



**ZIAUDDIN UNIVERSITY**  
EXAMINATION BOARD

**RESOURCES FOR**  
**“HSC-I ZOOLOGY**  
**ZUEB EXAMINATIONS 2021**



**PREFACE:**

The ZUEB examination board acknowledges the serious problems encountered by the schools and colleges in smooth execution of the teaching and learning processes due to sudden and prolonged school closures during the covid-19 spread. The board also recognizes the health, psychological and financial issues encountered by students due to the spread of covid-19.

Considering all these problems and issues the ZUEB Board has developed these resources based on the condensed syllabus 2021 to facilitate students in learning the content through quality resource materials.

The schools and students could download these materials from [www.zueb.pk](http://www.zueb.pk) to prepare their students for the high quality and standardized ZUEB examinations 2021.

The materials consist of examination syllabus with specific students learning outcomes per topic, Multiple Choice Questions (MCQs) to assess different thinking levels, Constructed Response Questions (CRQs) with possible answers, Extended Response Questions (ERQs) with possible answers and learning materials.

**ACADEMIC UNIT ZUEB:**



Lined writing area with 30 horizontal lines.

1	Describe salient features of phylum Annelida and classify the phylum with their characteristics and examples.	<p><b>PHYLUM ANNELIDA</b></p> <ul style="list-style-type: none"> <li>▪ The animals of this phylum are called segmented worms, which are considered as the most complex worms. There are about 15,000 species of segmented worms.</li> </ul> <p><b>Metamerical Segmentation or Metamerism:</b> In annelids metamerical segmentation is present which is characterized by external grooves and internal septa. Due to metamerical segmentation body is divided into many small segments which are known as Somites or Metameres. In these animals all the metameres are almost similar, such type of metamerism is known as homonomous metamerism.</p> <ul style="list-style-type: none"> <li>▪ These animals are triploblastic, bilaterally symmetrical, and coelomate with an organ system level of body organization.</li> <li>▪ They locomote by the help of chitinous setae.</li> <li>▪ Excretion takes place by nephridia.</li> <li>▪ Digestive, excretory, nervous and reproductive systems are well developed.</li> <li>▪ They have closed type of blood circulation which includes blood vessels and many pulsatile hearts.</li> <li>▪ They live on land, in moist soil, in fresh water or in sea.</li> <li>▪ Many annelids are active free swimming predators.</li> </ul> <p><b>CLASSES OF ANNELIDA</b></p> <p><b>i. CLASS POLYCHAETA:</b> Polychaetes are usually free living marine animals.</p> <ul style="list-style-type: none"> <li>▪ Each metamere bears a pair of parapodia with setae.</li> <li>▪ Sexes are usually separate.</li> <li>▪ Head is distinct with eyes and tentacles.</li> <li>▪ Clitellum is absent.</li> <li>▪ Development passes through a trochophore larval stage e.g. <i>Neries</i>, <i>Sabella</i>.</li> </ul> <p>▪ <b>CLASS OLIGOCHAETA:</b> These are terrestrial free living animals.</p> <ul style="list-style-type: none"> <li>▪ Parapodia are absent only setae are present.</li> <li>▪ They are hermaphrodite animals.</li> <li>▪ Fertilization is always cross.</li> <li>▪ Head is indistinct.</li> <li>▪ Clitellum is present.</li> </ul>	R	C
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	<ul style="list-style-type: none"> <li>▪ There is no larval stage during development. e.g. Earth worm (<i>Pheretima posthuma</i>).</li> <li>▪ <b>CLASS HIRUDINEA:</b> These are fresh water parasitic animals having suckers on their body.</li> <li>▪ There are ectoparasites.</li> <li>▪ Parapodia and setae are absent.</li> <li>▪ They are hermaphrodite.</li> <li>▪ Head is indistinct. <ul style="list-style-type: none"> <li>▪ Clitellum appears at the time of fertilization. e.g. <i>Hirudinia</i> (leech).</li> </ul> </li> </ul>		
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2	Explain in detail the Factors Effecting The activity of enzymes.	<p>FACTORS AFFECTING ENZYME ACTIVITY Page 21</p> <p>1. CONCENTRATION OF SUBSTRATE: The rate of reaction increases with an increase in the concentration of substrate until the available enzyme becomes saturated with substrate. 2. EFFECT OF TEMPERATURE: All enzymes are heat sensitive i.e. thermolabile. The temperature plays an important role in the activity of an enzyme. At OoC the rate of an enzymatic reaction is zero. As the temperature increases the reaction rate also increases, generally over the range of OoC to 40o C. Most of the enzymes show their maximum activities at 37oC, and they are completely destroyed at 100oC. 3. EFFECT OF pH. Typically an enzyme has an optimum pH, for its maximum activity, a shift to alkaline or acid side of pH, the enzymatic activity is reduced e.g. Pepsin of stomach has an optimum pH of 2. It is inactive in neutral or alkaline solution. 4. CO-ENZYMES, ACTIVATORS AND INHIBITORS: i. CO-ENZYMES: If the prosthetic group is an organic molecule, then it is called co-enzyme e.g. Coenzyme A ( CoA), NAD, FAD etc, without co-enzyme certain enzyme are inactive. ii ACTIVATORS: Certain inorganic substances which increase the activity of an enzyme called activators .e.g. Mg++ _____ Phosphatase Zn++ _____ Carbonic anhydrase iii. INHIBITORS: Those substances which decrease the activity of an enzyme are called inhibitors. There are two types of inhibitors: a) Competitive inhibitors b) Non-competitive inhibitors. a) Competitive Inhibitors: Their molecular structure resemble with the substrate molecule so they complete with substrate to bind with the active site of enzyme. b) Non Competitive Inhibitors: These inhibitors bind with the enzyme molecule other than the active site, this binding site is called allosteric site. After binding, this inhibitor modifies the active site of enzyme, so the</p>	U	B
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		<p>substrate is unable to bind with enzyme and the reaction is stopped.</p> <p>5. EFFECT OF WATER: All enzymes perform their activity in the presence of water e.g. a seed starts its germination when it absorbs water. This water activates the enzymes already present in the seed.</p> <p>6. RADIATIONS: All enzymes are sensitive to the radiations such as UV-rays, <math>\gamma</math>, <math>\beta</math> and X-rays</p>		
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3	<p>Define digestion. Describe the human digestive system.</p>	<p>Digestion is the breakdown of large insoluble food molecules into small water-soluble food molecules so that they can be absorbed into the watery blood plasma.</p> <p><b>HUMAN DIGESTIVE SYSTEM</b></p> <p>In man, the food is digested inside the gastro – intestinal tract (G.I Tract) which is composed of the following parts.</p> <ol style="list-style-type: none"> <li>1. Oral Cavity</li> <li>2. Pharynx</li> <li>3. Oesophagus</li> <li>4. Stomach</li> <li>5. Small Intestine</li> <li>6. Large Intestine</li> </ol> <p><b>1. ORAL CAVITY:</b> It is the first part of G.I Tract which has an external opening which is called Mouth. In this cavity two types of digestion takes place;</p> <p><b>i. Mechanical Digestion:</b> This digestion is performed by the chewing action of teeth .In this process the tongue also plays an important role.</p> <p><b>ii. Chemical Digestion:</b> The chemical digestion is performed by saliva, which is secreted by the salivary glands .There are three types of salivary glands</p> <p>Parotid Salivary Glands: These salivary glands are found at the base of pinnae.</p> <p>Sub – lingual Salivary Glands: These glands are found below the tongue.</p> <p>Sub – Mandibular Salivary Glands: These glands are found at the base of lower jaws.</p> <p><b>2. PHARYNX:</b> It is a small passage which opens into the oesophagus</p> <p><b>3. OESOPHAGUS:</b> It is a narrow tube of about 25cm length which opens into the stomach.</p>	U	B
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**Function:**It transfers the food into the stomach by the peristaltic activity

**4. STOMACH:** It is a sac-like organ which is found in the left side of the abdominal cavity below the diaphragm. It stores food for few hours. The food is digested in stomach by gastric juice which is secreted

by the gastric gland .Each gastric gland contains three types of cells;

**i. Mucous secreting cells:** These cells secrete mucus which lubricates the food and also protects the inner lining of stomach by the self digestion of pepsin.

**ii. Zymogen cells:** These cells secrete pepsinogen which is converted into pepsin, when it is mixed with HCl .The pepsin converts the proteins into peptones.

**iii. Oxyntic Cells:** These cells secrete Hydrochloric acid which performs the following functions:-

- It maintains the pH of stomach in between 1.5 to 2.5
- It kills the germs.
- It softens the food.

**RENIN:**It is an enzyme, which is found in the stomach of infants. This enzyme converts caseinogen (soluble milk protein) into casein (insoluble protein)

#### **5. SMALL INTESTINE:-**

It is about 6 meters long and its diameter is about 2.5 cm. It is composed of following three parts:-

**i. DUODENUM:** It is the first part of small intestine its length is about 30 cm. It receives a common bile duct which brings bile juice from the liver and pancreatic juice from the pancreas.

**BILE JUICE:** There are three main components of bile juice;

**a) Bile Salts:** These are two main functions of Bile Salts.

- They neutralize the acidic food coming from the stomach.
- They convert the fats into small globules , this function is called the emulsification of fats

**b) Bile Pigments:** They are the excretory products which are produced during the decomposition of



haemoglobin. Bilirubin(Yellow) and Biliverdin (green) are main bile pigments.

**c) Cholesterol:** It is also the excretory product.

**PANCREATIC JUICE:** There are following components of pancreatic juice;

**a) Trypsin:**It converts pepsin into polypeptides. This enzyme is secreted in the form of trypsinogen which is converted into trypsin in the presence of **enterokinase** enzyme.

**b) Amylase:** It converts starch and glycogen into maltose

**c) Lipase:** It converts emulsified fats into fatty acids and glycerol.

**d) Chymotrypsin:** It converts casein into short chain amino acids.

**ii. JEJUNUM:** It is the middle part of small intestine which is about 2.4 meters long. The walls of jejunum secrete intestinal juice which is composed of many enzymes.

**iii. ILEUM:** It is the last and the largest part of small intestine which is about 3.6 meters long. It receives the completely digested food in the form of chyle. The inner wall of ileum contains many finger-like projections which are known as **Villi**.

**Function of ileum:** By the help of villi the food is absorbed in the body. Carbohydrates and amino acids are absorbed in the blood capillaries, while fatty acids and glycerol are absorbed in the lacteals of villi.

**6. LARGE INTESTINE:** It is about 6.5 cm wide. It is divided into a short caecum, a long colon and a terminal rectum.

**Page 117**

**i.CAECUM:** It is the last first part of large intestine which gives off a blind tube of about 18 cm long, which is known as vermiform appendix which is a vestigeal organ in human body. It is very important in herbivores because it contains cellulose digesting bacteria.

**ii.COLON:** It is the largest part of large intestine which consists of three parts i.e. ascending colon, transverse colon and descending colon.

		<p><b>Function:</b> Absorption of water, salts and vitamins</p> <p><b>iii.RECTUM:</b> It is the last part of large intestine which receives undigestible food which is released from the body through the anus in the form of faeces</p>		
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4	Describe the features of phylum Arthropoda. Classify the phylum with the characteristics and examples of their classes.	<p><b>PHYLUM</b></p> <p><b>ARTHROPODA</b></p> <ul style="list-style-type: none"> <li>▪ <b>Introduction:</b> Arthropoda is the largest phylum of animal kingdom and includes about one million species.</li> <li>▪ <b>Occurrence:</b> They are found everywhere on the earth where the life is possible, even in the oil wells.</li> <li>▪ <b>Symmetry:</b> Arthropods are bilaterally symmetrical, triploblastic and metamerically segmented animals.</li> <li>▪ <b>Parts of Body:</b> The bodies of the most Arthropods are divided into a head, thorax and an abdomen.</li> <li>▪ <b>Coelom:</b> Coelomic space in arthropoda is called haemocoel because it is occupied by blood sinuses of the open circulatory system.</li> <li>▪ <b>Respiration:</b> Respiration takes place through gills in aquatic forms, by trachea in insects and by book-lungs in scorpions.</li> <li>▪ <b>Excretion:</b> Excretory organs are mostly malpighian tubules.</li> <li>▪ <b>Eyes:</b> Compound eyes with mosaic vision are also a factor of advantage in arthropods.</li> <li>▪ <b>Reproduction:</b> Sexes are usually separate and metamorphosis is of common occurrence.</li> </ul> <p><b>CLASSIFICATION OF ARTHROPODA</b></p> <p><b>1) CLASS MEROSTOMATA (MOUTH PLATES):</b></p> <ul style="list-style-type: none"> <li>➤ It is a small group of marine arthropods in which mouth is surrounded by many small plates.</li> </ul> <p><b>Example:</b> <i>Limulus</i> (King crab).</p>	A	A
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**2) CLASS ARACHNIDA (SPIDER LIKE):**

- These are terrestrial arthropods.
- They have four pairs of walking legs.
- They respire by the help of book lung, tracheae or general body surface.

**Examples:** Scorpions and Spiders.

**3) CLASS CRUSTACEA (WITH CARAPACE):**

- They are marine, fresh water and even terrestrial animals.
- They have two pairs of antennae, a pair of mandibles and two pairs of maxilla around the mouth.
- In many cases e.g. Prawn and Crab, head and thorax become fused to form cephalothorax which is covered by a single plate of skeleton called carapace.

**Examples:** Prawns, crabs, shrimps and lobsters.

**4) CLASS MYRIAPODA:**

- These are terrestrial arthropods leading a hidden life in the soil.
- Their body consists of head and a very long trunk.
- The trunk is provided with paired lateral appendages.

**Example:**

Centipedes and Millipede.

**5) CLASS INSECTA OR HEXAPODA:**

- This is the largest class of the animal kingdom.
- There is a separate branch of biology for the study of these animals which is called Entomology
- Their body is divided into head, thorax and abdomen.
- They are found in all types of habitats.
- There are two types of Insects.

**i) Pterygota:** These insects have wings.

**ii) Apterygota:** These insects are without wings.

- These animals have specialized mouth parts to suit their mode of feeding. They may be biting and chewing type (cockroach), piercing and sucking type (Mosquito), chewing and lapping type (Honey bees), sponging type (House fly), siphoning type (Butter fly)

		➤ Some insects e.g. Few ants , termites and honey bees live in large colonies with a marked labour of division and are called social insects.		
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5	Write about the Phylum Platyhelminthes in detail. Their general characteristics and classes with examples	<p><b>PHYLUM PLATYHELMINTHES</b> They have flat leaf-like or ribbon shaped body. About 15000 species are included in this phylum. ☐ Excretion takes place by flame cells. ☐ They are mostly hermaphrodite. ☐ They are mostly external or internal parasites. ☐ Flat worms are monogenic or digenic parasites. ☐ They are acoelomate and triploblastic animals. ☐ Their body is bilaterally symmetrical. ☐ They have a mouth which opens into a gut but anus is absent. Examples: Planaria (Dugesia sp.) Liver-like (Fasciola hepatica) Tape worm (Taenia saginata)</p> <p><b>CLASSES OF PLATYHELMINTHES</b></p> <p>1. Class Turbellaria: ☐ These are free living animals. ☐ Mouth is present in the centre of the body. ☐ They mostly reproduce by sexual method. While asexual reproduction takes place by regeneration. ☐ Some times cilia are present on the body, which help in locomotion. ☐ Example : Dugesia (Planaria)</p> <p>2. Class Trematoda: ☐ Most of the members of this class are parasites. ☐ They are digenic parasites and complete their life cycle in two hosts i.e. vertebrates. ☐ Their body is covered with cuticle. ☐ They have suckers to absorb nutrients from the host. ☐ They are bisexual animals and fertilization is internal. ☐ Example: Fasciola hepatica (sheep liver fluke).</p> <p>3. Class Cestoda: ☐ These animals lack mouth and alimentary canal. ☐ They have a ribbon like, segmented body. ☐ The head is called scolex, which has hooks and suckers by which they anchor their body with the of alimentary canal of vertebrates. ☐ The body is covered by cuticle. ☐ The food is absorbed by the entire body surface. ☐ Example:- Taenia saginata (Tape worm)</p>	R	B
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6	Describe the structure of the human heart and draw a labelled diagram of human heart.	<p><b>HUMAN HEART</b></p> <p><b>LOCATION:-</b> The heart is a hollow muscular organ present in the thoracic part of the body between the two lungs.</p> <p><b>PROTECTION:-</b> It is enclosed in a double-layered membrane, called pericardium, its outer layer is the parietal layer and inner is called, visceral layer. Between the two layers is a space which is filled with a</p>	A	A
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fluid, called pericardial fluid which protects the heart from shocks and jerks.

## **STRUCTURE OF HEART**

**CHAMBERS OF HEART:-** The human heart consists of four chambers:

(i) Right atrium (auricle) (ii) Left atrium (auricle)  
(iii) Right ventricle (iv) Left ventricle.

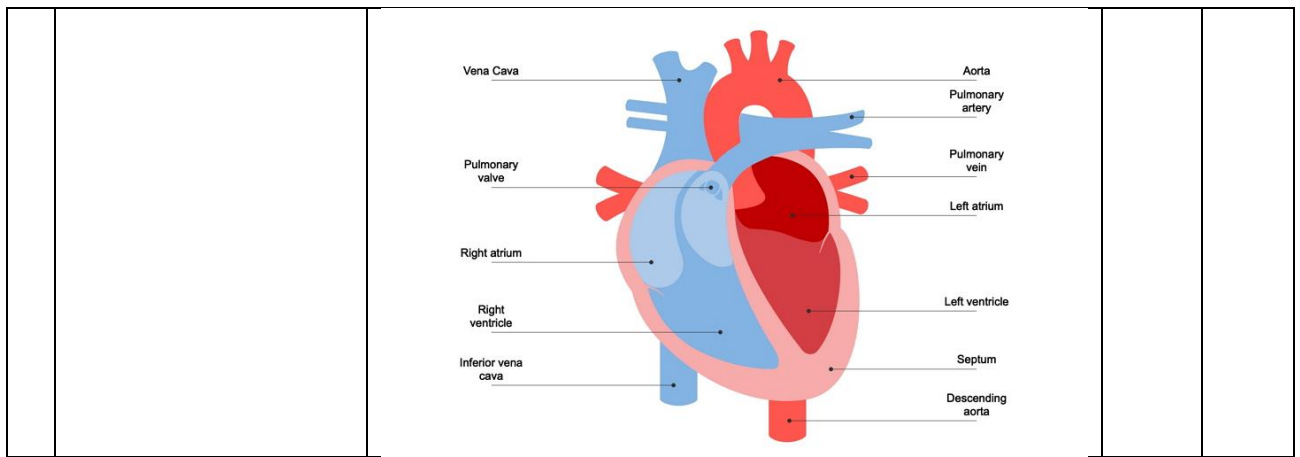
**ATRIA:-**The two atria (auricle) form the anterior part of the heart. The two atria are separated from each other by a septum, called **inter-atrial-septum**. In the right atrium there are openings by which one precaval and one postcaval open separately and bring deoxygenated blood from all parts of the body. In the left atrium two pulmonary veins open by separate apertures and bring oxygenated blood from the lungs. In this way in the right atrium deoxygenated and in the left atrium oxygenated blood is collected.

**VENTRICLES:-**The two ventricles form the posterior part of the heart. They are also separated from each other by a septum, called **inter-ventricular-septum**. The right atrium opens into the right ventricle by an aperture, called right auriculo-ventricular aperture. This aperture is guarded by a **tricuspid valve**, which allows the blood to flow from right atrium into right ventricle but not in backward direction. The left atrium also opens into left ventricle by an aperture, called left auriculo-ventricular aperture. It is guarded by a **bicuspid or mitral valve**, which allows the flow of blood from left atrium into left ventricle, but not in backward direction.

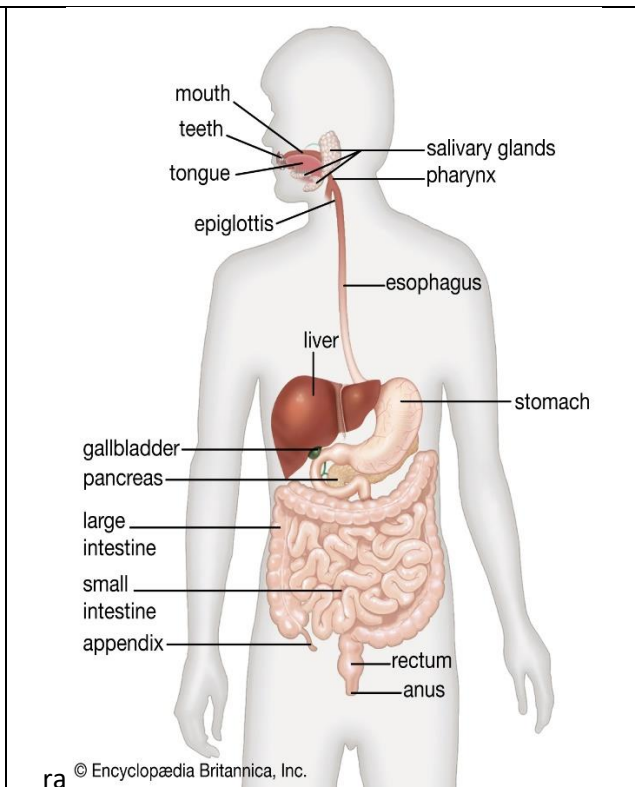
### **PAPILLARY MUSCLES AND CHORDAE TENDINAE:-**

Internally the walls of ventricles are raised into conical, processes called **papillary muscles**. The tricuspid and bicuspid valves are attached to the papillary muscles by fine threads, known as **chordae tendinae**. These threads control the movement of auriculo-ventricular valves i.e. bicuspid and tricuspid valves.

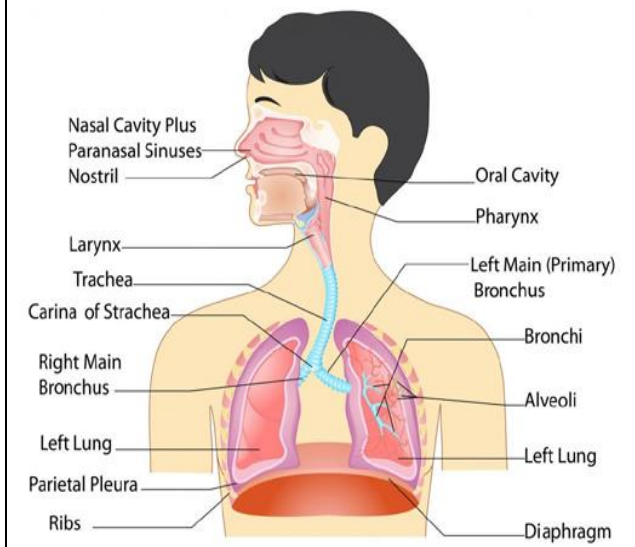
**SEMILUNAR VALVES:-**From the right ventricle **pulmonary artery** arises. The opening of pulmonary artery is guarded by **semilunar valves**, which allow the flow of blood from the ventricle into the pulmonary artery and not in the opposite direction. From the left ventricle the **aortic arch** or **systemic arch** arises, and its opening into the ventricle is also guarded by **semilunar valves** which allow the flow of blood into the aortic arch and not in backward direction



- 7 a) Draw a labelled diagram of human digestive system.  
 b) Draw a labelled diagram of respiratory system of man.



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8	Explain the Cardiac cycle.	<p><b>CARDIAC CYCLE (WORKING OF HEART)</b> The heart works in a systematic way. Its muscles are myogenic i.e. its muscles contract themselves without any external force. The process of working of heart which takes place during the completion of one heartbeat is called cardiac cycle.</p> <p><b>SYSTOLE AND DIASTOLE:-</b>The period during which chambers of heart contract is called systole and period during which its chambers show resting or expansion is known as diastole. This diastole and systole process helps in the working of heart.</p> <p>When right atrium shows diastole, it receives deoxygenated blood from different parts of the body through vena cava. Similarly during diastole the left atrium receives oxygenated blood from the lungs. When the atria are full of blood, they contract at the same time, this is called atrial systole. Due to this process the bloods are transferred into ventricles. The right ventricle receives deoxygenated blood and left ventricle receives oxygenated blood. When the ventricles are filled with blood, they also contract at the same time, it is called ventricular systole. At this time auriculo-ventricular valves are closed and pulmonary valves and aortic valves are opened.</p> <p>From the right ventricle the blood enters the pulmonary artery which carries this deoxygenated blood to the lungs, where it becomes oxygenated. From left ventricle the blood flows into systemic arch which supplies oxygenated blood to different parts of the body.</p>	A,U	A
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9	What is adaptive immune system? Explain it in complete detail.	<p><b>ADAPTIVE IMMUNE SYSTEM:</b> (Specific immune system) It is the specific immune response against specific microorganisms which is developed in the body specifically against many organisms, tumor cells, transplanted tissues and toxins. It is considered as third line of defence and works with the second line defense system. It is also called specific immune response system. In adaptive immune system special types of lymphocytes play an important role called B-cells and T-cells. These cells are produced in bone marrow or thymus. An organism or foreign particle, which enters the body and disturbs immune system, is called antigen. In the presence of antigen quick response takes place, the lymphocytes produce a specific soluble protein, called antibody. The antibody combines with antigen and helps to remove it from the body. The body is able to produce numerous antibodies against the antigens or foreign particles.</p>	U	B
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		<p>In adaptive immune system two types of immunity is developed. (i) Humoral immunity (ii) Cell mediated immunity (CMI) (i) HUMMORAL IMMUNITY: When B-cells produce antibodies in the circulatory system and these antibodies develop immunity, it is called humoral immunity. This immunity is effective against bacteria. The humoral immunity depends on the appearance of antibodies in the blood. Each B-cell contains a specific antibody on its outer surface, it is the antigenic receptor. This antibody combines with that particular antigen to form antigen-antibody complex binding. This complex binding causes B-cells to divide rapidly to give rise enlarged effector cells called plasma cells which secrete antibodies into the circulation to kill the antigen. Some of the effector cells do not secrete antibodies and they become memory cells, which play an important role in future when the same pathogen invades into the body. Page 151</p> <p>(ii) CELL MEDIATED IMMUNITY (CMI) This immunity is developed by T-cells, another type of lymphocytes. The T-cells do not secrete antibodies, but they kill infected cells. This immunity is effective against virus and parasites that hide in the cells of host body. This immunity involves the production of effector cells, called Lymphoblasts. There are different types of T-cells (i) Helper T-cells (TH), (ii) Cytotoxic T-cells (Tc). On the plasma membrane of helper T-cells and cytotoxic T-cells antigen receptors are present, called Tcells receptors (TCRs).</p> <p>1. Helper T-cell: The helper T-cell receptor can recognize the combination of an antigen fragment with one of the body's own self marker, called major Histo-compatibility complex (MHC) Class II molecules on the surface of B-cells or macrophage. 2. Cytotoxic T-cells: The receptors on the cytotoxic T-cells recognize the combination of antigen fragment and self surface maker molecules, called MHC Class I, present on every nucleated cells of its own body. 3. Suppressor T-cells: These cells help to stop the immune response in both B-cells and cytotoxic Tcells, when infection is over. 4. Memory T-cells: During the CMI response some T-cells are converted into memory T-cells. These cells help in quick response when there is another attack of some infectious organism</p>		
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10	Write notes on transport in a) Hydra b) Planaria and explain the double circuit plan.	In some lower animals -there is no proper circulatory system, like Hydra and Planaria. (i) Transportation in Hydra: Hydra is a diploblastic animal, consists of two layers in the body,	U	B
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		<p>ectoderm (outer layer) and endoderm (inner layer). Oxygen enters into its body through body surface by diffusion, and it is distributed to all parts. Food is digested in the body cavity, which is also transported throughout the body by diffusion.</p> <p>(ii) Transportation in Planaria: Planaria is triploblastic and the cells of its body are close to the environment. The transportation of O<sub>2</sub> and food takes place by diffusion. Oxygen is directly absorbed through the body surface and it is supplied through out the body by diffusion. In its body the food enters from outside. It is digested by the action of enzymes and then transported to different parts of the body by diffusion. The transportation of food occurs by the help of branches of intestine (diverticula).</p> <p>DOUBLE CIRCUIT PLAN: In amphibians, reptiles, birds and mammals double circuit plan is present, because heart receives oxygenated blood from lungs and it is supplied to different parts of the body, it is called systemic system. From the body deoxygenated blood is carried back to the heart, which pumps into the lungs for oxygenation, it is called pulmonary system. This circuit plan is called double circuit plan. There are two types of double circuit circulation. (a) Incomplete double circulation: In amphibians and reptiles the heart consists of two atria and one ventricle i.e. three-chambered heart. The left atrium receives oxygenated blood from the lungs and right atrium receives deoxygenated blood from different parts of the body. Thus oxygenated and deoxygenated bloods remain separate in two atria. These two atria open into ventricle, in which both bloods are mixed together to some extent, this circulation is called incomplete double circulation. In crocodile the heart is four- chambered two atria and two ventricles.</p> <p>(b) Complete double circulation: In birds and mammals the heart consists of two atria and two ventricles. Left atrium of heart receives oxygenated blood from lungs, it is transferred into left ventricle, from where it is supplied to different parts of the body. Right atrium receives deoxygenated blood from the body. It is transferred into right ventricle, from where it is carried to the lungs. Due to the presence of two atria and two ventricles, oxygenated and deoxygenated bloods remain quite separate from each other. It is called complete double circulation.</p>		
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