ARTHROPODA COCKROACH UPTO LOCOMOTION

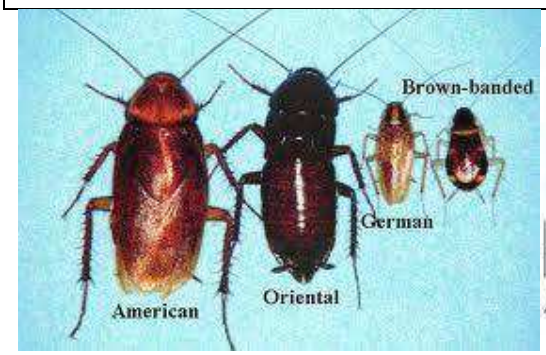
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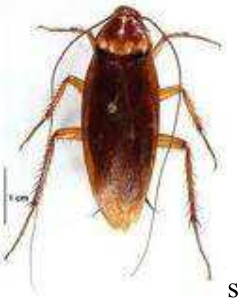
1. Which features help the arthropods for their success?

- Presence of hard and rigid exoskeleton as chitinous cuticle to prevent the dehydration.
- Presence of jointed legs or appendages shows rapid movement.
- Striated muscles.
- Haemocoel with open type of blood vascular system serves to bathe the tissues of all organs with blood or haemolymph.
- Tracheal respiratory organs and malphighian tubules minimize the loss of water.

2. What are the differences between Periplaneta americana and Blatta orientalis.?

PERIPLANETA AMERICANA	**BLATTA ORIENTALIS**
1.Larger 2.honey colored 3.wings are longer than the body in both males and females 4.Pronotum has two large brown patches	Smaller Snuff colored Wings do not extend beyond the abdomen of male. But vestigial in females. Pronotum is completely dark.





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3. Name the term used to indicate the grouping of segments to form functional regions.

- Heteronomous type of metamerism which leads to tagmatisation.

4. Name the most common types of cockroaches in India?

- *Periplaneta americana* and *Blatta orientalis* are the two types of cockroaches in India.

5. Name the six sclerites that cover the head of cociroach.

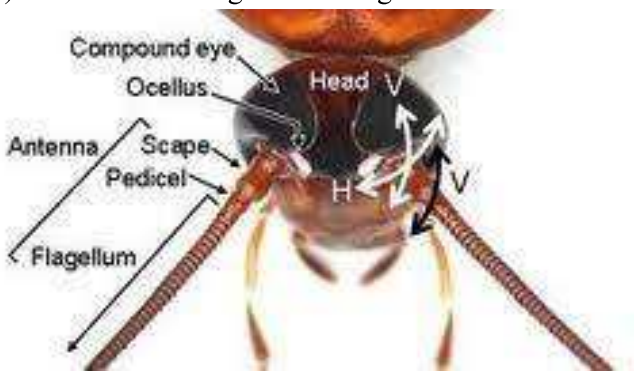
- Head capsule, the exoskeleton of head in cockroach is formed by 6 sclerites. They are
  a)Epicranial plates ---- paired sclerites present between the eyes on vertex.
  b)Frons --- Largest sclerite of head.
  c)Clypeus ----present below frons.
  d)Genae ---- a pair of cheek plates

6. Why arthrodial membrane is flexible inspite of the presence of cuticle in it?

--- Arthrodial membrane lacks exocuticle with scleratization.

7. What are the three parts of antenna of cockroach?

- Antenna has 3 segments. They are a)Basa Scape b)middle Pedicel C) Terminal multisegmented Flagellum



7. Distinguish between Palpifer and Palpiger.?

- Palpifer is a sclerite belongs to 1st pair of maxillae. It is present on stipes. A five segmented maxillary palp is present on it.
- Palpiger is a sclerite belongs to 2nd pair of maxillae or labium. It has a 3 segmented labial palp.

8. Name the actual biting & chewing organs in mouthparts of cockroach.

- Mandibles.

9. What is ligula and lingua?

- Glossae and paraglossae of labium together form the ligula.
- Hypopharynx or tongue is known as Lingua.

10. Name the terga of thoracic segments in cockroach.

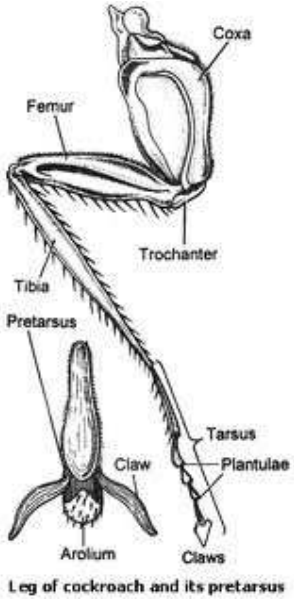
- Terga are the dorsal sclerites in cockroach.

Thoracic segment	Tergum
1.PROTHORAX	PRONOTUM (largest)
2.MESOTHORAX	MESONOTUM
3.METATHORAX	METANOTUM

11. What are the five joints present in a leg of cockroach in sequence from the thorax?

- Each leg is made up of 5 podomeres. They are

a)COXA : articulates with thorax. It is broad and highly muscular.
b)TROCHANTER : Smallest. Fused with femur and movably articulated to the coxa.
c)FEMUR : Strongest. It has spines.
d)TIBIA : Longest. It also has spines.
e)TARSUS : It has 5 tarsomeres. Last tarsomere is pretarsus.



Leg of cockroach and its pretarsus

Pretarsus has a pair of claws with pulvillus or arolium between them.

12. Which structures of leg in cockroach help for the movement on smooth and rough surfaces?

- Arolium and Claws help in locomotion on rough surfaces.
- Plantulae are useful in locomotion on smooth surfaces.

13. Name the chitinous tubes that support the wings in cockroach.

- Veins or nervures are the network of fine sclerotised tubes that support wings.

14. Which sterna form the genital pouch in female cockroach?

- In female cockroach, sterna of 8th and 9th abdominal segments are infolded to form the genital pouch or brood pouch.
- Sterna of 7th abdominal segment bears a pair of gynovalvular plates posteriorly . They form the floor of the genital pouch on the4 ventral side.
- 8th sternum forms the anterior wall of genital pouch. It has female genital aperture.
- 9th sternum forms the roof of the genital pouch.

15. Name the gonapophyses in male cockroach.

- Gonapophyses in males are known as phallomeres. They are formed from the 9th sternum.
- Male has three phallomeres. They are
  a) Ventral phallomere: male genital aperture is present at the base of it.
  B) Left phallomere: it has pseudopenis, titillator, an asperate lobe and inner acculobolus lobe.
  c) Right phallomere: it has a hook and a serrate lobe.

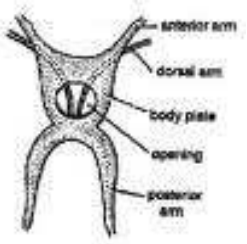
16. What are the three layers of cuticle in cockroach? Which layer forms the sclerites?

- Cuticle consists of three layers like epicuticle, exocuticle and endocuticle.
- Epicuticle is thin nonchitinous layer with outer lipoprotein cement layer, middle wax layer and inner poyphenols.

- Exocuticle is the rigid middle layer that forms sclerites.
- Endocuticle is the innermost layer.

17. What do you mean by apodemes and tentorium ?

- Lateral invaginations of sclerotised cuticle are known as apodemes.
- Tentorium is the endoskeleton of head and formed by the ingrowths of the exoskeleton called apophyses.



18. Why is body cavity in cockroach called haemocoel?

- Body cavity in cockroach is filled with blood .So it is known as haemocoel.

19. What types of locomotion are observed in cockroach?

- A)Cursorial – fast running locomotion
- B)Flying

20. Write the names of dorsal, ventral and lateral plates of exoskeleton of cockroach ?

- Dorsal plate is TERGUM.
- Ventral plate is STERNUM.
- Lateral plates are PLEURA.

21. How does tripod movement occur in cockroach?

- Two tripods are formed in cockroach during cursorial locomotion.
- Each tripod is formed by foreleg and hind leg of one side and middle leg of the other side.
- Foreleg pulls the body, while hind leg pushes the body and middle leg of opposite side acts as pivot.
- Insect moves in a zig zag pattern.

22. How does a cockroach conserve water in its body?

- Cockroach conserves water for successful terrestrial mode of life by following methods….
- A)Covering of body by impervious hard chitinous exocuticle and waxy epicuticle.
- B)Tracheal system with physiology of respiration.
- C)Malphigian tubules which open into alimentary canal.
- D)Rectal papillae in rectum to reabsorb the water from undigested food.

23. What is the largest phylum in the kingdom Animalia ? How that name is derived?

- Arthropoda is the largest phylum
- Due to the presence of jointed feet or appendages, the term arthropoda is derived.

24. Why is head is called hypognathous /?

- Orientation of head is hypognathous as it is bent at right angles to the long axis of the body, as a result of which the jaws are directed downwards.

25. What fenestrae in cockroach? Write their significance.

- Fenestrae are a pair of whitish spots present close to the base of the antennae.
- Fenestrae represent the ocelli which are simple eyes.

26. Distinguish between apodemes and phragmata.

- Apodemes are the lateral invaginations of sclerotised cuticle.
- Phragmata are the anterior and posterior below the antecostal sutures, marking the primary intersegmental folds between segments
- They provide rigid surfaces for the attachment of muscles

27. How are corpora adipose of cockroach functionally similar to the liver of vertebrates?

- Corpora adipose store glycogen, fats and proteins. They secrete lipids and store them. In these aspects, they are functionally similar to liver of vertebrates.

28. Name the different blood sinuses in cockroach.

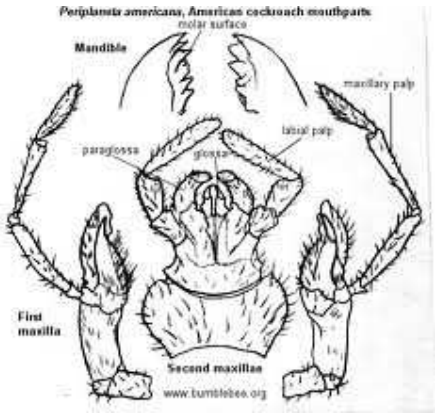
- The body cavity of cockroach or haemocoel is divided into three sinuse by two diaphragms. They are….
  a) Pericardial sinus -- dorsal. It encloses heart.
  b) Perivisceral sinus --- middle. Surround alimentary canal.
  c) Perineural sinus ---- ventral. Encloses nerve cord.

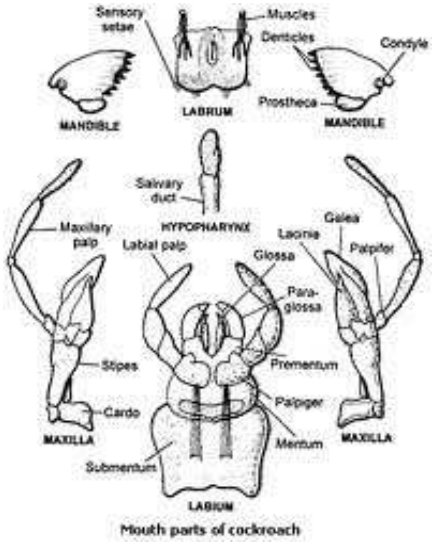
29. A nymph of cockroach is capable of growing inspite of being covered with a chitinous exoskeleton. How it happens?

- ❖ Moulting or ecdysis where the exoskeleton shed off.

SHORT ANSWER TYPE QUESTIONS

1) **Draw a neat labelled diagram of mouth parts of cockroach?**

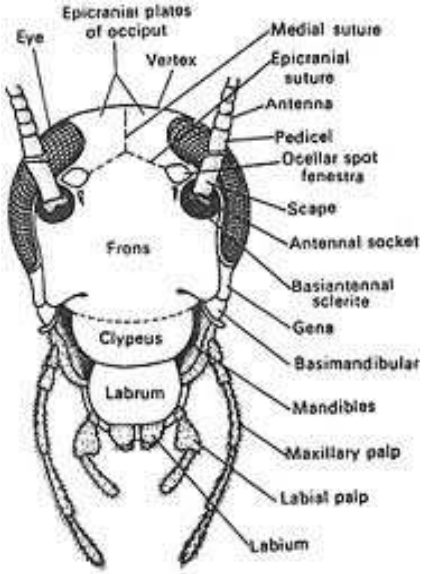




Mouth parts of cockroach

LONG ANSWER TYPE QUESTIONS:

1. **Describe the structure of the head of a cockroach with neat labelled diagram.?**



Head of Cockroach (Dorsal View)

HEAD OF COCKROACH:

- The body of cockroach has three tagmata like head, thorax and abdomen
- Head consists of the following parts ….

a) Head capsule, the exoskeleton of head in cockroach is formed by 6 sclerites. They are

a)Epicranial plates ---- paired sclerites present between the eyes on vertex.

b)Frons --- Largest sclerite of head.

c)Clypeus ----present below frons.

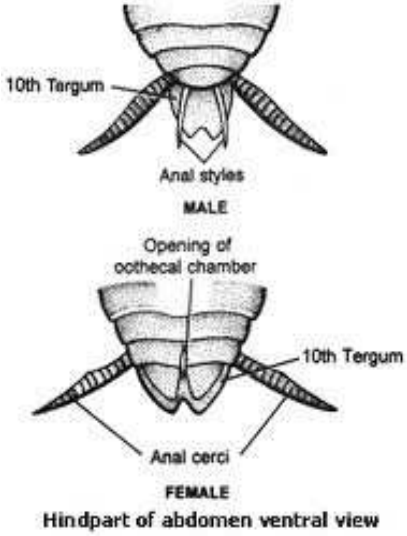
d)Genae ---- a pair of cheek plates

- Occipital foramen is the opening on the posterior side of the head. It is bordered by a sclerite known as Occiput.
- Fenestrae are a pair of whitish spots present close to the base of the antennae. They represent the ocelli which are simple eyes.
- Orientation of head is hypognathous as it is bent at right angles to the long axis of the body, as a result of which the jaws are directed downwards.
- Appendages of SEGMENTS of head are

CEPHALIC SEGMENT	APPENDAGES
1`. First	No appendages
2.Second	Antennae
3. Third	No appendages
4. Fourth	Mandibles
5. Fifth	Ist pair Maxillae
6. Sixth	2nd pair maxillae (LABIUM)

- **Mouth parts**: Biting & chewing type of mouth parts are present in cockroach. They include Labrum, mandible, first maxillae, labium and a tongue or hypopharynx.
- Labrum is upper lip which attaches with lower edge of clypeus. It has gustatory sensilla.
- Mandibles are triangular, hard, unjointed stout, chitinised structures with toothed nature. They are masticatory. Their horizontal movements are controlled by adductor and abductor muscles. Each mandible has a sensory lobe known as prostheca.
- First pair of Maxillae is present behind the mandibles. Each maxilla has Cardo and stipes. Stipes has a sclerite, palpifer on its outer side. It has five segmented maxillary palp. Stipes has inner lacinea and outer galea.
- Labium or lower lip is formed by the fusion of the second pair of maxillae.
  It has basal postmentum with submentum and mentum and terminal prementum.
  Prementum has palpiger with a 3 segmented labial palp. Dista end of prementum has a pair of paraglossae and a pair of glossae. Both are combinedly known as LIGULA.
- Hypopharynx or Lingua or Tongue is a chitinous, grooved, rod like part. It divides the proximal part of the preoral cavity into a larger anterior Cibarium and a posterior Salivarium.

2. Describe the abdomen of cockroach.



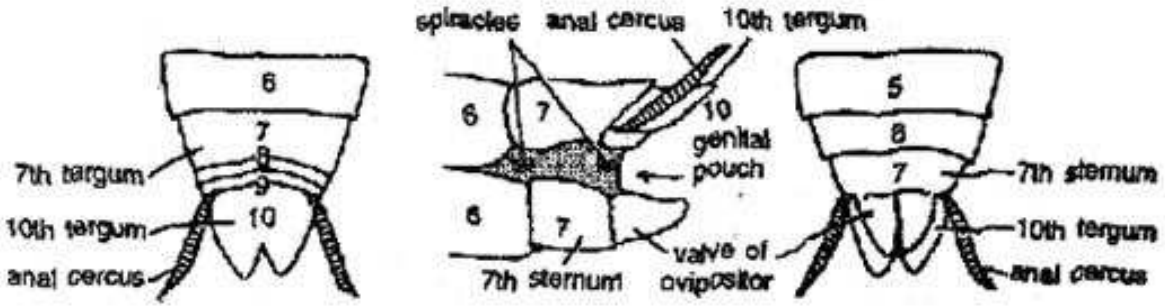
Hindpart of abdomen ventral view

- Abdomen in cockroach is formed by 10 segments in adult but with 11 segments in embryonic stage.
- Abdomen has 10 terga but 9 sterna only.
- Anus is present behind the 10^{th} tergum. Pair of triangular, plate like paraprocts is present on both sides of anus.
- Abdomen has 8 pairs of spiracles.
- A pair of 15 segmented Anal Cerci arises from junction between the 9^{th} and 10^{th} segments on dorsal side. They are regarded as the appendages of vestigial 11^{th} segment.
- A pair of unsegmented Anal Styles is attached to 9^{th} abdominal sternum in male.
- In female cockroach, sterna of 8th and 9^{th} abdominal segments are infolded to form the genital pouch or brood pouch.
- Sterna of 7^{th} abdominal segment bear a pair of gynovalvular plates posteriorly. They form the floor of the genital pouch on the4 ventral side.
- 8^{th} sternum forms the anterior wall of genital pouch. It has female genital aperture.
- 9^{th} sternum forms the roof of the genital pouch.
- Genital pouch has two parts i.e., anterior Gynatrium for fertilization and posterior Oothecal chamber.
- Female has external genitalia for 8^{th} to 10^{th} abdominal segments. These segments are known as terminalia. They form the ovipositor.
- In male cockroach,
- Gonapophyses in males are known as phallomeres. They are formed from the 9^{th} sternum.
- Male has three phallomeres. They are

  a) Ventral phallomere : male genital aperture is present at the base of it.

  b)Left phallomere : it has pseudopenis, titillator, an asperate lobe and inner acculobolus lobe.

  c) Right phallomere: it has a hook and a serrate lobe.



VSAQ:

01. Name the two parts of Genital pouches in female cockroach (May'07)
02. Largest phylum in the kingdom Animalia. How that name is derive (May'10)
03. Water conservation in cockroach
04. Tripod movement in cockroach
05. Gonapophyses in male cockroach

06. Ligula and lingua in cockroach
07. Hypognathous head (March'11)

SAQ:

01. Mouth parts of cockroach (May'04;March'08 ; May'09)

COCKROACH --- DIGESTIVE SYSTEM & RESPIRATORY SYSTEM

VERY SHORT ANSWER TYPE QUESTIONS:

1. How many denticulate plates are present in the gizzard of cockroach?

- 6 denticulate plates are present in gizzard of cockroach.
- Sclerotised chitin is present in the form of 6 long primary folds known as denticulate plates or teeth.
- Food is grinded among these plates.

2. What are the three regions of the alimentary canal of cockroach?

- Alimentary canal of cockroach has three regions. They are….
  A) FOREGUT or STOMODAEUM ---- lined by ectoderm with cuticle
  B) MIDGUT or MESENTERON ---- lined by endodermal cells only
  C) HINDGUT or PROCTODAEUM --- lined by ectoderm with cuticle.

3. Name the enzymes present in the juice secreted by anterior part of mid gut.

- Maltase, Invertase, Proteases and lipases are the enzymes present in the juice secreted by anterior part of mid gut.

4. Which cells secreted the peritrophic membrane in cockroach?

- Glandular cells of anterior part of the ventriculus or mesenteron secrete peritrophic membrane around the food.
- It is a chitinous, porous-mesh like membrane.
- It protects the wall of the ventriculus from hard food particles.

5. How many rectal papillae are present in the rectum of cockroach?

- Rectum has 6 longitudinal chitinous folds known as rectal papillae on its inner side.
- Rectal papillae are concerned with the reabsorption of water from the undigested food.

6. How many salivary glands are present in cockroach? Name the enzyme secreted by them.

- One pair of salivary glands are present in cockroach. They are attached to ventrolateral sides of crop.
- Acinar cells secrete saliva with starch digesting enzymes like AMYLASE.

7. Which parts of cockroach help in locating the food?

- Cockroach locates the food by the olfactory sensilla of antenna, labial palps and maxillary palps.

8. In which part of gut, water is absorbed in cockroach?

- Absorption of water takes place in rectum in cockroach.
- Rectum has rectal papillae to absorb water from undigested food.

9. Which parts of mouthparts those help in biting and tasting the food in cockroach?

- Food is seized with the help of forelegs, labrum and labium.
- Mandibles help in biting and chewing.
- Gustatory sensillae to taste the food are present on inner surface of labrum, maxillary palps and lalbial palps.

10. How most of the digestion occurs in crop inspite of the absence of any enzymes in it?

- Major part of digestion occurs in crop.
- Enzymes from mesenteron enter into crop through the grooves of gizzard by the process known as 'Regurgitation'.

11. How many spiracles are present in cockroach?

- 10 pairs of spricacles are present in tracheal system of cockroach.
- Among them 2 pairs are present in thoracic region and 8 pairs are present in abdominal region.

12. Why respiratory system of cockroach is called holopneustic system?

- As all the ten pairs of spiracles are functional in cockroach, the respiratory system is considered as holopneustic sytem.

13. Name the chitinous rign that encircles the spiracle of cockroach.

- Peritreme

14. What is intima ?

- Inner layer of the wall of tracheae in cockroach is known as intima.

15. What are taenidea and ctenidia ?

- A**) Taenidea** : These are the spiral thickenings formed by intima in the wall of trachea. They keep the tracheae always open.
  B)**CTENIDIA** : These are the gills in molluscans.

16. Name the protein that lines the tracheole of cockroach.

- Trachein

17. Which spiracles open during inspiration and which open during expiration?

Phase of respiration	**Thoracic spiracles**	**Abdominal spiracles**
1.INSPIRATION	OPEN	CLOSED
2.EXPIRATION	CLOSED	OPEN

18. Inspiration in cockroach is a passive process and expiration is an active process. How?

- Inspiration is a passive process in cockroach due to relaxation of the dorso ventral muscles and ventral longitudinal muscles occur.
- Expiration is an active process as the muscles undergo contraction during that phase.

19. Why the respiratory system in cockroach is considered as polypneustic System?

- Respiratory system in cockroach has 10 pairs of spiracles. So it is known as polypneustic system (presence of more than 8 pairs)

20. Respiration in cockroach is discontinuous ventilation. Justify.

- Discontinuous ventilation is shown by insects like cockroaches, beetles and grasshoppers.
- In this mode of respiration, continuous exchange of gases is interrupted by extended periods during which spiracles are closed.
- The movement of oxygen into tracheae and expulsion of carbon dioxide out form the body occur in bursts, when the spiracles open.

21. Write the names of Stomodaeum and proctodaeum in the alimentary canal of cockroach.

- A)Stomodaeum : pharynx, oesophagus, crop, gizzard(proventriculus)
- B) Proctodaeum : ileum, colon and rectum.

SHORT ANSWER TYPE QUESTIONS:

1. **Describe the physiology of digestion in cockroach.**
   - The food passes through the pharynx and oesophagus and reaches the crop. In crop, the food is mixed with digestive juices which are regurgitated into the crop through the grooves of gizzard.
   - Most of the food is digested in the crop.
   - Partly digested food is filtered into the ventriculus by bristles of gizzard and later it passes though stomodaeal valve.
   - Amylase of saliva converts starches into disacchraides.
   - Invertase or sucrose digests sucrose into glucose and fructose.
   - Maltase converts maltose into glucose.
   - Lipase digests lipids into fatty acids and glycerol.
   - Proteases digest proteins into amino acids.
   - Cellulase secreted by microorganisms of hindgut digests cellulose into glucose.
   - Peritrophic membrane surrounds the food in mesenteron.It protects the delicate walls of mesenteron as they are made with endoderm only.
   - Digested food is absorbed into haemolymph in posterior region of ventriculus.
   - Undigested food is passed into the ileum, colon and reaches the rectum.
   - Rectal papillae reabsorb water from undigested food.
   - The remaining material is finally defecated as dry pellets through the anus.

2. **Describe the structure of trachea of cockroach.**
   - Several horizontal tracheae arise from atrium of each thoracic spiracle. They join together in thorax and form many tracheal trunks like dorsal cephalic, ventral cephalic trunks the branches.

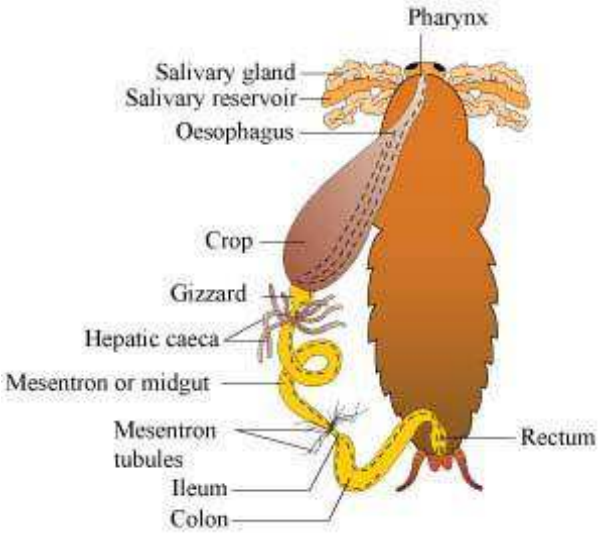
- Three tracheal tubes arise from the atrium of each abdominal spiracle and these tubes of one side open into three separate longitudinal tracheal trunks. They are LATERAL, DORSAL and VENTRAL longitudinal tracheal trunks. Lateral trunks are the longest.
- Three pairs of longitudinal tracheal trunks of both sides are interconnected by many commissural tracheas.
- Tracheal branches enter into an organ and end in a special cell known as Tracheole cell or Tracheoblast . It gives many tracheoles.

WALL OF TRACHEA;

- Wall of trachea is formed by three layers i.e.,
  a) Outer Basement membrane
  b) Middle epithelium
  c) Inner cuticle layer, Intima .
- Intima produces spiral thickenings known as Taenidia. They keep the tracheae always open.

LONG ANSWER TYPE QUESTIONS:

1. **Describe the digestive system of cockroach with the help of a neat labeled diagram.**



- Digestive system of cockroach consists of an alimentary canal and associated glands.

ALIMENTARY CANAL:

- It is a long coiled tube with three regions like foregut or stomodaeum, midgut or mesenteron and hindgut or proctodaeum.
- Foregut and hindgut are lined by ectoderm with cuticular lining while the mesenteron is lined byendodrm only.

I) FOREGUT or STOMODAEUM:

- It includes pharynx, oesophagus, crop and gizzard.
- Mouth opens into pharynx which leads into a narrow tubular oesophagus. Oesophagus opens into a thin walled crop.
- Crop leads into a thick walled muscular Proventriculus or gizzard.
- Gizzard has long denticulate plates and alternating folds. Nonsclerotised pads with backwardly directed bristles are present behind the teeth.
- Food is grinded into fine particles among the plates. Bristles filter the food particles. Thus gizzard acts both as grinding mill and sieve.
- Stomodaeal valve is membranous projection of gizzard into mesenteron to prevent backward passage of food from mesenteron into gizzard.

II) MIDGUT or MESENTERON:

- It contains a tubular ventriculus behing gizzard.
- 6 – 8 finger diverticula known as Hepatic caeca arise between the ventriculus and gizzard. They help in digestion and absorption.
- Anterior secretory part has gland cell to secrete enzymes. Glandular cells secrete a porous-mesh like peritrophic membrane around the food bolus to protect the delicate walls of mesenteron from hard food particles.
- Posterior absorptive region helps in absorption of digested food into haemocoel.
- A sphincter muscle controls the opening of ventriculus into ileum of hind gut. It prevents the entry of undigested food and uric acid from hind gut into the midgut.

III) HINDGUT or PROCTODAEUM:

- It is long coiled tube with regions like ileum, colon and rectum.
- Ileum is a short tube which collects uric acid from Malpighian tubules and undigested food from mesenteron.
- Six bundles of fine yellow Malpighian tubules open into ileum near the junction between mesenteron and ileum.
- Ileum leads into long coiled tube known as Colon.
- Colon leads into a short and wide rectum. It opens out through anus.
- Rectum has rectal papillae as six longitudinal chitinous folds which are concerned with reabsorption of water from undigested food.

DIGESTIVE GLANDS:

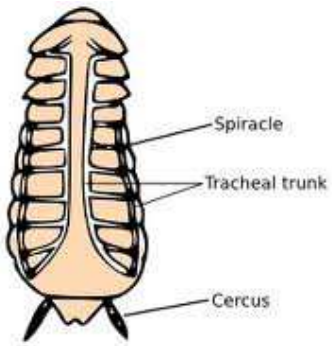
- **SALIVARY GLANDS** :

  A pair of salivary glands are attached with ventrolateral sides of crop. Each gland has two lobes with many lobules known as acini.
  Median salivary duct and common receptacular ducts form the efferent salivary duct. It opens at the base of hypopharynx.
  Acinar cells secrete saliva with amylase.
- Hepatic caecae: they have secretory and absorptive cells.
- Glandular cells of Mesenteron : They secrete enzymes like maltase, invertase, proteases and lipases.

2. **Describe the respiratory system of cockroach..?**
   - ❖ Tracheal system in cockroach delivers the air directly to tissues. The respiratory system of cockroach consists of stigmata, tracheae and tracheoles.

a) STIGMATA or SPIRACLES:

- ❖ Tracheal system opens out through 10 pairs of spiracles.
- ❖ Thoracic segments hve the first 2 pairs of spiracles in mesothorax and metathorax.
- ❖ First 8 abdominal segments have the remaining 8 pairs of spiracles.
- ❖ Spiracles are located on pleura of those segments.
- ❖ Respiratory system in cockroach is considered as Polypenustic type as it contains 1o pairs of spiracles (more than 8 pairs).
- ❖ As all the spiracles are functional, this system is known as Holopneustic
- ❖ All spiracles are valvular. Each spiracle is surrounded by a chitinous ring known as Peritreme.
- ❖ All spiracles have small hairs known as trichomes to filter the dust parts
- ❖ Each spiracle leads into a small chamber known as Atrium.



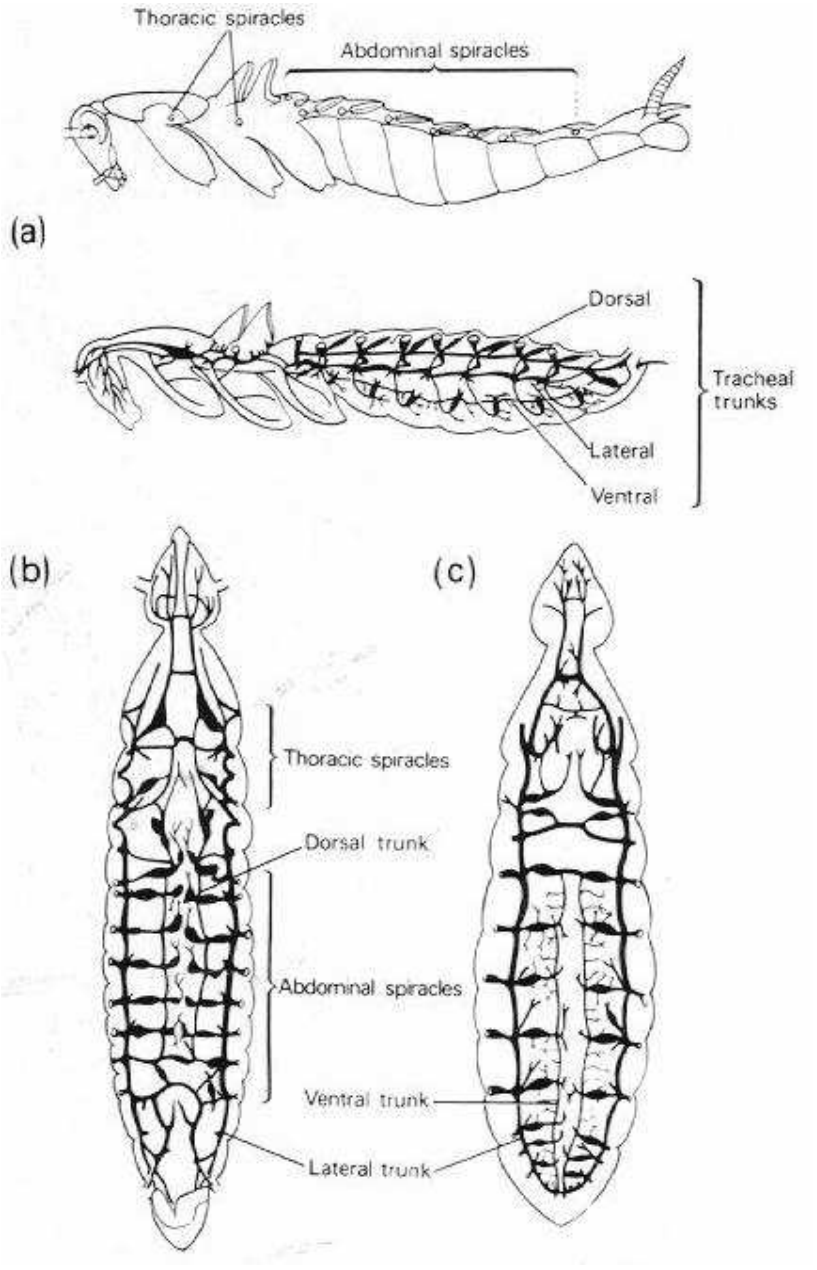
b) TRACHEAE:

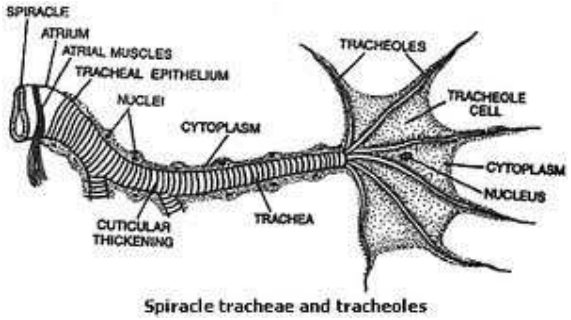
- ➢ Several horizontal tracheae arise from atrium of each thoracic spiracle. They join together in thorax and form many tracheal trunks like dorsal cephalic, ventral cephalic trunks the branches.
- ➢ Three tracheal tubes arise from the atrium of each abdominal spiracle and these tubes of one side open into three separate longitudinal tracheal trunks. They are LATERAL, DORSAL and VENTRAL longitudinal tracheal trunks. Lateral trunks are the longest.
- ➢ Three pairs of longitudinal tracheal trunks of both sides are interconnected by many commissural trachea.
- ➢ Tracheal branches enter into an organ and end in a special cell known as Tracheole cell or Tracheoblast. It gives many tracheoles.

WALL OF TRACHEA;

- ➢ Wall of trachea is formed by three layers i.e.,
  d) Outer Basement membrane
  e) Middle epithelium
  f) Inner cuticle layer, Intima .

Intima produces spiral thickenings known as Taenidia. They keep the tracheae always open





Spiracle tracheae and tracheoles

C) TRACHEOLES:

- ❖ Tracheoles are the intracellular tubular branches arise from tracheole cell or tracheoblast of tracheae.
- ❖ Intima of tracheoles is very thin with epicuticle only. It remains in moulting. Intima is thrown into many taenidial ridges. They are without chitin.
- ❖ Tracheoles have tracheolar fluid. The levels of tracheolar fluid are varies with the condition of insect….
  - i) Inactive condition of insect …. More tracheolar fluid.
  - ii) Active condition of insect ….. Very less fluid as it is reabsorbed by tissues
- ❖ Tracheoles penetrate the cell and intimately associated with mitochondria.

MECHANISM OF RESPIRATION:

- ➢ Respiration includes inspiration and expiration. Principal muscles in respiration are Dorsoventral muscles.

a) **INSPIRATION:** Intake of air into the body is inspiration.

- ■ It occurs by relaxation of dorsoventral muscles and ventral longitudinal muscles.
- ■ Due to the relaxation of dorsoventral muscles, body tergum is elevated and the volume of the body cavity increases.
- ■ Due to the relaxation of ventral longitudinal muscles telescoped segments come to normal condition.
- ■ So the volume of the body cavity increases.
- ■ Inspiration is a passive process as the muscles relax.
- ■ During inspiration, the thoracic spiracles re kept open and the abdominal spiracles are kept closed.

b) EXPIRATION: sending out air from the body is expiration.

- ➢ Contraction of dorsoventral muscles depresses the tergum. It results in the depressed body cavity.
- ➢ Due to the contraction of ventral longitudinal muscles the volume of body cavity decreases as the segments are telescoped.
- ➢ Expiration is an active process as the muscles contract.
- ➢ During expiration thoracic spiracles are closed and abdominal spiracles are kept open.

Cockroach Nervous System and Sense Organs

VERY SHORT ANSWER TYPE QUESTIONS;

1. Which structure of cockroach acts as sensory centre and endocrine structure?

- ► Brain or supraoesophageal ganglia are sensory and endocrine centre.
- ► Brain receives sensory impulses from various sense organs.

2. Which is the main motor centre in cockroach?

- ► Sub-oesophageal ganglion is the motor centre that controls the movements of mouthparts, legs and wings.

3. How many ganglia are present on ventral nerve cord of cockroach?

- ► 9 abdominal ganglia are present in double ventral nerve cord of cockroach.
- ► Of these, 3 are present in thoracic segments (Prothoracic, mesothoracic and metathoracic).
- ► Six ganglia are present in the abdominal segments.
- ► Abdominal segments with ganglia are --- 1^{st}, 2^{nd}, 3^{rd} ,4^{th} ,6^{th} & 7^{th} .
- ► Abdominal segments without ganglia are --- 5^{th}, 8^{th}, 9^{th} & 10^{th} .

4. Which ganglia are related to autonomous nervous system in cockroach?

GANGLIA OF ANS	**LOCATION**
1.Frontal ganglion	Dorsal wall of pharynx, infront of brain
2.Hypocerebral ganglion	Above oeophagus, behind the brain
3.Visceral or Ingluvial ganglion	On the wall of crop
4.Proventricular ganglion	On gizzard.

5. What are the three lobes of brain in cockroach?

LOBE OF BRAIN	**RECEIVES SENSORY IMPULSES FROM**
1.Protocerebrum	Compound eyes through Optic nerves
2.Deutocerebrum	Antennae through antennal nerves
3.Tritocerebrum	Labrum through labrofrontal nerve

6. Name the structural and functional units in the compound eye of cockroach?

- ► Ommatidia are the structural and functional units of compound eye.

7. Name the transparent structure present among the vitrellar cells ?

- ► Transparent crystalline cone is present among the vitrellae or one cells or simper cells.

8.What are the components of a sensillum ?

- ► Sensillum consists of a trichogen cell with a movable hair like process, a tormogen cell that forms the socket around the base of movable hair and a sensory neuron which starts at the base of the hair and conducts impulses to the central nervous system.

9. What are Scolopidia ?

- ► Scolopidia are the units of mechanoreceptors of chrodo-tonal organs.
- ► Scolopidium is present below the epidermis. It contains an attachment-cell that attaches the scolopidium to the epidermis, scolopale-cell that lies around the cilium like process and a nerve cell whose dendrite is cilium-like process.

10. What are semper cells?

- ► Semper cells or cone cells or vitrellae are the foue transparent conical cells that surround crystalline cone of ommatidium in compound eye.

11. Distinguish between apposition image and superposition image.

APPOSITION IMAGE	**SUPERPOSITION IMAGE**
1.formed in diurnal insects like Houseflies	Formed in nocturnal insects like cockroach
2. Retinulae are present below the vitrellae and crystalline cone	Retinulae are present deep below the vitrellae and crystalline cone.
3. retinal sheath is present	Retinal sheath is absent.
4. It is mosaic of several small images.	Overlapping of images.
5. clear image and mosaic vision	Blurred image. Superposition vision

12. What is the largest abdominal nerve ganglion in cockroach?

- ► 6^{th} abdominal ganglion present in 7^{th} abdominal segment is considered as the largest abdominal ganglion in cockroach.
- ► It is formed by the fusion of ganglia of7th, 8^{th},9^{th} and 10^{th} abdominal segments.
- ► It sends nerves to reproductive organs, copulatory appendages and anal cerci.

SHORT ANSWER TYPE QUESTIONS;

1. Describe the Mechanoreceptors in cockroach.

- ► Mechanoreceptors are cuticular and subcuticular.
- ► Cuticular receptors are tactile and proprioreceptors.
- ► Subcuticular mechanoreceptors are present in chordo-tonal organs with units known as scolopidia.
- ► Types of Chordotonal organs are ….
  a)Sub-genual organs -- sensitive to ground vibrations --- proximal of tibia.
  b)tympanal organs – sensitive to sound vibrations --- Anal cerci

c) Johnston's organs --- sensitive to movement of flagellum according to pedicel.

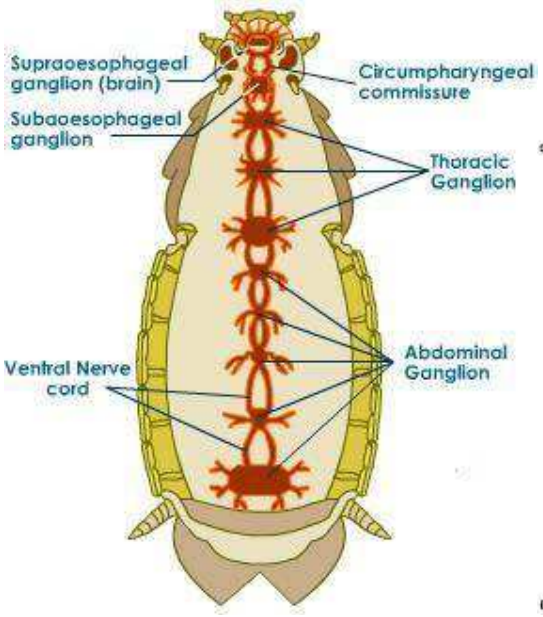
2. Describe about the various types of sensillae in cockroach.

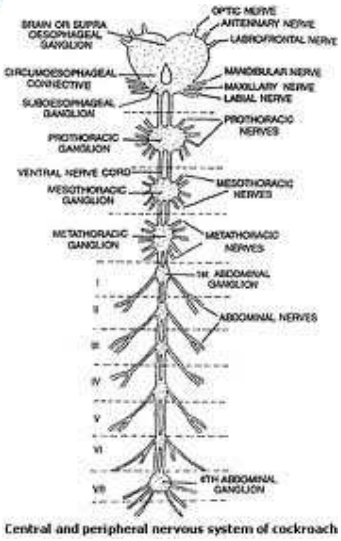
TYPE OF SENSILLAE	LOCATION	ROLE
1.Olfactory	Antennae,maxillary palps, Labial palps	smell
2.Gustatory	Inner surface of labrum, labial Palps, maxillary palps	Taste
3.Thermoreceptors	1st, 2nd,3rd tarsomeres of tarsus of leg	Temperature changes



LONG ANSWER TYPE QUESTIONS:

1. **Describe the nervous system and compound eye of cockroach.**





Central and peripheral nervous system of cockroach

- Nervous system in cockroach consists of central nervous system, peripheral nervous system and autonomous nervous system
- **CENTRAL NERVOUS SYSTEM**: it consists of a nerve ring and nerve cord.

a) **NERVE RING**: It is present around the oesophagus. It is formed by

i) Brain … present above oesophagus. It is a main sensory and endocrine centre. It has 3 lobes in the following manner.

LOBE OF BRAIN	RECEIVES SENSORY IMPULSES FROM
1.Protocerebrum	Compound eyes through Optic nerves
2.Deutocerebrum	Antennae through antennal nerves
3.Tritocerebrum	Labrum through labrofrontal nerve

ii) Sub-oesophageal ganglion: present below the oesophagus. It is the motor centre. It controls the movements of mouthparts, legs, wings.

iii) Circum-oesophageal connectives: a pair of connectives is present round the oesophagus and connects tritocerebrum with sub-oesophgeal ganglion.

b)VENTRAL NERVE CORD :

- Double ventral nerve cords are solid and ganglionated. They arise from sub-oesophageal ganglion and extend up to the 7^{th} abdominal segment.
- 9 ganglia are present along their length. Three of them in thoracic region and the remaining six are present in abdominal region.
- Abdominal segments with ganglia are 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 6th and 7^{th}.
- Last or 6^{th} abdominal ganglion present in 7^{th} segment is the largest and it is formed by the fusion of the ganglia of 7^{th}, 8^{th}, 9th and 10^{th} abdominal segments.

■ **PERIPHERAL NERVOUS SYSTEM ;**

It consists of nerves related to ganglia of CNS.

■ Brain receives a) optic nerves -- from compound eyes.
b) Antennal nerves – from antennae
c)labrofronta nerves ---from labrum and frontal ganglion

-- Suboesophageal ganglion --- gives motor nerves to mandibles, maxillae and labium.

■ Thoracic ganglia --- supply nerves to wings and legs.

■ Abdominal ganglia send nerves to various parts

Ganglion	Sends nerves to
1.Metathoracic ganglion	Parts of 1st abdominal segment
2.1st abdominal ganglion	Parts of 2nd abdominal segment
3.2nd abdominal ganglion	Parts of 3rd abdominal segment
4.3rd abdominal ganglion	Parts of 4th abdominal segment
5. 4th abdominal ganglion	Parts of 5th abdominal segment
6. 5th abdominal ganglion	Parts of 6rth abdominal segment

7. 6th abdominal ganglion	Parts of 7th, 8th, 9th and 10th segments.

■Autonomous nervous system :

It is the stomatogastric nervous system or visceral nervous system. It controls the visceral organs like alimentary canal, and the heart.

It includes 4 ganglia in the following manner.

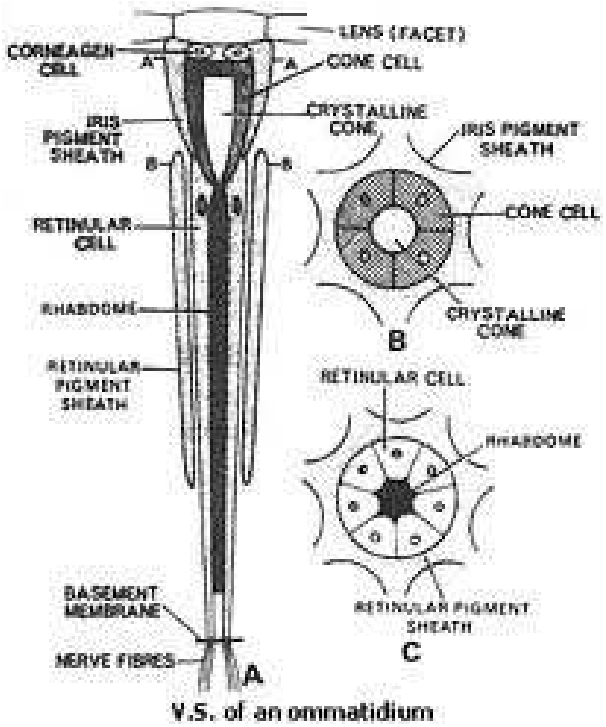
GANGLIA OF ANS	LOCATION
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B) COMPOUND EYE:

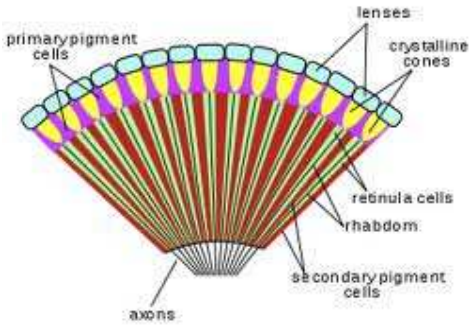
A pair of dark, kidney-shaped compound eyes is present on the dorsolateral sides of the head.

Each compound eye is composed of about 2000 functional units, Ommatidia.

2. Describe the ommatidium of cockroach with diagram.



V.S. of an ommatidium



- Ommatidia are the functional units of compound eye of cockroach.

Structure of OMMATIDIUM:

- Each ommatidium is elongated and pyramidal in shape with the parts like cornea, corneagen cells, vitrellae, crystalline cone and retinule.

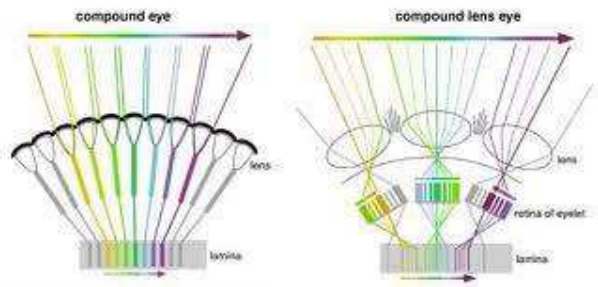
  a) CORNEA: it is the outermost part and forms the hexagonal facet of compound eye. It is a biconvex lens of cuticle. It allows the entry of light rays.

  b) CORNEAGEN CELLS or LENTICULAR CELLS: Two cells
  These are specialisd epidermal cells that secrete cornea.

  c**) VITRELLAE or CONE CELLS or SEMPER CELLS:**
  Four cells present below the cornegen cells. They secrete crystalline cone and surround them.

  d) CRYSTALLINE CONE : It focuses the light.
  It is the transparent conical structure. it is secreted by vitrellae. The region with cornea and crystalline cone form DIOPTRICAL REGION.

  e) RETINULAE: Seven in number.
  Innermost and elongated cells. They are present on basement membrane. Microvilli of each cell from a rhabdomere with photoreceptor pigment. All rhabdomeres fuse along the axis of ommatidium to form the rhabdome .
  Retinulae are the nerve cells from which sensory nerve fibres leave as optic nerve to reach the protocerebrum of brain.
  Rhbdome and retinulae form Retinal or Receptor region where image is formed.



MOUTH PARTS & ECONOMIC IMPORTANCE OF INSECTS

Very short answer type questions:

1. Which mouth parts is the most primitive type among insects?

- ► Biting & chewing type of mouthparts are the most primitive type of mouthparts among insects.
- ► The larvae of all most all insects have biting & chewing type of mouthparts while the adults have different types of mouthparts.

2. Which structure connects the labella of mosquito?

- ► Dutton's membrane connects the labella of proboscis in mosquitoes.
- ► Labella are modified forms of labial palps.

3. which structure forms the proboscis of mosquito, butter fly?

- ► A)female mosquitoes - --- Labium forms proboscis.
- ► B)Butterfly ----- Galeae of 1st pair maxillae form proboscis.

4. Name the anticoagulant present in the saliva of mosquito.

- ► Haemolysin is an anticoagulant present in saliva of mosquito. It prevents blood clotting.

5. How is food canal formed in mosquito and housefly?

- ► Apposition of labrum-epipharynx and hypopharynx form food canal in both mosquitoes and houseflies.

6. Why are male mosquitoes unable to suck the blood of man?

- ► In male mosquitoes, mandibles are absent. The first pair of maxillae is vestigial. Hypopharynx is fused with proboscis.
- ► So male mosquitoes are unable to suck the blood of man.

7. What are the three parts of proboscis of house fly?

- ► Proboscis of housefly has three parts….
  a)Rostrum : basal part of proboscis. It has pharynx and salivary duct.
  b)Haustellum : middle part of proboscis. It is the proximal part of labium.It has food canal.
  c)Labellum : terminal part of proboscis. It has two lobes known as labella.

8. What are pseudotracheae?

- ► Labella in labellumof proboscis in housefly contain pseudotracheae.
- ► Labella bear many grooves supported by semicircular chitinous rings. They appear as trachee and known as pseudotracheae. All pseudotgracheae lead into preoral opening.

9. In which types of mouthparts, mandibles are absent?

- ► Mandibles are absent in
  a)Sponging & sucking type -- housefly
  b) Siphoning-sucking type -- Butterfly and moths.

10. What are stylets in piercing and sucking type of mouthparts ?

- ► Various mouth parts are modified as long pointed structures known as Stylets in piercing and sucking type of mouthparts.

11. Distinguish between trachea and pseudotrachea ?

- ► Tracheae are the respiratory tubes present in insects. They are supported by spiral thickenings known as taenidia.
- ► Pseudotracheae are the grooves present in labella of labellum of proboscis in housefly.They are supported by semicircular chitinous rings.

12. Write any two differences between queen and worker bees.

QUEEN BEE	WORKER BEE
1.bee hive contains only one queen	Many worker bees are present
2. Large bee with reduced wings.	Smallest with well developed wings
3.Fertile female	Sterile female
4.it lays eggs only	Functions are diverse.

13. What is meant by Apiculture and Sericulture?

- ► Apiculture is the culturing of honeybees.
- ► Sericulture is the culturing of silk moths.

14. What are apiaries?

► The places where beehives are kept and bees are raised are apiaries.

15. What are common honeybees of India?

► Three common types of honeybees of India are

a)*Apis indica* : most domesticated type

b)*Apis dorsata* : Largest Indian honey bee. It is wild rock bee.

c)*Apis florea* : Smallest Indian honey bee.

16. How do honey bees communicate?

► Worker honey bees communicate among themselves through two types of dances like Round dance and Waggle dance.

► The meaning of these dances was deciphered by Karl Von Frisch.

17. List out any two holometabolous insects you have studied. Write their larvae and pupae.

► The insects that show holometabolous metamorphosis are Silkworm moth,housefly and mosquito

INSECT	LARVAE	PUPAE
1.Bombyx mori	Eruciform larva	Chrysalis
2.Musca domestica	Maggots / gentles	
3.Mosquitoes	Wriggler	Tumbler

18. Name any four pathogens transmitted by housefly.

Pathogen	Disease caused by pathogen
1.*Salmonella typhi*	Typhoid
2.*Entamoeba histolytica*	Amoebic dysentery
3.Mycobacterium tuberculosis	Tuberculosis
4.Vibrio cholera	cholera

19. Write the scientific name of mulberry silkworm moth.

► *Bombyx mori*

20. Which stage of silkworm yields silk?

► Fully grown larva stage secretes silk to spin its cocoon.

21. Write zoological name of lac *insect.*

► *Kerria lacca or laccifer* lacca or *Tachardia lacca* is the scientific name

22. What re halters or balancers?

► Metathoracic wings in mosquito and housefly are modified into halters which act s organs of balance.

23. Write the zoological name of bedbug.?

► *Cimex hemipterus* (*Cimex rotundus)*

24. Name the wingless and blood sucking ectoparasite found among bases of the hair in man.?

► *Pediculus humanus capitis.*

25. Mention the number of moults occur in the life history of various insects.

Insect	Number of moults
1.Head louse	3
2.Bedbug	4
3.Mosquito	4
4.Housefly	2
5.Lac insect	3
6.Silkworm moth	4

26. Explain about Nonmulbery silkworm moths?

Nonmulbery silkworm moth	Caterpillar feeds on	Type of silk produces
1.Philosamia recini	*Recinus communis(*castor)	Eri silk
2.Antheraea assamensis	*Machillus bombycina*(som)	Muga silk
3.Antheraea paphia	*Terminalia tomentosa*	Tassar silk

SHORT ANSWER TYPE QUESTIONS;

1. Explain the economic importance of silkworm moth.

- Sericulture is the industry where rearing the silk worm and extraction of silk from cocoon takes place.
- Sericulture includes 3 activities
  i) Cultivation of mulberry, *Morus alba* or *Morus indica* or other plants (moriculture)
  ii) Production of quality seed by rearing silkworms
  iii) Reeling of cocoons for silk.
- Seed is the fresh cocoons in the industry. Some of the cocoons are spared as reproductive seed to continue the life cycle.
- Other seed is considered as industrial seed.
- The pupae in the industrial seed are killed by keeping cocoons in hot water by the process known as Stifling.
- Free end of silk thread over the cocoon is held and the entire thread is pulled out. Single filaments are combined to form yarn. It is drawn under tension through several guides and wound onto reels. The yarn is dried. This process is known as reeling or filature.
- China leads in silk production in the world followed by Japan.
- Karnataka occupies the first place in India.

2. What is the economic importance of honey bees ?

- Honey is a good nourishing food. It contains the sugars like levulose, dextrose and maltose.
- Honey is used in the preparation of jellies, jams and cakes.
- Wax from beehive is used in making polishes and candles.
- Honey bees are best pollinators.
- They produce propolis. It usded in the treatment of inflammations, superficial burns.
- Bee venom is useful in treatment of arthritis.
- Honey is a good antiseptic and applied to wounds to prevent infection.

3. Explain the economic importance of Lac insect.

- Stick lac is collected from the branches of host trees.
- Stick lac is crushed and sieved to remove impurities and form Dust lac.
- Dust lac is repeatedly washed to remove insect parts and other soluble material. It produces Seed lac.
- Seed lac is processed by heat treatment or solvent extraction to remove impurities and form Shellac.
- Refined lac is molded into flakes or sticks which are used in making toys, varnishes, paints, gramphone records, buttons and bangles.
- Bodies of lac insect have some medicinal value.
- India is the largest quality lac producing country.
- Bihar produces largest quantity of lac in India.
- The Indian Lac Research Institute (ILRI) is present at Namkum near Ranchi in Jharkhand.

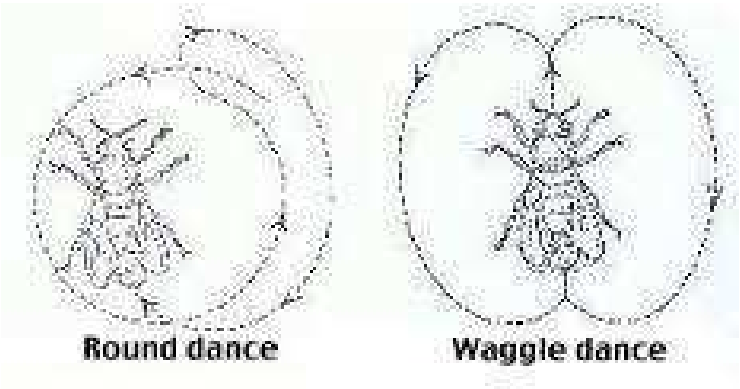
LONG ANSWER TYPE QUESTIONS;

1. Write an essay on the beneficial insects you have studied.
Useful insects are reared in special are as for their commercial products.
Honey bee, silk moth and lac insect are the useful insects…?

A) **HONEY BEE:** It is a colonial and social insect.



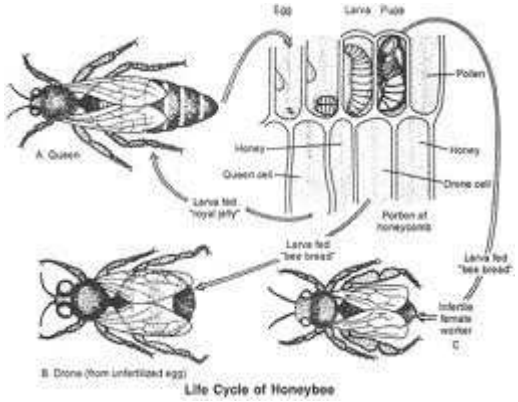
- *Apis indica, Apis dorsata and Apis florea* are the 3 species of honey bees of India.
- Culturing of honey bees is known as Apiculture.
- Bee hive consists of three castes like queen, drones and workers.
- Queen is large bee with reduced wings. It has a large abdomen with ovaries. It is copulated with the male during nuptial flight.
- Drones are haploid males developed from unfertilized eggs. They have large wings, reduced mouthparts.
- Workers are sterile females and smallest among the castes. They collect polen grains and nectalr from flowers. They collect pollen with pollen brushes and store them in pollen baskets.
- Pollen brushes are present on the tarsus of legs.
- Pollen basket, or corbicula, pollen press and pllen rake are present on the tibia of metathoracic legs.
- Workers have as sting at tip of abdomen. Workers are of 4 types ….
  a) Laying worker bee -- lays unfertilized eggs which develop into drones.
  b)Nurse workers -- 1 – 10 days old. They serve queen with royal jelly.
  c) House workers – 10 – 20 days old. They perform hous cleaning, comb building. They have wax glands on 2^{nd}, 3rd, 4^{th} and 5^{th} abdominal segments to secrete bee wax.
  d)Field workers : after 20 days . They collect nectar, pollen grains and resins from flowers. They convert the nectar into honey in crop. They make propolis (bee glue) from resins and tree saps and use the propolis to seal the cracks in comb.
  Workers communicate about food source and other information among themselves by two types of dances like round dance and waggle dance.



ECONOMIC IMPORTANCE of honey bee:

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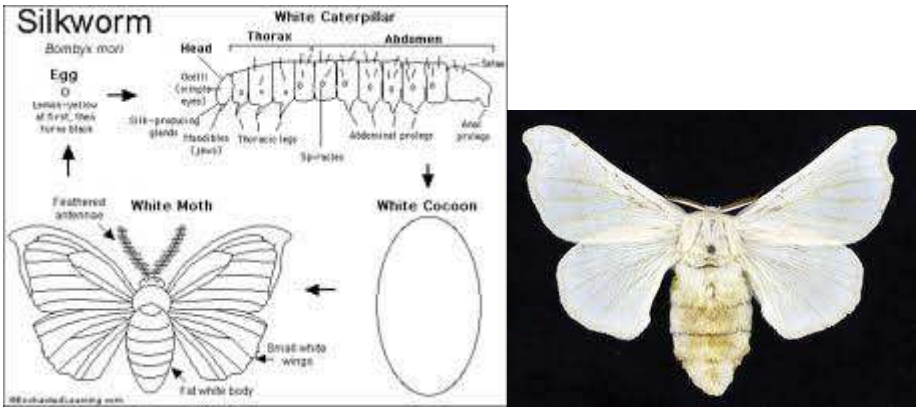


Life Cycle of Honeybee

B) SILKWORM MOTH:

► *Bombyx mori* is Chinese silk worm moth or mulberry silkworm moth.

LIFE CYCLE:



► Holometabolous insect with 4 stages like egg, larva, pupa and adult.

a) **EGG:** female lays 300-400 eggs on upper surface of mulberry leaves.

b)LARVA : it is eruciform larva . It has soft cylindrical body with head and short thoracic legs. Its body has head, thorax and abdomen. It has biting and chewing mouthparts. It feeds on mulberry leaves for 2-3 weeks. It moults for 4 times. Its salivary glands are modified into silk glands. Abdomen has 10 segments. 3rd, 4th, 5th, 6th and last segments have Pseudolegs,. 8th abdominal segment has a dorsal anal horn. Later the larva stops feeding and secretes silky fluid out through a spinneret present on labium. Silk becomes hard thread outside the body. With the help of silk thread, it spin cocoon. The silk contains fibroin protein and a gum called sericin to cement the filaments together.

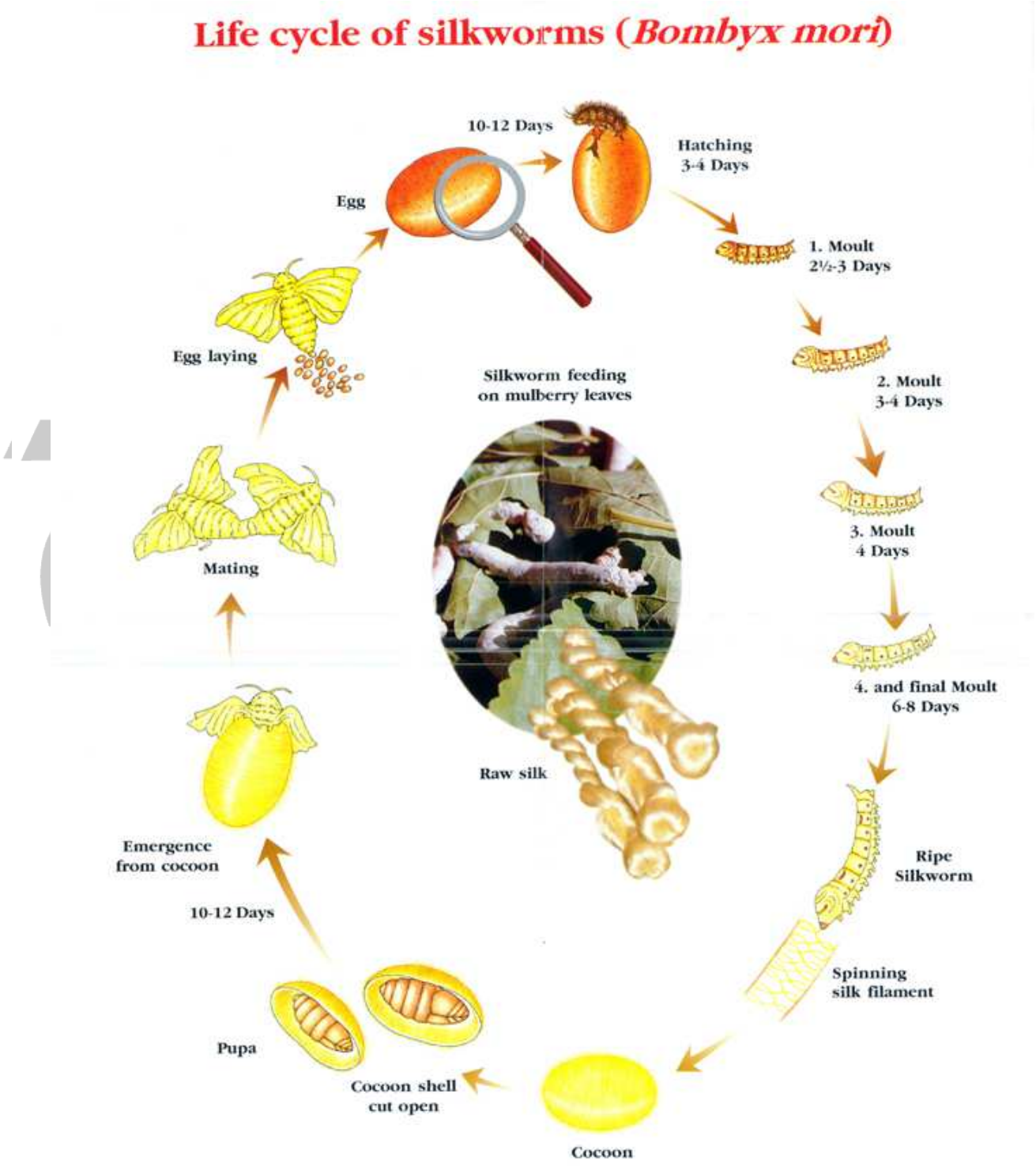
c) PUPA: larva undergoes completed metamorphosis and becomes a pupa or Chrysalis. It is non-feeding stage. It becomes imago. Imago secretes Cocoonase to digests the silk fibres which help in the coming out of adult from cocoon.

d) ADULT: It has 2 pairs of wings and 3 pairs of legs. It has siphoning mouth parts.

ECONOMIC IMPORTANCE OF SILKMOTH WORM:

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- Sericulture includes 3 activities
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  - ii)production of quality seed by rearing silkworms
  - iii)reeling of cocoons for silk.
- Seed is the fresh cocoons in the industry. Some of the cocoons are spared as reproductive seed to continue the life cycle.
- Other seed is considered as industrial seed.
- The pupae in the industrial seed are killed by keeping cocoons in hot water by the process known as Stifling.

- free end of silk thread over the cocoon is held and the entire thread is pulled out. Single filaments are combined to form yarn. It is drawn under tension through several guides and wound onto reels. The yarn is dried. This process is known as reeling or filature.
- China leads in silk production in the world followed by Japan.
- Karnataka occupies the first place in India.



C) LAC INSECT:



- *Kerria lacca* is the Indian lac insect. It is a scale insect. It has piercing and sucking type of mouthparts.
- *Laccifer lacca, Tachardia lacca* are the junior synonyms.
- Lac is a resinous substance secreted by the hypodermal glands of skin.

LIFE HISTORY:

- Female lac insect lays 200-500 eggs in the cell. Nymphs come out.
- Nymphs feed on plant juices with piercing and sucking mouthparts.
- Nymphs secretes a coat of lac from hypodermal glands of skin,
- After the 1st moult, male and female nymphs lose their antennae and eyes.
- After the 3rd moult, nymphs become adult stages. The mouthparts become atrophied in males and stop feeding.
- Cell of female is round and the insect remains fixed to the twig. The female insect is degenerate without wings and legs. Female becomes larger to accommodate more number of eggs.

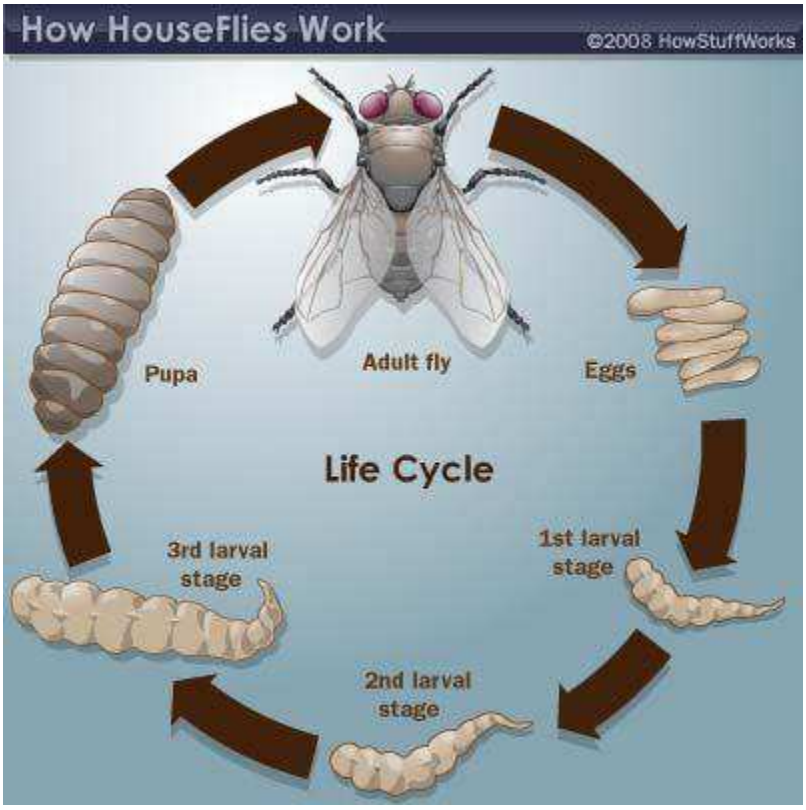
ECONOMIC IMPORTANCE OF LAC INSECT:

- Stick lac is collected from the branches of host trees.
- Stick lac is crushed and sieved to remove impurities and form Dust lac.
- Dust lac is repeatedly washed to remove insect parts and other soluble material. It produces Seed lac.
- Seed lac is processed by heat treatment or solvent extraction to remove impurities and form Shellac.
- Refined lac is molded into flakes or sticks which are used in making toys, varnishes, paints, gramphone records, buttons and bangles.

2. Write an essay on the harmful insects you have studied.

Harmful insects are housefly, mosquito, and bed bug and head louse.

A) HOUSE FLY:



- World wide distribution ---*Musa doemstica*
- Indian housefly --- *Musca nebula*
- Two pairs of wings are a)Mesothoracic wings -- for flying
  b)Metathoracic wings -- small, rod like balancers or halters

Antenna has arista on its last segment.

Sponging type of mouthparts are present.

LIFE HISTORY: housefly is holometabolous

- Female lays 500-600 eggs in 5 batches on decomposing organic matter.
- Eggs hatch out into maggots or gentles.
- Maggots are 13 segmented. It has small stumpy legs known as Spiniferous pads on 6^{th} to 12^{th} segments for locomotion. Maggots feed on organic matter and undergo 2 moults to become pupae.
- Pupae undergo metamorphosis to become an adult.

HARMFUL NATURE:

House fly acts as a disease-spreading agent. Hairy legs, body easily carry eggs of roundworms and other pathogens. It spreads the following pathogens

Pathogen	**Disease caused by pathogen**
1.*Salmonella typhi*	Typhoid
2.*Entamoeba histolytica*	Amoebic dysentery

3.Mycobacterium tuberculosis	Tuberculosis
4.Vibrio cholera	cholera
5. *Ascaris lumbricoides*	Ascariasis

** Housefly lays eggs on open wounds. Maggots of these eggs invade the subcutaneous tissues and cause a cavity like condition known as MYIASIS in cattle.

B) MOSQUITO:

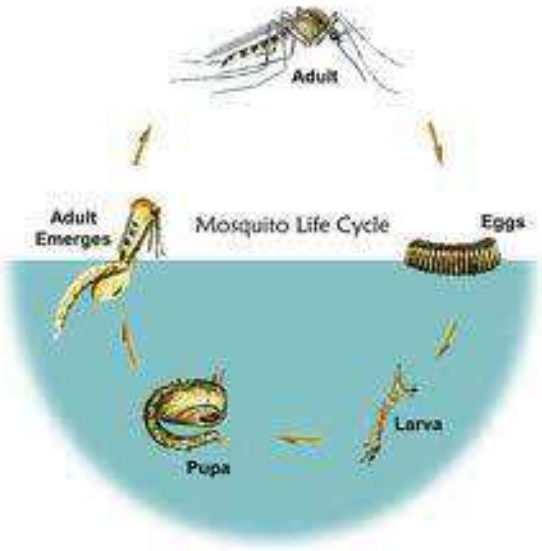
- Three general of mosquitoes are important vectors in India belong to the family Culicidae. They are *Anopheles, Aedes* and *Culex.*
- Body has head, thorax and abdomen.
- Two pairs of wings are a)Mesothoracic wings -- for flying
  b)Metathoracic wings -- small, rod like balancers or halters
- Female produces sound with vibration of thin membrane on skin.
- Female mosquitoes have piercing and sucking type of mouth parts. They are sanguivorous and live as intermittent ectoparasites of human beings.
- Males feed on plant juices. Females can feed on plant juices as their primary energy source, but they require a blood meal for egg production.

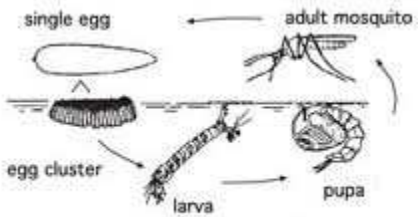
LIFE HISTORY:

- Mosquitoes are holometabolous.
- Eggs hatch out into larvae known as wrigglers. Larvae feed on organic matter in water



wriggler



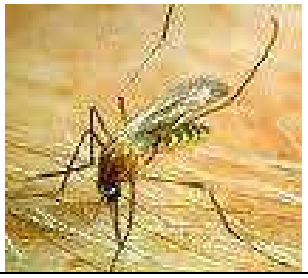


Mosquito life cycle.

- . They metamorphose into pupae by 4 moults.

- Pupae are known as tumblers.
- Larvae have respiratory siphons while tumblers have respiratory trumpets.

COMPARISION OF ANOPHELES & CULEX

Character	Anopheles 	Culex 
1.position of body	Abdomen is held at an Angle to surface	Parallel to surface
2.eggs	40-200 eggs in clean Water, singly,. Egg has Lateral air floats	200-400 eggs in dirty water, in clusters
3. Wrigglers	Parallel to water surface	Angle to surface
4. respiration in larva	8th abdominal segment has chitinous plate with spiracles	8th abdominal segment has siphons end with Spiracles for breathing

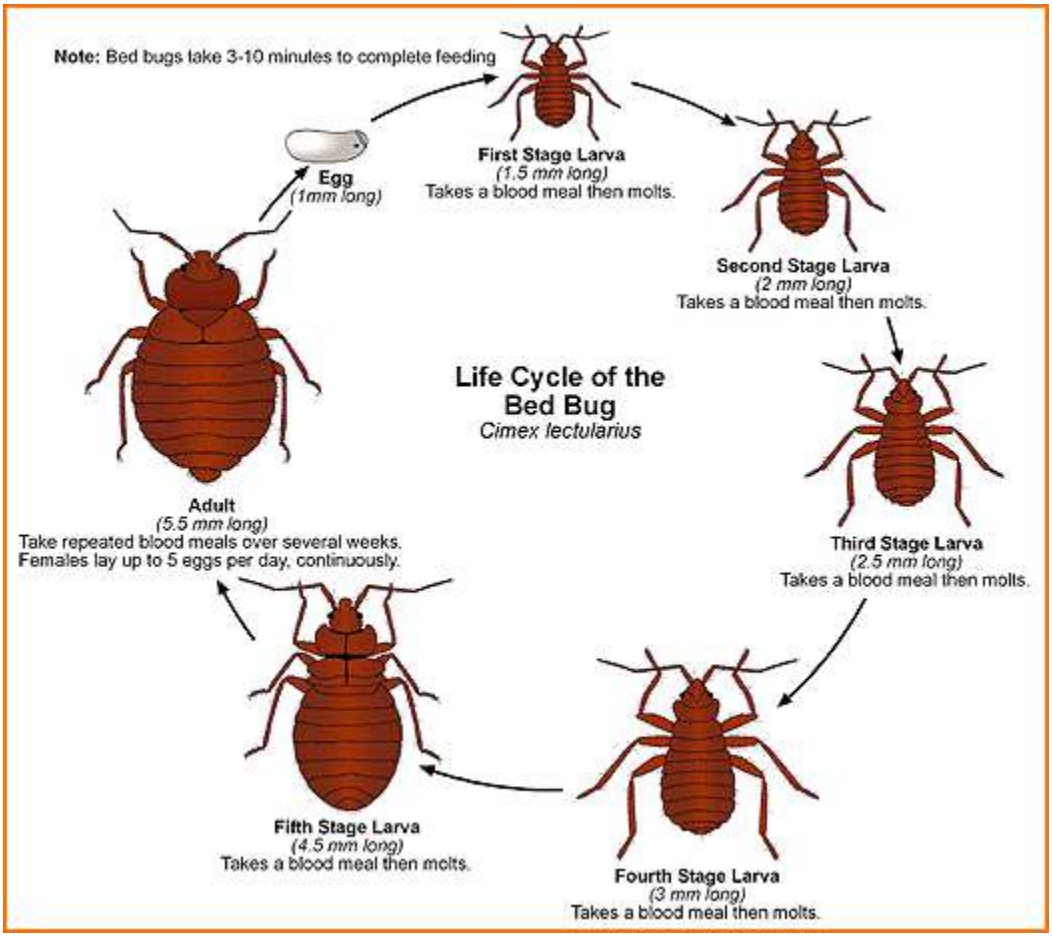
HARMFUL NATURE :

MOSQUITO	SPREADS
Anopheles	Malaria
Culex	Filariasis, encephalitis, bird malaria
Aedes aegypti	Yellow fever, dengue fever (break Bone fever)
Psorophora	Eggs of botfly which causes Dermatobiasis in cattle.



C) BEDBUG:

- Bedbug is a sanguivorous insect.
- Indian bedbug is *Cimex hemipterus (Cimex rotundus*);
- World wide distributing bedbug is *Cimex lectularius*.
- It lives as an intermittent parasite. It has piercing and sucking type mouthparts. It nocturnal.
- Body is dorsoventrally flattened.
- Reduced forewings are Hemelytra. Hind wings are absent.
- Stink glands are present at the bases of legs on ventral side of metathorax.
- It shows cannibalism.
- Bedbug is hemimetabolous insect.
- Female lays 200 eggs. Eggs hatch into nymphs which moult 4 times to become adults



Bedbugs are vectors for pathogens which cause diseases in the following manner

DISEASE	CAUSED BY
Relapsing fever	Borrelia spp
Typhus fever	Rickettisia prowazekii
Trench fever	Rickettisia quintana
Bubonic plague	Yersinia pestis
Leprosy	Mycobacterium leprae

D) HEAD LOUSE:

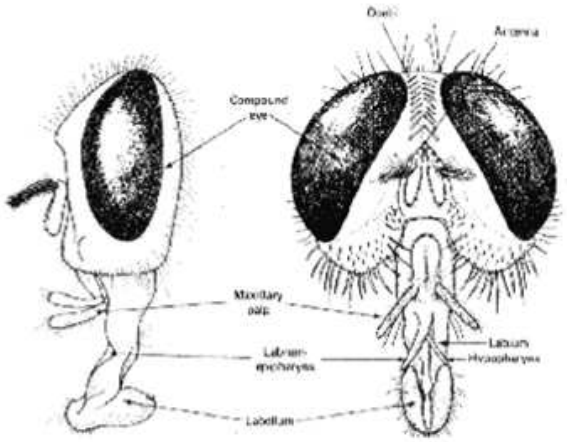
- Common head louse --- *Pediculus humanus capitis*
- Body louse --- *Pediculus humanus humanus.*
- Pubic louse --- *Pithirus pubis.*



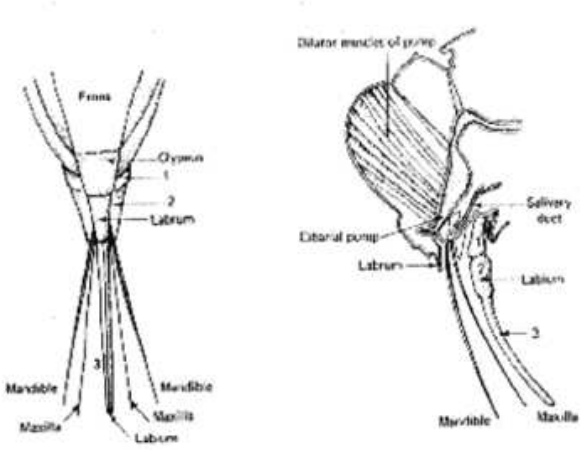
- The body is dorsoventrally flattened.
- Mouth parts are of piercing and sucking type.
- Tips of legs have curved claws with which it clongs to scalp of head and hair.
- Front legs are very large to grab on to the shaft of hair.
- Female lays 3-7 eggs per day for 30 days.
- Whitish eggs are Nits.
- Eggs hatch into nymphs in 7 days.
- Nymphs become adults after 3 moults.

HARMFUL NATURE:

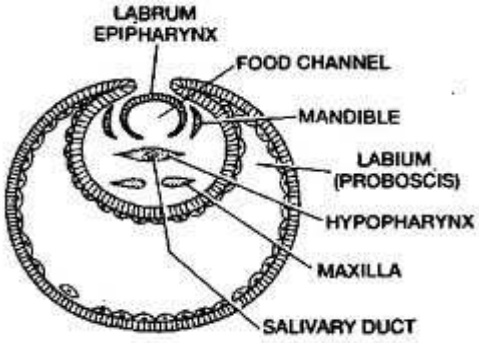
Head lice transmit pathogens which cause diseases like relapsing fever and typhus fever.

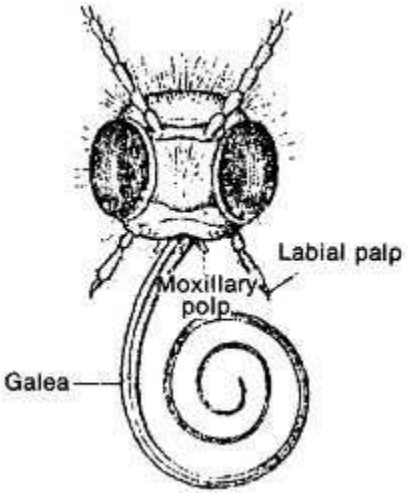


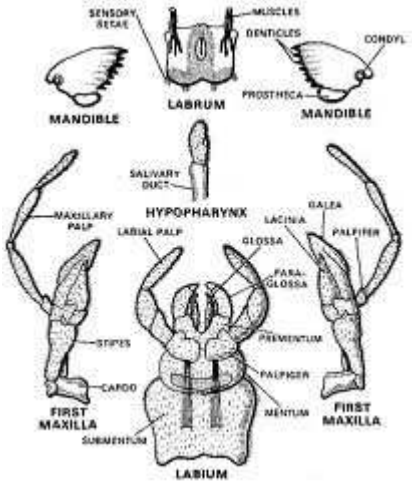
House fly head and mouthparts.

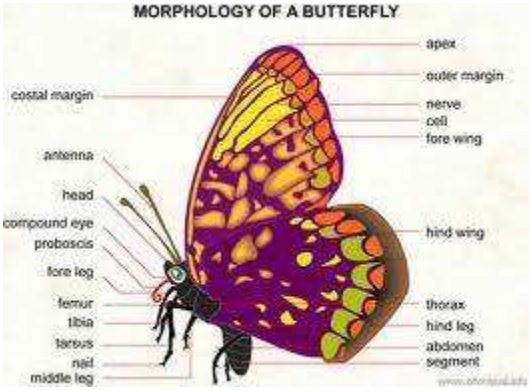


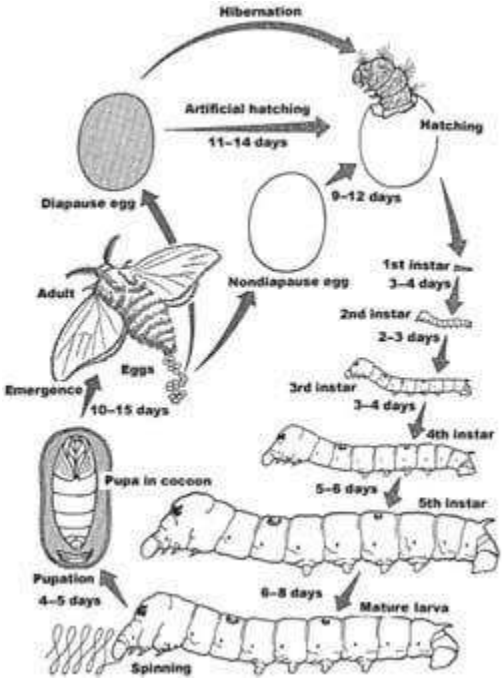
Cicada head and mouthparts.


LABRUM
EPIPHARYNX
FOOD CHANNEL
MANDIBLE
LABIUM
(PROBOSCIS)
HYPOPHARYNX
MAXILLA
SALIVARY DUCT


Labial palp
Maxillary
palp
Galea


SENSORY SETAE
MUSCLES
DENTICLES
CONDYL
MANDIBLE
LABRUM
PROSTHECA
MANDIBLE
SALIVARY DUCT
HYPOPHARYNX
MAXILLARY PALP
LABIAL PALP
GALEA
LACINIA
PALPIFER
GLOSSA
PARA-GLOSSA
PREMENTUM
STIPES
CARDO
PALPIGER
MENTUM
FIRST MAXILLA
FIRST MAXILLA
SUBMENTUM
LABIUM


MORPHOLOGY OF A BUTTERFLY
apex
outer margin
costal margin
nerve
cell
fore wing
antenna
head
compound eye
proboscis
hind wing
fore leg
femur
tibia
tarsus
nail
middle leg
thorax
hind leg
abdomen
segment



Life Cycle of Butterfly