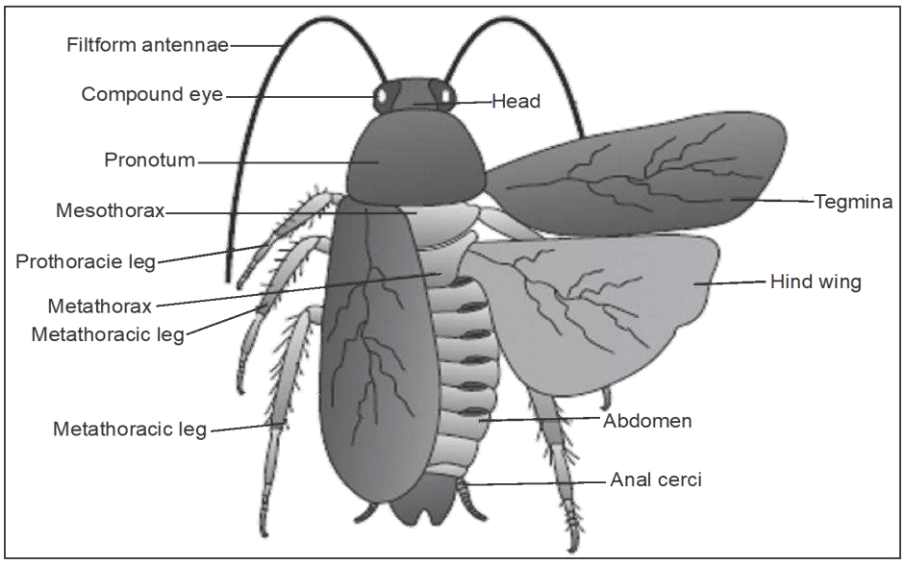
Cockroach

Taxonomic Status

- **Kingdom - Animalia**
- **Phylum - Arthropoda** (Jointed appendages and chitinous exoskeleton)
- **Class- Insecta** (3 pairs of jointed legs)
- **Order- Dictyoptera/Orthropetra** (Disimilar wings)
- **Genus - Periplanata**
- **Species - americana**



Introduction

- It is also known as **"American** or **common cockroach or ship cockroach".**
- Size ranges from 1/4 inches to 3 inches (0.6 - 7.6 cm) long with wings that extends beyond the abdomen of males.
- It is **omnivorous, nocturnal** and **cursorial** (fast runner) animal.
- Number of chromosomes = 34
- It also exhibit **cannabalism,** feeds on their fellows ocassionally.

Morphology

- **Body is divisible into 3 parts**

  Body = Head + Thorax + Abdomen

  = 6 + 3 + 11 = 20 segments in embryo.

  = 1 + 3 + 10 = 14 segments in adults.
- The entire body is covered by a hard **chitinous exoskeleton** (Brown in colour).
- Exoskeleton of each segment consists of Chitin plate called **"sclerites"**.
- Sclerites joined each other by a thin flexible membrane called **"articular or arthroidal membrane"**.

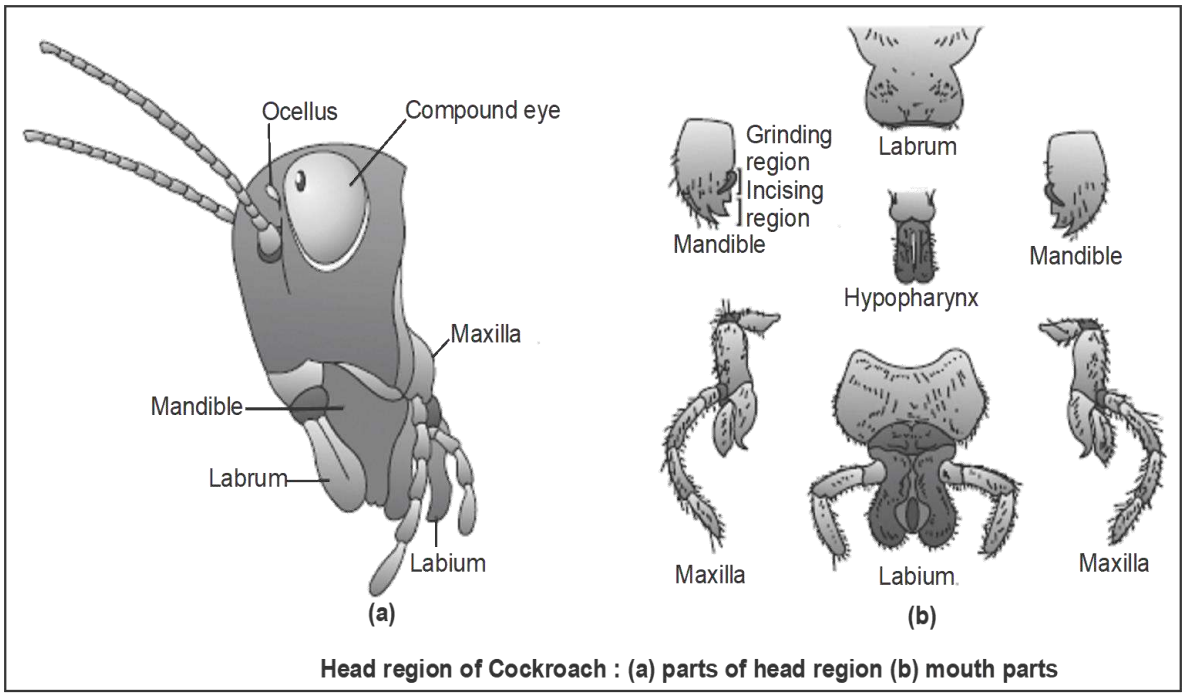
  Sclerites of dorsal side – **Tergum or tergite.**

  Sclerites of Ventral side – **Sternum or sternite.**

  Sclerites of lateral side – **Pleurons or pleurites**.

Head

- It is triangular and **"Hypognathus"**, bent downwards at an angle of 90º from the long axis of body.
- It is formed by the fusion of six segment and shows great mobility in all direction due to flexible neck.
- Endoskeleton of Head is called Tentarium.
- On the lateral side of head apex 1 pair of compound eye
- Each compound eye made up of 2000 units called **"ommatidia"**
- A small light coloured spot called **fenestra or ocellar** spot is located upon dorsal surface close to each eye. In insect it function as a photoreceptor organ but in **Cockroach,** it is inactive and called **"Vestigial simple eye".**
- **Antennae :-** Lateral side of head apex, 1 pair of **antennae** are present, acts as, main receptor of touch, temperature and vibration in cockroach.
- All these sensory receptors present on antenna help in monitoring the environment. Each antenna extending forwards from an antennal socket located dorsally upon head capsule near the compound eye of its side. These are long, filamentous, unbranched and free moving.
- A mouth situated in the anterior side of head which in surrounded by many chitinous structure called "mouth parts".



Head region of Cockroach : (a) parts of head region (b) mouth parts

Mouth Parts of Cockroach

- **"Bitting and chewing type"**
- A cavity formed due to mouth parts called "Preoral cavity".

(1) Labrum or upper lip :

- Broad, flattend and movable sclerite of the dorsal side of head capsule. it dorsally overhangs the mouth and hence referred to as "upper lip".

(2) Mandibles or Jaw :

- 1-pair or triangular structure with Chitinous teeth on inner surface.
- They form the lateral wall of preoral cavity and moves horizontally (Grinding)

(3) First maxillae :

- One-pair and form lateral wall of preoral cavity.
- With the help of maxillary palp cockroach pickup its food and put it in preoral cavity for chewing.
- Maxillary palps also used as brush to clean antenna and wing.

(4) "Labium"or lower lip (Fused 2nd maxillae) :

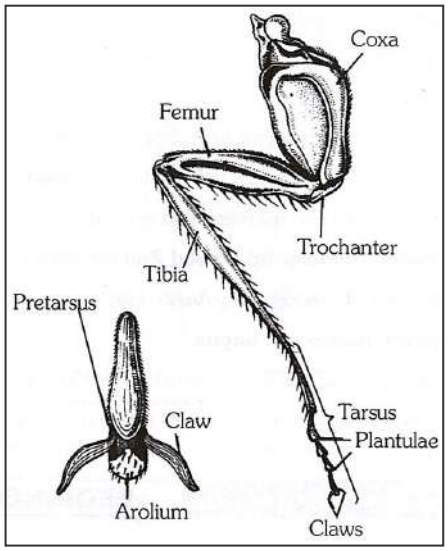
- Form floor of preoral cavity (Ventral side) and provides a platform for food materials.

(5) Hypopharynx : or "lingua"

- Small, non-chitinous, **median flexible lobe** that lies on the floor of preoral cavity.
- It bears several sensory setae at its free end, and the common salivary duct opens at the base of hypopharynx, therefore it is also considered as **tongue** of cockroach.

Thorax

- Head is connected with torax by a short extension of prothorax known as **neck.**
- It has 3 segments : **Prothorax, Mesothorax** and **Metathorax.**
- Legs :- One- pair of legs are present on each segement of thorax. **(Total 3 pairs)**
- **Each leg has 5 segment :**
  (1) Segment - ***"Coxa"*** :- broadest segment
  (2) Segment - **trochanter** :- small segment
  (3) Segment - **femur**
  (4) **Tibia** - longest segment
  (5) **Tarsus** - tarsus made up of five segments called tarsomeres and the last one is called***"pretarsus"***



- Each pretarsus bears one pair of claws and large adhessive pads **Arolium or Pulvilus.**
- Cockroach move on the smooth surface by the help of "arolium" and on rough surface with the help of claws.
- Small adhessive pads present at the junction of tarsomeres are called **"Plantuli".**
- **Cockroach climb on the wall by the help of plantuli and Arolium.**
- Tactile setae are present on each segemet of legs.

"Wings" 2 - pair

(1) fore wings
↓
on mesothorax
↓
long, narrow, opaque, dark and leathery
↓
fore wings are so long so cover
full abdomen and hind wings when at rest.
These are called **Elytra or Tegmina.**

(2) Hind wing
↓
on Metathorax
↓
small, broad, transparent, membranous and fan like
↓
these wings help in flight

"Abdomen"

(1) Consists of 10 segments

- Exoskeleton of each body segment consists of 4 chitinous plates or sclerites one tergum, one sternum and two pleurons.
- 7th tergum covers 8th and 9th terga in both ♂ and ♀.
- Sting gland/Scent gland present in between 5th and 6th abdominal tergum. It produce smell which repel the enemies.
- 10th tergum - bowl shaped and bifurcated. In 10th tergam 1 pair - ***"anal cerci"*** present.
- Each ***"anal cerci"*** - "15 segmented" :- These are main sound receptor.
- **Sternum :** In male - 9 sternum visible
  In female - 7 sternum visible
- 7th sternum is largest and Boat shaped in female. 7th, 8th & 9th sterna together forms female genital pouch.
- Projected one-pair short, thread like structure from 9th sternum of male called **"anal styles".** These are nonsegmented and help in copulation.
- In female Free end of 7th sternum is divided into two plates called **gynovolvular plates** that surounds oothecal pore.

Body Wall

Made up of three layers :

1. **Outermost : thick cuticle**. A waxy layer occurs on cuticle.
   Cuticle is made up of alternate layer of protein and chitin.
2. **Hypodermis :** Made up of columnar epithelium
3. **Basement Layer : Simple squamous epithelium**

Body cavity or Haemocoel

All arthropods are **"True coelomate"** but coelom is highly reduced and found only in the form of cavity of **"gonads"** known as **gonocoel.**

- Body cavities are found as blood-filled sinuses called **Haemocoel.**

Concept Builder

1. Which is not true about hypopharynx of Cockroach ?
(1) Acting as tongue of Cockroach (2) Lateral flexible lobe
(3) Unpaired structure (4) Salivary duct opens at base of hypopharynx

2. Identify incorrect statement in the respect of morphology of Cockroach :-
(1) Wings that extend beyond the tip of the abdomen in males cockroach
(2) Have long antenna, legs flat etension of the upper body wall that contceals head
(3) In male cockroach abdominal segements are more than female cockroach
(4) The hind wings are transparent, menbranes and are used in flight.

3. Cockroach head is connected with thorax by a short extension of :-
(1) Mesothorax (2) Prothorax (3) Metathorax (4) None of the above

4. Transparent and membranous wings are :-
(1) Mesothoracic wings (2) Prothoracic wings
(3) Tagmina (4) Methoracic wings

5. Which is not true about anal cerci ?
(1) Paired structure (2) Filamentous structure
(3) Sound receptor (4) helps in copulation

Concept Builder (Answer-Key)					
Que.	**1**	**2**	**3**	**4**	**5**
Ans.	2	3	2	4	4

Digestive System

- **Digestive System is divided in two parts :**

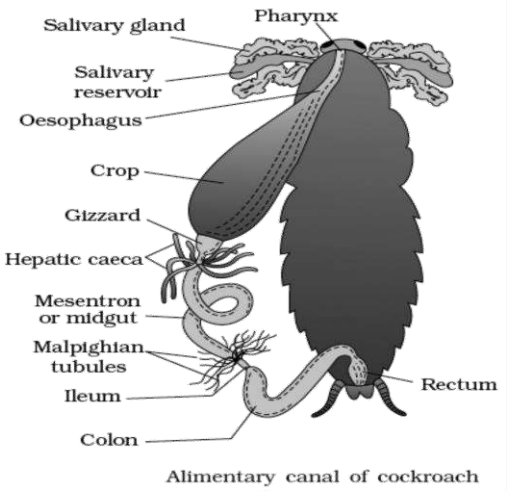
  (1) Alimentary canal **(2) Digestive glands**

(1) Alimentary canal :

- **It has 3-parts :**

  (i) Fore gut or stomodaeum : Ectodermal", Formed by the invagination of body wall.

  - Mouth to - gizzard is foregut
  - The mouth opens into a short tubular pharynx, leading to a narrow tubular passage called oesophagus.
  - This in turn opens into a sac like structure called crop used for storing of food.
  - The crop is followed by gizzard or proventriculus.
  - It has an outer layer of thick circular muscles and thick inner culicle forming six highly chitinous plate called teeth.



Alimentary canal of cockroach

  - Gizzard helps in grinding the food particles.
  - Cuticular hairs present in the posterior part of gizzard these form "sieve".
  - Gizzard - grinding in upper part - filteration in lower part.
  - The entire foregut is lined by cuticle.

  (ii) "Mesenteron" or "Mid gut" (endodermal) :

  - Gizzard open in mesenteron by "stomodial valve".
  - 6-8 small and tubular, finger like blind tubules called hepatic caeca (gastric caecae) project freely into the heamocoel from the anterior part of mesenteron.
  - Hepatic or gastric caecae is present at the junction of foregut and midgut.
  - They secrete "digestive juice"
  - Wall of mesenteron is muscular.

  (iii) "Hind gut or Proctodaeum" (ectodermal) :

  - At the junction of midgut and hindgut is present another ring of 100-150 yellow coloured thin filamentous Malphigian tubules.
  - They help in removal of excretory products from haemolymph.
  - Hind gut is differentiated into 3 parts .

    (i) Ileum : Its wall in thin and internally folded. Its cuticle bears minute spines, which serve to break the peritrophic membrane.

    (ii) Colon : Longest and broader part

    (iii) Rectum : last part, oval shaped and internally folded wall.
    Its wall - 6 folds - called rectal papilllae. These absorb water

    - **Anus :** at the end of 10th abdominal segement.

DIgestive Glands

(A) Salivary gland :

- One pair and attached with oesophagus.
- Common efferent salivary duct arises from both salivary gland.
- This duct open in preoral cavity at base of hypopharynx.
- Saliva contains "Carbohydrate - digestive enzymes". eg. : **Amylase, Cellulase, Chitinase etc.**

(B) Hepatic Caecae ⇒ Secretes Digestive Juice

Food - "Omnivorous"

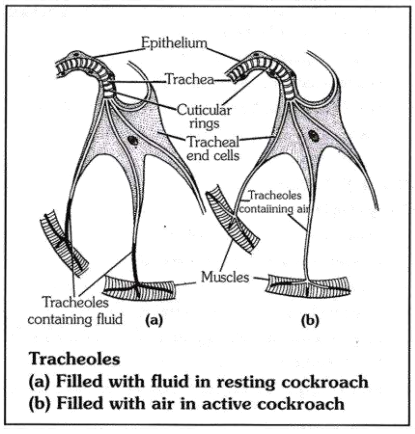
(a) Bread, food grain, vegetable, wood clothes, insects (dead), nymph, moulted exoskeleton.
(b) identification of food by the help of **antenna.**

Digestion

- Start from preoral cavity
- Saliva : Enzymes of saliva act upon the food till reaches the crop. Digestion of carbodydrate takes place.
- In crop : Hepatic caeca- complete digestive juice release in crop. Most of digestion occur in the crop.
- Gizzard : Food throughly grinded into a paste by the thick and sharp edged cuticle of internal folds and grooves.
- Grinded food enter in to the midgut through stomodial valve.
- **Wall of mesenteron secrete a membrane around the food called peritrophic membrane. It serves to protect the wall of midgut from friction with hard food particles.**
- This membrane is permeable to digestive enzyme and digestive food. Bacteria and symbiotic protozoans are present in midgut which are helpful in digestion of cellulose.
- Digestion completes in the anterior part of midgut.
- Absorption of digested food mainly occurs in the posterior part of mid gut.
- Distribution of digested food : by "heamocoelomic fluid"
- Peritrophic membrane and undigested food enter into the Ileum.
- Spines of ileum break the peritrophic membrane, so undigested substance release in ileum.
- maximum absorption of H_2O occured in rectum by rectal papilla.

Respiration

- Respiratory organ - ***"respiratory tubules"*** **or Tracheal system.**
- The respiratory system consists of a network of trachea, that open through 10 pairs of small holes called spiracles present on the lateral side of the body.
- 10- pair spiracles, 2-pair on thorax and 8 pairs on abdomen.
- **The spiracles are located on "Pleurone" (Lateral side of body) each spiracles** is guarded by a valve and bears cilia like **bristles** for filtering the incoming air.
- Valve absent in 1-pair spiracles of thorax and abdomen both. So they remain always open.
- each spiracles open into chamber called ***"atrium"*** or tracheal chamber.
- The tracheal chambers are connected with several ***main tracheal trunks*** which repeatedely branch in to a diffuse network of small ***trachea.***



Tracheoles
(a) Filled with fluid in resting cockroach
(b) Filled with air in active cockroach

- last branches of trachea called ***"Tracheal Capillaries" or "tracheoles"***
- Tracheal capillaries developes as cytoplasmic processes of tracheal end cells.
- These process deeply merge in tissues of body
- Each cell of body is directly in contact with processes, blood does not related with respiration in blood respiratory pigment absent.
- Exchange of gases take place between the tracheoles and tissues by simple diffusion

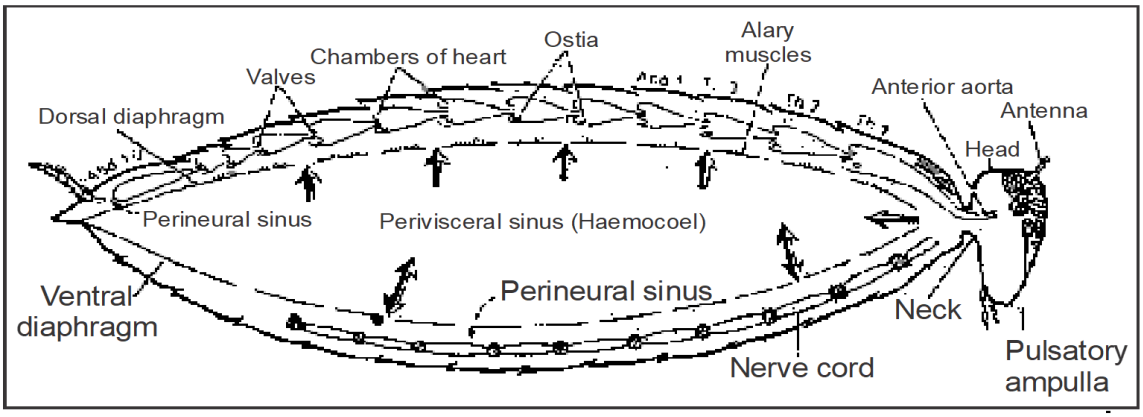
Breathing

- ***Several tergo - sternal*** muscles extend between the tergites and sternites of all abdominal segments.
- When the abdomen expands, atmospheric air gets filled in the tracheal system through spiracles. This is ***inspiration.***
- When the abdomen contracts, the air is forced out. This is ***expiration.*** Expiration takes place through first pairs of spiracles of thorax and first pairs spiracles of abdomen.
- The spiracular valves control and regulate the in and out passages of the air and abdomen.

Blood Vascular System

- "Open types" or ***"lacunar types"*** in which blood remain filled in tissue spaces or **blood sinuses.**
- Blood vessel are poorly developed and open into tissue space or haemocoel.
- Visceral organs located in the haemocoel are bathed in blood.
- **Blood of cockroach - "haemolymph"** { Colourless - plasma; Blood corpuscles (haematocytes)
- "Haematocytes" :
  (i) Phagocytosis of bacteria (ii) Related with blood clotting.
- Blood is not related with respiration, because respiratory pigment absent but it helps in transportation of food, hormones and excretory materials.
- Two horizontal septa are present in body cavity.

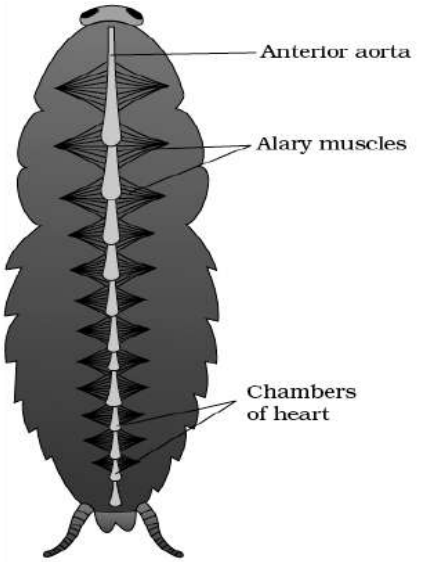
Dorsal diaphragm, Ventral diaphragm } Both have minute pores called ***"fenestrae"/sphincters***



- Diaphragms divide the haemocoel into three sinuses i.e.
  (1) Dorsal sinus :- Peri Cardial Sinus has heart.
  (2) Middle sinus :- Peri Visceral sinus has alimentary canal and fat body.
  (3) Ventral sinus :- Perineural sinus has nerve cord.

Heart of Cockroach

- It consists of elongated muscular tube along the mid-dorsal line of thorax and abdomen.
- Dorsal, tubular and 13 chambered.
- It is differentiated into funnel shaped chambers with ostia on either side. These pores act as valve.
- Blood enters from pericardial sinus to heart through ostia when heart chamber relaxes (Diastole)
- Each Posterior chamber of heart connected/related with anterior chamber by a valve like pore.
- Each heart chamber pumps blood into anterior chamber when it contracts (systole), and thus blood reaches into head sinus.
- special type of cells attached with heart wall are called ***"nephrocytes".*** They probably helps in regulation of HBR (49 beats/minute) and excretion.



Open circulatory system of cockroach

- First chamber of heart opens into head sinus through a long tubule called ***"anterior aorta".***
- 12-pair fan like muscles present in Pericardial sinus called ***alary muscles***. One end which, is pointed is attached to tergum and other end is connected to dorsal diaphragm. These also fused with heart wall these help in ***"blood circulation".***
- Tergosternal muscle also help in blood circulation.
- ***"Pulsatile ampulla"*** present at base of each antennae and base of each wing. ***pulsatile ampulla*** helps in blood circulation in antennae and wings.

Excretory System

- main excretory organ - Malpighian tubules
- These are yellow coloured, thin, filamentous, blind tubules located at the junction of **midgut** and **hind gut.**
- Number of malpighian tubules *100-150.*
- They are lined by glandular and ciliated epithelium.
- They help in removal of excretory substance from heamolymph.
- Excretory substance mainly in the form of ***"potassium Urate"***
- Potassium urate converted into ***"Uric Acid"*** and potassium bicarbonate and uric acid is finally relased into alimentary canal by malpighian tubules.
- Water absorbed by hind gut and excretory materials along with undigested food is released outside.
- They are enteronephric and also help in osmoregulation (Water conservation)
  - (i) **fat bodies (Urate cells)**
  - (ii) **Nephrocytes** Also helps in excretion (Storage excretion)
  - (iii) **Body wall**
  - (iv) **Uricose glands :** These help in excretion in male cockroach only.
- Body wall absorbs excretory materials from Haemocoel and store in cuticle. Then at the time of moulting excretory substances and cuticle separate out from body.

Concept Builder

1. Which is not true about Gizzard of Cockroach ?
(1) Small chamber situated at below of crop
(2) Helps in grinding the food particles
(3) Inner cuticle forms three pairs chitinous teeth
(4) Hepatic caeca is present at lateral side of gizzard

2. Hindgut of cockroach differentiates into respecitvely :-
(1) Jejunum, ileum, colon (2) Duodenum, jejunum, ileum
(3) Caecum, colon, Rectum (4) Ileum, Colon, Rectum

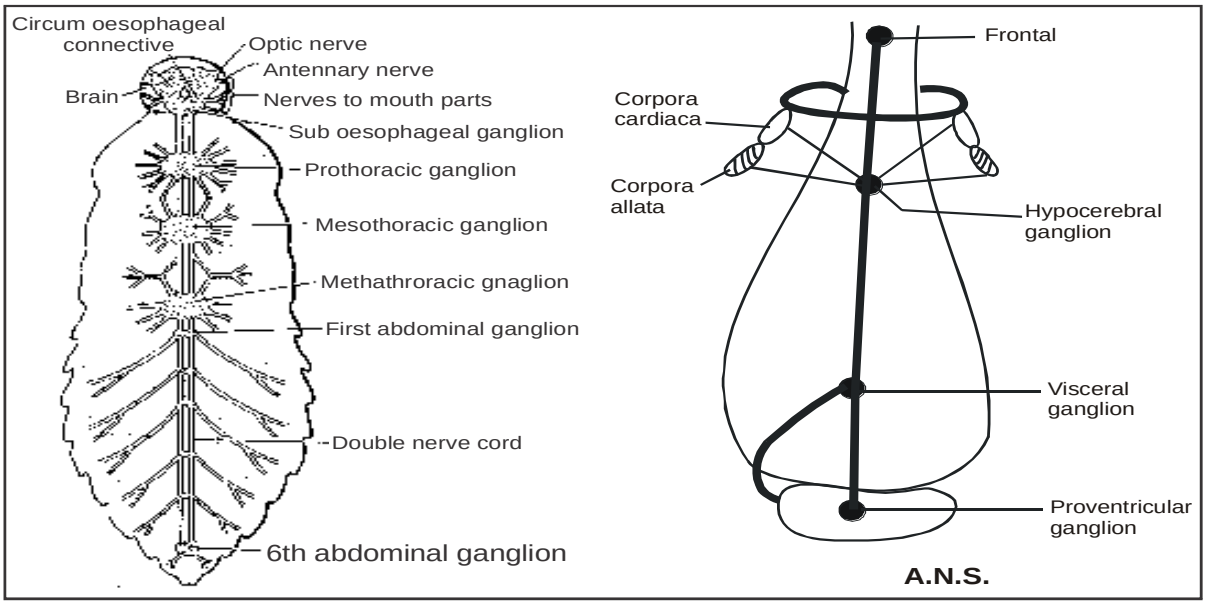
3. Blood vascular system of cockroach is situated ?
(1) Mid ventrial line of thorax and abdomen
(2) Mid dorsal line of thorax and abdomen
(3) Mid dorsal line of thorax only
(4) Mid ventral line of thorax only

4. Choose the correct pathway of blood circulation in cockroach :-
(1) Heart ⟶ ostia ⟶ Sinus (2) ostia ⟶ Sinus ⟶ Heart
(3) Sinus ⟶Heart ⟶ ostia (4) Sinus ⟶ ostia ⟶ Heart

5. Which structure is lined by Glandular cells and ciliated cells :-
(1) Hepatic caeca (2) Malpighian tubule
(3) Gastric caeca (4) Both (1) and (3)

Concept Builder (Answer-Key)					
Que.	**1**	**2**	**3**	**4**	**5**
Ans.	4	4	2	4	2

Nervous System



(1) Central Nervous system :

It consists of brain (Nerve ring) and ventral nerve cord with segmentally arranged ganglia.

(a) Brain : It is represented by Supra-oesophageal gandlia in head region and their nerve supplies to antenna and compound eyes.

- Sub-oesophageal ganglion on ventral side of oesophagous remain connected with **Supraoesophageal** ganglia by **circumoesophageal connectives.**

(b) Nerve Cord : Paired, longitudinal, solid nerve cord is located on ventral side of body.

- Nerve cord has nine segmental ganglia. i.e. Three large ganglia in thorax and six in abdomen. Last ganglion is located in 7^{th} abdominal segement.
- All ganglia formed in embryo stage by the fusion of 1 pair of ganglia. last segmental ganglion formed by fusion of many ganglia.

(2) Peripheral Nervous System :

- Several nerves arises from CNS (Nerve ring & Nerve cord) and innervate different part of body.
- All these nerves are mixed nerves [motor nerve fibers. / sensory nerve fibers.

(3) Autonomous System (ANS) :

- It consists of 5 ganglia located on different parts of foregut and are inter-connected by nerves. It regulates peristalsis movement in foregut (involuntary activity)

Endocrine Glands

(1) Corpora Cardiaca : It stimulates prothoracic glands for secretion of ecdysone hormone which is responsible for metamorphosis/moulting.

(2) Corpora allata : It secretes Juvenile hormone which prevent early moulting.

Extra Points

- The nervous system of cockroach is spread throughout the body. The head holds a bit of nervous system while the rest is situated along the ventral (belly side) part of the body. So now you understand that if the head of cockroach is cut off, it will still live for as long as one week.
- In cockroach, the sense organs are **antennae, eye, maxillary palps, labial palps anal, cerci** etc.

Compound Eyes

- Each compound eye made up of 2000 units called ommatidia.

Mechanism :

- Two types of vision are found in insects.

(1) Apposition or mosaic vision :

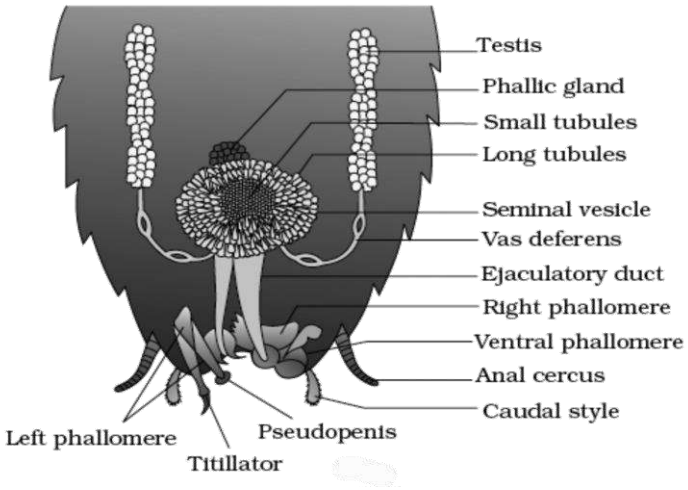
- Apposition vision form in bright light
- Omatidia fully covered by pigmented membrane. The light rays reflected from an object enter in to a number of ommatidia.
- Several images (Pieces) of an object are received and assembled by brain, thus whole object becomes visible.

(2) Superposition image :

- In dim light in nocturnal insects.
- In the night, the pigment sheath of ommatidia contracts and shrinks to their bases, hence the light rays can easily cross over from one ommatidium to adjacent ommatidia.
- complete images are formed in all ommatidia. This results in the formation of blurred superpostion of the objects.
- In cockroach only mosaic or apposition images are formed throughout the day and night beacuse there is no power of contraction in pigmented sheath.
- Cockroach is a nocturnal insect, but in it mosaic vision forms during night and therefore it has more sensitivity but less resolution.

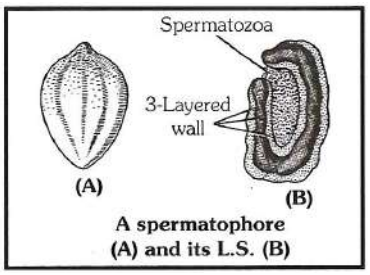
Reproductive System

(i) Male Reproductive System :-



- **Cockroach -** is dioecious ***(Unisexual)*** and have well developed reproductive organs.
- Consists of 1-pair of testis located on lateral side in "4-6" abdominal segments.
  Each testis formed of ***"3 or 4 lobes"*** and each lobe divided into many lobules that produces sperms.
- **Vasa deferentia** - A vasa deferens arises from each testis, these open in an ejaculatory duct through seminal vesicle.
- **Ejaculatory duct** opens outside by male genital pore situated ventral to anus
- **Seminal vesicles** are numerous sac like structures located at the junction of vas-deferens and ejaculatory duct.
- A gland associated with seminal vesicles called ***mushroom gland or utricular gland*** *Present in the 6th – 7th abdominal segments and having* two types of **tubules,**
  (i) small tubules at inner side - **utriculi brevivores.**
  (ii) Long tubules at outside - **utriculi majores**

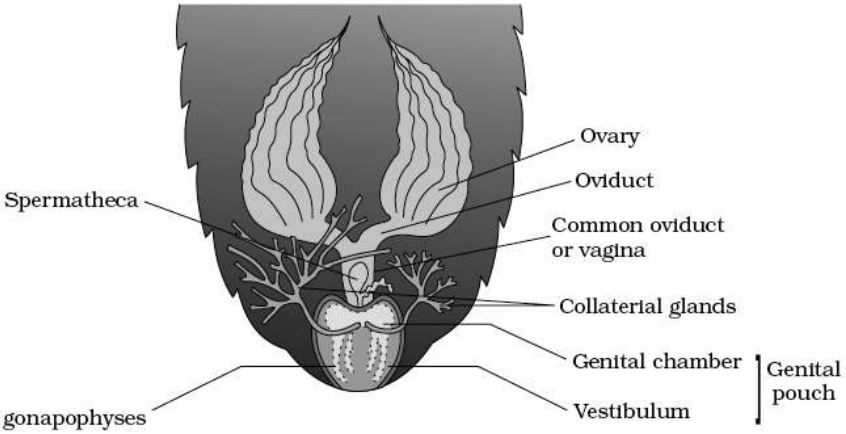
- Tips of these long tubules are called ***"Uricose gland"*** These absorb excretory material from haemocoel.
- A gland located on mushroom gland called **phallic gland or congloblate gland**. It opens out side by a seperate duct.
- Three asymmetrical shaped Chitinous structures associated with male gential pore are called ***"phellomeres"*** or ***male gonapophysis***." (External genitalia)



A spermatophore (A) and its L.S. (B)

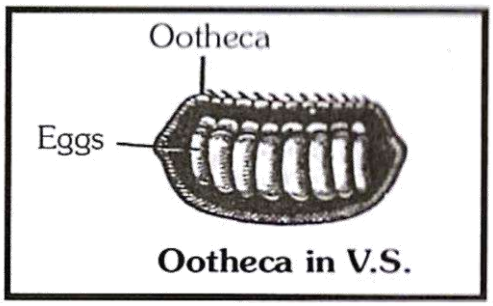
- **Phellomeres** — (i) Left Phellomere; (ii) Right Phellomere; (iii) Ventral Phellomere
- Phallic aperature present on left phellomeres
- Male genital pore situated on Ventral phellomeres.
- Sperm produced in testes are stored in **Seminal vesicle.**
- All sperms released from seminal vesicles glued together in the form of bundles called **spermatophore**.
- Long tubules of mushroom gland secrete a **inner membrane** around spermatophore.
- Small tubules : Secrete a nutritive fluid in spermatophore.
- At the time of copulation spermatophore enters into ejaculatory duct.
- Ejaculaotry duct secrete **middle membrane** on spermatophore and hence it becomes double layered.
- When they go out side from male genital pore then phallic gland secretes **outer membrane**, so spermatophore becomes **three layered.**

(ii) Female Reproductive System :-



- 1-pair of large ovary are situated on lateral side in ***"2nd to 6th segment of abdomen".***
- each ovary is made up of 8-long tubules called ***"Ovarioles",*** Containing a chain of developing ova.
- Only one egg from in each ovariole. It means 16 ova are matured at a time in cockroach.
- Both the oviduct of ovaries fused to form "vagina", Which opens into the gential chamber.
- Genital chamber formed by fusion of 3 abdominal sternum.
- The 7 sternum is boat shaped and together with the 8th and 9th sterna form brood or genital pouch whose anteriar part is gential chamber and posterior oothecal chamber.

- A pair of unequal sized Spermataeca is present in the 6th segments which opens into gential chamber.
- Gential chamber contains female gonopore, spermathecal pore and collaterial glands.
- 1-pair of collaterial glands associated with gential chamber. These are branched tubular gland, left collaterial gland is more branched.



Ootheca in V.S.

- Both glands open in genital chamber by a common pore
- Three pairs of chitinous processes hanging from the roof of genital chamber into its cavity are the external ganitalia of female cockroach . These are called ovipositor or female gonapophyses beacuse these serve to arrange the ova in a newly formed ootheca, and possibly help in giving proper shape to the oothecae.

Copulation

- **"Breeding season** : from march to september
- The females secrete a highly odourous and volatile "sex attracting scent from their scent glands called **pheromones or ectohormones.**
- Male perceive the smell of this scent with the help of olfactory sensillae located upon their antennae.
- Male cockroach opens the ootheca pore with the help of hooks.
- The male insert whole of its phallomeres into the females's gential pouch. then it inserts its pseudopenis into the female gonopore for firm anchorage.
- Sperms are transffered through spermatophores.
- Copulation time ⇒ one hour
- The spermatophore remains inside the body of the female for about 20 hours. during this period all its sperms escape out and fill in the two spermathecae of the female, then the female drops out the case of empty spermatophore.
- Sixteen ova, one from each ovariole of the two ovaries, are dischagred at a time into the genital pouch where these are arranged by the gonapophyses into two parallel row.
- Simultaneously, sperms stored in the spermathecae are also discharged into the genital pouch to fertilize the ova.

Fertilization

- **Fertilization** is internal and their fertilised are encased in capsules called **oothecae.**
- After fertilization the left collaterial gland secretes a soluble ***"milky protein"*** while the right one secrete dihydroxyphenol.
- Sclero protein forms a common egg. case, called ***ootheca.***
- Otheca is a dark reddish to blackish brown capsule, about 3/8" (8mm) long.
- They are dropped or glued to a suitable surface, usally in crack or crevice of high relative humidity near a food source.

Development

- Egg of Cockroach is megalecithal and Centrolecithal.
- On an average, female producces **9-10 ootheca,** each containing **14-16 eggs.**
- Development of egg takes place inside ootheca
- Development is Paurometabolous, meaning there is development through nymphal stage.
- Development time - ***"4 to 8" weeks***
- *The* ***Nymph*** look very much like adult, The nymph grows by moulting about 13 times to reach the adult form.
- The next to last nymphal stage has wing pads but only adult cockroah have wings.
- Nymph changes into an adult in - 1 year
- time interval between two moulting called ***"stadium".***
- In between moulting nymph called ***"instar".***

Concept Builder

1. Which is incorrect matched pair according to structures and their location ?

(1) Testes $\longrightarrow$ 4^{th} – 6^{th} abdominal segments

(2) Mushroom gland $\longrightarrow$ 6^{th} – 7^{th} abdominal segments

(3) Ovary $\longrightarrow$ 4^{th} – 6^{th} abdominal segments

(4) Spermatheca $\longrightarrow$ 6^{th} abdominal segment

2. All structures are open in male genital pouch except :-

(1) Ejacutatory duct (2) Spermatheca (3) Phallic duct (4) None of these

3. Which is unpaired structure from followings ?

(1) Testis (2) Oviduct (3) Spermatheca (4) Phallic gland

4. Identify structure present in same number as cranial nerves in amphibians :-

(1) Ostia (2) Heart chamber (3) Neural Ganglia (4) Spiracles

5. Ootheca of cockroach has _____ eggs which are _____ :-

(1) 14 to 16, fertilized (2) 12 to 14, fertilized

(3) 14 to 16, unfertilized (4) 12 to 14 , unfertilized

Concept Builder (Answer-Key)					
Que.	**1**	**2**	**3**	**4**	**5**
Ans.	3	2	4	4	1

Exercise - I

Morphology

1. Zoological name of cockroach is :
(1) *Glossina palpalis*
(2) *Periplaneta americana*
(3) *Musca nebulo*
(4) *Apis indica*

2. Characteristic of group insecta is :
(1) Joined appendages
(2) 3 pair of jointed legs
(3) Chitinous exoskeleton
(4) Compound eyes

3. Sclerite are attached to each other by a thin & flexible articular membrane which is also called as :
(1) Arthroidal membrane
(2) Synovial membrane
(3) Sclerital membrane
(4) All of these

4. Tergum is joined on the sides with :
(1) Pleuron (2) Sternum
(3) Alimentary canal (4) Muscles

5. The dorsal plate of skeleton found on the abdomen of cockroach is called :
(1) Pleuron (2) Sternum
(3) Tergum (4) Vertex

6. Outer border of tergum bends downwards in cockroach and attaches with :
(1) Muscles (2) Sternum
(3) Pleura (4) Fat body cells

7. Mandibles of cockroach are :
(1) Short with grinding and incising teeth
(2) Long and pointed and griding teeth
(3) short without teeth
(4) long and coiled and incising teeth

8. Head of cockroach according to its position is known as :
(1) Hypopharynx (2) Hypocyrebral
(3) Hypognathus (4) Supragnathus

9. Tongue like structure in *Periplaneta* is :
(1) Maxilla (2) Hypopharynx
(3) Labium (4) Labrum

10. Which structure is known as lower lip of cockroach ?
(1) Labrum (2) Labium
(3) Mantum (4) Submentum

11. Number of segments in cockroach leg :
(1) 3 (2) 5
(3) 6 (4) 9

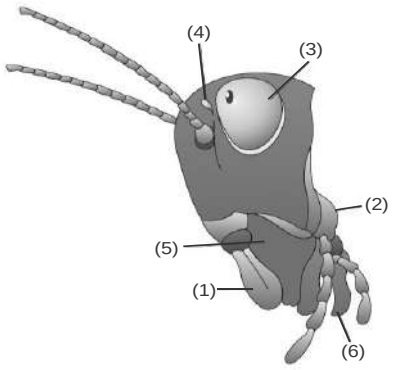
12. Pseudopodia of *Amoeba* are similar to :
(1) Legs of cockroach
(2) Teeth in rabbit
(3) Spicules of *Neucosolenia*
(4) Suckers of *Taenia*

13. Plantulae are found in cockroach in :
(1) Tarsus (2) Femur
(3) Trochanter (4) Coxa

14. Most swollen segment in leg cockroach is :
(1) Tarsus (2) Coxa
(3) Femur (4) Trochanter

15. In cockroach arolium is helpful in :
(1) In digestion (2) Respiration
(3) Locomotion (4) Reproduction

16. See carefully following diagram and identify different parts sequencially :



(1) Labrum, labium, compound eye, ocellus, mandible and maxilla
(2) Maxilla, labrum, compound eye, ocellus, labium and mandible
(3) Labrum, maxilla, compound eye, ocellus, mandible and labium
(4) Mandible, labrum, compound eye, ocellus, labium, and maxilla

17. Main character for the distinction between male and female cockroach :
(1) Antennae (2) Mandibles
(3) Anal cerci (4) Anal style

18. Anal styles are found in :
(1) Housefly
(2) Female cockroach
(3) Male cockroach
(4) Both male & female cockroach

19. In cockroach the audioreceptors are situated on:
(1) On legs (2) Antenna
(3) Sensory receptor (4) Anal cerci

20. The gynovalvular plates in female cockroach are modification of :
(1) 7th tergum
(2) 7th sternum
(3) 8th Tergum
(4) 8 sternum

21. Stink glands are found in :
(1) Only in males
(2) Only in female
(3) In both male & female
(4) None

22. Exoskeleton of cockroach is made up of :
(1) Chitin
(2) Chondrin
(3) Ossein
(4) Scleroprotein

23. Cockroach and other insects have exoskeleton made up of :
(1) Keratin
(2) Spongin
(3) Chitinous cuticle
(4) Cuticle

24. Tentorium is endoskeleton of ?
(1) Head (2) Thorax
(3) Abdomen (4) In all parts

25. The body cavity of cockroach is called :
(1) Pseudocoel (2) Coelom
(3) Hydrocoel (4) Haemocoel

26. Salivary glands of cockroach open on :
(1) Maxilla
(2) Hypopharynx
(3) Labium
(4) Labrum

27. Mouth part of cockroach are suitable for :
(1) Piercing
(2) Absorbing
(3) Biting & chewing
(4) Drinking

Digestive, Respiratory Circulatory & Excretory System

28. Choose correct statement about excretion in cockroach :
(1) Malpighian tubules absorbs nitrogenous waste from haemolymph (coelomic fluid) and convert then into uric acid which is excreted out through mid gut.
(2) Malpighian tubules absorbs uric acid from haemolymph and excrete out through hind gut.
(3) Malpighian tubules absorbs nitrogenous waste from haemolymph and convert them into uric acid which is excreted out through hind gut.
(4) Malpighian tubule absorbs nitrogenous waste and uric acid from haemolymph and excrete them out through hind gut.

29. Malpighian tubules absorbs excretory substance from :
(1) Coelomic fluid (2) Haemolymph
(3) Blood (4) All of above

30. Hepatic caeca in cockroach are derived from :
(1) Crop (2) Gizzard
(3) Midgut (4) Proctodaeum

31. Saliva of cockroach contains enzyme :
(1) Lipase (2) Amylase
(3) Pepsin (4) Trypsin

32. Choose correct statements about cockroach :

(i) Hind gut is broader than midgut

(ii) Hind gut and fore gut is lined with cuticle

(iii) Rectum opens out through cloaca

(iv) Blood is colourless and also called as haemolymph

Options :

(1) (i), (iii) and (iv) (2) (i), (ii) and (iii)

(3) (i), (ii) and (iv) (4) Only (iii)

33. In cockroach food is crushed in which part :

(1) Crop (2) Gizzard

(3) Mesenteron (4) Oesophagus

34. In which part of alimentary canal of cockroach is invagination of cuticle found ?

(1) Anterior part

(2) In midpart

(3) In posterior part

(4) Both in antherior and posterior part

35. The inner layer of gizzard of cockroach is covered by :

(1) keratin

(2) Chitinous cutical

(3) Cutical

(4) Mucus

36. Maximum digestion takes place in which part of cockroach ?

(1) In crop

(2) In Gizzard

(3) In mesenteron

(4) In oesophagous

37. Oxygen is carried to the tissues of cockroach by which organ :

(1) Skin

(2) Trachea

(3) Plasma

(4) Respiratory pigment

38. Allary muscles in cockroach are helpful in activity of :

(1) Trachea (2) Heart

(3) Legs (4) Alimentary canal

39. Number of pairs of spiracles in cockroach are :

(1) 4 pair (2) 6 pair

(3) 8 pair (4) 10 pair

40. Following are the part of respiratory system of cockroach ?

(1) Spiracles (2) Trachea

(3) Trachioles (4) All of these

41. Blood of cockroach does not contain haemoglobin because :

(1) It respires through atmosphere

(2) Respires through book lungs

(3) It does not respire

(4) It has some other means to carry oxygen direct into the tissues

42. Give the name of blood vessel, which arises from first chamber of heart in cockroach :

(1) Nephrocyte (2) Fenestrae

(3) Ostia (4) Anterior aorta

43. Number of chambers in the heart of cockroach :

(1) 5 (2) 9

(3) 13 (4) 16

44. Blood circulation in insects :

(1) Flows in arteries and veins

(2) With red blood corpuscles

(3) Open type

(4) Absent

45. The colour of haemolyph of cockroach is :

(1) Yellow (2) Red

(3) Green (4) Colourless

46. Physiologically the heart of cockroach is :

(1) Neurogenic (2) Myogenic

(3) Epigenic (4) Agenic

47. Main excretory product of cockroach is :
(1) Urea (2) Ammonia
(3) Uric acid (4) Amino acid

48. Function of Malpighian tubules of cockroach :
(1) Digestion (2) Respiration
(3) Excretion (4) Reproduction

49. Absorption of uric acid take place from haemolymph to lumen of malpighian tubule in the form of :
(1) Sodium urate (2) Potassium urate
(3) Hydro urate (4) Flouro urate

Nervous System, Eye & Reproduction system

50. The nerve cord of cockroach is :
(1) Double, ventral and solid
(2) Double dorsal and hollow
(3) Single, dorsal and solid
(4) Single, ventral and hollow

51. In cockroach which is helpful in sexual attraction?
(1) Hormone ecdyson (2) Pheromone
(3) Juvenile hormone (4) Anal cerci

52. Ommatida are found in :
(1) Eyes of birds (2) Eye of frog
(3) Eye of insects (4) Eye of rabbit

53. Structural units found in the compound eye of cockroach are called :
(1) Rhabdom (2) Cone cells
(3) Ommatidia (4) Simple eye

54. What type of vision is found in cockroach ?
(1) Mosaic (2) Super position
(3) Binocular (4) None of them

55. Ommatidia are units in the eyes of :
(1) Amphibians (2) Mammals
(3) Insects (4) Fishes

56. Apposition image in eye of insects is formed in :
(1) Dim light (2) Bright Light
(3) ocelli (4) None

57. Which of the following secrete outermost layer of spermatophore ?
(1) Utricle breyoris
(2) Utricle majoris
(3) Phallic gland
(4) Uricose gland

58. Ootheca is formed in cockroach by :
(1) Phallic Gland
(2) Conglobate gland
(3) Utricular gland
(4) Collaterial Gland

59. Ootheca of Cockroach has fertilized eggs, this numbers is :
(1) 6 (2) 8
(3) 16 (4) 24

60. From egg laying to the development of adult cockroach. How many moluting occur ?
(1) 13 times (2) 9 times
(3) 6 times (4) 3-4 times

61. Sexual dimorphism is distinct in :
(1) *Hydra* (2) Earthworm
(3) Sponge (4) Cockroach

62. Number of moultings in cockroach after hatching and development of complete animal are :
(1) Less than 7 (2) Upto 8
(3) Upto 9 (4) More than 10

63. How many ovarioles are found in each overy of cockroach ?
(1) 3 (2) 6
(3) 8 (4) 16

64. In the life history of cockroach (*Periplaneta*) There is :
(1) No Metamorphosis
(2) Paurometabolus metamorphosis
(3) Complete metamorphosis
(4) Anamorphosis

65. Juvenile of cockroach is known as :

(1) Tadepole (2) Amocyte

(3) Nymph (4) Naid

66. The time period between the two moulting is called :

(1) Instar (2) Stadium

(3) Metamorphosis (4) Ecdysis

67. Cockroach is :

(1) Nocturnal and omnivorous

(2) Diurinal and omnivorous

(3) Nocturnal and carnivorous

(4) None

68. In male genital pouch/chamber surrounded by :

(1) Dorsally 9^{th} and 10^{th} terga and ventrally by 9^{th} sternum

(2) Ventrally 9^{th} and 10^{th} sterna and dorsally by 9^{th} terga

(3) Dorsally 8^{th} and 9^{th} terga and ventrally by 9^{th} sterna

(4) Dorsally 9^{th} and 10^{th} sterna and Ventrally 10^{th} turga

69. Spermatophore is _____ :

(1) Group of sperm glued together.

(2) Site of sperm storage

(3) A chamber in which female cockroach receives sperm

(4) None of these

ANSWER-KEY

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Ans.	2	**2**	1	1	**3**	3	1	3	2	2	2	1	1	2	3	3	4	3	4	2	3	1	3	1	4
Que.	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
Ans.	2	3	3	4	3	2	3	2	4	2	1	2	2	4	4	4	4	3	3	4	1	3	3	2	1
Que.	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**						
Ans.	2	3	3	1	3	2	3	4	3	1	4	4	3	2	3	2	1	1	1						

Exercise – II

1. In cockroach anal cerci is/are :

(1) One pair jointed filamentous structure present at 8th segment of both male and female

(2) One pair jointed filamentous structure present at 9th segment of both male and female

(3) One pair jointed filamentous structure present at 10th segment of both male and female

(4) One pair jointed filamentous structure present at 7th segment of both male and female

2. Malpighian tubule of cockroach absorbs nitrogenous waste from haemolymph and convert it into :

(1) Pottassium urate

(2) Urea

(3) Trimethyle amine

(4) Uric acid

3. Vision of cockroach is :

(1) Mosaic vision with more resulution but less sensitivity

(2) Mosaic vision with more resolution and sensitivity

(3) Mosaic vision with less resolution and sesitivity

(4) Mosaic vision with more sensitivity and less resolution

4. Heart of cockroach is dorsal, tubular and consists of 13 chamber. The first chamber of heart is called as :

(1) Anterior aorta

(2) Posterior aorta

(3) Anterior alary

(4) Posterior alary

5. Following mouth parts are present in mouth of cockroach :

(a) A pair of mandible (b) One labrum

(c) A pair of maxilla (d) One labium

Which of above mouth part forms lower lip

(1) a and c (2) c and d

(3) c only (4) d only

6. Choose the correct statement about cockroach :

(a) Its exoskeleton made up of chitinous cuticle

(b) In each segment exoskeleton is in form of plates called sclerite

(c) Dorsal sclerite is turgite while ventral sclerite is sternite

(d) Selerites are attached together by arthroidal membrane

(1) a and c

(2) b and d

(3) a, b, c and d

(4) a, b and c

7. Which of the following statement is incorrect w.r.t malpighian tubules in cockroach ?

(1) They convert nitrogenous waste products into urea which is excreted out through hind gut

(2) Each tubule is lined by glandular and ciliated cells

(3) These are 100-150 blind yellow tubules present at the junction of midgut and hind gut

(4) They absorb urates salt from haemolymph.

8. If the head of cockroach is cut off, it will still live for as long as one week because :

(1) Whole nervous system placed inside head region

(2) Whole nervous system situated in abdomen

(3) Brain represented by supraesophageal ganglion present in head region

(4) Very bit part of nervous system at situated in head

9. Find out the incorrect statements w.r.t head of cockroach :

(1) Head is formed by the fusion of six embryonic segments

(2) Chewing and lapping type of mouth parts are found in head

(3) Tentorium is the endoskeletal structure of the head

(4) Head is triangular and present at an angle of 90º from the long axis of the body

10. How many of the following statements are **wrong** w.r.t. Periplaneta ?

(i) Coelom is reduced by presence of blood containing cavity called haemocoel

(ii) Wings in male cockroach are relatively larger than female wings

(iii) Diploid number of chromosome in female while male is haploid

(iv) Embryologically body is made of twenty segments

(1) One (2) Two

(3) Three (4) Four

11. The nymphal stage during development of *Periplaneta americana* :

(1) Looks completely distinct from adult

(2) Undergoes thirteen moultings to reach to adult form

(3) Bear wings but cannot fly

(4) Has well developed gonads and can reproduce

12. Which of the following structures are present in 4-6th and 2-6th abdominal segment only in male and female cockroach respectively ?

(1) Utricular gland and ovary

(2) Phallic gland and gonopore

(3) Testes and ovary

(4) Seminal vesicles and genital chamber

13. Which of the following is **mismatched** w.r.t. *Periplaneta* ?

(1) **Head –** Triangular in shape, lies at right angles to longitudinal axis of body and is formed by fusion of six segments

(2) **Thorax –** Consists of three segments; each segment of it bear a pair of walking legs and a pair of wings

(3) **Abdomen of male –** Consists of ten segments; Genital pouch or chamber lies at the hind end bounded dorsally by 9th and 10th terga and ventrally by 9th sternum.

(4) **Abdomen of female –** Consists of ten segments 7th sternum is boat shaped and together with 8th and 9th sterna forms a brood or genital pouch

14. Which of the following is **incorrect** w.r.t. structure/gland of cockroach and its total number in body ?

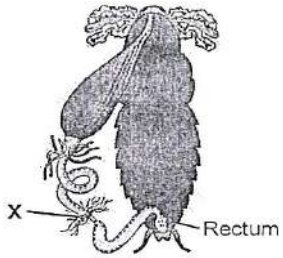
(1) Collaterial glands in female cockroach-2

(2) Malpighian tubules – 100 – 150

(3) Spiracles – 10

(4) Ommatidia in each compound eye – 2000

15. Following is a diagram of alimentary canal of cockroach :



Which of the following is not a correct statement for the structure marked as X?

(1) These are structures at the junction of mid-gut and ileum

(2) These help in the removal of excretory products from haemolymph

(3) They are yellow coloured & 100-150 in number

(4) These are thin filamentuous structure which secrete digestive juices into alimentary canal

16. Mark the incorrect statement w.r.t. cockroach :

(1) Haemolymph is composed of colourless plasma and blood cell

(2) All the spiracles are always remains open

(3) Haemolymph enters heart through ostia and is pumped from posterior to anterior direction

(4) Haemolymph has no major role in transportation respiratory gases.

17. Choose the **incorrect** match :

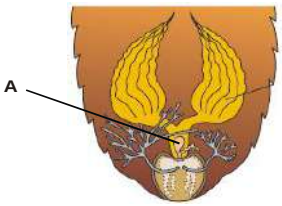
(1) Malpighian - Help in removal of tubule excretory products in form of urea

(2) Tentorium - Endoskeleton of the head

(3) Spiracles - 10 pairs present on lateral side of body

(4) Phallic gland - Forms covering of spermatophore

18. Given below is a diagram of female reproductive system of cockroach. Identify the labelled structure 'A'. Choose the correct option w.r.t. the function of the labelled structure. :



(1) Storage of sperm after sexual mating

(2) Secretion of wall of ootheca

(3) Regulates moulting in cockroach

(4) Secretes juvenile hormone which retains nymphal character

19. Read following sentances carefully :

(A) Each thoracic segment have one pair leg

(B) One pair fore wings are present on prothorax

(C) 7^{th} sterna in female is boat shaped

(D) Each ootheca have 14-16 eggs

Which of above sentence are correct for cockroach ?

(1) A and C (2) A, B and D

(3) A, C and D (4) A, B and C

20. Ootheca arround fertilised egg of cockroach is secreted by :

(1) Ovariole (2) Mashroom gland

(3) Collateral gland (4) Spermatheca

21. In males cockroach :

(A) Abdominal segment are 10 in no.

(B) Wings extends beyong the tip of abdomen

(C) Have anal style

(D) Genopophysis also called as phallomere acts as external genitilia

Options :

(1) (A), (B) and (D) are correct

(2) (A), (C) and (D) are correct

(3) (B) and (C) are correct

(4) All are correct

22. Position of head in cockroach is called hypognathus condition because :

(1) Head lies along the body axis

(2) Head lies anteriorely at 90º (right angle) to longitudinal body axis

(3) Head is formed by fusion of six segment

(4) Both (3) and (4)

23. Movement of oxygen in cockroach during breathing is :

(1) Air → Trachea → Blood → Tissue

(2) Air → Spiracle → Trachea → Blood → Tissue

(3) Air → Spiracle → Trachea → Tissue

(4) Air → Trachea → Spiracle → Tissue

ANSWER-KEY																							
Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Ans.	3	4	4	1	4	3	1	4	2	1	2	3	2	3	4	2	1	1	3	3	4	2	3

Exercise – III (Previous Year Questions)

[AIPMT-2009]

1. Uric acid is the chief nitrogenous component of the excretory producted of :-
(1) Frog (2) Man
(3) Earthworm (4) Cockroach

[AIPMT-2011]

2. Which of the following correctly state as it happens in the common cockroach ?
(1) Malpighian tubules are excretory organs projecting out from the colon.
(2) Oxygen in transported by haemoglobin in blood
(3) Nitrogenous excretory product in urea
(4) The food is grinded by mandibles and gizzard

[AIIMS-2012]

3. Which of the following animal correctly matched to their corresponding respiratory organ ?
(1) Earthworm – Open circulatory system with haemoglobin
(2) Corkroach – Three pairs of spiracles in each throax.
(3) Frog in water – skin and lungs
(4) Frog on land – skin, buccal cavity, lungs

[AIIMS-2014]

4. Which type of mouth parts are present in cockroach ?
(1) Lapping & chewing
(2) Siphoning
(3) Sucking and pirecing
(4) Chewing and biting

[AIPMT-2015]

5. The terga, sterna and pleura of cockroach body are joined by : -
(1) Muscular tissue
(2) Arthrodial membrane
(3) Cartilage
(4) Cementing glue

[RE-AIPMT-2015]

6 The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of :
(1) Calcium carbonate
(2) Ammonia
(3) Postassium urate
(4) Urea

[NEET-2016]

7. Which of the following feature is not presenting Periplanata amaricana ?
(1) Schizocoelom
(2) Indeterminate and radial cleavage during embryonic development
(3) Exoskeleton composed of N-acetylglucosanine
(4) Metamerically segmented body

8. Which one of the following groups of structures/organs have similar function :
(1) Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in Amoeba
(2) Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubules in rat
(3) Antennae of cockroach, tympanum of frog and clitellum of earthworm
(4) Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish

[AIIMS-2017]

9. Which of the following statement is correct regarding cockroach ?
(1) Nocturnal, omnivorous found in damp places
(2) Malpighian tubules found only in forward part of hindgut
(3) Head is formed by 5 parts
(4) Hypopharynx and mandible are paired

10. What is true about cockroach ?
(1) Ureotelic animal
(2) Entire foregut is lined by cuticle
(3) Male have spermatheca in 6th segment
(4) Female have caudal style

[NEET-2018]

11. Which of the following features is used to identify a male cockroach from a female cockroach ?
(1) Presence of a boat shaped sternum on the 9th abdominal segment
(2) Presence of caudal styles
(3) Forewings with darker tegmina
(4) Presence of anal cerci

[NEET-2019]

12. Select the correct sequence of organs in the alimentary canal of cockroach starting from mouth :
(1) Pharynx → Oesophagus → Gizzard → Ileum → Crop → Colon → Rectum
(2) Pharynx → Oesophagus → Ileum → Crop → Gizzard → Colon → Rectum
(3) Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum
(4) Pharynx → Oesophagus → Gizzard → Crop → Ileum → Colon → Rectum

[NEET-2020]

13. If the head of cockroach is removed, it may live for few days because:
(1) The head holds a 1/3rd of a nervous system while the rest is situated along the dorsal part of its body.
(2) The supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.
(3) The cockroach does not have nervous system.
(4) The head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.

[NEET-2020(COVID-19]

14. In cockroach, identify the parts of the foregut in correct sequence :
(1) Mouth → Oesophagus → Pharynx → Crop → Gizzard
(2) Mouth → Crop → Pharynx → Oesophagus → Gizzard
(3) Mouth → Gizzard → Crop → Pharynx → Oesophagus
(4) Mouth → Pharynx → Oesophagus → Crop → Gizzard

15. Match the following columns with reference to cockroach and select the correct option :

Column – I	**Column - II**
(a) Grinding of the food particles	(i) Hepatic caecal
(b) Secrete gastric juice	(ii) 10th segment
(c) 10 pairs	(iii) Proventriculus
(d) Anal cerci	(iv) Spiracles
	(v) Alary muscles

(1) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
(2) (a)-(iv), (b)-(iii), (c)-(v), (d)-(ii)
(3) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)
(4) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)

[NEET-2021]

16. Which of the following characteristics is incorrect with respect to cockroach?
(1) A ring of gastric caeca is present at the junction of midgut and hind gut.
(2) Hypopharynx lies within the cavity enclosed by the mouth parts.
(3) In females, 7th - 9th sterna together form a genital pouch.
(4) 10th abdominal segment in both sexes, bears a pair of anal cerci.

[NEET-2022]

17. Tegmina in cockroach, arises from:
(1) Prothorax
(2) Mesothorax
(3) Metathorax
(4) Prothorax and Mesothorax

ANSWER-KEY																	
Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Ans.	4	4	4	4	2	3	2	2	1	2	2	3	4	4	1	1	2