

## **MAN IN HEALTH AND DISEASES**

### **TOPICS COVERED: DIGESTION, HOMOEOSTASIS AND IMMUNITY**

#### ***QUESTIONS WITH ANSWERS - 1 MARK***

##### **1. What is digestion?**

It is the enzymatic and biochemical transformation of complex food molecules into simple absorbable forms.

##### **2. Name the type of muscle present in the tongue.**

Skeletal muscle

##### **3. What is uvula?**

The soft palate ends in a muscular projection called uvula.

##### **4. Which teeth are known as wisdom teeth?**

Last molars

##### **5. Give the location of cardiac sphincter.**

Between oesophagus and stomach

##### **6. Which cell of gastric gland secretes proteases?**

Chief cell

##### **7. Name the first part of small intestine.**

Duodenum

##### **8. Which part of alimentary canal stores the food temporarily?**

Stomach

##### **9. Name the substance that gives rise to bile salts.**

Cholesterol

##### **10. Define emulsification.**

The process of breaking the fats into small oil droplets by bile salts is called emulsification.

##### **11. What is peristalsis?**

The series of contraction and relaxation of smooth muscles in the lining of oesophagus is called as peristalsis.

**12. Name the substrate on which rennin acts.**

Casein

**13. What is bolus?**

The round mass of partially digested food in the buccal cavity.

**14. Give the other name of pancreatic lipase.**

Steapsin

**15. Name the exopeptidase present in pancreatic juice.**

Carboxypeptidase

**16. What is heterodont condition?**

Presence of four different types (heterodont) namely incisors (cutting), canines (tearing), premolars(grinding) and molars(grinding) in the buccal cavity.

**17. Name the substance of gastric juice which kills bacteria.**

Lysozyme

**18. What is deglutition?**

The phenomenon of swallowing bolus is known as deglutition.

**19. Name the non digestive enzyme present in saliva.**

Lysozyme

**20. What is succus entericus?**

The combined secretion of intestinal glands constitute the intestinal juice or succus entericus.

### ***QUESTIONS WITH ANSWERS – 2 MARKS***

**1. Mention any four proteolytic enzymes secreted in digestive juice.**

Pepsin, Rennin, Trypsin, Chymotrypsin and Carboxypeptidase

**2. List any four causes of peptic ulcers.**

Peptic ulcers are caused due to over secretion of pepsin, stress, frequent intake of drugs, tea, coffee, spicy food, tobacco, infection by Helicobacter pylori etc.

**3. How does digestion of fats occur in small intestine?**

Bile salts combine with fats and break them into small oil droplets by a process called emulsification. These droplets offer greater surface area for the action of

pancreatic lipase which converts them into fatty acids, glycerol and monoglycerides.

Emulsified fat  $\frac{\text{pancreaticlipase}}{7.1-8.2} \rightarrow$  Fatty acids, Glycerol, Monoglycerides

**4. Mention the four parts of stomach.**

Cardiac, Fundus, Body and Pylorus.

**5. List the functions of HCl.**

The gastric juice contains HCl which changes the medium into acidic, loosens the fibrous contents of food, inactivates ptyalin, kills bacteria and activates pepsinogen into pepsin.

**6. Give the composition of bile.**

It is an alkaline, olive green coloured liquid with a pH of 7.6 -8.6. Apart from water, bile contains bile pigments – bilirubin and biliverdin, bile salts –  $\text{Na}^+$  and  $\text{K}^+$  glycocholate and taurocholate, cholesterol and lecithin. Bile does not contain any digestive enzymes.

**7. What is hepatitis? Mention its types.**

It is the inflammation of liver where the hepatocytes are either damaged or destroyed. It is due to the viral infections by the strains of Hepatitis A, B, C, D and E virus, known as Viral hepatitis. Toxic effects of drugs like aspirin, paracetamol, mushroom poisoning leads to Toxic hepatitis. Heavy consumption of alcohol over a long period of time leads to Alcoholic hepatitis.

**8. State the role of exopeptidases in digestion.**

Carboxypeptidases hydrolyses terminally situated peptide bond and releases tripeptides, dipeptides and amino acids.

Polypeptides  $\frac{\text{carboxypeptidase}}{7.1-8.2} \rightarrow$  Tripeptides, dipeptides, amino acids.

**9. Mention the non digestive enzyme present in intestinal juice. What is its significance?**

Enterokinase. It activates the inactive trypsinogen into active trypsin.

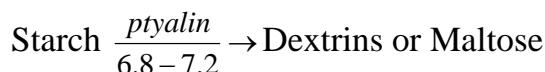
## **10. Name the bile salts.**

Na<sup>+</sup> and K<sup>+</sup> glycocholate and taurocholate

### **QUESTIONS WITH ANSWERS – 5 MARKS**

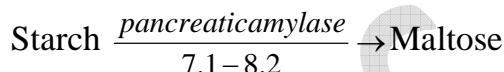
#### **1. Describe the digestion of carbohydrates in human body.**

In the buccal cavity, salivary amylase or ptyalin converts insoluble starch into dextrins or maltose.

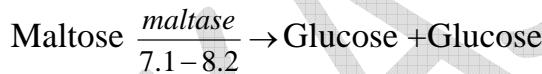


The carbohydrate digestion restarts in the small intestine.

Pancreatic amylases (amylopsin) act on polysaccharides like starch and glycogen and convert them into disaccharides like maltose.



Disaccharidases hydrolyse disaccharides into monosaccharides.



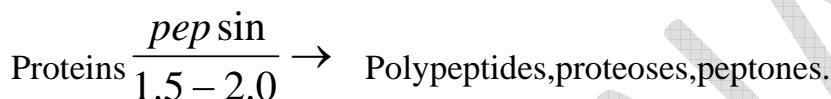
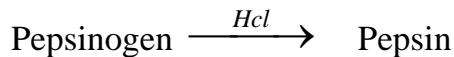
Thus the simple sugars which are formed will be absorbed by the villi of the small intestine

#### **2. Describe the process of digestion in stomach.**

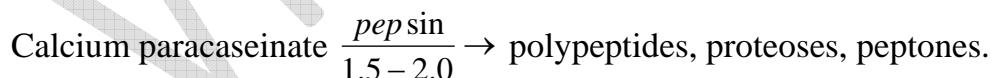
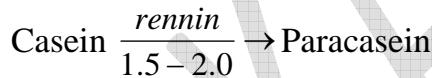
The bolus enters the stomach through oesophagus. The entry of food into the stomach stimulates the gastric mucosa to secrete gastrin which influences the gastric glands to produce gastric juice. The gastric juice contains HCl which

changes the medium into acidic, loosens the fibrous contents of food, inactivates ptyalin, kills bacteria and activates pepsinogen into pepsin.

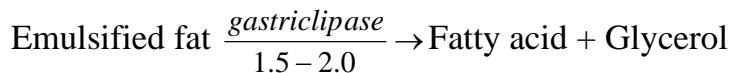
**Digestion of proteins :** Pepsin and rennin are the proteases present in the gastric juice. Pepsin is an endopeptidase which acts on internally situated peptide bond of proteins and converts it into short fragments of proteins (polypeptide chains).



Rennin or chymosin is a milk curdling enzyme which acts on casein converting it into paracasein. In the presence of calcium of milk, paracasein is converted into calcium paracaseinate which settles down as curds. This is further hydrolysed by pepsin into polypeptides or proteoses.



Gastric lipase is a weak lipid digesting enzyme whose activity is inhibited by acidic pH in the stomach. It can act on finely emulsified fat converting them into fatty acid and glycerol.



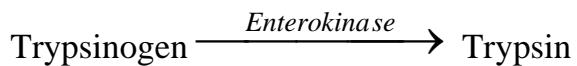
Carbohydrates and fats remain unchanged. As digestion proceeds in the stomach, the food becomes liquefied. Such a liquefied, acidic, pulpy food present in the stomach is called chyme.

### 3. Explain the digestion of proteins in small intestine.

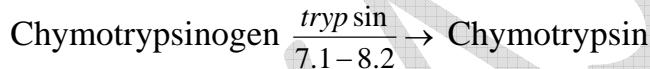
Proteins are digested by pancreatic and intestinal proteases.

#### Action of pancreatic proteases :

- Trypsin secreted as trypsinogen gets activated by enterokinase of intestinal juice. Trypsin acts on proteins and converts them into proteoses, peptones and polypeptides.



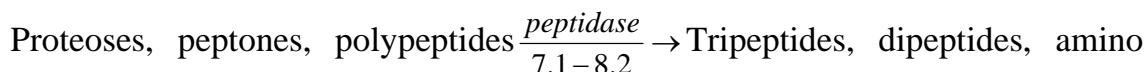
- Chymotrypsinogen gets activated into chymotrypsin by the action of trypsin. It hydrolyses proteins into their fragments.



- Carboxypeptidases hydrolyses terminally situated peptide bond and releases tripeptides, dipeptides and amino acids.



#### Action of intestinal proteases : They act on fragments of proteins.



acids.

Tripeptides  $\xrightarrow[7.1-8.2]{tripeptidase}$  Dipeptides, amino acids

Dipeptides  $\xrightarrow[7.1-8.2]{dipeptidase}$  Amino acids

The free amino acids will be absorbed by the villi of the small intestine.

**4. List any five digestive enzymes with their action on food.**

Salivary amylase or ptyalin converts insoluble starch into dextrins or maltose.

Starch  $\xrightarrow[6.8-7.2]{ptyalin}$  Dextrins or Maltose

Pepsin is an endopeptidase which acts on internally situated peptide bond of proteins and converts it into short fragments of proteins (polypeptide chains).

Proteins  $\xrightarrow[1.5-2.0]{pepsin}$  Polypeptides, proteoses, peptones.

Trypsin secreted as trypsinogen gets activated by enterokinase of intestinal juice. Trypsin acts on proteins and converts them into proteoses, peptones and polypeptides.

Trypsinogen  $\xrightarrow{\text{Enterokinase}}$  Trypsin

Proteins  $\xrightarrow[7.1-8.2]{trypsin}$  Proteoses, peptones, polypeptides.

Chymotrypsinogen gets activated into chymotrypsin by the action of trypsin . It hydrolyses proteins into their fragments.

Chymotrypsinogen  $\xrightarrow[7.1-8.2]{trypsin}$  Chymotrypsin

Proteins  $\xrightarrow[7.1-8.2]{chymotrypsin}$  Proteoses, peptones, polypeptides

Carboxypeptidases hydrolyses terminally situated peptide bond and releases tripeptides, dipeptides and amino acids.

Polypeptides  $\xrightarrow[7.1-8.2]{\text{carboxypeptidase}}$  Tripeptides, dipeptides, amino acids

**5. Draw a neat diagram of alimentary canal and label any six parts.**

Diagram 2 marks , 6 correct labellings – ½ mark each.

**6. What is digestion? Describe the digestion of fats in small intestine.**

It is the enzymatic and biochemical transformation of complex food molecules into simple absorbable forms.

The fat digesting enzyme is pancreatic lipase or steapsin. The digestion requires the assistance of bile salts. Bile salts combine with fats and break them into small oil droplets by a process called emulsification. These droplets offer greater surface area for the action of pancreatic lipase which converts them into fatty acids, glycerol and monoglycerides.

Emulsified fat  $\xrightarrow[7.1-8.2]{\text{pancreaticlipase}}$  Fattyacids, Glycerol,Monoglycerides

The bile salts combine with the products of fat digestion to produce water soluble complexes called micelles which are absorbed by the villi of the small intestine which enter the lymph vessels.

The milky alkaline fluid of the intestine absorbed into the lacteal of a villus is called chyle.

**7. What is jaundice? Explain any two types of jaundice.**

It is also called icterus. It is a disorder in which the skin, mucus membrane and sclera of eyes become yellowish in colour. It is caused due to the presence of large quantities of bilirubin in the extra cellular fluids exceeding 2mg/dL.

**Symptoms:** Yellow colouration of body tissues particularly skin and sclera, burning sensation in the eyes, ears and head, headache, low back pain, sleeplessness.

**Types :**

- a. **Obstructive or Extrahepatic Jaundice :** It is caused due to the blockage of bile passage which may be because of gall stones, cancer of pancreas, presence of worms etc. Due to the blockage, bilirubin instead of passing into the duodenum passes into the blood and lymph causing jaundice.
- b. **Hepatic or Haemolytic Jaundice :** It is caused by the rapid release of bilirubin in blood due to excessive destruction of RBCs. It generally occurs in viral infections, haemolytic anaemia and malaria.
- c. **Viral or Infective Jaundice :** It is caused by Hepatitis A and B virus due to which liver cells gets damaged leading to partial obstruction to the flow of bile.

## HOMEOSTASIS

### QUESTIONS WITH ANSWERS – 1 MARK

**1. What is homeostasis?**

It is defined as the maintenance of a constant internal environment within tolerable limits in relation to changing external environment.

**2. What is the normal range of blood glucose level in man?**

80 to 100 mg/dL

**3. Define glycogenesis.**

Conversion of glucose into glycogen.

**4. What is glycogenolysis?**

Conversion of glycogen into glucose.

**5. Name the cell of pancreas which secretes glucagon.**

Alpha cell

**6. Name the condition that stimulates the release of glucagon.**

Hypoglycemia

**7. What is polyuria?**

Excessive loss of water through urine

**8. What is glycosuria?**

Presence of glucose in urine.

**9. Which type of diabetes must be treated with regular insulin supply?**

Type I

**10. Which organ acts as glucostat?**

Liver

### QUESTIONS WITH ANSWERS – 2 MARKS

**1. State two functions of glucagon.**

Glucagon promotes gluconeogenesis – synthesis of glucose from lactic acid, amino acids and fatty acids. It also stimulates lipolysis – breakdown of stored fats into fatty acids and glycerol.

**2. List any four symptoms of diabetes mellitus.**

Blood carries glucose to kidneys which excrete it with urine- glycosuria which leads to excessive loss of water through urine – polyuria, excessive thirst – polydipsia, over eating – polyphagia. Excess of urea in blood due to oxidation of proteins – Uremia and oxidation of fats which release ketone bodies in blood – Ketonuria.

### **3. What is the role of insulin in glucose homeostasis?**

Insulin is secreted by beta cells and stimulates the liver, skeletal muscles and adipocytes to absorb glucose from blood resulting in lowering the blood glucose level. It inhibits glycogenolysis and thus acts as a **hypoglycemic** factor. Mention any four factors to be kept constant in the body.

### **4. Name any four long term complications seen in diabetes.**

Diabetes leads to problems like retinopathy, gangrene of limbs, neuropathy, diabetic coma, nephropathy etc.

### **5. Name any two endocrine cells of pancreas with their secretions.**

Alpha cell – glucagon and Beta cell – insulin.

## **QUESTIONS WITH ANSWERS – 5 MARKS**

### **1. Describe the role of liver and pancreas in maintaining blood glucose level.**

**Action of Liver :** Liver acts as a **glucostat** by absorbing glucose from the small intestine after digestion and stores it in the form of insoluble glycogen in its hepatic cells, a process known as **Glycogenesis**. When the blood glucose level decreases the stored glycogen is converted back into glucose and released to the blood stream known as **Glycogenolysis**. The hepatic cells can convert non-carbohydrates such as amino acids and glycerol into glucose **Gluconeogenesis**. Liver can also convert glucose into lipids and store it – a process known as **Lipogenesis**.

**Action of Pancreas :** The Islets of Langerhans secretes hormones like insulin and glucagon. Insulin is secreted by beta cells and stimulates the liver, skeletal muscles and adipocytes to absorb glucose from blood resulting in lowering the blood glucose level. It inhibits glycogenolysis and thus acts as a **hypoglycemic** factor. Insulin stimulates body cells to absorb amino acids from blood and synthesize proteins. In short, insulin is secreted when glucose is abundantly

available in blood. Its activity helps in decreasing blood glucose levels and thus favours the storage of absorbed nutrients. Hence it is a hormone of energy storage or hormone of abundance.

Glucagon is secreted by alpha cells which promotes glycogenolysis and releases glucose into blood by the liver cells, hence it acts as a **hyperglycemic** factor. Glucagon promotes gluconeogenesis – synthesis of glucose from lactic acid, amino acids and fatty acids. It also stimulates lipolysis – breakdown of stored fats into fatty acids and glycerol. In short, glucagon is secreted when less glucose is available and thus favours a breakdown of stored nutrients. Hence it is a hormone of energy release.

## **2. Explain any five factors to be kept constant in the body to maintain homeostasis.**

1. **Acid base balance :** It is the regulation of H<sup>+</sup> ions in the body fluids. Any change in the pH value can cause alterations in the rate of chemical reactions. This can be maintained by buffering systems within the body.
2. **Ionic balance :** It is the regulation of ions like H, Na, Cl, K, Mg, HCO<sub>3</sub> which is regulated by the kidneys. If the concentration of ions is more it is excreted and if it is less it will be conserved.
3. **CO<sub>2</sub> :** If more CO<sub>2</sub> accumulates in the tissue fluids it would inhibit the respiratory process. To avoid this, the rate of expiration increases which removes CO<sub>2</sub> from the blood and extra cellular fluid.
4. **O<sub>2</sub> :** It is one of the major substances required for chemical reactions in the cell which can be maintained by continuous supply of blood to the cells which acquire O<sub>2</sub> from lungs.
5. **Temperature :** When there is a rise in temperature the sweat glands produce more sweat which when evaporated cools the skin. If there is fall in temperature, the skeletal muscles contracts resulting in shivering which generates a lot of heat and increase the temperature.
6. **Nutrients :** The digestive system provides nutrients like glucose, fatty acids, amino acids to the extra cellular fluid required by the cells. Liver and pancreas regulate the concentration of glucose in ECF.
7. **Wastes :** The end products of cellular metabolism, excess of ions, water is removed by the kidneys.

**8. Hormones :** They are transported in the ECF to all parts of the body to regulate cellular functions.



## **BODY DEFENCE AND IMMUNITY**

### **QUESTIONS WITH ANSWERS – 1 MARK**

#### **1. What is phagocytosis?**

The process by which pathogens entering the connective tissues are engulfed and destroyed by phagocytes is called phagocytosis.

#### **2. Name the phagocytes involved in cellular defence.**

Macrophage

#### **3. What is Natural Killer Cell ?**

They are a group of non-phagocytic large lymphocytes that can recognize and kill cancer cells, virus infected body cells before the activation of immune system.

#### **4. What are interferons?**

They are proteins released by virus infected cells that protect other healthy tissue from getting infected i.e., they are antiviral proteins.

#### **5. What is an epitope?**

The region of the antigen that reacts with the antibody is called antigenic determinant or Epitope.

#### **6. What is paratope?**

The region of antibody that reacts with the antigen is called antigen binding site or Paratope.

#### **7. Mention the gland where T lymphocytes mature.**

Thymus

#### **8. To which group of proteins do antibodies belong.**

Globular proteins

#### **9. Name the leucocytes involved in the third line of defence.**

Lymphocytes

#### **10. Name the most abundant type of antibody.**

IgG

#### **11. What is the role of serum globulin in immunity?**

Serum containing antibodies is used for snake bites, botulism, tetanus etc. It is essential to inject the serum because fatal diseases would kill a person before active immunity could be established.

**12. Name the type of immunoglobulin transferred from mother to foetus.**

IgG

**13. What is inflammation?**

It is a non-specific defensive response of the body to tissue injury caused due to physical trauma, intense heat, chemicals, insect bites, infections etc.

**14. What is vaccination?**

It is a process where a dead or attenuated pathogen is introduced into the body in the form of vaccine which induces immune response and antibodies are produced in the body.

**15. What type of macrophage is Kupffer cell?**

Fixed macrophage

**QUESTIONS WITH ANSWERS – 2 MARKS**

**1. Mention any four components of second line of defence.**

Phagocytosis, Inflammation, Interferons and Natural Killer Cell

**2. List the symptoms of inflammatory response.**

Characters of inflammation are swelling, redness, heat and pain.

**3. What are lymphocytes? Mention its types.**

Lymphocytes are a type of agranular WBC found in the body. They are of two types namely B lymphocytes and T lymphocytes.

**4. Explain the role of B lymphocytes.**

They proliferate on coming in contact with an antigen. Most of them differentiate into antibody producing plasma cells which is called primary immune response. Cells that do not differentiate into plasma cells become memory cells which can be ever ready to attack if a second infection from the same antigens were to occur. Responses generated by memory cells are called

secondary immune responses. Memory cells persist for long periods in human and retain their capacity to produce humoral responses for life time.

### **QUESTIONS WITH ANSWERS – 5 MARKS**

#### **1. List the role of surface barriers in body defence.**

They constitute the body's first line of defense and include skin and mucous membranes. Skin is the outermost tough, impermeable barrier that prevents the entry of pathogens and harmful substances. It possesses insoluble fibrous protein called keratin which is resistant to weak acids, bases, bacterial enzymes and toxins. Mucous membranes lining all the body cavities secretes mucous and traps the microorganisms. Skin and mucous membrane produce chemical substances which are also protective in function.

1. Sweat from skin prevents the growth of bacteria (pH 3-5).
2. Sebum from sebaceous glands contains chemicals that are bactericidal and fungicidal.
3. Vaginal secretions are acidic inhibiting the growth of fungi and bacteria in the female reproductive tract.
4. Lacrimal fluid (tears) contain lysozyme that destroys bacteria.
5. Gastric cells produce HCl that kills bacteria in stomach.
6. The cilia propel dust and bacteria towards mouth preventing it from entering lower respiratory tract.
7. Saliva in mouth destroys bacteria due to the presence of hydrolytic enzymes like lysozymes.
8. Ear wax in the ear canal traps the dust, micro-organisms and insects that enter into the ear.
9. The melanin pigment of the epidermis protects the skin by absorbing the harmful UV radiations

## **2. What are lymphocytes? Describe the role of lymphocytes in body defence.**

**Lymphocytes :** Lymphocytes are a type of agranular WBC found in the body. A larger proportion of lymphocytes are present in lymphoid tissues which play a crucial role in immunity. Both the lymphocytes are produced in the bone marrow. At maturity they acquire the ability to recognize an antigen and bind to it. Depending on the region where maturation is acquired they are named as T- referring to Thymus and B- referred to as Bone marrow or Bursa in birds.

**Role of B lymphocytes :** They proliferate on coming in contact with an antigen. Most of them differentiate into antibody producing plasma cells which is called primary immune response. Cells that do not differentiate into plasma cells become memory cells which can be ever ready to attack if a second infection from the same antigens were to occur. Responses generated by memory cells are called secondary immune responses. Memory cells persist for long periods in human and retain their capacity to produce humoral responses for life time.

**Role of T lymphocytes :** They are involved in cell mediated immunity and do not produce antibodies. They are of different types :

- 1. Helper T cells or  $T_H$  cells :** They actively help B lymphocytes in the production of antibodies.
- 2. Cytotoxic T cells or  $T_C$  cells :** They are also called as killer T cells or Cytolytic T cells. They are capable of killing virus containing cells and cancer cells directly.
- 3. Suppressor T cells or  $T_S$  cells :** Once the infection has been controlled they stop the activity of B,  $T_H$  and  $T_C$  cells.

T cells also produce lymphokines which enhance immune and inflammatory responses.

## **3. Describe the structure of an antibody.**

According to Gerald Edelman and Rodney Porter, each antibody is Y or T shaped with four polypeptide chains linked with disulphide bonds. Two of them are called heavy chains (H) consisting of 400 amino acids each. The other two

are called light chains (L) with 200 amino acids each. Each chain consists of two regions variable (V) region and a constant (C) region. The sequence of amino acids varies in the variable region of different antibodies. In the constant region the sequence of amino acids is identical in antibodies belonging to same class. Variable regions form the antigen binding sites of antibody. The region of antibody that reacts with the antigen is called antigen binding site or Paratope. The antigen bearing invaders are not destroyed directly by antibodies but they inactivate them by forming antigen antibody complex.

#### **4. Explain active and passive immunity.**

**Active immunity :** Immunity exhibited when antibodies are produced in the body's own tissues by B lymphocytes when they encounter antigens is known as active immunity. It may be natural or artificial. Natural acquired active immunity results from any bacterial or viral infections. Antibodies are produced and they prevent the body from developing disease even if there is entry of the pathogen again. Artificially acquired active immunity is introduced into the body through a process called vaccination or immunization. It is a process where a dead or attenuated pathogen is introduced into the body in the form of vaccine which induces immune response and antibodies are produced in the body. If the same pathogen attacks the body there will be sufficient antibodies to combat the disease.

**Passive immunity :** Immunity provided to an individual by the introduction of borrowed antibodies obtained from an immunized animal is called passive immunity. Natural acquired passive immunity results through natural transfer of antibodies. The transfer of antibodies from mother to foetus through placenta protects the baby for several months after birth. Artificially acquired passive immunity results by the transfer of antibodies produced in the body of one individual into the other through injections. They provide protection for a short duration. Serum containing antibodies is used for snake bites, botulism, tetanus etc. It is essential to inject the serum because fatal diseases would kill a person before active immunity could be established.

**5. Write notes on a) phagocytosis b) inflammatory response**

**Phagocytosis:** Pathogens entering the connective tissues are engulfed and destroyed by phagocytes and the process is called phagocytosis. Phagocytosis is stimulated if the invading microbe has molecules called opsonins on their surface membranes. The chief phagocytes are – Macrophages which are derived from monocytes and Neutrophils – a type of granular WBC. They engulf the particulate matter through pseudopodia formation and encloses them forming phagosome. It fuses with the lysosome to form secondary lysosome which then releases the lytic enzymes and breaks the particulate matter.

**Inflammatory response :** It is a non-specific defensive response of the body to tissue injury caused due to physical trauma, intense heat, chemicals, insect bites, infections etc. Characters of inflammation are swelling, redness, heat and pain. Chemicals like histamine, kinins, prostaglandins are released at the site of inflammation which cause dilation of blood vessels leading to more blood flow resulting in redness in the inflamed region. They also increase the permeability of blood capillaries, antibodies and clotting factors accumulate in the tissue spaces leading to swelling (retention of water due to accumulation of plasma proteins causing localized edema) and later pain.

Inflammatory response prevents spreading of harmful agents to adjacent tissues, disposal of pathogens and dead cells, promotes tissue repair.