies rice insect pest and pest control methods.

⑦ Indian Institute of Horticultural Research [IIHR). Bengaluru.

- work on insect pests of fruits vegetables and ornamental crops.

⑧ Forest Research Institute (FRI)- Dehradun.

- conducts Research on forest insects and their management

⑨ National Centre for Integrated pest management [NCIPM), New Delhi

- Focused on Integrated pest managements (IPM) Strategies.

Page No.
Date

Q.4) Write down the different characteristics of class insecta.

→ ① Body is segmented and invested with the chitinous exoskeleton

② Body is divided into Head thorax. and abdomen.

③ Head bears pair of antennae. compound eyes and simple eye, mouth parts.

④ Thorax carries three pairs of legs (Hence Hexapoda) and two pairs of wings in the adult stage.

⑤ There is never more than one pair of jointed appendage borne on any body segment.

⑥ Abdominal appendages on 8th, 9th and 10th segmental are modified for mating or egg laying.

⑦ Body Cavity is haemocoel - open types of circulatory system.

⑧ Respiratory system consist of trachea and spiracles.

⑨ Ganglionated nervous system.

(1) Aristotle - (384 - 322 BC)

① Greek philosopher and Scientist
② Born in 384 BC in stagira, Greece.
③ Student of plato.
④ Teacher of Alexander the Great
⑤ the father of Biology and contributed to many subject like Biology logic, and philosophy.

(2) John Ray (1627 - 1705)

1. English naturalist known as the father of Natural History in Britain.
2. Born in 1627 in Black notley
3. First scientist to give Scientific definition to ~~gi~~ Species.
4) Worked on classification of plants and animals.
5) Died in 1705 and contributed greatly to taxonomy and biology.

3) Marcello Malpighi (1628 to 1694)

① Italian physician and biologist
② Born in 1628 in crevalcore
③ known as the father of microscopic Anatomy (Histology
④ Studied insects plants and human tissues using a microscope.
⑤ Discovered imp. Structures like capillaries & malpighian tubules in insects.

4) Thomas Reid Davys Bell
(2 may 1863 - 24 June 1948)
He was an Irish entomologist naturalist and forest officer who worked mainly in India.

① Born on 2 may 1863 in Bandon, Ireland
② worked in the Indian forest service and became chief.

5) Harold maxwell- Le froy :-
Birth 1877 in England
① He was the first imperial Entomologist of India and the played an important role in developing the study of insects in the country.

6) Karl Van frisch
(20 Nov 1886 to 12 June 1982)
- He was zoologist animal psychologist studied the behaviour in 1973.
- He foreused his study on honey bees and
- other things the bees sense of colour.

7) L.O HOWARD (1857-1950)

A brilliant promotee of entomology in America and world authority on medical entomology.
- He also made lasting Contributions to biological Control and insect taxonomy.

8) N.A COBB.
(1859 - 1932)

American nematologist called "The Father of Nematology".

- He developed excellent method of sampling extraction and mounting of nematodes.

9) Rachel Louise Carson
Born : 27 may 1907 in Pennsylvania USA
Died :- 14 April 1964

- She was a marine biologist and environmental

10) Dr. Edward F. Knipling
Born :- 20 March 1909 USA
Died :- 17 March 2000

- He was a famous entomologist
- He is known for developing the Sterile Insect Technique (SIT) to control harmful insect.

11) Dr. S. Pradhan.
Born :- 1913 India
Died :- 1988

- He helped, developed methods for pest mangement in agriculture.

12) R.H. Painter
Born :- 1901 USA
Died :- 1988

- He was an entomologist who studied insects affecting crops.

13) Adolf Butenandt
(24 march 1903 to 18 January 1995)

- Adolf Friedrich Johann Butenandt was a Gee man biochemist
-

14) M.L ROONWAL
Born : 1909 India
Died 1993

- He was a famous Indian entomologist
- He worked mainly on termites and desert insects.

15) H.S. PRUTHI
Born : 1897 India
Died : 1963

- He was a well-known Indian entomologist
- He helped in developing methods for pest control in India.

16) Paul Heman mullee
Birth : 12 January 1899 Switzeeland
Died : 13 octobee 1965

- He was a famous Swiss chemist know foe his work in pest control.

17) Salim Ali
Born: 12 November 1896 India
Died: 20 June 1987

- He was a famous Indian ornithologist (bird scientis)
- He studied and documented many Indian bird.

18) J.C. FABRICIUS
~~1g~~ 1745
Born - 7 January 1745 Denmark
Died: 3 March 1808

- He was a famous biologist and anatomist
- He contributed to the study of plant and animal anatomy.

~~19) J.C FABRICIUS~~

19) J.W MEIGEN
(1764 - 1845)
Birth - 8 may 1764
Death - 11 July 1845

- Known as father of Dipterology (Study of flies)
- Described many insect species.

20) Antonie Van Leeuwenhoek
Born :- 24 October 1632
Died : 26 August 1723
Country : Netherlands

- Known as the "Father of microbiology"
- First to observe bacteria & protozoa
- Discovered single-celled organisms.

21) John obadiah westwood
Born : 22 December 1805
Died : 2 January 1893
Country : England

- He was an important entomologist and achaeologist
- He described many insect speciel and wrote several scientific books on insects.

22) P. A LATREILLE
Born : 29 Nov 1762
Died : 1833

- Known as father of moden entomology.
- worked on classification of insects
- Gave important scientific names and grouping
- His work is still used in insect study.

23) Carl Linnaeus :-
Born : 23 May 1707
Died : 10 January 1778
Country : Sweden

Contribution :-
- know as the "father of Taxanomy"
- Developed binomial nomenclature
- Created a classification system for living organisms.

24) Julius Theodor christian Ratzeburg

Born : 20 march 1801
Died : 24 oct 1871
Country : Germany

- He was famous forest entomologist
- He studied insect that damage trees and forests.
- His work helped in understanding pest control in forestry.

Page No.
Date

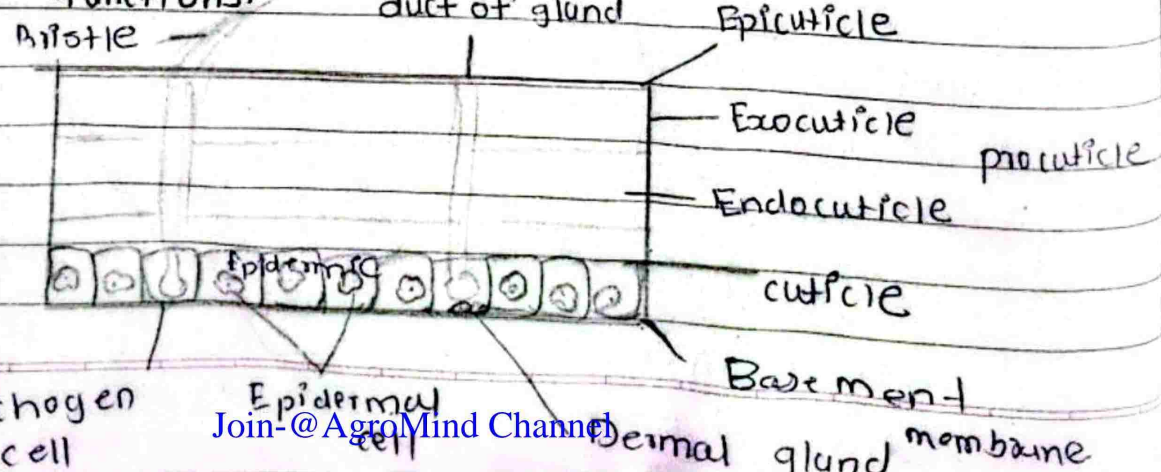
Assignment no.

1) Describe the factors responsible for insect dominance in animal kingdom.

→

1) Small size - need less food easy survival
2) High reproductive capacity - large population
3) presence of wings - easy dispersal
4) Metamorphosis - no competition between stages.
5) Adaptability - survive in all habitats
6) protective exoskeleton - prevents water loss
7) Short life cycle - quick multiplication
8) Diverse feeding habits - exploit many resources.

2) Draw a neat labelled diagram of structure of insects exoskeleton / integument / body wall and its functions.



Describe in detail about insect integument.

1) Cuticle ① It is outermost thick layer of integument by epidermis.
② It is non cellular
③ It is divided into the region
① Epicuticle (upper) ② procuticle (Inner)

A) Epicuticle-
It is a thin outermost layer verying in thickness from 1 to 4μ
Chitin is absent in epicuticle. It consist of the following 4 layer.

- Cement layer - protects body from external damage
- Wax layer - prevents water loss (waterproof layer)
- polyphenol layer - Helps in protein formation & gives chemical resistance
- cuticulin layer - provides strength & acts as permi

B) procuticle It is differentiated into exo & endocuticle.
Exocuticle - It is darkly pigmented hard and sclerotised
This layer is made of chitin & sclerotin.
Endocuticle - It is soft light coloured & unsclerotized.
This layer is made up of chitin & arthropodin.

- Composition of cuticle ① chitin ⑪ proteins.

2) Epidermis (or) hypodermis
Inner single cell layer present below cuticle
on basement membrane.
Function - i) cuticle secretion ② wound repairing
③ Digestion & absorption of old cuticle ④ Gives surface book

Structure -
- Cells are connected by desmosomes
- cells are glandular (secrete cuticle & enzymes)
For moulting.

3) Define moulting. Write in detail about process of moulting.

The moulting shedding of old cuticle (outer covering) to allow growth in insects is called as the moulting.

process of multing

1) Apolysis : [Apo = formation ; lysis = dissolution]
- The first step of moulting
- The old cuticle separates from the underlying epidermal cells.
- A space called the exuvial space is formed.
- Epidermal cells becomes active and start preparing for a new cuticle.

2) Ecdysis (shedding of old cuticle)
- The insect breaks and sheds the old cuticle.
- This is done by :-
  - Swallowing air or water to increase body pressure.
  - Muscular contractions.
- The old exoskeleton is called exuviae.

3) Sclerotization
- After shedding the new cuticle is soft.
- The insect expands its body size before it hardens.
- The cuticle then undergoes.
  - Sclerotization (hardening)
  - pigmentation (color development)

- This make the new exoskeleton strong and protective.

* Hormonal control of Moulting
moulting is controlled by Hormones

Ecdysone - initiates moulting

Juvenile Hormone (JH) - determines the type of moult (larva, pupa, adult)

Importance of moulting.
- Allows growth in insects
- Helps in metamorphosis (larva → pupa → adult)
- Replaces damaged cuticle
- essential for survival.

4.9* Define following terms

1) Insect :-
The insects are the tracheate arthropods in which body is divided into 3 regions Head thorax, abdomen & having 3 pairs of legs 1 pairs of antanae and 2 pairs of wing.

2) Entomlogy :-
is the branch of Agriculture science which deals with the study of zoological & biological the study of insect.

3) Ecdysis -

is the process by which an insect sheds its old exoskeleton (cuticle) & emerges with a new soft cuticle later hardens to allow growth.

4) Apolysis

The apolysis separation of old cuticle from the epidermis before moulting.

5) Exuvae :-

is the empty skin left behind after an insect sheds its old body covering is called of the exuvae.

Page No.
Date 11 04 2026

Assignment No.

1) Explain in detail Various sclerites & sutures of insect head & draw a neat labelled diagram of insect head capsule.

→ Sclerites : hard plates of insect head
Epicranium - main dorsal part of head
frons - front middle region
clypeus - Below frons above labrum
labrum - upper lip
~~Gena~~ Vertex - Top portion of head
~~occiput~~ Gena - side part (cheek region)
~~post~~ occiput - posterior part of head
post occiput - Back region margin around foramen.

Sutures :- lines dividing sclerites

Epicranial suture - Y-shaped suture on head
frontal suture - Betn frons & clypeus
clypeus-labral suture - Betn clypeus & labrum
post-occipital suture - At posterior head region
subgenal suture - On lateral sides.

Page No.
Date

Q. 2) Write the functions of insect head, thorax & Abdomen.

Head
- Sensory function (eyes, antennae)
- Feeding (mouthparts)
- Brain and coordination

Thorax
- locomotion (legs & wings)
- muscle attachment
- movement and flight

Abdomen
- Digestion
- Excretion
- Reproduction
- Respiration (spiracles)

Q. 3) Defn the following terms:

a) Suture / sculcy :-
- A suture is a line or groove in insect body separating Sclerites.
- A sulcus is a deep groove forming internal ridges.

b) Sclerite :-
Hard, chitinous plates forming insect exoskeleton.

c) Notum :-
Dorsal (upper) plate of each thoracic segment is called as the Notum.

Q. 4) Fill in the blanks

1) Mesothorax + ~~Meth~~ Metathorax Segments are called as pterothoracic Segments.

2) Dorsal (upper side) of insect is called as Notum (Tergum).

3) pleuron is absent in Abdomen.

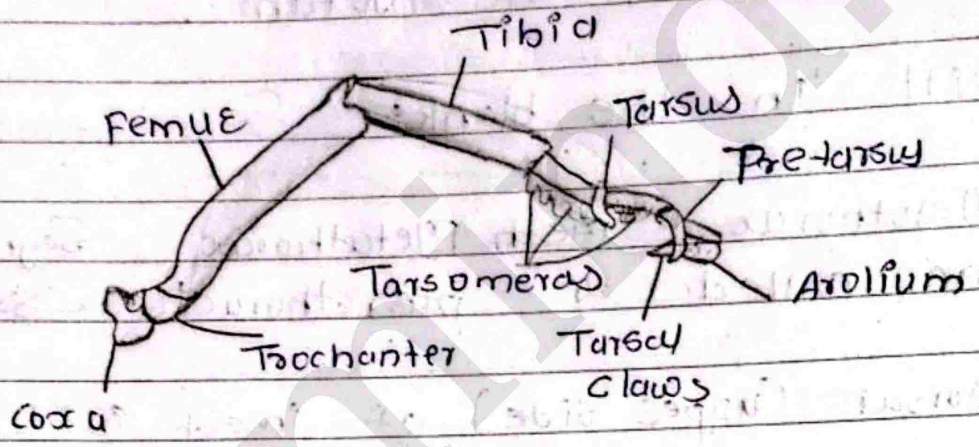
Sunday

Page No.

Date 12 04 2026

Assignment No :-

1) Draw a diagram of typical insect legs and write in detail about leg modifications in insects with examples.

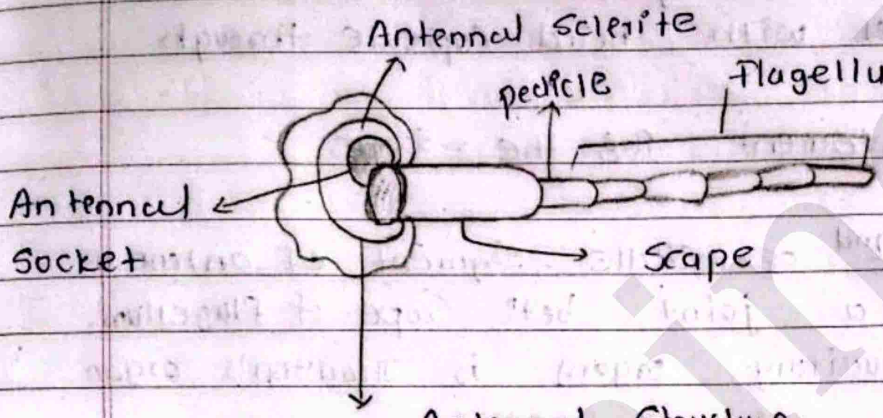


Type of leg modifications.

ex

① walking (Ambulatory) - cockroach
② Jumping (Saltatorial) - Grasshopper
③ Digging (Fossorial) - mole cricket
④ Grasping (Raptorial) - praying mantis
⑤ Swimming (Natatorial) - Water beetle
⑥ Clinging (Scansorial) - Lice
⑦ cleaning antennae (Antennal cleaning legs) - Honey bee
⑧ Pollen collecting ex :- Honey bee.

2) Draw a neat labelled diagram of typical insect antenna and write the functions of antenna.



Function of antenna :-

1. Smell (olfaction)
2. Touch (tactile)
3. Detect vibrations
4. Temperature & humidity Sensing
5. Finding food and mates.
6. To feel and find the its way
7. To find food
8. To detect dangee
9. To communicate with each othee ex (Ants)
10. To serve Secondary Sexual Characters.
11. Taste hairs occur on antennae ex:- (Cockroach)
12. Help in muting by holding opposite Sex. (Flea).
13. Useful for Clasping the female during Copulation

3) Describe in brief about insects antennae and their modifications with examples.

① Scape :- • the first segment of antenna.
• articulates with head capsule through antennifer
• provides movement for the scape.

② Pedicle :- • 2nd or middle segment of antenna that form a joint bet" scape & flagellum.
• Special auditory organs is Jhonston's organ

③ Flagellum :- last antenna
• The segment varies in shape & size.

S.N	Type	Structure	Example
1)	Filiform	All segments are equal thickness the shape cylindrical	Grasshopper
2)	Moniliform	Segments are globular	Thrips, Termites
3)	setaceous	Basal segments thicker go on reducing toward tip from base	cockroach
4)	Clavate	Segments are broader towards the tip	Butterfly

5)	Capitate	enlargement of segment towards tip is more abrupt & greater	Beetles.
6)	Serrate	Segments have short triangular one side of antenna like teeth of saw	mango stem borer
7)	Lamellate	Terminal Segments at tip is enlarged one side of antenna to form a flat plate	Bee beetle, Dung rollers
8)	Uni-pectinate	Segments with long slender lateral process.	female mulberry silk moth
9)	Bipectinate	Segments with long slender lateral process on both sides	male mulberry wasps
10)	Geniculate	Basal Segment is elongated. pedicel forms pivot & flagellum bent arm like structure	Honey bees & wasps.
11)	Plumose	whorl of hairs the joints hairs longer, more numerous & cover entire surface of feather	male culex mosquito
12)	pilose	only bases of each segment give whorl of hairs	female culex mosquito

13)	Aristate	Antenna 3 Segmented. Upper side the third Segment enlarged & bearel a dorsal bristle like structure	House fly
14)	stylate	Antenna 3 Segmented A bristle like structure present tip of antenna	Jassids, Robbee fly

Q.4) Write the answers in one Sentence

A) Jhonstons organ is present in which Segment of antennae.

→ Pedicle Segment

B) Name the Strongest part of Insect leg

→ Femur

C) Insect leg is Comprised of how many Segments

→ Six Segments

d) Saltatorial types of legs are present in which insects

→ Grasshoppers (orthoptera)

e) Hind legs of honey bees are modified for the purpose of ?

→ pollen collection (pollen basket / corbicula)

f) Antenna cleaning legs of honey bees are the forelegs (prothoracic legs)

g) Setaceous types of antennae are present in dragonflies & damselflies (Odonata)

h) Plumose types of antennae are present in which insects male mosquitoes

i) Antennae are absent in which order protura.

Page No.
Date

Assignment No.

1) Describe Digestive System of cockroach with well labelled diagram.

- Digestive System = Alimentary Canal + Salivary glands.

Alimentary Canal is long tubular from mouth → anus

Divided into

A) Foregut (Stomodaeum)
B) Midgut (Ventriculus or mesenteron or Stomach)
C) Hindgut (proctodaeum) (posterior)

1) Foregut (Stomodaeum)

- Ectodermal in origin
- Inner lining - Intima (Cuticular layer)

parts

1) pharynx
   - muscular organ are pharynx present.
   - pushes the food into esophagus.
   - Sucking pump is sap feeders.
   - Ingestion and back coord flow of food.

2) Esophagus
   - ~~Sac like~~ narrow simple tube
   - Carries food to crop.

3) Crop :-
- Sac like structure
- Storage of food material

4) Gizzard :-
- Thick muscular
- Hay teeth-like structure
- Solid feeders and absent in Fluid feeders or Sap feeders.

2) Midgut
- Endodermal in origin.

Function
① Digestion of food
② Secretion of enzymes
③ Absorption of food

- Inner delicate layer peritrophic membrane ~~Secreted by~~ epithelial cells.
- present in solid feeders and absent in sap feeders.

- long tube carries eight small blunt tubes gastric or hepatic or enteric caeca.

3) Hindgut (proctodaeum)
- Ectodermal in origin. Intima present
- The secretes the enzyme cellwase

Page No.
Date

Hindgut is divided 3 Region

① Ileum is a small intestine (DE) tube like structure

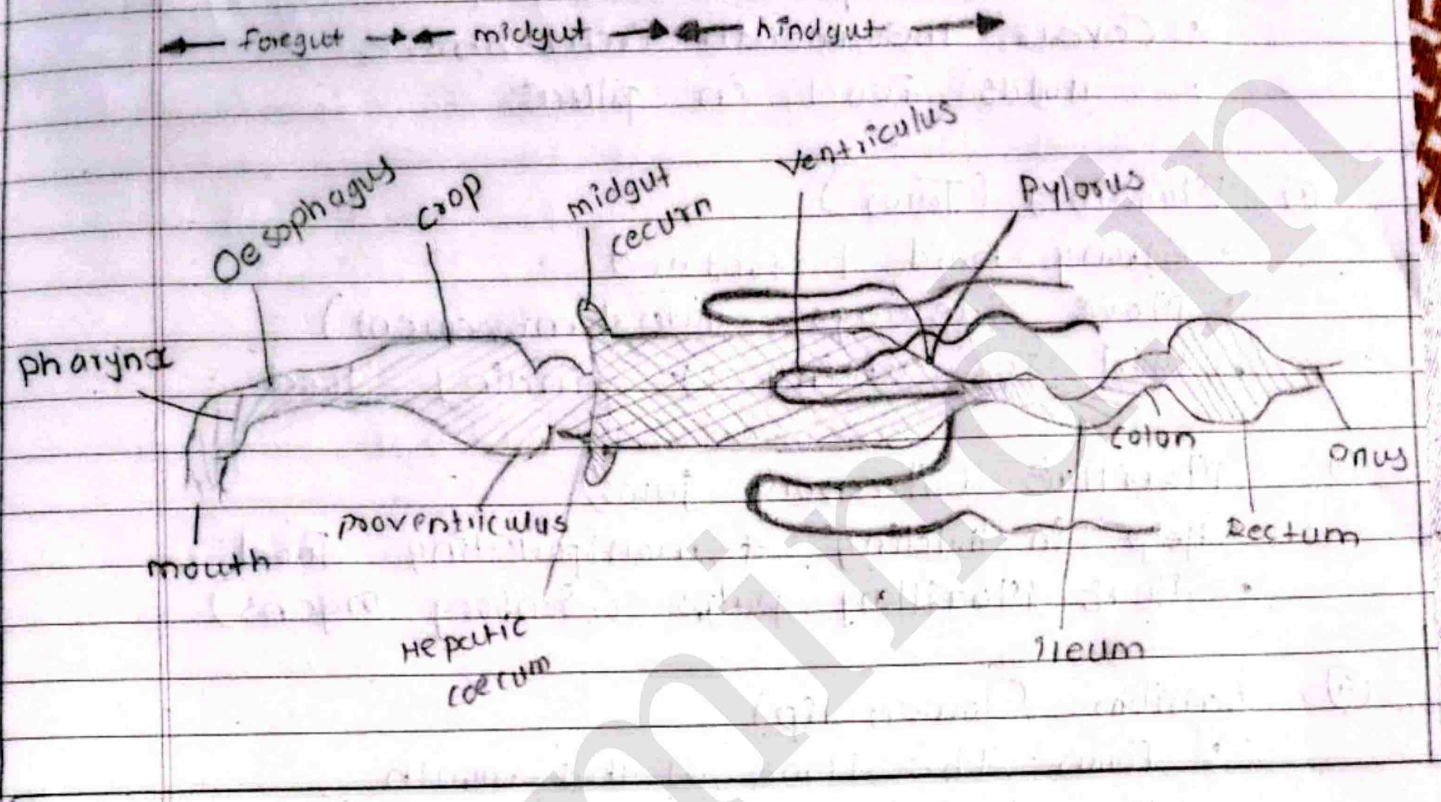
② Colon is a large intestine

③ Rectum - • rectal papillae (or) Pads
• vary in number from 3-6.

• Reabsorption of water results from the faecal (waste) Matter

• Salivary glands :-

• Digestive enzymes
• Amylases - digestion of starch
Lipases - digestion fats & lipids
proteases - digestion of protein
Invertase - digestion of Sucrose (present in bees)
maltase - Digestion of Maltose
Cellulase - Digestion of cellulose - (present in termites)



(Q.2) Enlist different types of mouth parts in insects and Describe in detail about Chewing and biting types of mouth parts with diagram.

→ Enlist

1. Biting & Chewing type
2. piercing & Sucking type
3. Siphoning type
4. Sponging type
5. Chewing & lapping type
6. Rasping and Sucking type

& Chewing & Biting mouth parts.

This is the primitive & most common type of insect mouthpart. It is found in insects like grasshoppers, cockroach, beetles, caterpillars.

① Labrum (upper lip) -
- Covers the mouth from above
- Holds food in place

② Mandible (Jaws)
- Strong, hard & toothed
- Move sideways (lateral movement)
- Used for cutting & grinding food

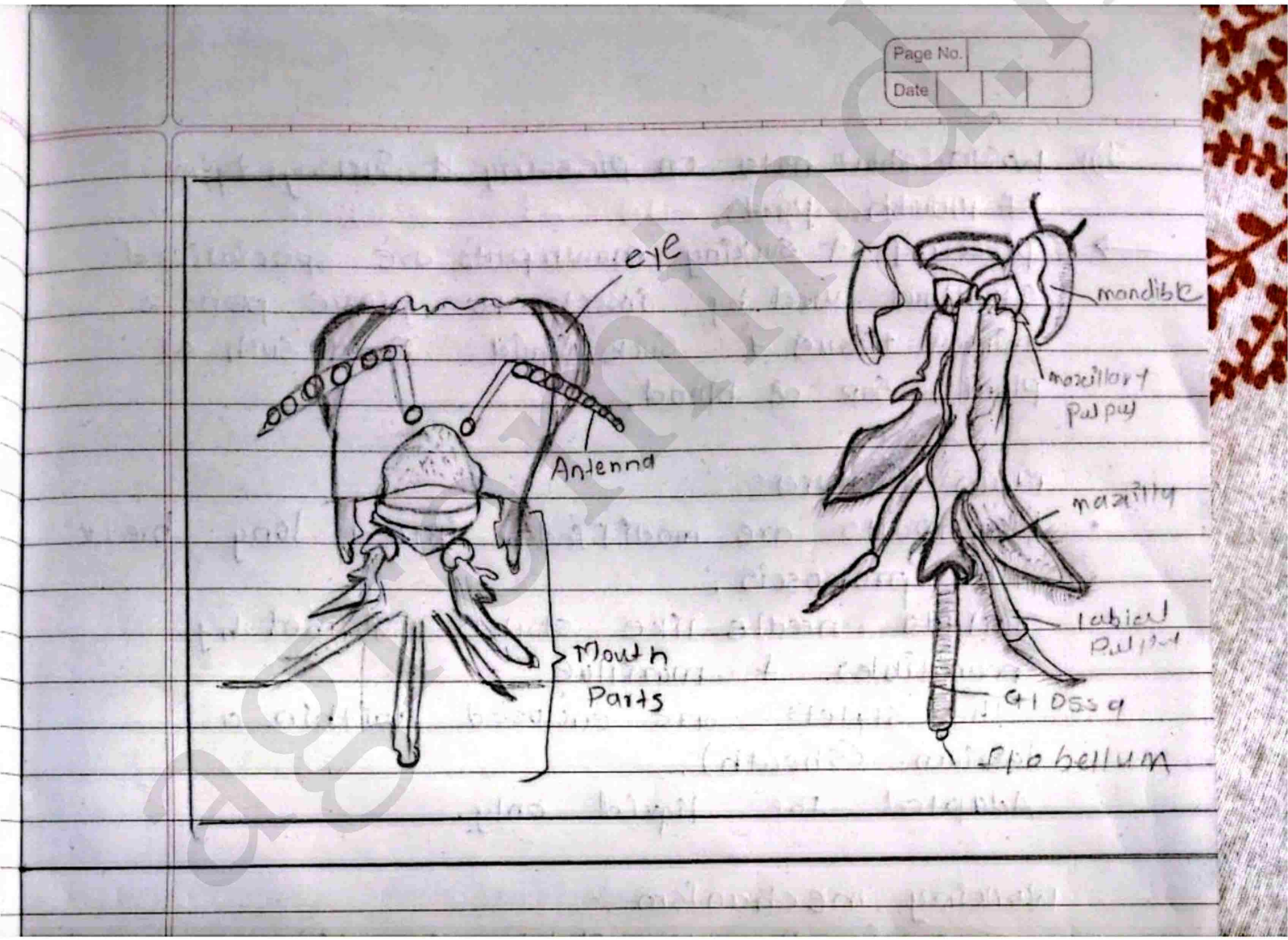
③ Maxillae (Accessory jaws)
- Help in holding & manipulating food
- Bear Maxillary palps (Sensory organs)

④ Labium (lower lip)
- Forms the floor of the mouth
- Has labial palps for tasting

⑤ Hypopharynx
- Tongue-like structure
- Helps in mixing food with saliva

Function

- Cutting, biting & chewing solid food
- Mechanical digestion of plant or animal material.



3) Write short note on piercing & sucking types of mouth parts.

→ piercing & sucking mouth parts are specialized structures used by insects to pierce plant or animal tissues & suck liquid food such as plant sap or blood.

Main features:
- Mouthparts are modified into a long beak or proboscis.
- Includes needle-like stylets formed by mandibles & maxillae.
- The stylets are enclosed within a labium (sheath).
- Adapted for liquid only.

Working mechanism :-
- The insects the stylets into tissues (plant or animal)
- saliva is injected to help digestion or prevent clotting.
- liquid food is then sucked through the food canal.

Type

i) plant sucking type - feeds on plant sap
ex :- Aphid

ii) Blood-sucking type - feeds on animal blood
ex :- Mosquito

Page No.
Date

Eg :- of insects
Aphid
Jassid
Bed bug
Mosquito

Importance-

- many are serious agricultural pests (damage crop by sucking sap)
- Some act as vectors of diseases (eg. Mosquitoes Spread diseases).

1) Intima layer is absent in Midgut

2) Foregut is also called as Stomodaeum

3) peritrophic membrane function is to protect midgut from abrasion of solid food materials.

4) Gizzard is also called as Proventriculus

5) Pyloric valve is present at the junction of Midgut and Hindgut

6) Palpigee is present on Labrum part of mouth.

Page No.
Date

7) Midgut. Part of alimentary canal is the major site of digestion.