7

Structural Organisation in Animals

Multiple Choice Questions (MCQs)

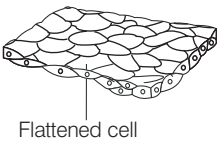
Q. 1 Which one of the following types of cell is involved in making of the inner walls of large blood vessels?

(a) Cuboidal epithelium (b) Columnar epithelium
(c) Squamous epithelium (d) Stratified epithelium

Thinking Process

Epithelium is the tissue covering the external and internal exposed lining of the body cavity. Blood vessels lymph vessels, glands and their ducts are derived from epithelium. Epithelium is a triplet in origin, i.e., from ectoderm (e.g., skin, epidermis) mesoderm (e.g., peritoneum) and endoderm (*e.g., gut epithelium).*

Ans. *(c)* **Squamous epithelium** is involved in the making of the inner walls of large blood vessels, where it is known as endothelium.



Squamous epithelial

Q. 2 Which one of the following categories does adipose tissue belong?

(a) Epithelial (b) Connective (c) Muscular (d) Neural

Ans. *(b)* **Adipose tissue** is a connective tissue, located mainly beneath the skin. The cells of adipose tissue are specialised in storing fats in the form of fat globules.

Epithelial tissue formed of a single layer of cells, resting on the basement membrane.

Muscular tissue has contractibility, it can be shorten forcefully and relaxed state is regained These are also called muscle fibres as they are long and elongated.

Neural tissue is made up of **neurons** and **neuroglial cells**, essential in transmitting electrical signals *via* neurotransmitter from one part of body to the another. *e.g.*, CNS and PNS (Central Nervous System) and Peripheral Nervous System are the chief components involved in nervous system.

Q. 3 Which one of the following is not a connective tissue?

(a) Bone (b) Cartilage (c) Blood (d) Muscles

Ans. *(d)* Muscle is not a connective tissue. It is composed of long, cylindrical, numerous fine fibrils called myofibrils.

Bone is a solid, rigid, connective tissue.

Blood is a fluid connective tissue.

Cartilage is a solid but semi-rigid and flexible connective, tissue.

Q. 4 The clitellum is a distinct part in the body of earthworm, it is found in

(a) segment 13 - 14 - 15 (b) segment 14 - 15 - 16

(c) segment 12 - 13 - 14 (d) segment 15 - 16 - 17

Ans. *(b)* The clitellum is a prominent circular band of glandular nature, present in 14th to 16th segments in earthworm. Clitellum secretes mucus and albumin, which helps in the formation of cocoons, and is used for fertilisation of eggs.

Q. 5 Setae help in locomotion in earthworm but are not uniformly, present in all the segments. They are present in

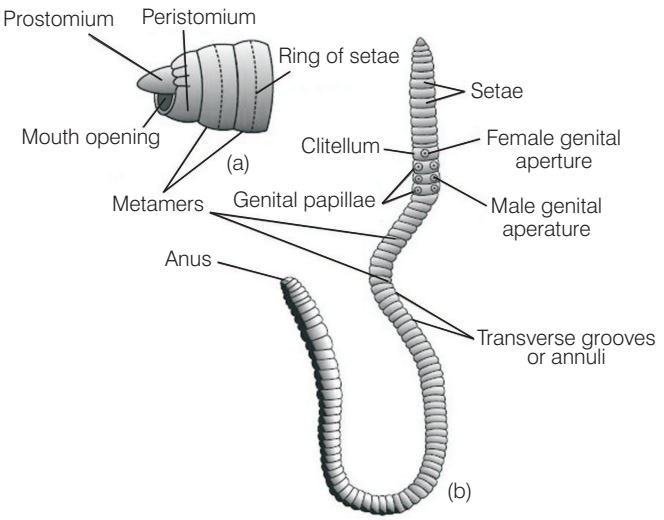
(a) 1st segment (b) last segment

(c) clitellar segment (d) 20th - 22nd segment

Thinking Process

Setae or chaetae are the locomotary structures in earthworm. They hold the substratum firmly, helps earthworm to move through, burrows.

Ans. *(d)* In earthworm, except for the 1st, last and clitellar segment, each segment bears a ring of tiny, curved, chitinous structures called **setae**.



Earthworm (a) Lateral view of earthworm showing ring of setae (b) Ventral view of earthworm

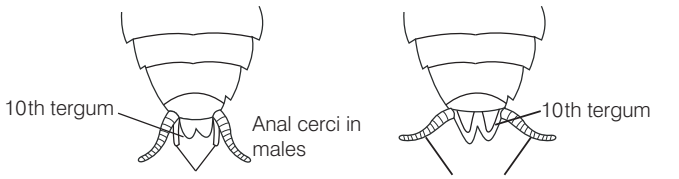
Q. 6 Which one of the following statements is true for cockroach?

(a) The number of ovarioles in each ovary are ten
(b) The larval stage is called caterpillar
(c) Anal styles are absent in females
(d) They are ureotelic

Thinking Process

These are a pair of short thread-art like structures found in male cockroach. These act as a sense organ and allows the cockroach to run in opposite direction.

Ans. ***(c)*** Anal styles in male cockroach are present in the 9th segment. These are absent in females.



Anal styles in male cockroach **Anal cerci in female cockroach**

Other statement are incorrect because

The female cockroach has paired ovaries, each consisting of 8 ovarioles

Cockroach possess **nymphal stage** instead of larval stage.

Excretory organ of cockroach is **Malpighian tubules,** they remove the nitrogenous waste in the form of uric acid. *i.e.,* they are uricotelic.

Q. 7 Match the following.

	Column I		Column II
A.	Adipose tissue	1.	Nose
B.	Stratified epithelium	2.	Blood
C.	Hyaline cartilage	3.	Skin
D.	Fluid connective tissue	4.	Fat storage

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	4	3	1	2
(c)	3	1	4	2	(d)	2	1	4	3

Thinking Process

Connective tissues are the most diverse tissues, with variety of functions. They range in consistency from gel-like softness of areolar connective tissue to the hardness of the bone. This tissue connects body with the vital organs and plays an important role in variety of functions like protection, secretion absorption.

Ans. ***(b)*** **Adipose Tissue** are specialised tissue associated with storing fats in the form of oil droplets.

Stratified Epithelium occurs in the epidermis of the skin of terrestrial vertebrates.

Hyaline Cartilage is a semi-transparent cartilage and is extremely strong but very flexible and elastic. It consists of living cells, chondrolytes, which are situated far apart in fluid filled spaces, the lacunae. Nose is composed of hayline cartilage.

Fluid Connective Tissue is a type of connective tissue in which the matrix is in the liquid form. It is known as plasma. Types of fluid connective tissue are blood and lymph.

Q. 8 Match the following.

Column I		Column II	
A.	Hermaphrodite	1.	Produces blood cells and haemoglobin
B.	Direct development	2.	Testis and ovary in the same animal
C.	Chemoreceptor	3.	Larval form absent
D.	Blood gland in earthworm	4.	Sense of chemical substances

Codes

	A	B	C	D
(a)	2	3	4	1
(c)	1	3	2	4

	A	B	C	D
(b)	3	2	4	1
(d)	2	4	3	1

Ans. *(a)* **Hermaphrodites** bear testis and ovary within the same organism, (*e.g.,* earthworm or *Pheretima*).

Direct development occurs in organisms in which there is no larval stage in the life-cycle and therefore no metamorphosis takes place, (*e.g., Pheretima* and *Lumbricus*).

Chemoreceptors or **chemosensors** are the sensory receptors used in sensing chemical substances,(*e.g*., olfactory receptor and taste buds in mammals).

Blood gland in earthworm are specialised glands that are associated with the generation of blood cells and haemoglobin in *Pheretima*.

Q. 9 Match the following with reference to cockroach and choose the correct option.

Column I		Column II	
A.	Phallomere	1.	Chain of developing ova
B.	Gonopore	2.	Bundles of sperm
C.	Spermatophore	3.	Opening of the ejaculatory duct
D.	Ovarioles	4.	The external genitalia

Codes

	A	B	C	D
(a)	3	4	2	1
(c)	4	2	3	1

	A	B	C	D
(b)	4	3	2	1
(d)	2	4	3	1

Ans. *(b)* **A.** → (3) **B.** → (4) **C.** → (2) **D.** → (1)

Phallomere also called as pseudopenis, is the external genitalia in cockroach.

Gonopore is a specific reproductive pore or aperture which acts as an opening of ejaculatory duct.

Spermatophore is a capsule or bundle of sperm created by male cockroach containing spermatozoa. During copulation, its transferred as a whole in to the female.

Ovarioles group of eight ovarian tubules or ovarioles forms ovary contains chain of developing ova.

Q. 10 Match the following.

Column I		Column II	
A.	Touch	1.	Nasal epithelium
B.	Smell	2.	Foramen magnum
C.	Cranial nerves	3.	Sensory papillae
D.	Medulla oblongata	4.	Peripheral nervous system

Codes

	A	B	C	D
(a)	3	1	2	4
(c)	3	4	2	1

	A	B	C	D
(b)	2	1	4	3
(d)	3	1	4	2

Ans. *(d)* **A.** → (3) **B.** → (1) **C.** → (4) **D.** → (2)

Sensory papillae are sensitive to touch.

Nasal epithelium is specialised epithelial tissues inside the nasal cavity that is involves in smell.

Crainal nerves are a part of peripheral nervous system. These nerves energy from brain and the brain stem.

Foramen magnum is a large opening in the occipital bone of the cranium, through which spiral cord (extension of medulla oblongata) enters and exits the skull vault.

Very Short Answer Type Questions

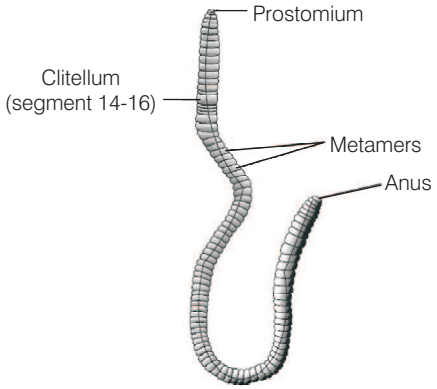
Q. 1 State the number of segments in earthworm which are covered by a prominent dark band or clitellum.

Thinking Process

Clitellum is a saddle shaped region made of glandular tissue in the body of earthworm, after copulation secretes a cocoon in which the eggs and sperms are deposited for fertilisation.

Ans. **Segments 14-16** are covered by a prominent dark band of glandular tissue called clitellum in a mature earthworm.

Which secretes mucus and albumen that help in formation of cocoon and is used for fertilisation of eyes and sperms.



Dorsal view of earthworm showing clitellum and metamer

Q. 2 Where are sclerites present in cockroach?

Thinking Process

Sclerites are hardened plates present in exoskeleton of cockroach.

Ans. Sclerites are present in all the body segments of cockroach. *These are of two types*
Dorsal sclerites often known as **tergites**, and
Ventral sclerites which are referred to as **sternites**.

Q. 3 How many times do nymphs moult to reach the adult form of cockroach?

Ans. The nymph grows by moulting about 13 times to reach. In cockroach, the development is indirect and paurometabous adult form and has three stages. *i.e.,* egg, nymph and adult. The nymph resembles adult except for undeveloped wings and genitalia.

Q. 4 Identify the sex of a frog in which sound producing vocal sacs are present.

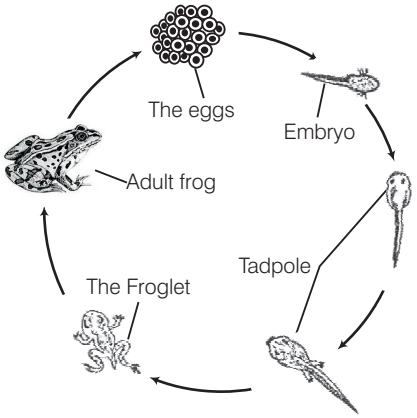
Ans. In amphibians, sex of frogs can be distinguished with the presence of sound producing vocal sacs. These organs are present in males which make them crock lauder, than females, so as to attract females for mating.

Q. 5 Name the process by which a tadpole develops into an adult frog.

Thinking Process

Metamorphosis is an essential feature in growth for lower animals including both invertebrates and vertebrates. In this phenomenon, organism shows change in physical form and structure especially during the growth process.

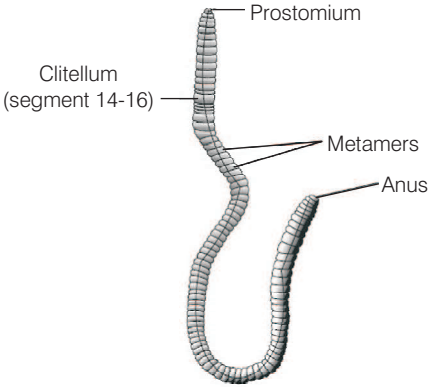
Ans. Tadpole undergoes metamorphosis to form adult.



Metamorphosis in frog

Q. 6 What is the scientific term given to earthworm's body segments?

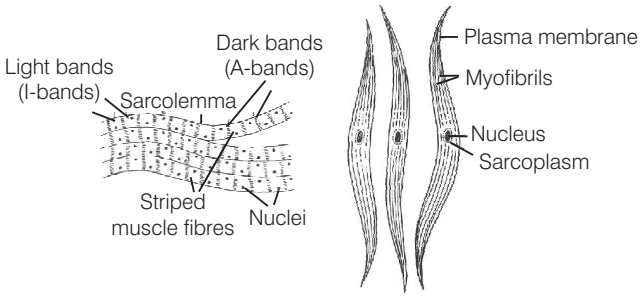
Ans. Metamers is the scientific term given to earthworm's body segments.



Dorsal view of earthworm showing clitellum and metamer

Q. 7 A muscle fibre tapers at both ends and does not show striations. Name the muscle fibre.

Ans. Smooth muscle fibres taper at both the ends (fusiform) and do not show striations. They are also called involuntary muscles.



Muscle (a) Striated skeletal muscle (b) Non-striated smooth muscles

Q. 8 Name the different cell junctions found in tissues

Ans. *The different cell junctions found in tissues are*

(i) **Tight junctions** are regions where plasma membrane of adjacent epithelial cells are held close together. They check the movement of material between then.

(ii) **Gap junctions** are meant for chemical exchange between adjacent cells.

(iii) **Adhering junctions** perform connecting function to keep neighbouring cells together.

Q. 9 Give two identifying features of an adult male frog.

Ans. *The two identifying features of an adult male frog are as follows*

(a) **Vocal Sacs** These are loose skin folds on throat of male frogs for producing louder croak.

(b) **Nuptial Pad** This copulatory pad present on the first digit of the forelimb of male frog and helps in closing female during amphelexus.

Q. 10 Which mouth part of cockroach is comparable to our tongue?

Ans. **Hypopharynx** acts as a tongue in cockroach and lies within cavity enclosed by the mouth parts.

Q. 11 The digestive system of frog is made of the following parts. Arrange them in an order beginning from mouth.
Mouth, oesophagus, buccal cavity, stomach, intestine, cloaca, rectum, cloacal aperture.

Ans. The correct arrangement of the parts of digestive system in frog is as follows
Mouth → Buccal cavity → Oesophagus → Stomach → Intestine → Rectum → Cloaca → Cloacal aperture.

Q. 12 What is the difference between cutaneous and pulmonary respiration?

Ans. In frog respiration takes place *via* two means, *i.e*., skin and lungs.
Cutaneous respiration occrrs through highly vascular moist skin. It takes place in water as well as land.
Pulmonary respiration through lungs. It takes place outside the water.

Q. 13 Special venous connection between liver and intestine and between kidney and intestine is found in frog, what are they called?

Ans. Special venous connection between liver and intestine is called hepatic portal system and venus connection between the kidney and the lower parts of the frog is called **renal portal system**.

Short Answer Type Questions

Q. 1 Give the location of hepatic caeca in a cockroach. What is their function?

Ans. Hepatic or gastric caecae are 6-8 narrow and hollow blind tubules called is present at the junction of foregut and midgut. The hepatic caecae are similar to vertebrate liver, secretes digestive juices and help in the digestion.

Q. 2 Frogs are beneficial for mankind, justify the statement.

Ans. Frogs are beneficial for mankind because they eat insects and thus, protect our crops. They serve as an important link of food chains and hence food web in the ecosystem, thus maintaining the ecological balance. Some countries use the muscular legs of frog as a food source.

Q. 3 The body of sponges does not possess tissue level of organisation though it is made of thousands of cells. Comment.

Ans. The level of organisation in sponges is of cellular level. The cells in sponges do not organise to form tissue, although they possess thousands of independently associated cells.

The cells may be solitary or colonial and function more or less independently. The cells show division of labour for performing specialised functions.

Q. 4 Structural organisation in animals attains different levels as cell-organ-organ system. What is missing in this chain? Mention the significance of such an organisation.

Ans. Tissue is the missing in the chain. Structural organisation can be shown as cell-tissue-organ-organ system.

Number of cells together form tissue, number of tissue together form organ which on when unit with several organ form organ-system.

In organisms like *Hydra*, the body is comprised of thousands of cells in which each cell works independently whereas in a complex body system as that in humans billions of cells perform various functions together *via* connecting each other through connecting tissue.

Q. 5 Stratified epithelial cells have limited role in secretion. Justify their role in our skin.

Ans. **Stratified epithelium** consists of epithelial cells in which the deepest layer is made up of columnar or cuboidal cells. It is a type of compound epithelium and outer few layers, a water proof protein called keratin is present.

These layers of dead cells is called horny layer which is shed at intervals due to frictions hence, has a limited role in secretion and absorption. The main function of stratified epithelium is to provide protection to the body against mechanical and chemical stresses.

Q. 6 How does a gap junctions facilitate intercellular communication?

Ans. Gap junctions facilitate intercellular communication by allowing small signaling molecules to pass from cell to cell. These are fine hydrophilic channels between two adjacent animal cells that are formed with the help of two protein cylinders called connexus.

Each connexus consists of six proteins subunits that surround a hydrophilic channel. pH and Ca^{2+} ion concentration controls, opening or closing of channels.

Q. 7 Why are blood, bone and cartilage called connective tissue?

Ans. Connective tissue provides the structural framework and support to different organ forming tissue. Blood is a fluid or vascular connective tissue, which connects various organs and transports substances from one place to another.

Bone is a solid, rigid and strong skeletal connective tissue, which support the body and help in locomotion. Cartilage is also a skeletal connective tissue, not as rigid bone but piable and resist comparission. It plays a role in support and protection and present in tip of nose, outer ear joints etc.

Q. 8 Why are neurons called excitable cells? Mention special features of the membrane of the neuron.

Ans. **Neurons** are called excitable cells because these membranes are in a polarised state. Different types of ion channels are present in the neural membrane, *i.e.*, are selectively permeable to different ions.

When a neuron is suitably stimulated an electric disturbance is generated, which swiftly travels along its plasma membrane.

Arrival of the disturbance at the neuron's ending or output zone, triggers events that may cause stimulation of adjacent neuron. These are excitable cells due to differential concentration gradient of ions (specially natural K^+) across the membrane.

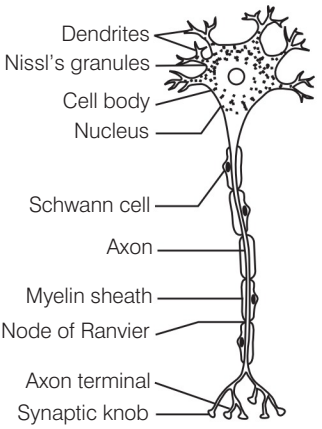
The special features of membrane of neuron are

(i) **Excitability** Neurons are able to percieve stimulus and enter a state activity caused by change in electrial potential difference across its covering membrane.

(ii) **Conductivity** Change in potential difference, spreads through the membrane to the whole neuron.

(iii) **Connectivity** Neurons are connected to several others, receiving and transmitting impulses to various directions.

(iv) **Response** The processed message may elicit a response in the form of a sensation.



Neuron

Q. 9 Why earthworm is called the friend of farmer?

Ans. Earthworms are called 'friends of farmer' because they make burrows in the soil and make it porous which helps plants in respiration and penetration within the soil.

The worm casting is rich in urea and ammonia which improves fertility of soil. Thus, they are of much importance to mankind and used as vermicompart.

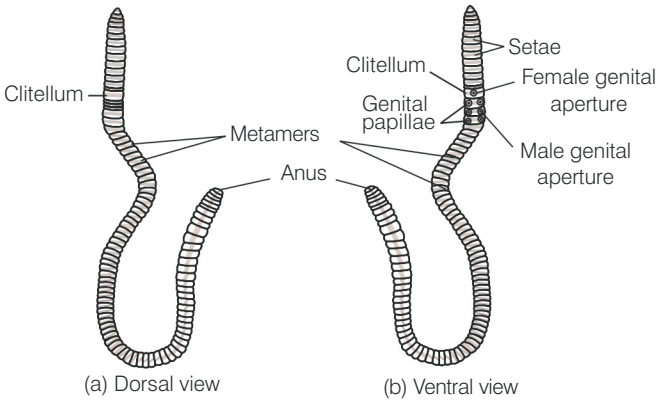
Q. 10 How do you distinguish between dorsal and ventral surface of the body of earthworm?

Ans. The body of earthworm can be distinguished into dorsal and ventral sides due to the presence of certain peculiar feature in it like.

(i) The dorsal surface is darker then ventral surface because it is marked by a **dark median mid dorsal** line along the longitudinal axis of body. This is due to dorsal blood vessel, seen through integument.

(ii) The ventral surface **genital openings** (pores), both male and female.

(iii) Genital papilla is located on ventral surface and help in copulation.



Body of the earthworm

Q. 11 Correct the wrong statements among the following.

(a) In earthworm, a single male genital pore is present.

(b) Setae help in locomotion of earthworm.

(c) Muscular layer in the body wall of earthworm is made up of only circular muscles.

(d) Typhlosole is the part of intestine of earthworm.

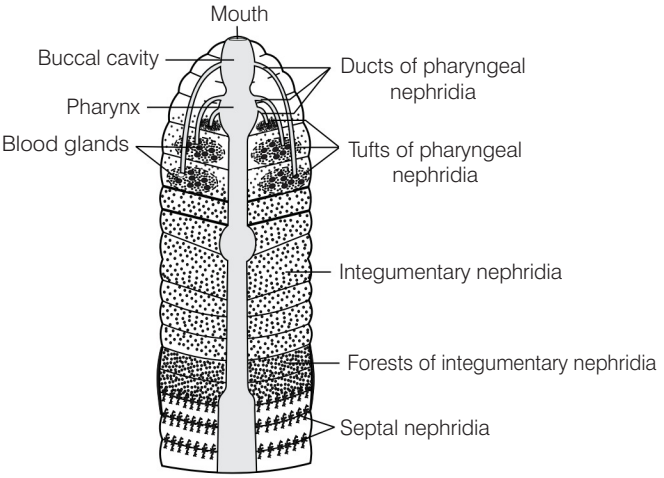
Ans. Among the given statements (b) and (d) are correct statement, correct statement for (a) would be in earthworm there are a pair of male genital pore lying on the ventro-lateral side of the **18th segment**.

Male reproductive fluid containing sperms is discharged by these pores. However, a single female genital pore is present in the mid ventral line of 14th segment. Correct statement for (c) Muscular layer in earthworm is consist of an outer layer of circular muscles and the inner layer of longitudinal muscles.

Q. 12 Why nephridia in earthworm that are basically similar in structure classified into three types? Mention the names of each.

Ans. Nephridia are the main excretory organs in earthworms. They are associated with excretory and osmoregulatory functions. The nephridia occur in all segments of earthworm except the first two segments. The three types of nephridia are found in earthworm according to their location.

They are distinguished on the basis of being enteronephric (nitrogen waste expelled input) and exonephric (nitrogen waste discharged outside directly).



Nephridia in earthworm

Septal Nephridia These are present on both sides of inter segmental septa of the segment starting from 15th to the last that open into intestine. They are enteronephric.

Integumenatry Nephridia These are attached to lining of the body wall of segment 3 to the last that open on the body surface. They are exonephric.

Pharyngeal Nephridia These are present as a three paired tufts in the 4th, 5th and 6th segments. They are also enteronephric.

Q. 13 Common name of some animals are given in column I, write their scientific name in column II

	Column I	Column II
A.	Tiger	.....
B.	Peacock	.....
C.	Housefly	.....

Ans. A. Tiger - *Panthera tigris*
B. Peacock - *Pavo cristatus*
C. Housefly - *Musca domestica*

Q. 14 Complete the following statement.

(a) In cockroach grinding of food particle is performed by ..... .
(b) Malpighian tubules help in removal of ..... .
(c) Hind gut of cockroach is differentiated into ..... .
(d) In cockroach blood vessels open into spaces called ..... .

Ans. (a) **Gizzard** It is a muscular and greatly folded structure which marks the end of foregut and bears six plates with teeth for crushing and grinding the food.

(b) **Malpighian tubules** They help in the removal of nitrogenous wastes in arthropods, hence are excretory in function.

(c) **Ileum, colon and rectum** and rectum opens and through anus.

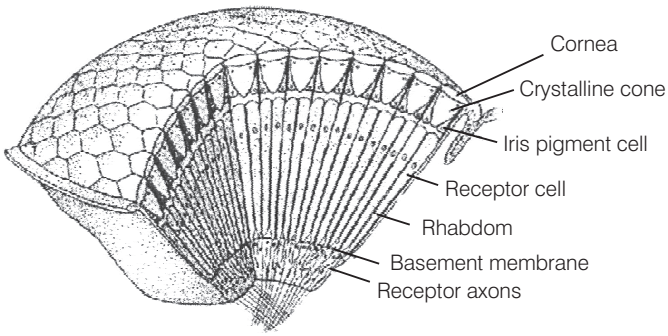
(d) **Haemocoel** It is the body cavity of cockroach divided into sinuses and contains visceral organs of cockroach floating in haemolymph.

Q. 15 Mention special features of eye in cockroach. Discuss compound eye in arthropods and mention its structural features.

Ans. The eyes in cockroach are large, sessile, paired, bean-shaped and present on either side of head. These are compound in nature. Each compound eye consists of a large number of visual elements called **ommatidia.**

Each ommatidium is composed of a diopteric region and reticular (receptor) region. It is capable of producing a separate image of a small part of object seen.

Thus, the image of the object viewed consists of several pieces and hence known as **mosaic image**. From the inner end of each ommatidium, fine nerve fibres arise, all of which combine to form one **optic nerve** connected to the brain.



Compound eyes in arthropods

Q. 16 Frog is a poikilotherm, exhibits camouflage and undergoes aestivation and hibernation, how are all these beneficial to it?

Thinking Process

An adaptation, also called as adaptive tract in biology, is a trait with a current functional role in the life history of an organism that is maintained and evolved by means of natural selection and evolution and help organism in its survival.

Ans. Frog is a poikilotherm (cold blooded animal), *i.e.,* it regulates its body temperature according to its environment.

For withstanding very cold temperatures, it undergoes winter sleep (hibernation) and summer sleep in hot temperatures (aestivation). During this period, it lives in a dormant stage with very minimal vital body activities.

Also, frog is capable of changing its body colour, though gradually, with the change in its surrounding and climatic conditions. This capability in frog is called as comouflage and lets it escape from the predators, an essential survival parameter for living.

Q. 17 Write the functions in brief in column II, appropriate to the structures given in column I.

	Column I	Column II
A.	Nictitating membrane	1. .....
B.	Tympanum	2. .....
C.	Copulatory pad	3. .....

Ans. (a) **Nictitating Membrane** It protects the eye from water and any other damaging matter by covering the eye ball of forg.

(b) **Tympanum** It is a present on each side of frog head and is involved in the hearing process.

(c) **Copulatory Pad** These pads are present in the limbs of the male frog and helps in copulation by holding the female during its sexual activity.

Q. 18 Write the appropriate type of tissues in column II according to the functions mentioned in column I.

	Column I	Column II
A.	Secretion and absorption	1. .....
B.	Protective covering	2. .....
C.	Linking and supporting framework	3. .....

Ans. (a) **Simple Columnar Epithelium** This epithelium lines the stomach, intestine, gall bladder etc. It forms goustric and intestinal glands, where it has a secretory role and is called as glandular epithelium. In intestinal mucosa, this epithelium has microvilli which increase the absorptive surface area and is called brush bordered columnar epithelium.

(b) **Stratified Epithelium** These are made up of more than one layer of epithelial cells (also called compound epithelium). They are the only cells of the deepest layer and rest on the basement membrane they cover the surface where constant wear and tear take place. They mainly function as a protective epithelium.

(c) **Connective Tissue** It is the tissue which connects different tissues or organs and provides support to various structures of animal body. These tissues are mesodermal in origin and consist of living cells and extra cellular matrix, *e.g.,* blood is a fluid or vascular connective tissue.

Q. 19 Using appropriate examples, differentiate between false and true body segmentation.

Ans. **Segmentation** is the serial repetition of similar body parts along with the length of an animal. The body of animals can be truely segmented or pseudo/false segmented.

True segmentation is found in annelids, arthropods and some chordates. In this, there is a linear repetition of body parts and each repeated unit is called somite (metamere).

In earthworms, the successive somites are essentially similar but they are dissimilar in different body regions of a crayfish or insect. Metamerism is conspicuous both externally and internally in annelids.

Pseudosegmentation is seen when body is divided into number of **pseudosegments** which are independent of each other. Each segment is able to perform all the vital function of body. Body grows by the addition of new segments from the anterior end, *e.g.,* tapeworm.

Q. 20 What is special about tissue present in the heart?

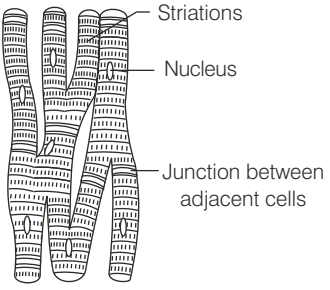
Ans. *Special tissue present in heart is cardiac muscle, these have the following features*

(i) Cardiac muscle fibres are supplied with both central and autonomic nervous system and are not under the control of animal will.

(ii) These muscles are immune to fatigue and show rhythmicity.

(iii) They have rich blood supply.

(iv) They possess the property of contraction even if isolated from the body completely, *i.e.*, they are myogenic

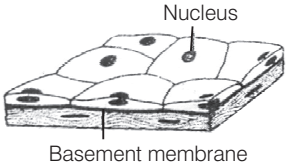


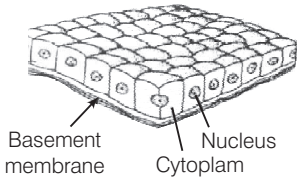
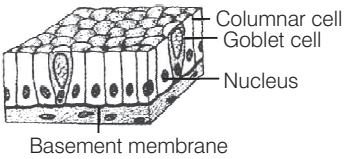
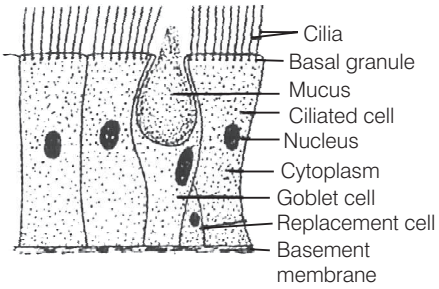
Cardiac muscle fibres

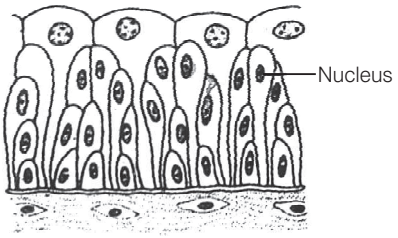
Long Answer Type Questions

Q. 1 Classify and describe epithelial tissue on the basis of structural modifications of cells.

Ans. *The table given below summarises the structure, location and function of the epithelial tissue*

Structure	Location	Functions
Simple squamous epithelium (pavement epithelium) Its composed of single layer of flat cells.  	This epithelium is present in the terminal bronchioles and alveoli of the lungs, walls of Bowman's capsules and descending limb of loop of Henle. In the blood vessels and heart it is called **endothelium**. In coelom, it is called as **mesothelium**.	Protection, excretion gaseous exchange and secretion of coelomic fluid.

Structure	Location	Functions
Simple cuboidal epithelium It is composed of short cube-shaped cells with round nuclei located in centre of the cells. The cells of cuboidal epithelium often form microvilli on their free surface.  	This epithelium is present in the small ducts of salivary glands and pancreas, thyroid vesicles, part of membranous labyrinth, proximal and distal convoluted tubules of the nephrons of kidneys, ovaries, seminiferous tubules and ciliary bodies.	Protection, secretion absorption and excretion.
Simple columnar epithelium In this, the cells are elongated and placed side by side like column. The outer free surface of each cell is slightly broader. This epithelium contains goblet (or mucous) cells.  	It lines the stomach, intestine, gall bladder and bile duct. It also forms the gastric glands, intestinal glands and pancreatic lobules.	Protection,secretion and absorption.
Simple ciliated epithelium This is made of cell bearing numerous delicate hair like outgrowth, arising from basal granules. Mucous secreting goblet cells are also present in them  	These are present in the respiratry tract and Fallopian tubes (oviducts), in certain parts of nephrons in the kidney.	Protection as well as movement of mucus, urine, eggs and cerebrospinal fluid in particular direction. with help of cilia
Compound stratified epithelium It has many layers of epithelial cells, the deepest layer made of cuboidal cells. *It is of four types* (i) Stratified squamous epithelium. (ii) Stratified cuboidal epithelium. (iii) Stratified columnar epithelium. (iv) Stratified ciliated columnar epithelium.	Occurs in the epidermis of skin of land vertebrates. Oral cavity, tongue, pharynx, eye lids and cornea of eyes. Covers the epiglottis, lines the larynx and upper part of palate.	It is found on dry surfaces and are subjected to wear and tear *i.e.*, skin, nails. Protects, underlying structures of body.

Structure	Location	Functions
Compound transitional epithelium It consists of 4 to 6 layers of cells. There is no germinative layer or basement membrane but shows mitosis. The inner most cells rest on under lying connective tissue.  	It lines the larynx and upper part of the soft palate. It is present in renal pelvis, ureters, urinary bladder and part of the urethra.	It forms epidermis of fishes and many urodeles. It permits distention thus, urinary bladder can be stretched considerably without being damaged.

Q. 2 Write down the common features of the connective tissue. On the basis of structure and function. Differentiate between bones and cartilages.

Ans. *Common features of connective tissue are*

(i) Connective tissue is the most abundent and widely distributed tissue of the body. It connect with tissue with organs and also provides support to various body structures in animals.

(ii) Connects tissue is developed from the embroyonic mesoderm.

(iii) Three components are majorly present in the connective tissue matrix, cells and fibres.

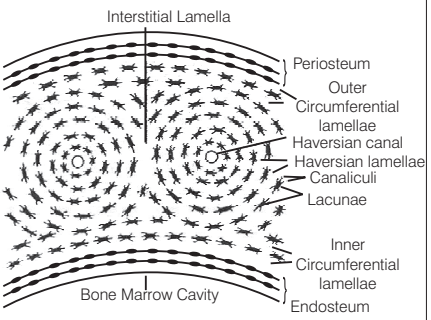
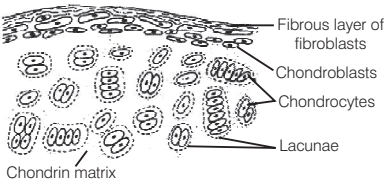
(iv) The extracellular matrix has nearly amorphous ground substance made of glycoproteins with associated monopolysaccharides. This ground substance may be liquid, gel or solid.

(v) The tissue has good amount of regenerative ability.

(vi) Functions of connective tissue include storage of energy, protection of organs and body's structural integrity.

Differences between Bone and Cartilage

	Bone	Cartilage
Type	Bones are either compact or spongy. Bones are classified into long, short, flat, irregular sesamoid and structural bones.	Hyaline cartilage, fibro cartilage and elastic cartilage
Function	Protect the body against the mechanical damage, assist in the movement of the body, provide a framework and shape for the body, store minerals and produce red blood and white blood cells.	Reduces friction at joints, supports the respiratory tract, acting as shock absorbers between weight bearing bones and maintaining the shape and flexibility of fleshy appendages.
Structure	Bones are made up of mostly of osteoblasts (progenitor cells), osteocyte (mature bone cell) and osteoclasts (large cells, that breakdown bone tissue for growth and repair). A bone is highly vascularised.	Cartilages comprise chondroblasts (precursor cells), chondrocytes and dense matrix of collagen and elastic fibres in which the mature chondrocytes are embedded, cartilage is vascular.

	Bone	Cartilage
Location	Bones make up the majority of the axial and appendicular skeleton.	Cartilage is much softer, more pliable component that is mostly found in between joints of bones (articular cartilage).
Fibrous covering	Periosteum is rich in sensory nerve endings.  **TS bone**	Perichondrium (but does not surround articular cartilage).  **TS cartilage**

Q. 3 Comment upon the gametic exchange in earthworm during mating. Discuss the physiology in reproduction of earthworm.

Ans. Mating in earthworm is a unique process, earthworm is a hermaphrodite organism. Breeding in earthworm takes place during rainy season and begins with copulation soon after maturation of the sperms.

The gametic exchange and the physiology reproduction during mating can described as below

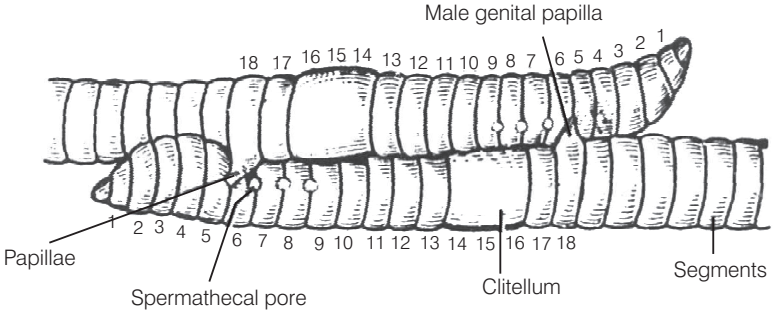
(i) Earthworms are **protandrous animal** (*i.e.,* maturation of sperm takes place much earlier then that of ova).

(ii) Mating process in earthworm occurs through cross-fertilisation.

(iii) The mating process involves exchange of sperms between the two worms.

(iv) Two individuals from adjacent burrows half emerge out and lie in contact with each other, and opposite gonadal opening exchange the packets of sperms called spermatophores.

(v) During the process, the skin encircling male pore, elevates a little to form a temporary papilla that fits like a penis into the opposite spermathecal pore to keep it open.



Anterior parts of two earthworms copulating

(vi) After filling of spermathecal, the copulating worm moves a bit to adjust another pair of spermathecae to face the male pores of the other. This is accomplished in about an hour's copulation.

(vii) Within the spermathecae, the sperms mostly remain in their diverticula and the ampulla is associated with the secretion of nutritive substances for the sperms.

(viii) The sperm and egg are passed into cocoon which is secreted by clitellar gland.

(ix) Fertilisation is therefore external and cross fertilisation.

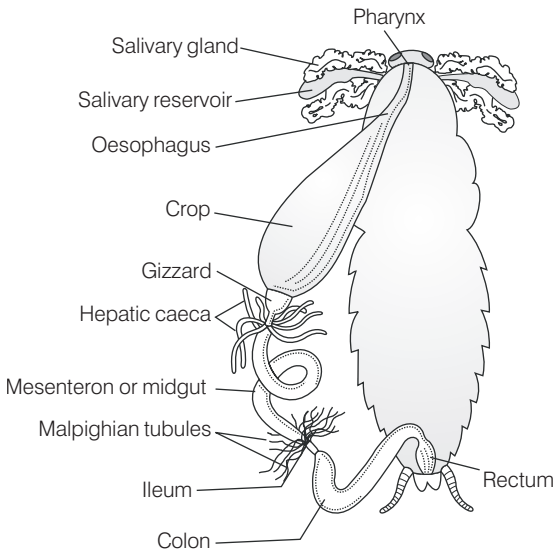
Q. 4 Explain the digestive system of cockroach with the help of a labelled sketch.

Ans. The alimentary canal present in cockroach is divided into three regions that foregut, midgut and hindgut.

(i) Foregut includes mouth cavity, pharynx, oesophagus, crop and gizzard.

(ii) Mouth cavity is a small space, surrounded by mouth parts. Food is crushed and acted upon by the salivary secretion in mouth.

(iii) The mouth opens into a short tubular **pharynx**, leading towards the narrow tubular passage called **oesophagu**s into a sac-like structure called crop which acts as a storage organ.



Alimentary canal of cockroach

(iv) **The crop** is further followed by gizzard (proventriculus). **Gizzard** the structure composed of thick circular muscles and thick inner cuticle forming six highly chitinous plates called as teeth. It associated with the grinding and crushing of food particles. Entire forgut is lined by a thick cuticle.

(v) **Midgut or mesentron** is about one-third middle part of alimentry canal. The internal lining of midgut is an endodermal epithelium of columnal cells raised into several small villi like folds.

(vi) Anterior most part of midgut surrounding the **stomadaeal valve** is called **cardia** and finger like blind processess are called as enteric or **hepatic caeca**, present the junction of foregut and midgut.

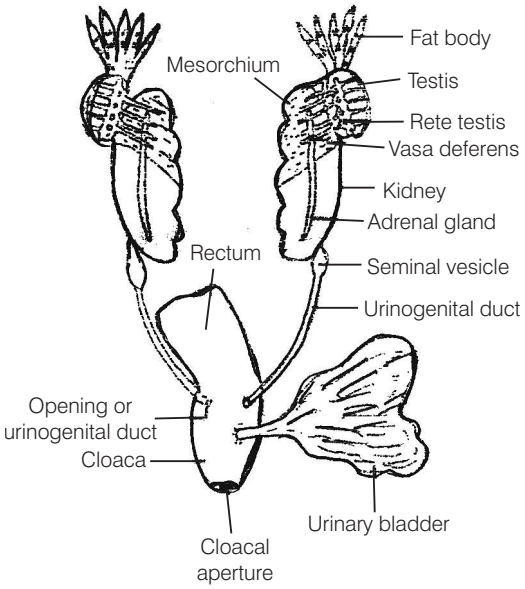
(vii) A ring of yellow filamentous structures formed between the midgut and hindgut are called Malpighian tubules help in the removal of excretory products from haemolymph.

(viii) **Hindgut** is the remaining one-third posterior part of alimentary canal. It is relatively thicker than the midgut is lined by cuticle and ectodermal epithelium.

(ix) Hindgut is differentiated into three parts, *i.e.,* anterior ileum, middle colon and posterior rectum. **Ileum** is short and relatively narrower and its cuticle bears minute spines. **Colon** is the longest, relatively thicker and a coiled part of hindgut. **Rectum** is a small and oval chamber that opens out through **anus**.

Q. 5 Draw a neat and well labelled diagram of male reproductive system of a frog.

Ans. *A well labelled diagram of male reproductive system is shown below*



Male reproductive system of frog