SAMPLE CONTENT

Precise

BIOLOGY

Vol. II

BASED ON LATEST BOARD PAPER PATTERN

Std. XII Science

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Precise BIOLOGY (Vol. II)

Std. XII Sci.

Salient Features

- Written as per **Latest Board Paper Pattern**
- Subtopic-wise segregation for powerful concept building
- Complete coverage of Textual Exercise Questions and Intext Questions
- Marks provided to the Questions as per relevant weightage as deemed necessary
- Relevant Previous Years' Board Questions:
  - **March 2009 to July 2023**
- Each chapter contains:
  - 'Quick Review' of the chapter for quick revision
  - 'Exercise' to provide Theory questions and MCQs for practice
  - Selective questions from NCERT textbook for practice
- Includes Important Feature to elucidate concept: ***Reading Between the Lines***
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PREFACE

Precise Biology Vol. II, Std. XII Sci. is intended for every Maharashtra State Board aspirant of Std. XII, Science. The scope, sequence, and level of the book are designed to match the latest textbook issued by Maharashtra State board.

With the examination in focus, the ***Precise Series*** has been specifically designed to make preparation easier, by providing a methodical and organized perspective of the curriculum, thus greatly improving the chances of scoring well.

Biological systems and their functions are the supreme complex chemical systems on Earth. We believe that the study of Biology helps in the understanding of many fascinating and important phenomena.

In order to make sure that students fully grasp the nub of the subject, it is important to present such concepts meaningfully and in an easy to read format.

In this vein, the Precise Biology book has been crafted to provide an **exam-centric approach** to the curriculum, while **retaining the essence** of the subject. Each chapter is thus structured to provide a **conceptual foundation**, in addition to offering **ample practice** for acing the board examination. We have put an effort to relate Biology to **real-world events** in order to show students that Biology is a vibrant, constantly evolving science that has relevance in our modern world.

We understand that Board Examinations can be daunting and the stress of cracking the examination can often leave students struggling to make sense of the curriculum. Relevant questions of Board Examination from **March 2009 to July 2023** are provided so that students would get an idea about the types of questions that are asked in Board Examinations.

A holistic preparation is the key to mastering any subject and conquering the board examination.

We hope this book becomes a valuable tool for you and helps you to understand the concepts of Biology.

Publisher

Edition: Sixth

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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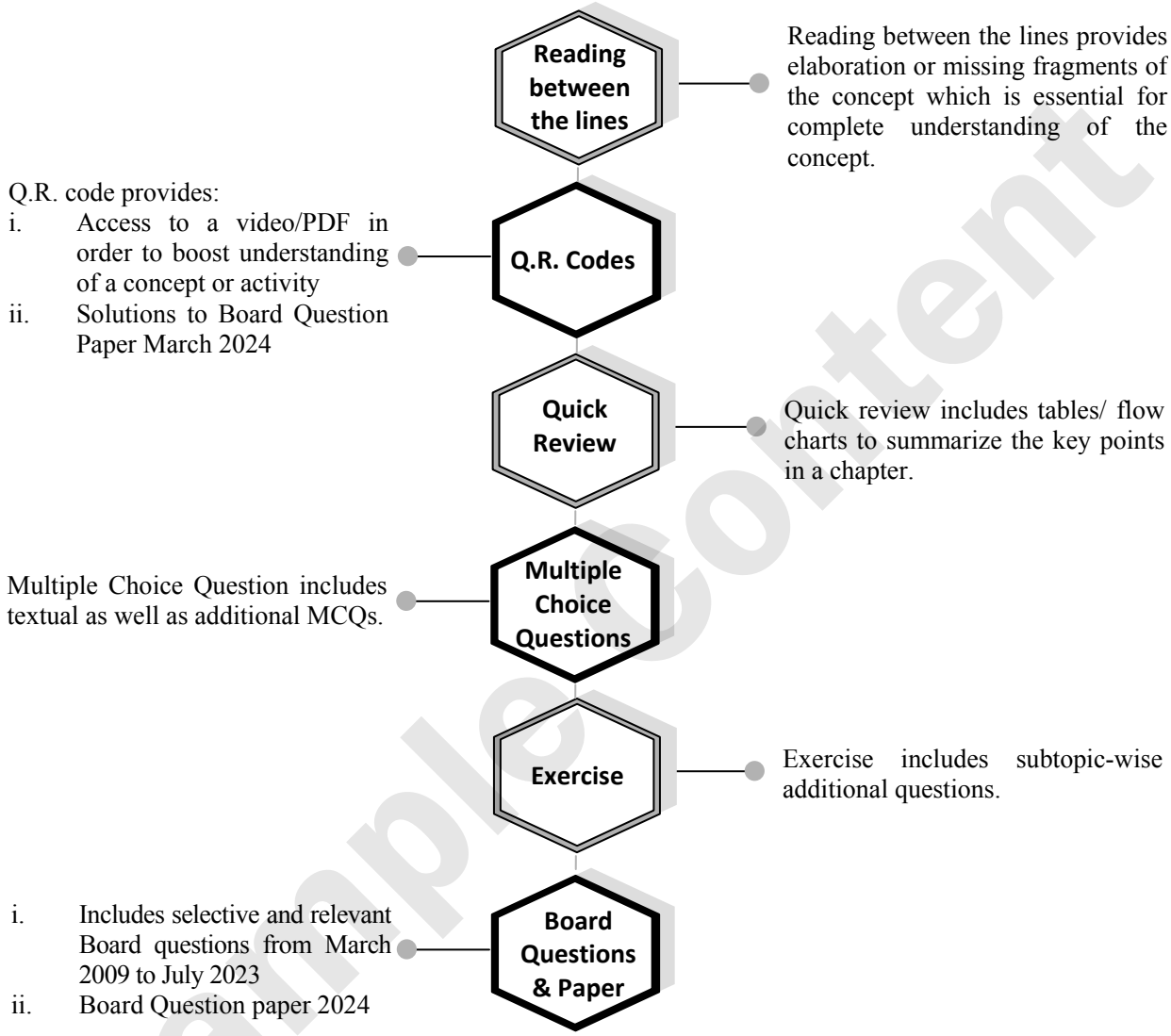
KEY FEATURES



PAPER PATTERN

- There will be one single theroy paper of 70 Marks and practical examination of 30 Marks in Biology.
- Duration of theory paper will be 3 hours.

Section A: **(18 Marks)**

This section will contain Multiple Choice Questions and Very Short Answer(VSA) type of questions.
There will be 10 MCQs and 8 VSA type of questions, each carrying **One** mark.
Students will have to attempt all the questions.

Section B: **(16 Marks)**

This section will contain 12 Short Answer (SA-I) type of questions, each carrying **Two** marks.
Students will have to attempt any 8 questions.

Section C: **(24 Marks)**

This section will contain 12 Short Answer (SA-II) type of questions, each carrying **Three** marks.
Students will have to attempt any 8 questions.

Section D: **(12 Marks)**

This section will contain 5 Long Answer (LA) type of questions, each carrying **Four** marks.
Students will have to attempt any 3 questions.

Distribution of Marks According to the Type of Questions

Type of Questions		
MCQ	1 Mark each	10 Marks
VSA	1 Mark each	8 Marks
SA - I	2 Marks each	16 Marks
SA - II	3 Marks each	24 Marks
LA	4 Marks each	12 Marks

CONTENTS

[Reference: Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04**]**

Note: 1. * mark represents Textual question.

2. 🔔 symbol represents textual questions that need external reference for an answer.

3. Questions from NCERT textbook are represented with tag [NCERT].

10 Human Health and Diseases

Contents and Concepts

10.0 Introduction

Q.1. Can you recall? *(Textbook page no. 221)*

i. Generally individuals are conscious about their health. So define health. **[1 Mark]**

Ans: Health is defined as the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

ii. Define infectious and non infectious disease? Give their examples. **[1 Mark]**

Ans:

a. Infectious disease: The diseases which are transmitted from infected person to another healthy person either directly or indirectly, are known as infectious or communicable diseases. **e.g.** Malaria

b. Non-infectious diseases: The diseases that cannot be transmitted from infected person to another healthy person, either directly or indirectly are known Non-Communicable or Non-Infectious diseases.
e.g. Cancer and deficiency diseases

***Q.2. Define health.** **[1 Mark]**

Ans: *Refer Q.1 (i)*

Q.3. Which factors are essential to maintain good health? **[1 Mark]**

Ans: To maintain good health, it is necessary that we have hygienic balanced diet, clean drinking water, personal and community hygiene, regular physical exercise, knowledge about diseases and their effect on body, proper disposal of waste and control of vectors.

10.1 Immunity

Q.4. Answer the following: **[1 Mark Each]**

i. What is the body's defense mechanism that protects against various infectious agents?

ii. What is the branch of science that focuses on the study of the immune system, its responses to foreign substances, and its role in resisting infection by pathogens?

Ans:

i. Immune ii. Immunology

Q.5. What are antibodies and antigens? **[2 Marks]**

Ans:

i. Any foreign substance invading the body and capable of stimulating an immune response, is called an **antigen**.

ii. The protective chemicals produced by immune cells in response to antigens are called **antibodies**.

***Q.6. Describe the different types of immunity.** **[4 Marks]**

Ans: There are two types of immunity i.e. Innate or Inborn (inherited) immunity and Acquired or Adaptive immunity.

i. Innate immunity or Inborn immunity: Innate immunity is the resistance to infections that an individual possesses genetically.
It is the natural (inborn) defense system of the body.
It is not affected by prior contact with microorganisms or immunization.

It is non-specific, when it indicates a degree of resistance to infection in general.
Innate immunity comprises of the various types of barriers which prevent entry of foreign agents into the body.

a. Epithelial surface:

1. The intact skin and mucous membranes (secrete mucous) covering the body, protects against invasion by microorganism(s).
2. The healthy skin possesses bactericidal activity due to the presence of high concentrations of salt in drying **sweat**.
3. **Sebaceous secretions** and long chain of fatty acids have bactericidal and fungicidal properties.
4. The **mucosa** of the respiratory tract has several innate mechanisms of defense.
5. The nose prevents entry of microorganisms to a large extent, the inhaled particles being arrested through **hair** at or near the nasal orifices.
6. Those foreign particles that pass the nasal orifices are held by **mucus lining** the epithelium and are swept back to pharynx where they tend to swallowed or coughed out.
7. The **cough reflex** is an important defence mechanism of respiratory tract.
8. The mouth is constantly bathed in **saliva** which has inhibitory effect on microorganisms.
9. The acidity of **gastric secretions** in the stomach destroys micro-organisms.
10. The flushing action of **urine** eliminates bacteria from the urethra.
11. **Spermine** and **zinc** present in semen are antibacterial.

b. Antimicrobial substances in blood and tissues:

1. The **complement system** contains more than 30 serum proteins, circulating in the blood in an inactive state.
2. The presence of microbial pathogens activates the '**Complement cascade'** to eliminate pathogens.
3. The **interferons** are a class of cytokines (soluble proteins) released by cells infected with viruses and certain white blood cells to stimulate other cells to protect themselves from viral infection.

c. Cellular factors in innate immunity:

1. Natural defence against the invasion of blood and tissues by microorganisms and other foreign particles, is mediated to a large extent by **phagocytic cells** which ingest and destroy them.
2. Phagocytic cells are grouped as microphages and macrophages.
3. These cells remove foreign particles that enter the body.
4. A class of lymphocytes called **Natural killer (NK) cells** is important in non-specific defence against viral infections and tumors.

d. Fever:

1. Increase in the body temperature following the infection is a natural defense mechanism.
2. It helps to accelerate the physiological processes to destroy the invading pathogens.
3. Fever stimulates the production of interferons and helps in recovery from viral infections.

e. Acute phase proteins (APPs):

1. Infection on injury leads to a sudden increase in concentration of certain plasma proteins, collectively called **acute phase proteins**.
2. These include C Reactive Protein (CRP), Mannose binding protein, Alpha-1-acid glycoprotein, Serum Amyloid P, etc.
3. APPs are believed to enhance host resistance, prevent tissue injury and promote repair of inflammatory lesions.

ii. Acquired immunity: The resistance that an individual acquires during life is known as Acquired immunity or Adaptive or Specific immunity.
It involves the formation of antibodies in the body, which neutralize the antigens.
Acquired immunity is of two types:

a. Active immunity: It is the resistance developed by individuals as a result of an **antigenic stimulus** (exposure to antigen).
It also known as "Adaptive immunity". Active immunity may be natural or artificial.

1. Natural Acquired Active immunity: Immunity acquired due to **infection** is called natural active immunity.
It is developed after entry of pathogens in the body.
It is long-lasting immunity. **e.g.** Person who has recovered from attack of measles develops natural acquired active immunity to measles, for the life time.

2. Artificial Acquired Active immunity: It is the resistance induced by **vaccines**.
Vaccine is introduced into the body to stimulate the formation of antibodies by the immune system.
e.g. Polio vaccine, BCG vaccine etc. such immunity may be temporary or permanent.

b. Passive immunity: Passive immunity is acquired when **ready-made antibodies** are received by the body cells. i.e. Body cells do not take any active part in the production of immunity.
Passive immunity can be acquired either naturally or artificially.

1. **Natural Acquired Passive immunity:** Natural acquired passive immunity is short lived.
   Before birth: **maternal antibodies** are transferred from mother to foetus through placenta.
   After birth: antibodies are transferred from mother to infant through colostrum (first milk of mother) and continue throughout the period of breast feeding.
2. **Artificially Acquired Passive immunity:** This immunity is developed by injecting **previously prepared antibodies** using serum from humans or animals. **e.g.** Antibodies obtained from hyper immunised horses are injected to humans against rabies pathogens. It is short lived.

Q.7. What are the unique features of acquired immunity? [2 Marks]

Ans: Acquired or Adaptive immunity has the following unique features.

i. **Specificity:** It can produce specific antibody or T-lymphocyte against a particular antigen/pathogen.

ii. **Diversity:** It can recognize a vast variety of diverse pathogens or foreign molecules.

iii. **Discrimination between self and non-self:** It differentiates between own body cells (self) and foreign (non self) molecules.

iv. **Memory:** When the immune system encounters a specific foreign agent for the first time, it generates an immune response and eliminates the invader. This is called first encounter. The immune system retains the memory of the first encounter. As a result, a second encounter with same pathogen brings about quicker and stronger immune response.

Q.8. Distinguish between the following:

i. Innate and acquired immunity. [2/3 Marks] [NCERT]

Ans:

No.	Parameter	Innate immunity or Non-specific immunity	Acquired or Specific immunity
a.	Presence	It is present since birth.	It develops after birth during the life time of an individual.
b.	Inheritability	It is inheritable immunity.	It is non-inheritable immunity.
c.	Acquisition	It is not acquired from previous exposure to a pathogen.	It is developed by way of infection or immunization.
d.	Duration	It remains throughout the life.	It is either short lived or may persist throughout the life.
e.	Specificity	It is non-specific for any particular pathogen.	It is specifically produced against a particular pathogen.
f.	Defense mechanisms	It consists of various types of barriers for defense.	It consists of various types of cells producing antibodies.

***ii. Active immunity and passive immunity. [2/3 Marks] [NCERT]**

Ans:

No.	Parameter	Active Immunity	Passive Immunity
a.	Definition	When resistance is developed by individuals as a result of an antigenic stimulus it is called as active immunity.	When ready-made antibodies are directly given to protect body against foreign agents, immunity is called as 'Passive immunity'.
b.	Types	The types of active immunity are natural acquired active immunity and artificial acquired active immunity.	The types of passive immunity are natural acquired passive immunity and artificially acquired passive immunity.
c.	Side effects	It has no side effects.	It may cause reaction.
d.	Onset of relief	It provides relief only after long period.	It provides immediate relief.
e.	Duration	It is long lasting immunity.	It is short-lived immunity.
e.g.	Examples	Polio vaccine, BCG vaccine, etc.	Rabies vaccine, maternal antibodies, etc.

Q.9. Describe the different types of cells associated with acquired immunity. [3/4 Marks]

Ans: There are two main types of cells involved in the working of the immune system:

i. **Lymphocytes:**

a. Lymphocytes are the main cells of the immune system.

b. They arise from the stem cells, the haemocytoblasts, present in liver of the foetus and in the bone marrow in adult.

c. Some of them undergo differentiation in the gut – associated bursal lymphoid tissues (Tonsils, Peyer's patches) and are called Bursal or B-lymphocytes.
   Others are differentiated in the thymus gland and are termed as T-lymphocytes.

d. The mature lymphocytes pass into body fluids (blood and lymph) and circulate in the body.Many of them stay in the lymph nodes.

e. The B-lymphocytes and T-lymphocytes form humoral or **antibody-mediated immune system (AMIS)** and **cell-mediated immune system (CMIS)** respectively.
f. Both the immune systems need antigens to come into action, but they respond in different ways.
g. T-lymphocytes on coming in contact with an antigen, forms clones of T-cells which are similar but they perform different functions.
h. The different types of T-cells are as follows:

1. **Helper T-cells:** Sensitized helper T-cells produce lymphokines for performing several types of functions like proliferation of other T-cells, stimulation of B-lymphocytes, macrophages, etc.
2. **Killer T-cells** or **Cytotoxic T-cells:** They directly attack and destroy invading microbes, infected body cells and cancer cells. Killer T-cells bind to infected cell and secrete perforins, which forms a hole in infected cell. It also releases substances that kill the cell, hence the name cytotoxic T-cell.
3. **Suppressor T-cells:** These cells suppress entire immune system against attack on the own body cells.
4. **Memory T-cells:** These are previously sensitized cells which retain the sensitization memory for long time in the future.

ii. **Antigen presenting cells:** Antigen presenting cells engulf the invading pathogens and process the antigens. Then the processed antigens are presented on their own surface. These cells are able to deliver a stimulatory signal that is necessary for activation of helper T-cell.

***Q.10. What do the abbreviations AMIS and CMIS denote?** **[2 Marks]**

Ans:

i. **AMIS:** Antibody mediated immune system **ii.** **CMIS:** Cell mediated immune system

Q.11. Describe the mechanism of action of B-lymphocytes against antigens. **[2 Marks]**

Ans:

i. B–lymphocytes are sensitized directly by both antigens as well as by helper T-cells.
ii. Activated B-lymphocyte multiplies very fast to produce clone of plasma cells and memory B-cells.
iii. The plasma cells produce specialized glycoproteins, called antibodies which are circulated through body fluids (humor) like blood and lymph.
iv. The antibody molecules may bind to a cell membrane or they remain free.

Q.12. Answer the following questions:

***i. Which cells stimulate B-cells to form antibodies?** **[1 Mark]**

Ans: Helper T cells stimulate B cells to form antibodies.

ii. Explain three main functions of free antibodies produced by B-lymphocytes. **[3 Marks] [Mar 23]**

Ans: The free antibodies have three main functions:

a. **Agglutination** of particulate matter, including bacteria and viruses. The immobilized mass is then engulfed by phagocytes.
b. **Opsonisation** or coating of bacteria to facilitate their subsequent phagocytosis by macrophages.
c. **Neutralization** of toxins released by bacteria e.g. tetanus toxin.

***Q.13. Differentiate between B-cells and T-cells.**

OR

Differentiate between B-cells and T-cells eith reference to percentage in lymphocytes and funtions. **[2 Marks]**

Ans:

No.	Parameter	B-cells	T-cells
i.	Maturation	B-cells mature in bone marrow.	T-cells mature in the thymus gland.
ii.	Involvement in immunity	They are involved in humoral immunity.	They are involved in cell mediated immunity.
iii.	Origin and maturation	B cells originate and mature in bone marrow.	T cells originate in bone marrow and mature in thymus
iv.	Percentage in lymphocytes	They occupy 20% of total lymphocytes	They occupy 80% of lymphocytes
v.	Function	B-cells produce specific plasma cells which produce antibodies.	T-cells produce clone T-cells and can kill the infected cell.

Q.14. Can you tell? *(Textbook page no.224)*

Which is kind of immunity provided by vaccination? **[1 Mark]**

Ans: Artificial acquired active immunity

Q.15. Explain why vaccination is important. Describe the concept of herd immunity. [3/4 Marks]

Ans:

i. Administration of vaccine (i.e. inactivated pathogen or antigenic protection of particular pathogen) to protect against a particular pathogen, is called vaccination.
ii. Normally, the body's immune system helps to protect against pathogens that cause infection.
iii. However, some pathogens can overwhelm the immune system. This results in serious illness.
iv. The pathogens most likely to cause an illness, are the ones the body doesn't recognize and which go undetected by the immune system.
v. Vaccination is a method in which the immune system is exposed to a safe antigenic preparation that helps it recognize and eliminate a pathogenic organism when it is encountered.
vi. Vaccination is an important form of primary prevention, that can protect people from getting sick.
vii. Vaccination has helped control deadly diseases like measles, polio, tetanus and whooping cough.
viii. The more number of people that are vaccination, the more protected the individuals and the society are against diseases by a phenomenon known as herd immunity.

Q.16. Explain how vaccination works. What are the different forms of vaccines? [3 Marks]

Ans:

i. Vaccination teaches the body to recognize new pathogens causing diseases.
ii. It stimulates the body to make antibodies against antigens of pathogens.
iii. It also primes immune cells to remember the types of antigens, allowing a faster response to the pathogen in future encounter.
iv. Vaccines work by exposing a person to a safe version of a pathogen.
v. The different forms of vaccines are as follows:
   a. A protein or sugar from the pathogen.
   b. A dead or inactivated form of a pathogen
   c. A toxoid containing toxin produced by a pathogen.
   d. A weakened (attenuated) pathogen. When the body responds to the vaccine, it builds an adaptive immune response. This helps to equip the body to fight off an actual infection.

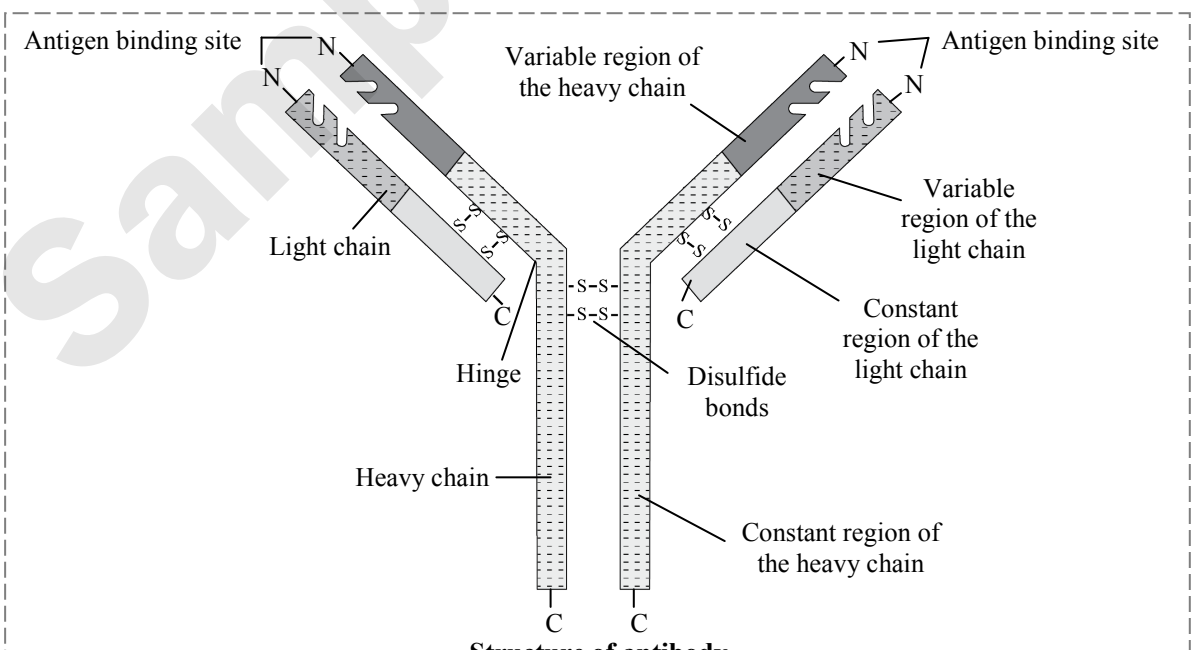
***Q.17. Write a note on Vaccination. [3 Marks]**

Ans: *Refer Q. 15 and 16.*

10.2 Structure of Antibody

***Q.18. Describe the structure of antibody. [3 Marks] [Oct 15, Mar 14]**

Ans:



Structure of antibody

Antibodies are glycoproteins which are highly specific to specific antigens.

Antibodies are also known as Immunoglobulins (Igs), produced in response to antigenic stimulation. Antibodies are produced by plasma cells which in turn are formed by B–lymphocytes.
The mature plasma cells produce antibodies at an extremely rapid rate i.e. about 2000 molecules per second.

Structure of antibody:

i. Antibody is a 'Y' shaped molecule.
ii. Each immunoglobulin molecule is made up of four polypeptide chains.
iii. There are two heavy or **H-chains** and two light or **L-chains**.
iv. The four polypeptide chains are held together by **disulfide bonds** (-s-s-) to form a 'Y' shaped structure.
v. The region holding together arms and stem of antibody is termed as **hinge**.
vi. Each chain of the antibody includes two distinct regions, the **variable region** and the **constant region**.
vii. Variable regions constitute the **antigen-binding site (paratope)**.
viii. This part of antibody recognizes and binds to the specific antigen to form an **antigen-antibody complex**.
ix. Since most antibodies carry two antigen binding sites, they are said to be **bivalent**.

Q.19. Define serology. **[1 Mark]**

Ans: Study of antigen-antibody interactions is called serology.

Q.20. *Write a note on antigen-antibody complex.

OR

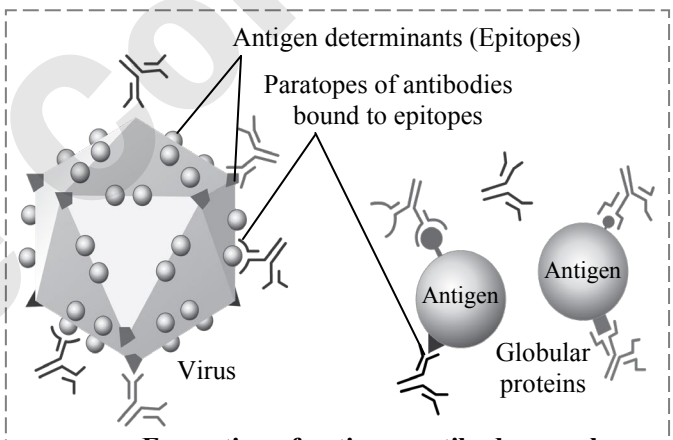
Describe the antigen - antibody complex. **[Oct 13]**

OR

Explain in brief the mechanism of antibody antigen complex formation with a neat, labelled diagram. **[3 Marks] [July 18]**

Ans:

i. Each antibody is specific for a particular antigen.
ii. Combining sites of antigen, called antigenic determinants (epitopes) react with the corresponding antigen binding sites of antibodies called **paratopes**.
iii. The antigen binding sites (paratopes) are located on the variable regions of the antibody.
iv. Small variations in the variable regions make each antibody highly specific for a particular antigen.
v. The variable region enables the antibody to recognize the specific antigen and bind to specific antigen in a lock and key manner forming an **antigen-antibody complex**.



Formation of antigen- antibody complex

Q.21. Differentiate between antigen and antibody. **[2 Marks]**

Ans:

Sr. No.	Parameter	Antigen	Antibody
i.	Definition	Any foreign material which brings about an immune response in the body is called antigen.	Glycoproteins formed in the body to fight against antigen is called antibody.
ii.	Role in immune response	It triggers the formation of antibodies.	It is produced against antigens.
iii.	Location	It may be a free molecule or component of microbial cell surface.	It is extruded from surface of plasma cells.
iv.	Structure	Structure of antigen is variable.	Antibody is Y-shaped.

Q.22. *Write a note on antigens on blood cells.

OR

With the help of a chart, explain the compatibility of human blood groups. **[Mar 15]**

OR

Explain ABO blood group system in human being with a suitable chart. **[3 Marks] [Mar 17]**

Ans:

i. There are several known antigens on the surface of human red blood cells. These antigens give rise to different blood groups.

ii. **ABO Blood Groups:** The A, B and O blood groups were discovered by Karl Landsteiner in 1900. He found two antigens or agglutinogens on the surface of human red blood cells and named them as **antigen A** and **antigen B**.

iii. He also noticed the corresponding antibodies or agglutinins in the serum called '**a**' and '**b**'.

Blood group	Genotype	Antigen on Surface of RBC	Antibody in Serum	Can donate blood to	Can receive blood from
A	$I^A I^A$ or $I^A I^O$	A	Antibody b	A, AB	A, O
B	$I^B I^B$ or $I^B I^O$	B	Antibody a	B, AB	B, O
AB (universal acceptor)	$I^A I^B$	A and B	Nil	AB	A, B, AB, O
O (universal donor)	$I^O I^O$	Nil	Both Antibody a and Antibody b	A, B, AB, O	O

iv. In ABO system, the blood groups are determined by the presence or absence of antigen A and antigen B. The blood group of person is classified into four groups A, B, AB and O.

a. Blood group A: Individuals, with blood group 'A' have the antigen A on the surface of their red blood cells (RBCs) and antibody 'b' in their plasma.

b. Blood group B: Individuals with blood group 'B' have the antigen B on the surface of their RBCs and antibody 'a' in their plasma.

c. Blood group AB: Individuals with blood group 'AB' have both antigens A and B on the surface of their RBCs and no antibodies in their plasma.

d. Blood group O: Individuals with blood group 'O' lack both antigens A and B on the surface of their RBCs and show presence of both 'a' and 'b' antibodies in their plasma.

e. Rh factor: Rh – factor is an antigenic protein present on the surface of the red blood cells in the human beings.

[Note:

1. Though people with O blood group are universal donors, O Rh+ve blood cannot be given to those people who are Rh -ve. Hence, more specifically, a universal donor has O Rh-ve blood group.

*2. Though people with AB blood group are universal blood acceptors, people with blood group AB Rh-ve would not be able to accept blood from AB Rh+ve. Hence, more specifically, a universal blood acceptor has AB Rh+ve blood group.**]***

[Note: Scan the given Q. R. Code in *Quill - The Padhai App* for better understanding about blood types.**]**

Q.23. Name the different genetically determined blood groups in humans. [1 Mark]

Ans: There are many genetically determined blood groups system like ABO, Rh, Duffy, Kidd, Lewis, P, MNS, Bombay blood group, etc.

***Q.24. What is Rh factor? [2 Marks]**

Ans:

i. Rh is the most complex of the blood group system.

ii. Rh – factor is an antigenic protein present on the surface of the red blood cells in the human beings.

iii. It was first discovered by Landsteiner and Wiener (1940), on the surface of RBCs of Rhesus monkey, so it is called Rh factor/ Rhesus factor (also called D antigen).

iv. Person having Rh factor (D antigen) are called Rh positive (Rh +ve) and those lacking D antigen are called Rh negative (Rh -ve).

Q.25. Write a note on erythroblastosis foetalis. [2/3 Marks]

Ans:

i. Rh (D) antigen induces a strong immunogenic response when introduced into Rh-ve individuals.

ii. Rh blood group is an important factor in blood transfusion and is involved in haemolytic disease of the newborn (HDN), which is called erythroblastosis foetalis (destruction of the erythrocytes of the foetus).

iii. It occurs when an Rh -ve mother conceives Rh+ve foetus.
iv. The Rh +ve RBCs from the foetus may enter the mother's circulatory system during child birth, causing her to produce anti-Rh antibodies.
v. As a result, subsequent Rh+ve foetuses will be exposed to the anti-Rh antibodies produced by mother, which result in HDN.
vi. In order to prevent HDN, Rh -ve mother is injected with the anti-Rh antibody during all pregnancies carrying Rh +ve foetus.

10.3 Common Human Diseases

Q.26. Define disease. **[1 Mark]**

Ans: Disease is defined as condition of disturbed or deranged functioning of one or more organs or organ systems of the body, caused due to infections, defective diet or heredity.

Q.27. How are diseases categorized? **[2/3 Marks]**

Ans: All human diseases can be broadly categorized into congenital diseases and acquired diseases.

i. **Congenital diseases** are present from birth; may be caused by genetic abnormality or metabolic disorder. They may be permanent and were practically incurable.
Recently modern research has helped to cure some inborn diseases through gene therapy, enzyme replacement therapy, etc.

ii. **Acquired diseases** develop after the birth. These diseases can be subdivided into the following categories:
a. **Communicable or infectious diseases:** The diseases which are transmitted from infected person to another healthy person either directly or indirectly, are known as Communicable or Infectious diseases. Communicable diseases are caused by pathogens like viruses, bacteria, fungi, helminth worms, etc. **e.g.** Malaria, typhoid, ascariasis, etc.
b. **Non-Communicable or Non-infectious diseases:** The diseases that cannot be transmitted from infected person to another healthy one either directly or indirectly are known as Non- Communicable or Non - Infectious diseases. **e.g.** Cancer, deficiency diseases, etc.

***Q.28. What are acquired diseases?** **[1 Mark]**

Ans: *Refer Q.27 (ii)*

Q.29. Explain the following terms: **[1 Mark Each]**

i. Pathogen

Ans: All the disease causing organisms are called 'Pathogens'.

ii. Vector

Ans: Many pathogens use another organism (parasite) to transmit the disease from one person to another. This parasite is known as the vector.

iii. Parasite

Ans: It is an organism that lives in or on the body of another organism and derives its nutrition from that of host organism.
Parasites are two categories:
a. Ectoparasite **e.g.** bedbug
b. Endoparasite. **e.g**. *Plasmodium*, a protozoan endoparasite of the mosquito (vector) and human beings.

Q.30. What are the various public health measures, which you would suggest as safeguard against infectious diseases? **[3 Marks] [NCERT]**

Ans: Some public health measures that must be taken to safeguard the population against infectious diseases are as follows:
i. Improved access to vaccinations and contraceptives (to prevent STDs)
ii. Facilitation of screening, counselling and education of those at risk of infection.

iii. Support to access to treatment
iv. Following good hygiene practices like hand washing
v. Infection control standard, contact, droplet and airborne precautions
vi. Procedures for decontamination of persons and disinfection of equipment and environment, if needed.
vii. Quarantine of contacts (if necessary)
viii. Prophylaxis of exposed individuals
ix. Control of the vectors of transmission of infection
x. Spreading awareness about route of transmission of infected diseases
xi. Practice good food – safety techniques
xii. Precautionary measures while traveling to areas of known epidemics.
xiii. Controlling spread by rodents like rats

[Sources:

1. https://www.health.harvard.edu/staying-healthy/how-to-prevent-infections
2. https://www.who.int/healthsystems/topics/health-law/chapter10.pdf
3. https://www.sfcdcp.org/communicable-disease/infection-control-practices/]

Malaria:

***Q.31. Name the pathogen causing Malaria.** **[1 Mark]**

Ans: *Plasmodium* is the pathogen that causes malaria.

Q.32. Name the different species of *Plasmodium*. Which of them causes serious illness? **[2 Marks]**

Ans:

i. There are four species of *Plasmodium* namely*, P. vivax , P. ovale, P. malariae, P. falciparum.*
ii. Only *P. falciparum* causes serious illness while others are rarely fatal.

***Q.33. Name the infective stage of *Plasmodium*. Give any two symptoms of malaria.** **[2 Marks]**

Ans:

i. For humans, **sporozoites** are the infective stage of malaria.
ii. **Signs and symptoms of malaria:** Symptoms of malaria begin to appear about 7 to 15 days after the bite of infective mosquito.
   a. Initial symptoms are fever, headache, and chills.
   b. Classical symptom of malaria is cyclic occurrence of high fever followed by sweating and sudden shivering. Such entire episode lasts for four to six hours and recurs every two days or three days.
   c. Vomiting and convulsions.
   d. Arthralgia (joint pain), anemia due to rupturing of RBCs.
   e. Haemoglobinuria, hepatomegaly (liver enlargement).
   f. Retinal damage (eye).
   g. Cerebral malaria (brain infection).

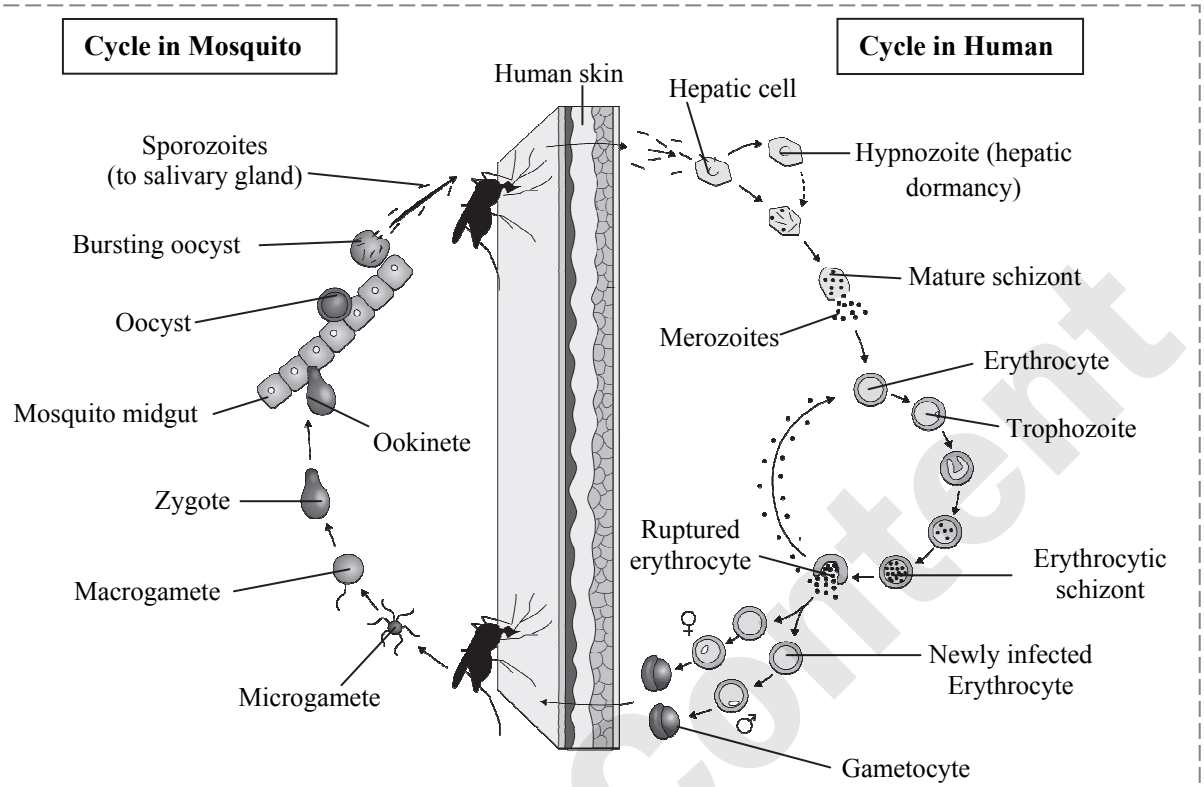
Q.34. What is incubation period? Complete the table with incubation period of different *Plasmodium* species. **[3 Marks]**

Species of *Plasmodium*	Incubation period	Pattern of high fever
P. vivax	**(i)**	High fever after 48 hours interval
P. malariae	**(ii)**	High fever after 72 hours interval
P. ovale	**(iii)**	High fever after 48 hours interval
P. falciparum	**(iv)**	High fever at irregular intervals between 22-48 hours

Ans: The time interval from the invasion of a pathogen to the development of clinical manifestations, is known as **Incubation period.**

i. 14 days; ii. 28 days; iii. 17 days; iv. 12 days

Q.35. Explain the stages of the life cycle of *Plasmodium* and its mode of transmission with a diagram. **[4 Marks]**



Stages in the life cycle of *Plasmodium* in mosquito and human

Ans: Mode of transmission :

i. The malaria parasite life cycle involves two hosts.

ii. *Plasmodium* is transmitted from one person to other through an insect vector- female *Anopheles* mosquito.

iii. When infected female *Anopheles* sucks the human blood, it may transfer **sporozoites** to human circulation. Sporozoites reproduce asexually through fission (schizogony) in the **liver cells** or **erythrocytes**. The cells formed are now called **merozoites**. The cells formed within erythrocytes function as **gametocytes** (gamogony).

iv. Gametocytes if taken up by female *Anopheles*, fertilization occurs in its gut.Diploid zygote is formed which transforms into **oocyst**.

v. Oocyst forms large number of haploid **sporozoites** through meiosis (sporogony), which migrate to salivary glands and are ready to infect new human host.

[Note: Scan the given Q. R. Code in *Quill - The Padhai App* for better understanding about life cycle of *Plasmodium*.**]**

***Q.36. What is schizont?** **[1 Mark]**

Ans: Schizont is a cell formed from a trophozoite during the asexual stage of the life cycle of *Plasmodium.*

Q.37. Write a note on malaria with respect to the following points: **[3 Marks]**

i. Diagnosis ii. Treatment iii. Prevention and control

Ans:

i. Diagnosis: Malaria can be diagnosed by microscopic study of blood smear. Other rapid diagnostic tests based on nucleic acid amplification techniques are also used.

ii. Treatment: WHO has recommended 5 different Artemisinin based combination therapies (ACTs) which includes various combinations of artesunate, sulfadoxine, pyrimethamine, etc. In addition, quinine is also used.

iii. Prevention and Control of malaria:

a. Prevention of mosquito bite by using mosquito nets and insect repellents.

b. Spraying insecticides and draining stagnant water where mosquito lays eggs.

c. Mosquito larve can be controlled by using *Gambusia* fresh water fish (biocontrol).

***Q.38. What are the symptoms of malaria? How does malaria spread? [3 Marks]**

Ans: *Refer Q. 33. (ii) and Q.35.*

Amoebiasis

Q.39. What is amoebiasis? [1 Mark]

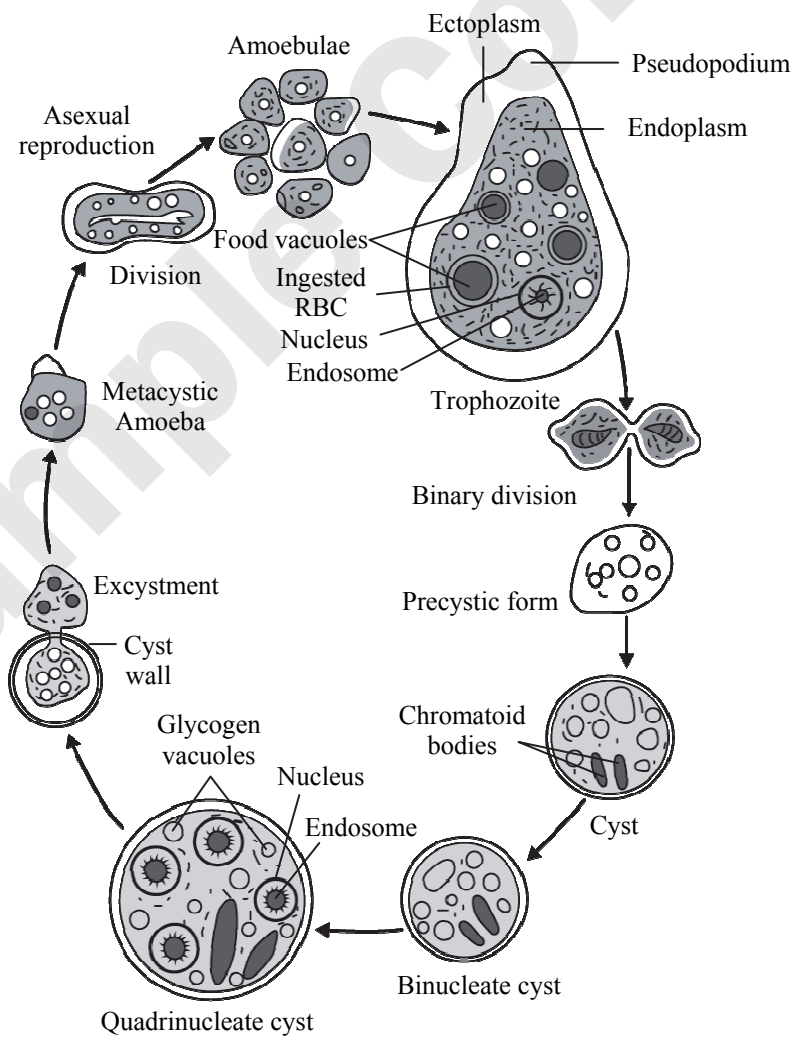
Ans: Amoebiasis is also known as Amoebic dysentery caused by a parasite *Entamoeba histolytica*. It is a common infection of human gastro-intestinal tract, which affects 15 % population of India.

Q.40. Draw a diagram of the life cycle of *Entamoeba histolytica*.

OR

Draw a diagram of the life cycle of *Entamoeba histolytica* and label the trophozoite stage, binucleate stage and metacystic *Amoeba*. [2/3 Marks]

Ans:



Life cycle of *Entamoeba histolytica*

Reading between the lines

Cysts and trophozoites are the infective stages of amoebiasis and are passed in feces

i. Cysts are typically found in formed stool, whereas trophozoites are typically found in diarrheal stool.
ii. Infection by Entamoeba histolytica occurs by ingestion of mature cysts
iii. Excystation occurs in the small intestine and trophozoites are released, which migrate to the large intestine.
iv. The trophozoites multiply by binary fission and produce cysts and both stages are passed in the feces
v. The cysts can survive days to weeks in the external environment because of the protection conferred by their walls, and are therefore responsible for transmission.
vi. In some patients the trophozoites invade the intestinal mucosa or, through the bloodstream, extra-intestinal sites such as the liver, brain, and lungs with resultant pathologic manifestations.

[Source:** https://www.cdc.gov/parasites/amebiasis/pathogen.html**]

Q.41.

i. Which is the causative organism for amoebiasis?

ii. Describe the modes of transmission of amoebiasis. [2 Marks]

Ans:

i. Causative organism: *Entamoeba histolytica* (protozoan).

ii. Mode of transmission:

a. Amoebiasis is usually transmitted by the faeco-oral route.
b. It can be transmitted indirectly through contact with dirty hands or objects.
c. It is transmitted through contaminated food and water. Infection spreads through ingestion of cyst form of the parasite.

Q.42. What are the signs and symptoms of amoebiasis? [2 Marks]

Ans: Signs and symptoms of amoebiasis are as follows:

i. Diarrhoea, flatulence, stool with mucus and abdominal pains (cramps) are common.
ii. Passing of blood with stool is common in severe cases.
iii. Hepatomegaly (enlarged liver) occurs if parasite enters the liver. Liver develops amoebic liver abscess accompanied with fever and pain in right abdomen.

Q.43. How is amoebiasis diagnosed and treated? [2 Marks]

Ans:

i. Diagnosis of amoebiasis is made through microscopic examination of the stool sample.
ii. Amoebiasis is treated by the use of Metronidazole and Tinidazole which can destroy the *E. histolytica* in the digestive tract as well as other tissues.

Q.44. What are the preventive measures of Amoebiasis? [2 Marks]

Ans: Amoebiasis can be prevented by the following measures:

i. Wash hands with hot water and soap after using toilets and changing baby's diaper.
ii. Drink boiled water.
iii. If not boiled, water must be chlorinated and filtered.
iv. Avoid eating unhygienic food.
v. Vegetables must be properly washed and cooked.
vi. Proper sanitary facilities including sewage disposal help in prevention.

Ascariasis

Q.45. What is ascariasis? [1 Mark]

Ans: It is an infectious disease of human intestinal tract, caused by the endoparasitic roundworm (Nematode), *Ascaris lumbricoides*.

Q.46. Explain the life cycle of *Ascaris*. What is its mode of transmission? [3 Marks]

Ans:

The life cycle of *Ascaris* involves only one host, i.e. human.

i. *Ascaris* is present in gastrointestinal tract and faecal matter. Adult worms live in the lumen of the small intestine.

ii. Ingestion of infective eggs takes place from contaminated vegetables and water is the primary route of infection.

iii. A female worm may produce approximately 2, 00,000 eggs per day, which are passed with the faeces.

iv. Unfertilized eggs may be ingested but are not infective.

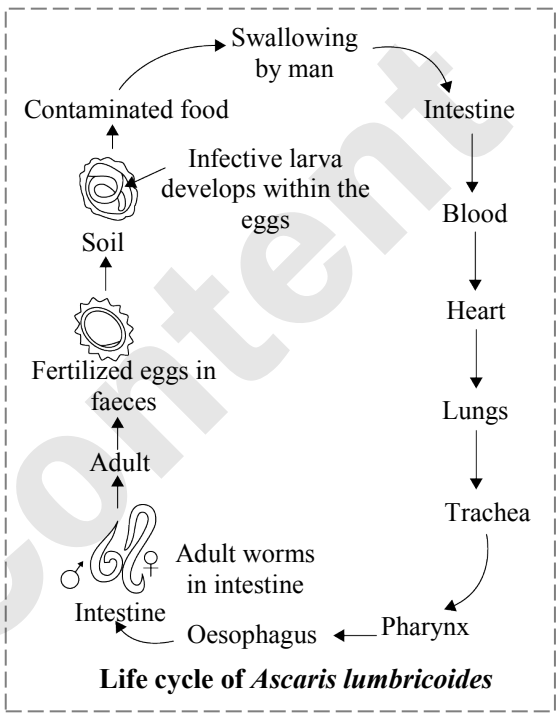
v. Fertile eggs develop into embryos and become infective after 18 days to several weeks depending on the environmental conditions (Optimum conditions: moist, warm, shaded soil).

vi. After swallowing the infective eggs, the larvae hatch and are carried via. circulation to lymphatics and the lungs.

vii. The larvae mature further in the lungs (10 to 14 days), penetrate the alveolar walls, ascend the respiratory tract to the throat and are swallowed. Upon reaching the small intestine, they develop into adult worms.

viii. Two-three months are required from ingestion of the infective eggs to oviposition by the adult female. Adult worms can live for 1 to 2 years.

ix. The eggs appear in stools after 60-70 days. In larval ascariasis, symptoms occur 4-16 days after infection.



Life cycle of *Ascaris lumbricoides*

Mode of transmission

a. Food and drinks contaminated with the eggs of these worms is the main mode of transmission.

b. Eggs hatch inside the intestine of the new host.

c. The larvae pass through various organs and settle as adults in the digestive system.

Q.47. What are the symptoms of Ascariasis? [2 Marks]

Ans: Symptoms of Ascariasis include:

i. Gastro-intestinal discomfort accompanied with vomiting and fever.

ii. Presence of live worms in faecal matter.

iii. Pulmonary disorders occur in some patients. **e.g.** Pneumonitis (inflammation in alveolar wall).

iv. Loss of appetite and weight loss.

v. Eosinophilia (number of eosinophils is increased).

Q.48. How can Ascariasis be diagnosed and treated? [1/2 Marks]

Ans:

i. Diagnosis can be done by microscopic examination of the stool.

ii. Anti-helminthic drugs like Piperazine, Mebendazole, Levamisole, and Pyrantel are effective against *Ascaris lumbricoides*.

Q.49. What are the preventive measures for Ascariasis? [2 Marks]

OR

Mention the control measures to prevent ascariasis. [2 Marks] [July 23]

Ans: The preventive measures for Ascariasis are as follows:

i. Avoiding defaecation in open space prevents the spread of *Ascaris*.

ii. Personal hygienic habits like washing hand with water and soap after using toilet are also important.

iii. Washing vegetables thoroughly before cooking and avoiding raw vegetables is important for prevention of ascariasis.

Filariasis/ Elephantiasis

Q.50.

i. What is filariasis?

ii. Mention its three subtypes. **[3 Marks]**

Ans:

i. Filariasis is caused by thread like worms or nematodes. These nematode parasites are transported from person to person via mosquito bite.

ii. Filariasis can be divided into three subtypes:

a. Lymphatic Filariasis (Elephantiasis): It is caused by the worms *Wuchereria bancrofti*, *Brugia malayi*, *Brugia timori*

b. Subcutaneous Filariasis: It is caused by *Loa loa*, *Mansonella* spp.

c. Serous (abdominal) cavity Filariasis: It is caused by *Mansonella* spp.

***Q.51. Name the vector of Filariasis.** **[1 Mark]**

Ans: *Wuchereria bancrofti* is transmitted to human body by female *Culex* mosquito.

Q.52. Enlist the signs and symptoms of filariasis. **[2 Marks]**

Ans: *Wuchereria bancrofti* affects the legs, arms, breasts, scrotum, etc. and hence the following symptoms are observed:

i. Edema with thickening of skin and underlying tissue.

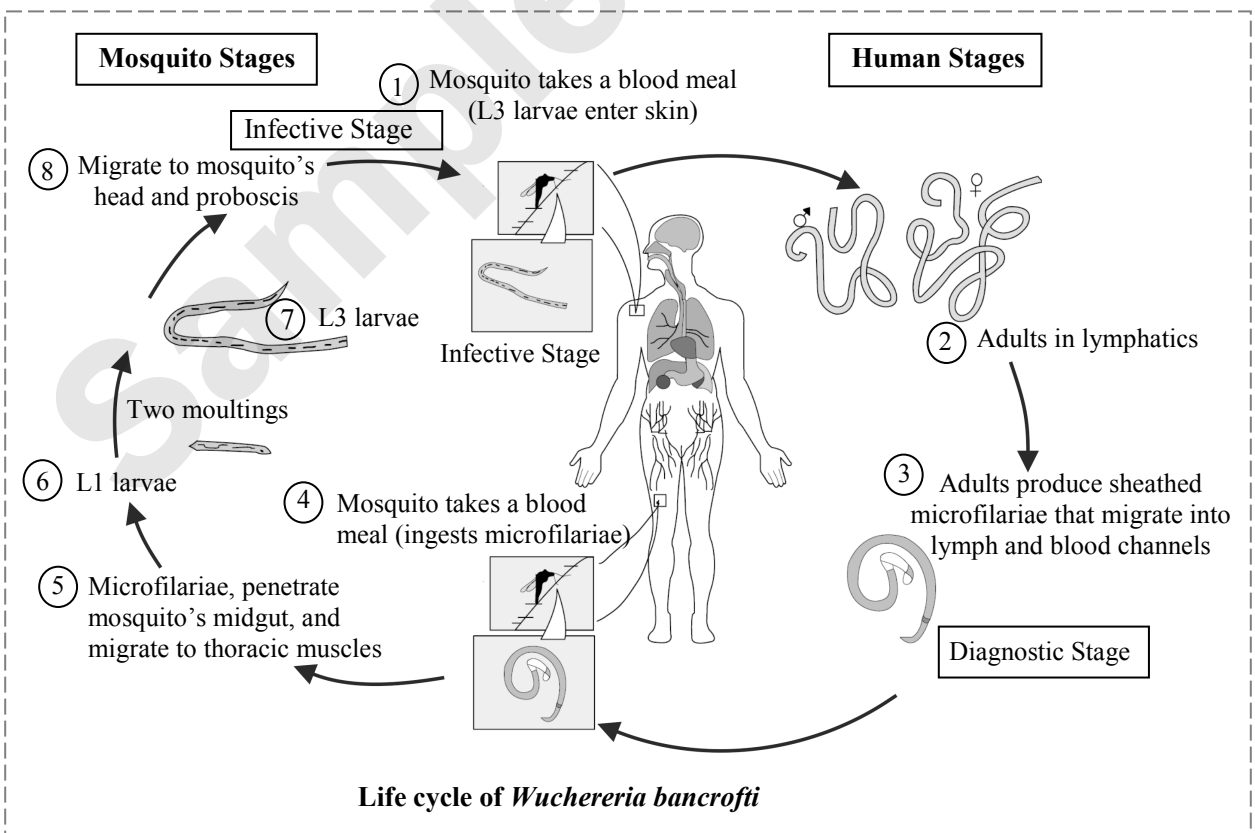
ii. In lymphatic filariasis, worms infect lymphatic system and causes enlargement of lymph vessels and nodes. This is the prominent feature of elephantiasis i.e. limbs are swollen like legs of elephant.

iii. Lymphedema i.e. accumulation of lymh fluid in tissue causing swelling.

iv. Hydrocele i.e. testis are enlarged due to accumulation of lymphatic fluid in testis.

***Q.53. Explain the mode of infection and cause of elephantiasis.** **[4 Marks]**

Ans:



Life cycle of *Wuchereria bancrofti*

Life cycle of *Wuchereria bancrofti:*

i. *Wuchereria bancrofti* has a complicated life cycle which consists of five stages.
ii. After mating of male and female worms, female gives birth to thousands of live **microfilariae**.
iii. These microfilariae are taken up by vector insect (intermediate host), as blood meal.
iv. In the intermediate host, microfilariae moult and develop into **3rd stage (infective) larvae**, in the intermediate host.
v. When the vector bites a healthy person, infectious larvae are injected in the dermis of the skin.
vi. After about one year, the larvae moults through two more stages maturing into adult worms.

Mode of transmission:

Wuchereria bancrofti is transmitted to human body by female *Culex* mosquito.

The larvae escape mosquito body and arrive on the human skin.

They penetrate the skin, undergo two moultings before they become adults and settle in the lymphatic system.

Incubation period can be as long as 8-16 months.

Q.54. How can filariasis be managed? [1/2 Marks]

Ans: Filariasis can be managed by:

i. Use of diethyl - carbamazine citrate twice a day for three weeks and thereafter for five days every six month is effective against filarial worms.
ii. It is best to prevent infection by avoiding mosquito bite and using mosquito nets and insect repellents.
iii. Eradication of mosquitoes is essential for control of filariasis.

[Note:** Eradication of an entire species (mosquitoes) is likely not possible and hence control by preventing large scale breeding should be followed to reduce transmission of vector borne diseases through mosquitoes,**]

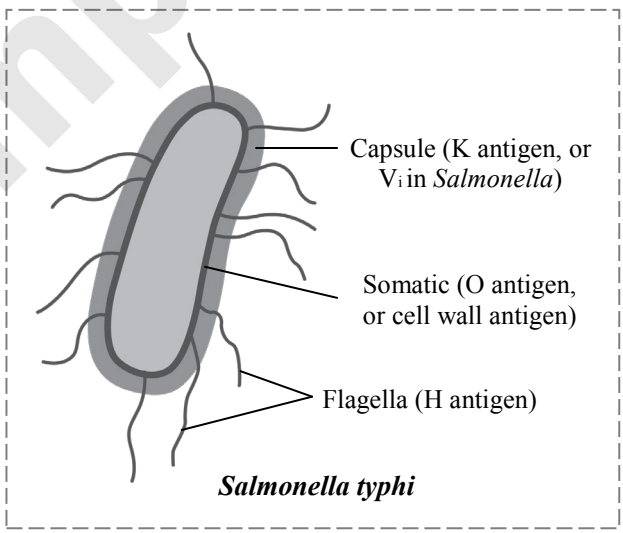
Typhoid

***Q.55. Name the causative agent of typhoid fever? [1 Mark]**

Ans: *Salmonella typhi*

Q.56. Describe the structure of *Salmonella typhi* with a neat diagram. [2/3 Marks]

Ans:



Salmonella typhi

i. Typhoid is an acute infection of intestine caused by *Salmonella typhi*.
ii. It is Gram negative bacteria found in intestinal lumen of infected person.
iii. Pathogenicity of the bacteria is due to "O"- antigen, a lipopolysaccharide (LPS), present on surface coat.
iv. The flagella contain "H"- antigen.

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