Human Health and Diseases

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions (MCQs)

1. Identify the correct pair representing the causative agent of typhoid fever and the confirmatory test for typhoid.
(a) *Salmonella typhi* / Widal test
(b) *Plasmodium vivax* / UTI test
(c) *Streptococcus pneumoniae* / Widal test
(d) *Salmonella typhi* / Anthrone test

2. Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown here?

(a) Hallucinogen (b) Depressant
(c) Stimulant (d) Painkiller

3. Which of the following sets of diseases is caused by bacteria?
(a) Cholera and tetanus
(b) Typhoid and smallpox
(c) Tetanus and mumps
(d) Herpes and influenza

4. A doctor identifies symptoms of nasal congestion, headache, sore throat, hoarseness, cough in a patient. The conclusion is that, the patient is infected by a pathogen
(a) *Plasmodium* (b) Adenovirus
(c) *Salmonella* (d) Rhinovirus.

5. Some of the events occur during life cycle of *Plasmodium* are given below. Identify the correct statement.
(a) Female mosquito take up sporozoites with blood meal.
(b) The sporozoites reproduce sexually in liver cells.
(c) When mosquito bites a man, gametocytes are injected.
(d) The gametocytes develop in RBCs.

6. Which of the following diseases is caused by a protozoan?
(a) Amoebiasis (b) Ascariasis
(c) Syphilis (d) Influenza

7.

X

In the given figure, *X* is caused by
I. *Wuchereria* II. *Microsporum*
III. *Haemophilus* IV. *Epidermophyton*
(a) I and II (b) II and III
(c) II and IV (d) I and IV

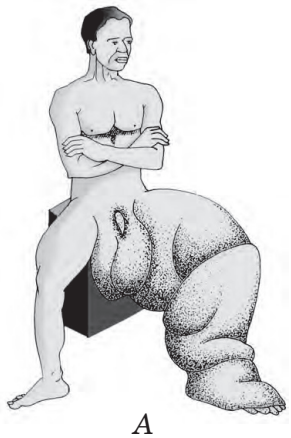
8. Which of the following is an opioid drug ?
(a) Heroin (b) Cocaine
(c) Marijuana (d) Hashish

9. Internal bleeding, muscular pain, blockage of the intestinal passage and anaemia are some of the symptoms caused due to infection by
(a) *Ascaris* (b) *Wuchereria*
(c) *Plasmodium* (d) *Trichophyton.*

10. The mature infective stages of malarial parasite which are transferred from mosquito to man are
(a) trophozoites (b) sporozoites
(c) gametocytes (d) merozoites.

11. Infection of *Ascaris* usually occurs by
(a) Tse-tse fly
(b) mosquito bite
(c) drinking water containing eggs of *Ascaris*
(d) eating imperfectly cooked pork.

12. Which of the following body parts is majorly affected in the disease A?

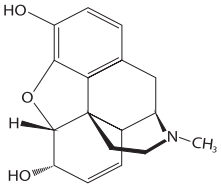


A

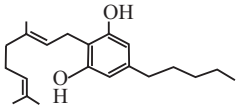
(a) Muscles of the legs
(b) Blood vessels of the thigh region
(c) Skin between the fingers
(d) Lymphatic vessels of the lower limbs

13. Select the correct statement from the ones given below.
(a) Barbiturates when given to criminals make them tell the truth.
(b) Morphine is often given to persons who have undergone surgery as a pain killer.
(c) Chewing tobacco lowers blood pressure and heart rate.
(d) Cocaine is given to patients after surgery as it stimulates recovery.

14. Identify the molecules (A) and (B) shown below and select the right option giving their source and use.



A



B

	Molecule	**Source**	**Use**
(a)	A-Cocaine	*Erythroxylum coca*	Accelerates the transport of dopamine
(b)	B - Heroin	*Cannabis sativa*	Depressant and slows down body functions
(c)	B-Cannabinoid	*Atropa belladonna*	Produces hallucinations
(d)	A - Morphine	*Papaver somniferum*	Sedative and pain killer

15. Common cold differs from pneumonia in that
(a) pneumonia is a communicable disease whereas the common cold is a nutritional deficiency disease
(b) pneumonia can be prevented by a live attenuated bacterial vaccine whereas the common cold has no effective vaccine
(c) pneumonia is caused by a virus while the common cold is caused by the bacterium *Haemophilus influenzae*
(d) pneumonia pathogen infects alveoli whereas the common cold affects nose and respiratory passage but not the lungs.

16. Which one of the following options gives the correct matching of a disease with its causative organism and mode of infection?

	Disease	**Causative organism**	**Mode of infection**
(a)	Typhoid	*Salmonella typhi*	With inspired air
(b)	Pneumonia	*Streptococcus pneumoniae*	Droplet infection
(c)	Elephantiasis	*Wuchereria bancrofti*	With infected water and food
(d)	Malaria	*Plasmodium vivax*	Bite of male *Anopheles* mosquito

17. Match the causative organisms with their diseases.

(A)	*Haemophilus influenzae*	(1)	Malignant malaria
(B)	*Entamoeba histolytica*	(2)	Elephantiasis
(C)	*Plasmodium falciparum*	(3)	Pneumonia
(D)	*Wuchereria bancrofti*	(4)	Typhoid
(E)	*Salmonella typhi*	(5)	Amoebiasis

(a) A – 1, B – 5, C – 3, D – 2, E – 4
(b) A – 3, B – 5, C – 1, D – 2, E – 4
(c) A – 5, B –1, C – 3, D – 4, E – 2
(d) A – 1, B – 3, C – 2, D – 5, E – 4

18. A person suffering from a disease caused by *Plasmodium,* experiences recurring chill and fever at the time when
(a) the sporozoites released from RBCs are being rapidly killed and broken down inside spleen
(b) the trophozoites reach maximum growth and give out certain toxins
(c) the parasite after its rapid multiplication inside RBCs ruptures them, releasing haemozoin.
(d) the microgametocytes and megagametocytes are being destroyed by the WBCs.

19. Which part of poppy plant is used to obtain the drug "smack"?

(a) Flowers (b) Latex
(c) Roots (d) Leaves

20. Identify the wrongly matched pair.

(a) Ringworm – *Trichophyton*
(b) Plague – *Varicella zoster* virus
(c) Malignant malaria – *Plasmodium falciparum*
(d) Common cold – Rhinovirus

21. Which one of the following is incorrect about cancer cells?

(a) They exhibit mass proliferation.
(b) They exhibit the property of contact inhibition.
(c) They are produced when cellular oncogenes of normal cells are activated.
(d) They are metastatic.

22. Which immunoglobulin can pass through placenta?

(a) IgA (b) IgD
(c) IgG (d) IgE

23. Transplantation of tissues/organs fails often due to non-acceptance by the patient's body. Which type of immune response is responsible for such rejections?

(a) Cell-mediated immune response
(b) Hormonal immune response
(c) Physiological immune response
(d) Autoimmune response

24. In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to

(a) autoimmune disease
(b) active immunity
(c) allergic response
(d) graft rejection.

25. Short-lived immunity acquired from mother to fetus across the placenta or through mother's milk to the infant is categorised as

(a) active immunity (b) passive immunity
(c) CMI (d) autoimmunity.

26. Which one of the following statements is correct with respect to AIDS?

(a) The HIV can be transmitted through eating food together with an infected person
(b) Drug addicts are least susceptible to HIV infection
(c) AIDS patients are fully cured with proper care and nutrition
(d) The causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers.

27. Which of the following immunoglobulins does constitute the largest percentage in human milk?

(a) IgA (b) IgG
(c) IgD (d) IgM

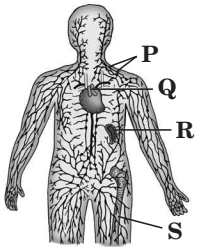
28. At which stage of HIV infection does one usually show symptoms of AIDS?

(a) Within 15 days of sexual contact with an infected person.
(b) When the infected retrovirus enters host cells.
(c) When HIV damages large number of helper T - Lymphocytes.
(d) When the viral DNA is produced by reverse transcriptase.

29. The blood does not clot inside the body because of

(a) oxygenation of blood
(b) movement of blood
(c) presence of heparin in blood
(d) absence of fibrinogen in blood.

30. Select incorrect option regarding the lymphoid organs labelled as P, Q, R and S in the diagram of human lymphatic system.



(a) T cells mature in Q.
(b) B and T cells undergo maturation in R.
(c) B and T cells undergo proliferation and differentiation in P.
(d) B cells mature in S.

31. Read the statements.

(i) IgE antibodies are produced in an allergic reaction.
(ii) B-lymphocytes mediate cell mediated immunity.
(iii) The yellowish fluid colostrum has abundant IgE antibodies.
(iv) Spleen is a secondary lymphoid organ.

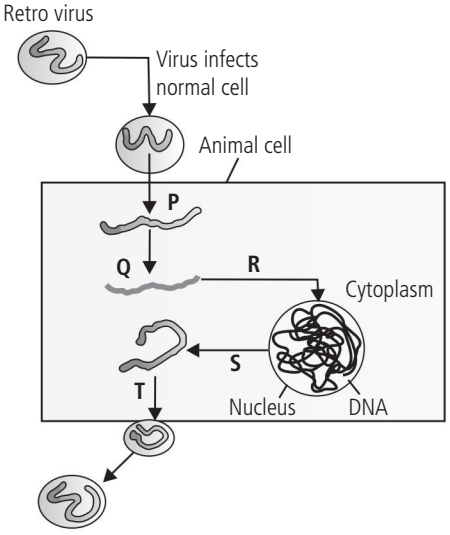
Of the above statements

(a) (i) and (iv) are correct
(b) (i) and (ii) are correct
(c) (ii) and (iii) are correct
(d) (iii) and (iv) are correct.

32. Which of the following is correct regarding AIDS causative agent HIV?
(a) HIV is an enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase.
(b) HIV is an enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase.
(c) HIV is an unenveloped retrovirus.
(d) HIV is an enveloped virus containing two identical molecules of single stranded RNA and one molecule of reverse transcriptase.

33. The cell-mediated immunity inside the human body is carried out by
(a) thrombocytes (b) erythrocytes
(c) T-lymphocytes (d) B-lymphocytes.

34. The figure given below shows mode of action of AIDS virus. Which step shows formation of viral DNA from RNA by reverse transcription?



(a) P (b) Q
(c) R and S (d) T

35. Which one of the following statements is correct with respect to immunity?
(a) Preformed antibodies need to be injected to treat the bite by a viper snake.
(b) The antibodies against small pox pathogen are produced by T-lymphocytes.
(c) Antibodies are protein molecules, each of which has four light chains.
(d) Rejection of a kidney graft is the function of B-lymphocytes.

36. In which one of the following options the two examples are correctly matched with their particular type of immunity?

	Examples	**Type of immunity**
(a)	Polymorphonuclear leukocytes and monocytes	Cellular barriers
(b)	Anti-tetanus and anti-snake bite injections	Active immunity
(c)	Saliva in mouth and tears in eyes	Physical barriers
(d)	Mucus coating of epithelium lining the urinogenital tract and the HCI in stomach	Physiological barriers

37. In the immune system, interferons are a part of
(a) physiological barriers
(b) cellular barriers
(c) physical barriers (d) cytokine barriers

38. Find out the wrong match.
(a) Eosinophils – Allergic response
(b) Basophils – Secrete histamine and serotonin
(c) Neutrophils – Phagocytic and destroy foreign organisms
(d) Monocytes – Secrete heparin

39. Select the correct statement with respect to diseases and immunisation.
(a) If due to some reason B and T lymphocytes are damaged, the body will not produce antibodies against a pathogen.
(b) Injection of dead/inactivated pathogens causes passive immunity.
(c) Certain protozoans have been used in mass production of hepatitis B vaccine.
(d) Injection of snake antivenom against snake bite is an example of active immunisation.

40. Consider the following four statements (i - iv) regarding kidney transplant and select the two correct ones out of these.
(i) Even if a kidney transplant is proper, the recipient may need to take immuno-suppresants for a long time.

(ii) The cell-mediated immune response is responsible for the graft rejection.

(iii) The B-lymphocytes are responsible for rejection of the graft.

(iv) The acceptance or rejection of a kidney transplant depends on specific interferons.

The two correct statements are

(a) (ii) and (iii) (b) (iii) and (iv)

(c) (i) and (iii) (d) (i) and (ii)

Case Based MCQs

Case I : Read the following passage and answer questions from 41 to 45 given below:

X and Y are communicable diseases whereas W and Z are non-communicable diseases. X is transmitted through vectors whereas Y is transmitted through droplet infection. W is caused due to a hormone deficiency whereas Z is a degenerative disease.

Based on the above information, answer the following questions.

41. Identify W, X, Y and Z.

	W	X	Y	Z
(a)	Coronary artery disease	Cholera	Chikun-gunya	Hypertension
(b)	Diabetes	Malaria	Rhinitis	Alzheimer's disease
(c)	Arthritis	AIDS	Shigella	Plague
(d)	Gonorrhea	Diphtheria	Pertussis	Anthrax

42. Select the correct statement.

(a) If X is sleeping sickness then its vector is *Leishmania*.

(b) If Y is diphtheria then it is caused by *Bacillus anthracis*.

(c) If W is hypothyroidism then it is caused by deficiency of thyroxine hormone.

(d) If Z is myocardial infarction then patient develops acute rheumatic fever, joint pain and throat infection.

43. If X and Y both are usual diseases then which of the following holds true?

(a) X could be dengue caused by flavivirus and Y could be AIDS caused by HIV.

(b) X could be chikungunya whereas Y could be rhinitis.

(c) X could be hepatitis whereas Y could be rabies.

(d) X could be chicken pox caused by *Varicella zoster* virus whereas Y could be yellow fever caused by flavivirus.

44. If X and Y both are bacterial diseases then select the correct match from the following.

(a) X- Bubonic plague – *Yersinia pestis*

(b) Y - Gonorrhea – *Neisseria gonorrhoeae*

(c) X - Whooping cough – *Bordetella pertussis*

(d) Y - Botulism – *Clostridium botulinum*

45. Read the given statements and select the correct option.

Statement A : Communicable diseases could be contagious or non-contagious.

Statement B : Diseases that spread through vectors are non-contagious disease.

(a) Both statements A and B are true.

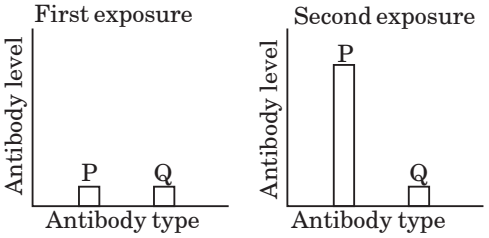
(b) Statement A is true but statement B is false.

(c) Statement A is false but statement B is true.

(d) Both statements A and B are false.

Case II : Read the following passage and answer questions from 46 to 50 given below:

In a study to test a new vaccine against a viral disease, mouse model testing is done. In this process, mice are vaccinated and their blood samples were tested. Mice developed mild disease symptom. After few days those mice were again infected with the virus. This time they do not show any disease symptoms. Their blood samples were tested. Two graphs show antibody concentration for the first and second infection in mice blood.



Based on the above information, answer the following questions.

46. P and Q in the given graphs indicate

(a) IgM and IgG respectively

(b) IgG and IgM respectively

(c) IgG and IgE respectively

(d) IgM and IgA respectively.

47. Which form of pathogen is used in vaccination?

(a) Activated and strong pathogenic antigens
(b) Inactivated and weakened pathogenic antigens
(c) Hyperactive and strong pathogen
(d) Preformed antibodies

48. Which of the following is incorrect for P?
(a) It is the most abundant class of Ig.
(b) It is found in blood, lymph and intestine.
(c) It is unable to cross the placental barrier.
(d) It is a monomer.

49. How does vaccination work?
(a) The immune system produces antibodies which stay in the blood.
(b) Memory lymphocytes remain in the body to fight off any future infection with the same pathogen.
(c) Antigenic proteins of pathogens generate primary immune response and the memory B and T cells.
(d) All of these.

50. Read the given statements and select the correct option.

Statement A : Mice do not show any disease symptoms during second exposure to the pathogenic virus.

Statement B : The antibody production is accelerated and more intense during secondary immune response.

(a) Both statements A and B are true.
(b) Statement A is false but statement B is true.
(c) Statement A is true but statement B is false.
(d) Both statements A and B are false.

Assertion & Reasoning Based MCQs

For question numbers 51-60, two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

51. Assertion : Some diseases that occurred in childhood do not attack again.
Reason : Memory cells plays an important role.

52. Assertion : Inflammatory response is produced in the body after some infections.
Reason : This is one of the ways of defence mechanism.

53. Assertion : Smack is a by-product of heroin synthesis.
Reason : Heroin is an opium alkaloid.

54. Assertion : Spleen produces all type of blood cells in fetus but produces only lymphocytes in adults.
Reason : Macrophages of spleen are phagocytic.

55. Assertion : Immunity is the ability of the body to protect-against all type of foreign bodies that enters the body.
Reason : Spleen is the only organ involved in immunity.

56. Assertion : Allergy is an autoimmune disorder.
Reason : Allergy involves IgE antibodies and chemicals like histamine and serotonin from mast cells.

57. Assertion : Cancer patients are given chemotherapeutic treatments.
Reason : Chemotherapeutic agents are used to destroy malignant cells.

58. Assertion: Tranquilizers are used to treat schizophrenia.
Reason : Tranquilizers are psychedelic drugs.

59. Assertion : Mucous membrane are physiological barriers.
Reason : Microorganisms and dust particles entering the respiratory tract are trapped in the mucus.

60. Assertion : Smoking causes oxygen deficiency in the body.
Reason : Carbon monoxide when inhaled while smoking, combines with haemoglobin to form chemically stable compound.

SUBJECTIVE TYPE QUESTIONS

Very Short Answer Type Questions (VSA)

1. How does saliva act in body defence?

2. How do neutrophils acts as a cellular barrier to pathogens in humans?

3. When is tumour referred to as malignant?

4. A boy of ten years had chicken-pox. He is not expected to have the same disease for the rest of his life. Mention how it is possible.

5. What does the enzyme reverse transcriptase catalyze?

6. How does nicotine affect human body?

7. Name any two infectious diseases that are transmitted through fecal-oral route.

8. Name the drugs obtained from hemp plant.

9. How does colostrum provide initial protection against diseases to new born infants?

10. Which disease is associated with the following symptoms : Sudden onset of profuse watery stool followed by vomiting, rapid dehydration, and muscular cramps?

Short Answer Type Questions (SA-I)

11. How does moderate fever help a person in combating infections? What is to be done to bring down very high body temperature?

12. What category of pathogens causes poliomyelitis? How is crippling caused in the victim of this disease? How this disease can be prevented?

13. How does the skin serve as the first line of defence?

14. Why is using tobacco in any form injurious to health?

15. A young boy when brought a pet dog home started to complain of watery eyes and running nose. The symptoms disappeared when the boy was kept away from the pet.
(a) Name the type of antibody and the chemicals responsible for such a response in the boy.
(b) Mention the name of any one drug that could be given to the boy for immediate relief from such a response.

16. (a) Name a drug used (i) as an effective sedative and painkiller (ii) for helping patients to cope with mental illnesses like depression, but often misused.
(b) How does the moderate and high dosage of cocaine affect the human body?

17. Differentiate between benign and malignant tumours.

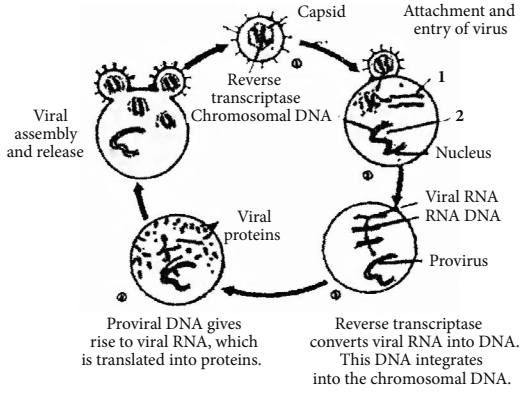
18. What is meant by contact inhibition? How does this phenomenon operate in cancer cells?

19. Name one plant and the addictive drug extracted from its latex. How does this drug affect the human body?

20. List the specific symptoms of typhoid. Name its causative agent.

Short Answer Type Questions (SA-II)

21. The diagram below illustrates the attack of a virus on a host cell.



(i) Name the parts numbered 1 and 2.
(ii) Describe the functions performed by the part labelled number 1 on its entry into host cell.
(iii) What are such viruses called?
(iv) Name any two human diseases caused by such viruses.

22. (a) Name the infective stage of *Plasmodium* which *Anopheles* mosquito takes in along with the blood meal from an infected human.
(b) Why does the infection cause fever in human?
(c) Give a flow chart of the part of the life cycle of this parasite passed in the insect.

23. Name the type of cell the AIDS virus first enters into after getting inside the human body. Explain the sequence of events that the virus undergoes within these cells to increase their progeny.

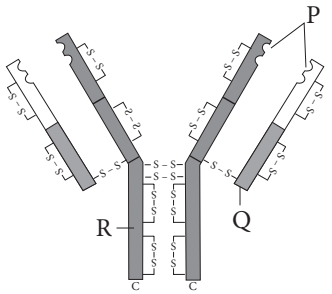
24. Name the pathogen that causes amoebiasis in humans. Give the symptoms and the mode of transmission of the disease.

25. (a) What is meant by addictive disorder?
(b) Name any two opiate narcotics.
(c) How does amphetamines affect human body?

26. Why does a doctor administer tetanus antitoxin and not a tetanus vaccine to a child injured in a roadside accident with a bleeding wound? Explain.

27. How is the fetus with Rh-positive blood affected if the mother is Rh-negative?

28.



Identify P, Q and R in the schematic diagram of an antibody given above and answer the questions.

(a) Write the chemical nature of an antibody.
(b) Name the cells that produce antibodies in humans.
(c) Mention the type of immune response provided by an antibody.

29. (a) List any two situations when a medical doctor could recommend injection of preformed antibodies into the body of a patient. Name this kind of immunization and mention its advantages.
(b) Name the kind of immunity attained when instead of antibodies, weakened antigens are introduced into the body.

30. Describe the structure of immunoglobulin (Ig). Draw diagram showing the formation of antigen-antibody complex and label the parts.

31. What is the role of each of the following in the body defences.
(i) Antihistamine (ii) Plasma cells
(iii) Helper T cells

32. Which pathogen causes diphtheria? Why is it dreaded as fatal disease? How can it be prevented?

33. What is metastasis? List any four danger signals of cancer.

34. Differentiate between active immunity and passive immunity. Give any one example where passive immunisation is needed.

Long Answer Type Questions (LA)

35. Describe the asexual and sexual phases of life cycle of *Plasmodium* that causes malaria in humans.

36. (a) Name and explain any four lymphoid organs present in humans.
(b) Categorise the named lymphoid organs as primary or secondary lymphoid organs, giving reasons.

37. Give the scientific name of the organism that causes whooping cough. Give two main symptoms of this disease. What vaccine gives protection from this disease?

38. (a) What happens to a normal cell in a body when oncogenes get activated under certain conditions?
(b) Which techniques are useful to detect cancer of internal organs?
(c) Why are cancer patients often given α-interferon during their treatment?

ANSWERS

OBJECTIVE TYPE QUESTIONS

1. (a) : Typhoid is caused by bacterium *Salmonella typhi*, transmitted through fecal oral route. It results in high fever, abdominal pain and frequent stools and is confirmed by Widal test.

2. (a) : The plant illustrated in the diagram is *Datura*. Seeds of *Datura stramonium* are misused for their hallucinogenic properties because of the presence of anticholinergic alkaloids atropine, hyoscyamine and scopolamine (= hyoscine). However, even in slight excess, they can cause death.

3. (a) : Cholera is caused by bacterium *Vibrio cholerae*, tetanus is caused by bacterium *Clostridium tetani*, typhoid is caused by bacterium *Salmonella typhi*, small pox is caused by *Variola* virus, mumps is caused by Paramyxovirus, herpes is caused by *Herpes simplex* virus and influenza is caused by *Orthomyxovirus*.

4. (d) **5. (d)**

6. (a) : Ascariasis is caused by filiarial worm, syphilis is a sexually transmitted disease and influenza is caused by orthomyxovirus.

7. (c) : X is ringworm which is a fungal disease caused by *Microsporum*, *Trichophyton* and *Epidermophyton*. *Wuchereria* causes elephantiasis and *Haemophilus* causes influenza.

8. (a) : Opioids are the drugs derived from opium along with their synthetic relatives. Heroin is a semisynthetic opiate. Heroin is formed from morphine by acetylation. It is highly addictive and therefore considered most dangerous opiate.

9. (a) : Common ascariasis is caused by the common round worm *Ascaris lumbricoides*. It is an intestinal worm, white in colour and having females longer than the males.
There is no intermediate host of the parasite, so man acquires infection by directly ingesting *Ascaris* eggs. Since a large number of adult *Ascaris* worms normally infest a single host, they obstruct the intestinal passage and thereby causing abdominal discomfort, like colic pain, impaired digestion, diarrhoea and vomiting. The infection is followed by anaemia, leucocytosis and eosinophilia.

10. (b) : Infective stage of *Plasmodium* is sporozoite. When a female *Anopheles* mosquito carrying sporozoites bites a person, sporozoites are injected into the body of the person, which reach the liver through blood. The parasite reproduces asexually in the liver cells, bursting the cells and releasing into the blood. Parasites then enter the RBCs and reproduce asexually there, bursting the RBCs and causing the cycles of fever and other symptoms. The rupture of RBCs is associated with release of a toxic substance called haemozoin.

11. (c) : Man acquires infection of *Ascaris* by directly ingesting *Ascaris* eggs, containing the infective second stage larva, with contaminated food or water. Life cycle of *Ascaris* is monogenetic *i.e.,* there is no vector or intermediate host.

12. (d) : *Wuchereria bancrofti* is a dreaded human parasite. It is a digenetic parasite completing its life cycle in two hosts, the final host is man harbouring the adult worm. The disease passes through four stages in human beings. In the first stage, the patient has increased eosinophils, enlarged lymph nodes. Second or carrier stage is symptomless. Third stage is characterised by filarial fever, inflammation of lymph nodes (lymphadenitis) and lymph vessels (lymphangiectasis) and reversible lymphoedema (excess fluid in tissues due to obstruction of lymph vessels) in various body parts. The fourth or final stage is manifested by lymphoedema accompanied by thickening of subcutaneous tissues and skin so that there is permanent swelling mostly of feet, legs, thighs, scrotal sacs, breast etc. It is called elephantiasis.

13. (b) : Morphine is a potent opioid analgesic used mainly to relieve severe and persistent pain, particularly in terminally ill patients or who have undergone surgery. It also induces feelings of euphoria. It is administered by mouth, injection, or in suppositories. Common side-effects are nausea and vomiting, constipation, and drowsiness. With regular use, tolerance develops and dependence may occur.

14. (d) : The given chemical structures (A) and (B) are of morphine and cannabinoid respectively. Morphine is the principal opium alkaloid. It is a strong analgesic. It also has sedative and calming effect. Morphine depresses respiratory centre, it contributes to the fall in blood pressure. Morphine is a very effective sedative and painkiller. It is very useful in patients who have undergone surgery. Natural cannabinoids are obtained from the inflorescence of hemp plant *Cannabis sativa*, family cannabinaceae. They affect the cardiovascular system of the body.

15. (d) : Common cold or rhinitis is one of the most infectious diseases caused by Rhinoviruses. It affects nose and respiratory passage but not lungs. It spreads by droplet infection or contaminated objects. Pneumonia, caused by bacterium *Streptococcus pneumoniae* and *Haemophilus influenzae* is a serious disease of lungs in which fluid collects in the alveoli and bronchioles. The disease spreads by sputum of the patient.

16. (b)

17. (b) :

Haemophilus influenzae	–	Pneumonia
Entamoeba histolytica	–	Amoebiasis
Plasmodium falciparum	–	Malignant malaria
Wuchereria bancrofti	–	Elephantiasis
Salmonella typhi	–	Typhoid

18. (c) : *Plasmodium* is a tiny protozoan which is responsible for malaria in the human. In malaria the patient experiences high fever which periodically rises and also experiences recurring chills with fever. Such symptoms are seen because when the RBCs carrying *Plasmodium* (one of the stage in the life cycle of the parasite) ruptures it releases a toxic substance called haemozoin which is chiefly responsible for the chill and high fever recurring every three to four days.

19. (b) : Smack (Heroin) is chemically diacetylmorphine which is a white, odourless, bitter, crystalline compound. This is obtained by acetylation of morphine, extracted from the latex of poppy plant (*Papaver somniferum*).

20. (b)

21. (b) : Cancer is a disease of uncontrolled proliferation of cells without any differentiation. Cell growth and differentiation is highly controlled and regulated in normal cell, but in cancer cells, there is breakdown of these regulatory mechanisms. Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appear to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumors. Cells sloughed from tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property is called metastasis.

22. (c) : IgG is the most abundant immunoglobulin constituting 80% of the total immunoglobulins. It is found in blood, lymph and intestine. It protects against bacteria and viruses by enhancing phagocytosis, neutralising toxins and complement activation. It is the only class of antibody to cross the placenta from mother to fetus, thereby conferring considerable immune protection in newborns.

23. (a) : Transplantation of tissue/organ often fails due to non-acceptance by the patient's body therefore, tissue matching and blood group matching are essential before undertaking any graft/transplant. When the immune system recognises the protein in the transplanted tissue or organ as foreign, it initiates cellular immunity. As a result of this, there is a rejection of transplanted organs. To suppress the immune response during transplantation, histocompatibility antigen and immunosuppressants play an important role.

24. (a) : Autoimmunity is a disorder of the body's defense mechanism in which an immune response is elicited against its own tissues, which are thereby damaged or destroyed. Autoimmunity may be caused due to genetic or environmental factors.

25. (b) : Passive immunity is produced by a donor other than the infected person or an animal. It is short lived.

26. (d)

27. (a) : IgA immunoglobulins are the second most abundant class of immunoglobulins, which are mainly found in sweat, tears, saliva, mucus, colostrum and gastrointestinal secretions.

28. (c) : AIDS is a disorder of cell-mediated immune system of the body. Virus responsible for AIDS is HIV (Human immunodeficiency virus) which is a retrovirus. There is a reduction in the number of helper T-cells, which stimulate antibody production by B-cells. This results in the loss of natural defence against viral infection.

29. (c) : Heparin is a glycosaminoglycan with anticoagulant properties, which is produced by basophils and mast cells. It does not allow blood to clot inside blood vessels.

30. (b) : In the given diagram, 'P'-Lymph nodes, 'Q'-Thymus, 'R'-Spleen, 'S'-Bone marrow. Thymus and bone marrow are the primary lymphoid organs where maturation of T-cells and B-cells take place respectively. Lymph nodes and spleen are the secondary lymphoid organs where T-cells and B-cells undergo proliferation and differentiation.

31. (a) : Colostrum, the first milk secreted by mother is rich in IgA antibody. It provides protection against bacteria and virus. B-lymphocytes mediate humoral immune response whereas cell-mediated immunity is mediated by T-lymphocytes.

32. (b) : HIV is spherical virus with a diameter of about 90-120 nm. Its genome consists of a single-stranded RNA filament segmented into two identical filaments and associated with reverse transcriptase enzymes. The envelope consists of a lipid bilayer derived from host cell membrane and projecting knob like glycoprotein spikes. It contains two protein coats.

33. (c) : Cell-mediated immunity is mediated by cells of the T-lymphocytes with antigen-specific receptors on their surfaces. Reaction of the receptor with its antigen, triggers the release of physiologically active cytokinins.
Since the T-cells must be present on the spot to play their role, they are said to form cell-mediated immune system.
Helper-T-cells help in activating cytotoxic-T-cells which are capable of killing microorganisms. Hence, cytotoxic cells are responsible for cell-mediated immunity in body.

34. (b)

35. (a) : In case of snake bite the injection which is given to the patients contains preformed antibodies against the snake venom. This type of immunisation is called passive immunisation.

36. (a) :

(a) Polymorphonuclear leukocytes and monocytes – Cellular barriers

(b) Anti-tetanus and anti-snake bite injections – Passive immunity

(c) Saliva in mouth and tears in eyes – Physiological barriers

(d) Mucus coating of epithelium lining the urinogenital tract and HCl in stomach – Physical barriers

37. (d) : Interferons are a type of cytokine barrier. Interferons are the proteins secreted by the virus infected cells, which protect non infected cells from further viral infection.

38. (d)

39. (a) : Lymphocytes provide immunity to the body against pathogens. B lymphocytes generate antibody-mediated or humoral immunity while T lymphocytes generate cell-mediated immunity. B lymphocytes produce specialised proteins called antibodies. Antibody formation by B cells is stimulated by

T cells (helper T cell). Therefore, if due to some reason B and T lymphocytes are damaged, the body will not produce antibodies against a pathogen.
Injection of dead/inactivated pathogens causes active immunity. Injection of snake antivenom against snake bite is an example of passive immunisation.
Second generation vaccines are prepared by recombinant DNA technique/ genetic engineering. For example; hepatitis B virus vaccine.

40. (d) : Kidney transplant is allograft. Tissue matching, blood group matching are essential before undertaking kidney transplant and even after this the patient has to take immuno-suppresants all his/her life. The body is able to differentiate between 'self' and 'nonself' and thus, the cell-mediated immune response is responsible for the graft rejection.

41. (b) : X is a communicable disease that is transmitted through vectors. It could be malaria, chikungunya, etc. Y is communicable disease that is transmitted through droplet infection. It could be rhinitis, diphtheria, pertussis, etc
W is a non-communicable disease like diabetes that is caused by deficiency of insulin hormone.
Z is a non-communicable degenerative disease like Alzheimer's disease.

42. (c) : Sleeping sickness is caused by *Trypanosoma*. Diphtheria is caused by *Corynebacterium diphtheriae*.
In myocardial infarction a large portion of heart muscle is deprived of blood due to coronary thrombosis and patient develops heart attack.

43. (b)

44. (a) : Gonorrhea is a STD which is spread through sexual contact. Whooping cough spreads through droplet infection. Botulism spreads through faecal oral route.

45. (a)

46. (b) : Initial contact with an antigen causes primary immune response. In primary immune response, no antibodies are present initially. Then, a slow rise in the antibody titer occurs, first IgM and then IgG, followed by a gradual decline in antibody titer. In secondary immune response, the antibody formation is accelerated and more intense. This is also called booster response. It mainly consists of IgG antibodies.

47. (b) : Vaccine is a preparation or extract of an inactivated/ attenuated (weakened) pathogen of a disease which on inoculation into a healthy person provides immunity by inducing antibodies production.

48. (c) : IgG is the only class of antibody to cross the placenta from mother to fetus.

49. (d)

50. (a)

51. (a) : This can be explained in terms of memory cells. After the infection disappears as a result of antigen-antibody interaction and killer T-cell-nonself cell interaction, some of the specific lymphocytes remain in lymphatic tissue as "memory or primed cells" which are ready to produce the antibodies and killer cells if the same antigens reappear. That is why the second attack of the infectious disease elicits quick and abundant antibody formation. The memory cells can give rise to more effector cells and memory cells in case of a second attack of antigens. Whereas the effector cells have a life of a few days only, and the memory cells live long, some even for whole life. The memory cells are stored in the spleen and lymph nodes.

52. (a) : Infection or tissue injury often results in redness and swelling, along with pain and production of heat that may result in fever. Such manifestation is localized and, is known as inflammatory response. This response occurs due to release of chemical signals, alarm signals, notably histamine and prostaglandins, by the damaged mast cells. There is a leakage of vascular fluid, which contains serum proteins with antibacterial activity. Further, there is an influx of phagocytic cells into the affected area. These responses inhibit and destroy the invading microorganisms. Thus, inflammatory response is said to be a defence mechanism.

53. (b) : Heroin is diamorphine or diacetylmorphine commonly called smack. Opium is semisynthetic opiate (opium-derivative) which is most dangerous of all the opiates. Heroin is formed from acetylation of morphine.

54. (b)

55. (c) : The principal parts of the immune system are the bone marrow, thymus, lymphatic system, tonsils, and spleen. The lymph nodes, tonsils, and spleen act to trap and destroy antigens from the lymph, air, and blood, respectively.

56. (b) : Allergy is a non-infectious unusual reaction or hypersensitivity of an individual to a foreign substance or agent that may be harmless to other individuals (thus it is considered as immunity disorder). It is non-communicable as it is confined to a person only and does not spread from one person to another. Allergy involves mainly IgE antibodies and chemicals like histamine and serotonin from the mast cells.

57. (a) : Chemotherapeutic agents inhibit/kill invading parasite/malignant cell and have no/minimal pharmacodynamic effects on the recipient. Pharmacodynamic agents affect our body's physiology and biochemistry.
Chemotherapeutic drugs may be more toxic to cancerous cells than to normal cells.

58. (c) : Some tranquilizers are also called antipsychotic drugs (major tranquilizers) as they have good effect in all types of psychosis (patients having severe psychiatric illness, schizophrenic patients). They reduce aggressiveness. Thought and behaviour are gradually normalised and anxiety is

relieved. Examples of antipsychotic drugs are Phenothiazines, Chloropromazine, Reserpine, etc.

59. (d) : Innate immunity is a non-specific type of defence, that is accomplished by providing different types of barriers to the entry of the foreign agents into our body. Mucus coating of the epithelium lining in the respiratory, gastrointestinal and urogenital tracts are physical barriers which traps microbes and prevents their entry in our body.

60. (a)

SUBJECTIVE TYPE QUESTIONS

1. Saliva contains lysozyme which kills the microorganisms that come with food and drink, thus act in body defence.

2. Cellular barrier is a type of innate immunity. Neutrophil is a type of leucocyte (WBC) in the blood which phagocytose and destroy microbes, thus act as cellular barrier to pathogens in human.

3. Tumour is called malignant when it invades and destroys the tissue in which it originates and has the potential to spread to other sites in the body *via* the bloodstream and lymphatic system.

4. A body when encounters a pathogen for first time produces antibodies, that result in memory of the first encounter to protect the body in future.

5. Reverse transcriptase is an enzyme, found mainly in retroviruses, that catalyses the synthesis of DNA from RNA.

6. Nicotine stimulates the release of adrenaline leading to high blood pressure and heartbeat rate.

7. Poliomyelitis and Shigellosis

8. Bhang, ganja, charas marijuana and datura.

9. Colostrum provides protection against disease to new born babies because it is rich in antibodies, *e.g.* IgA.

10. Cholera

11. Moderate fever strengthens the defence mechanism by activating the phagocytes and by inhibiting the growth of microbes. A very high temperature may prove dangerous. It must be quickly brought down by giving antipyretics (fever reducing drugs *e.g.*, aspirin) and by applying cold packs.

12. Poliomyelitis is caused by poliovirus - one of a small group of RNA - containing viruses. They are included within the picornavirus group. It affects the central nervous system resulting in crippling. The disease can be prevented by avoiding contaminated food and water. Immunization using the Sabin vaccine (taken orally) or the Salk vaccine (injected) is highly effective.

13. The oil and sweat (chemical barriers) secreted by sebaceous and sudoriferous glands of skin contains fatty acids and lactic acid, which make the skin surface acidic. These have antibacterial and antifungal activity. Lysozyme present in sweat, also kills many bacteria. Thus it provides first line of defence.

14. Tobacco is used for smoking, chewing and snuffing. Its main stimulating component is a poisonous, volatile alkaloid nicotine, which causes addiction. Besides the poisonous nicotine, it also contains carbon monoxide and polycyclic aromatic hydrocarbons. It leads to various diseases such as cancer, high and low blood pressure, smoker's cough and bronchitis.

15. (a) Such a response in the boy is called allergy which occurs due to production of IgE antibodies and chemicals like histamine and serotonin from the mast cells.

(b) Anti-histamine could be given to the boy for immediate relief from such a response.

16. (a) (i) Morphine (ii) Barbiturates

(b) Cocaine taken in low dose induces sense of well being and pleasure and delays fatigue, but in high dosage, it causes hallucinations.

17. Benign tumour does not invade and destroy the tissues in which it originates or spread to distant sites in the body, *i.e.*, a tumour that is not cancerous. Benign tumour may nonetheless cause serious morbidity or mortality by compressing or obstructing vital structures.

Malignant tumour invades and destroys the tissue in which it originates and has the potential to spread to other sites in the body *via* the blood stream and lymphatic system.

18. The normal cells are characterised by contact inhibition *i.e.* they form monolayers. Further, they cannot move away from each other. However in cancer cells they form multilayer due to loss of contact inhibition. As a result, they freely move, and get deposited in any part of the body, a property referred to as metastasis.

19. Heroin commonly called smack is chemically diacetyl-morphine obtained by acetylation of morphine which is extracted from the latex of poppy plant *Papaver somniferum*. It is a depressant and slows down body functions. It induces drowsiness and lethargy. Its after effects include indigestion, reduced vision, decreased weight, sterility and total loss of interest in work.

20. Typhoid is caused by *Salmonella typhii.* Its specific symptoms are :

(i) constant high fever but low pulse rate

(ii) weakness and

(iii) abdominal pain and passes frequent stools.

21. (i) 1 is viral RNA and 2 is provirus.

(ii) Viral RNA initiates the formation of viral DNA in the host.

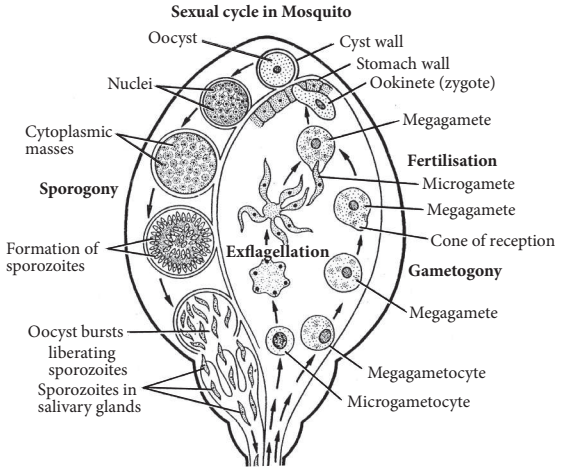
(iii) Retroviruses.

(iv) Cancer, AIDS.

22. (a) The infective stage of *Plasmodium* which *Anopheles* mosquito takes in along with the blood meal from an infected human is gametocyte.

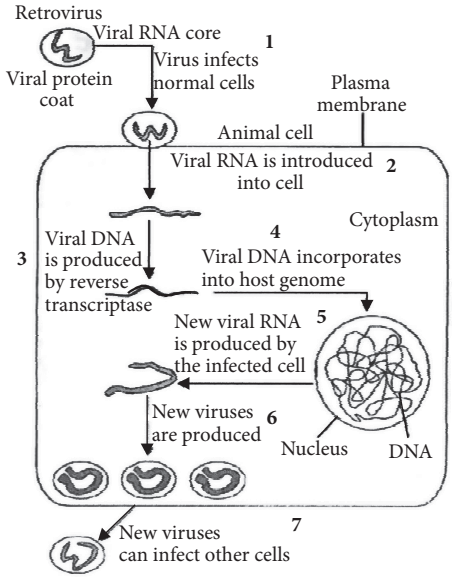
(b) Malaria is characterised by fever at intervals, sudden acute chillness (cold rigor stage) accompanied by shivering followed by rise in temperature. Peak fever (hot or febrile stage) is 41.1°C or 106°F which persists for 3-6 hours. After 2-4 hours of fever, there is profuse sweating (sweating or defervescence stage) which lowers the body temperature to near normal.

(c) Life cycle of *Plasmodium vivax* showing stages in insect



23. The AIDS virus first enters into macrophages after getting inside the human body.

Sequence of events are as follows:



24. Amoebiasis is caused by monogenetic protozoan *Entamoeba histolytica*. It is characterised by abdominal pain, mild diarrhoea alternating with constipation, passing out of mucus, pieces of necrotic mucous membrane and blood in faeces, and faeces with cysts. The infection occurs by the cysts of *Entamoeba* present in the stool of infected person, cat, dog, monkey, rat, rabbit etc. through the agency of house flies, manure, air currents, a number of other physical contacts and unsafe drinking water.

25. (a) Addictive disorder is a state in which a person has a strong desire to take the addictive substance (drugs, alcohol, tobacco etc.).

(b) The two opiate narcotics are morphine and heroin.

(c) Amphetamines are called antisleep drugs as they are CNS stimulants. They cause alertness, self-confidence, talkativeness and increased work capacity. They suppress hunger. High doses produce euphoria, depression and insomnia. After effects include nausea and vomiting.

26. A child injured in a roadside accident with a bleeding wound has chances of getting infected from tetanus so quick immune response is required, therefore, preformed antibodies, or antitoxin (a preparation containing antibodies to the toxin) is directly injected. In vaccination, a preparation of antigenic proteins of pathogen or inactivated/weakened pathogen (vaccine) are introduced into the body. The antibodies produced in the body against these antigens would neutralise the pathogenic agents during actual infection. Therefore, vaccine administration would not give quick relief and thus not considered effective.

27. An Rh-ve person, if exposed to Rh+ve blood, will form specific antibodies against the Rh antigens. This is observed in case of Rh-ve blood of a pregnant mother with Rh+ve blood of the foetus. Rh antigens of the foetus do not get exposed to the Rh-ve blood of the mother in the first pregnancy as the two bloods are well separated by the placenta. However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to small amounts of the Rh+ve blood from the foetus. In such cases, the mother starts preparing antibodies against Rh antigen in her blood. In case of her subsequent pregnancies, the Rh antibodies from the mother (Rh-ve) can leak into the blood of the foetus (Rh+ve) and destroy the foetal RBCs. This could be fatal to the foetus or could cause severe anaemia and jaundice to the baby. This condition is called erythroblastosis foetalis. This can be avoided by administering anti-Rh antibodies to the mother immediately after the delivery of the first child.

28. In the given structure of an antibody molecule, 'P' is the antigen binding site, 'Q' is constant region of light chain and 'R' is constant region of heavy chain.

(a) Antibodies are immunoglobulins which are protein in nature.

(b) B-cells produce antibodies.

(c) Humoral immune response is an antibody mediated immune response.

29. (a) If a person is infected with some deadly microbes to which quick immune response is required as in tetanus, we need to directly inject the preformed antibodies or antitoxin. Even in the cases of snakes bites the injection which is given to the patients, contain preformed antibodies against the snake venom. This type of immunisation is called passive immunisation. It provides immediate relief.

(b) In vaccination, a preparation of antigenic proteins of pathogens or inactivated weakened pathogens are introduced into the body. This produces immune response and the type of immunity is called active immunity.

30. Immunoglobulins are glycoproteins made up of four polypeptide chains (linked by disulphide bonds), two heavy and two light chains. Light and heavy chains are subdivided into variable and constant region. Variable portion is used for binding to antigen and a constant portion determines its adherence and diffusivity.

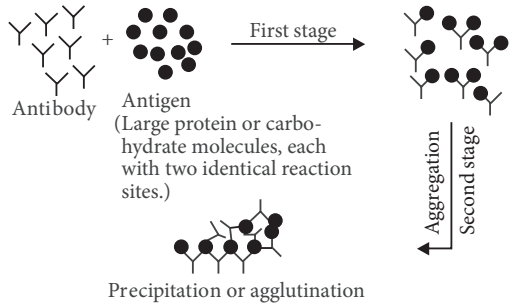


Fig.: Stages of the antigen antibody reaction.

31. (i) Antihistamine is a drug that inhibits the action of histamine in the body by blocking either of two types of receptors for histamine, H_1 or H_2. When stimulated by histamine, H_1 receptors may produce such allergic reactions as hay fever, pruritus (itching), and urticaria (nettle rash). Antihistamines that block H_1 receptors (H_1-receptor antagonists) are used to relieve these conditions.

(ii) Plasma cells are antibody-producing cells found in blood forming tissues and also in the epithelium of the lungs and gut. They develop in the bone marrow, lymph nodes, and spleen when antigens stimulate B-lymphocytes to produce the precursor cells that give rise to them.

(iii) Helper T cell is a type of T-lymphocyte that plays a key role in cell-mediated immunity by recognizing foreign antigen on the surface of antigen-presenting cells when associated with the individual's MHC antigens, which is further processed by antigen-presenting cells. Helper T-cell stimulates the production of cytotoxic T-cell, which destroys the target cells.

32. Diphtheria is caused by *Corynebacterium diphtheriae*. This disease is dreaded because at later stage, a soft grey membrane forms across the throat, constricting the air passage causing difficulty in breathing and swallowing. Bacteria multiply at the site of infection and release a toxin into the bloodstream which damages heart and nerves. Death from heart failure or general collapse can follow within four days. The disease is spread by direct contact with a patient or carrier or by contaminated milk. It can be prevented by taking DPT vaccine.

33. Metastasis is the phenomenon in which cancer cells spread to distant sites through body fluids to develop secondary tumour. This occur by three main routes : (i) through the blood stream (haematogenous), (ii) through the lymphatic system, (iii) across body cavities.

The four danger signals of cancer are :

– A lump or hard area in the breast.
– Unexplained loss of weight and low-grade fever
– An uncurable ulcer.
– Non-injury bleeding from the surface of skin, mouth or any other opening of the body.

34. The given table shows differences between active and passive immunity.

	Active immunity	**Passive immunity**
1.	Exposure to antigen.	No exposure to antigen.
2.	It is developed when the person's own cells produce antibodies in response to infection or vaccine.	It is developed when antibodies produced in other organisms are injected into a person to counter act antigen such as snake venom.
3.	It provides relief only after long period.	It provides immediate relief.
4.	It has no side effects.	It may cause reaction.
5.	It is long lasting.	It is not long lasting.

In case of snake bites, injection containing preformed antibodies against the snake venom is given to the patient.

35. Malaria is caused by the toxins produced in the human body by malarial parasite *Plasmodium*. Life cycle of *Plasmodium* requires two hosts for completion.

Life cycle of *Plasmodium* in man (asexual phase): The infective stage of *Plasmodium* is sporozoite. When the mosquito bites man, sporozoites present in the salivary gland of female *Anopheles* mosquito are injected into the blood of the man. The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture. The rupture of RBCs is associated with release of a toxic substance, haemozoin, which is responsible for the

chill and high fever recurring every three to four days. The released parasites from the ruptured RBCs infect new RBCs and develop into gametocytes (male and female). When a female *Anopheles* mosquito sucks the blood of an infected human host, it receives RBCs containing gametocytes.

Life cycle of *Plasmodium* in mosquito: The gametocytes come out of the RBCs into the lumen (cavity) of the stomach of the mosquito. Inside the stomach of the mosquito, the male and female gametocytes fuse (fertilize) to form zygote called oocyst. The nucleus of oocyst divides first by meiosis and subsequently by mitosis, forming large number of small haploid nuclei. At the same time, spindle shaped bodies called sporozoites are formed. When mature oocysts rupture, the sporozoites are liberated into the haemocoel (body cavity filled with blood) of the mosquito. Being motile, the sporozoites move to different organs in the body cavity of the mosquito, but many of them penetrate the salivary glands. The mosquito now becomes infective. When the female *Anopheles* mosquito bites a healthy person, the sporozoites are injected in his/her blood along with saliva. These sporozoites start the cycle again in human body.

36. (a) Four lymphoid organs present in humans are :

(i) Bone marrow : It is the main lymphoid organ where all blood cells including lymphocytes are formed. Maturation of B-lymphocytes occurs here.

(ii) Thymus : It is the site of T-lymphocyte maturation. Thymus is situated near the heart and is quite large in size at the time of birth but keeps reducing with age.

(iii) Lymph nodes: These are small solid structures found at intervals along the lymphatic system. They are composed of lymphoid tissue and act as filters for the lymph, preventing foreign particles from entering the bloodstream. Lymph nodes also produce lymphocytes and plasma cells.

(iv) Spleen: It is a bean shaped organ which is the largest single mass of lymphoid tissue in the body. In fetus the spleen produces all types of blood cells but in adult it only produces lymphocytes. Macrophages of spleen are phagocytic.

(b) Bone marrow and thymus are primary lymphoid organs where T-lymphocytes and B-lymphocytes mature and acquire their antigen-specific receptors. Lymph nodes and spleen are secondary lymphoid organs where B-lymphocytes and T-lymphocytes after maturation migrate via blood vascular and lymphatic system to the secondary lymphoid organs where they undergo poliferation and differentiation.

37. Whooping cough or pertussis is caused by *Bordetella pertussis* and is common childhood disease.

It causes constant cough leaving the child breathless, tired and red in face. Later the voice becomes hoarse and the cough gives a whoop or a loud crowing sound while inhaling. The child usually vomits and there is frothy discharge from his mouth and nose.

Immunisation of the disease is done by DPT vaccination within six weeks of birth.

38. (a) When cellular oncogenes or proto-oncogenes are activated under certain conditions in normal cells in a body, they could lead to oncogenic transformation of the cells. Transformation of normal cells into cancerous neoplastic cells may be induced by physical, chemical or biological agents also.

(b) Techniques like radiography (use of X-rays), CT (computed tomography) and MRI (magnetic resonance imaging) are very useful to detect cancers of the internal organs. Computed tomography uses X-rays to generate a three-dimensional image of the internal organ. MRI uses strong magnetic fields and non-ionising radiations to accurately detect pathological and physiological changes in the living tissue.

(c) Cancer patients are often given α-interferon during their treatment, because these biological response modifiers activate the immune system and help in destroying the tumour.

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