

Human Health and Diseases

CASE STUDY / PASSAGE BASED QUESTIONS

1

Read the following and answer any four questions from 1(i) to 1(v) given below:

Riya studies in II standard in a government school. She belongs to a backward family and her parents did not get her properly vaccinated according to immunisation programme. Once while playing in school playground she fell down due to weakness and developed high fever, headache and stiffness in her neck.

Identify the illness she could be suffering from and answer the following questions.

- (i) The microbe responsible for Riya's illness could be
- | | |
|----------------------------|----------------------------|
| (a) <i>Vibrio cholerae</i> | (b) <i>Enterovirus</i> |
| (c) <i>Plasmodium</i> | (d) <i>Mycobacterium</i> . |
- (ii) Which vaccine, if administered earlier, would have saved Riya from the illness she unfortunately contracted?
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|------------------|-----------------------|
| (a) Salk vaccine | (b) MMR vaccine |
| (c) BCG vaccine | (d) Varicella vaccine |
- (iii) The disease that Riya has contracted spreads through
- | | |
|----------------------------------|--|
| (a) bite of an infected mosquito | (b) bite of an infected dog |
| (c) faecal oral route | (d) direct contact with the infected person. |
- (iv) Riya can spread her illness to other children through
- | | |
|-----------------------------------|--------------------|
| (a) her faeces | (b) direct contact |
| (c) coughing and sneezing in open | (d) vectors. |
- (v) **Assertion** : Polio produces inflammation of the nervous system.
Reason : Stiffness of the neck, paralysis of particular skeletal muscle is an important symptom of polio.
- | |
|--|
| (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) Both assertion and reason are false. |

Syllabus

Pathogens; parasites causing human diseases (malaria, dengue,

chikungunya, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Read the following and answer any four questions from 2(i) to 2(v) 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.

(i) Identify W, X, Y and Z.

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

(ii) Select the correct statement.

- If X is sleeping sickness then its vector is *Leishmania*.
- If Y is diphtheria then it is caused by *Bacillus anthracis*.
- If W is hypothyroidism then it is caused by deficiency of thyroxine hormone.
- If Z is myocardial infarction then patient develops acute rheumatic fever, joint pain and throat infection.

(iii) If X and Y both are usual diseases then which of the following holds true?

- X could be dengue caused by flavivirus and Y could be AIDS caused by HIV.
- X could be chikungunya whereas Y could be rhinitis.
- X could be hepatitis whereas Y could be rabies.
- X could be chicken pox caused by *Varicella zoster* virus whereas Y could be yellow fever caused by flavivirus.

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

- | | |
|--|---|
| (a) X - Bubonic plague - <i>Yersinia pestis</i> | (b) Y - Leprosy - <i>Mycobacterium leprae</i> |
| (c) X - Whooping cough - <i>Bordetella pertussis</i> | (d) Y - Botulism - <i>Clostridium botulinum</i> |

(v) **Assertion** : Communicable diseases could be contagious or non-contagious.

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

- Both assertion and reason are true and reason is the correct explanation of assertion.
- Both assertion and reason are true but reason is not the correct explanation of assertion.
- Assertion is true but reason is false.
- Both assertion and reason are false.

Read the following and answer any four questions from 3(i) to 3(v) given below:

Rajesh, Ravi and Rohit are roommates. They are doing their graduation. Few months back Ravi fell ill. It took him around 3 weeks to recover. Both his friends were absolutely healthy at that time. After sometime Rajesh also fell ill from some other disease. This time Ravi and Rohit both contracted the same illness.

Based on the above information, answer the following questions.

(i) Which of the following holds true for Ravi's illness?

- Ravi was suffering from a communicable disease that is transmitted through vector.
- Ravi was suffering from a communicable disease that is transmitted through faecal oral route.

- (c) Ravi was suffering from a non-communicable disease like anaemia.
- (d) Ravi was suffering from a non-communicable disease like Down's syndrome.

(ii) Select the correct statement.

- (a) Ravi contracted a disease caused by air borne microbes.
- (b) Ravi could have suffered a nutritional disorder.
- (c) Ravi suffered a non-contagious disease.
- (d) Both (b) and (c)

(iii) Which could be correctly said for Rajesh's illness?

- (a) Rajesh's illness was due to a microbial infection.
- (b) Rajesh's illness could be contagious or non-contagious.
- (c) Rajesh's illness could be cured by antibiotics.
- (d) All of these

(iv) Which of the following may depicts Ravi's and Rajesh's illness?

Ravi	Rajesh
(a) Sickle cell anaemia	Myocardial infection
(b) Whooping cough	Tetanus
(c) Gastritis	Rhinitis
(d) Hypertension	Thyroid

(v) **Assertion :** Diabetes mellitus is a non-communicable disease which can be completely cured.

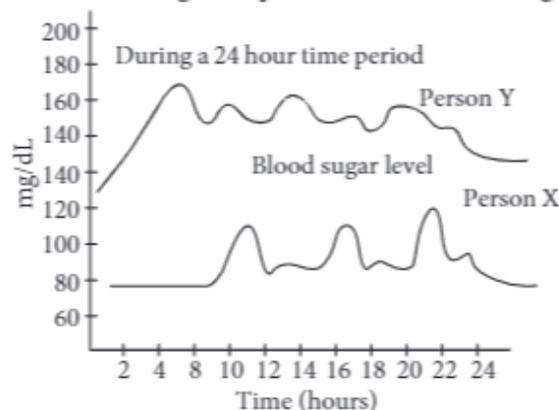
Reason : Diabetes mellitus is caused by deficiency of aldosterone hormone.

- (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) Both assertion and reason are false.

4

Read the following and answer any four questions from 4(i) to 4(v) given below:

The given graphs show fluctuations in blood sugar of person X and Y during a 24 hour time period.



Based on the above information, answer the following questions.

(i) Which of the following holds true for person X?

- (a) Person X is suffering from type I diabetes.
- (b) Person X shows severe insulin deficiency and beta cell depletion.

- (c) Person X is normal and shows good control of blood sugar level.
(d) Person X is subjected to excessive urination and abnormal thirst.
- (ii) The given graph indicates that person Y is suffering from
(a) diabetes (b) hypertension
(c) atherosclerosis (d) rheumatic heart disease.
- (iii) Which of the following conditions are common in person Y?
(a) Excretion of glucose in urine and excessive urination
(b) Polydipsia and mild beta cell depletion
(c) Progressive erosion of articular cartilage at synovial joint
(d) Both (a) and (b)
- (iv) A person suffering from diabetes mellitus becomes weak because
(a) the cells are unable to utilise glucose and other carbohydrates for energy production
(b) degradation of fat increases production of toxic ketone bodies
(c) cells utilize proteins for obtaining energy
(d) all of these.
- (v) **Assertion :** Type I diabetes involves failure of insulin to facilitate the movement of glucose into cells.
Reason : Type II diabetes is caused by failure of beta cells to produce adequate amount of insulin due to beta cell depletion.
(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) Both assertion and reason are false.

5

Read the following and answer any four questions from 5(i) to 5(v) given below:

Priya was 4 years old when she contracted chicken pox. It took her around 15 days to recover completely. Now Priya is 5 years old so her mother got her vaccinated few days back for DPT (5th dose) as per immunisation program. Recently she was playing with her friend in the park when her friend accidentally fell on iron pipe and badly bruised her knee. She was taken to the hospital where doctor gave her ATS injection and painkillers.

Based on the above information, answer the following questions.

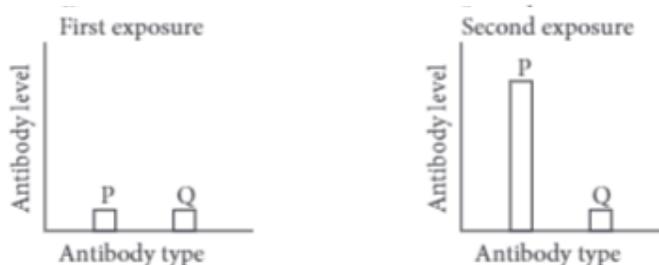
- (i) Select the correct statement.
(a) Priya has developed natural active immunity against chicken pox.
(b) Priya has developed artificial active immunity against DPT.
(c) Priya's friend has developed artificial passive immunity against tetanus.
(d) All of these
- (ii) Which of the following do you think is an example of natural passive immunity?
(a) Administration of AGS (anti gas gangrene serum) in a person
(b) Transfer of IgA antibodies from mother to baby through mother's milk
(c) A person recovered from viral infection
(d) A child vaccinated for polio

- (iii) Which of the following is true for active immunity?
- (a) It provides immediate relief. (b) It is temporary, not long lasting.
 (c) It has no side effects. (d) None of these
- (iv) Select the incorrect match.
- (a) Passive immunity - IgG antibodies crossing placental barrier to reach fetus
 (b) Active immunity - Vaccination against corona virus
 (c) Active immunity - Administration of antidiphtheria serum in patient
 (d) Passive immunity - Fetus having mother's milk
- (v) **Assertion** : A person recovered from measles develops an active immunity against this infection.
Reason : In active immunity, person's own cells develop antibodies in response to infection.
- (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) Both assertion and reason are false.

6

Read the following and answer any four questions from 6(i) to 6(v) 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.

- (i) 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.
- (ii) 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
- (iii) 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.
- (iv) 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) The dead pathogen stays in the body and constantly stimulates the immune system.
 (d) All of these.

- (v) **Assertion** : Mice do not show any disease symptoms during second exposure to the pathogenic virus.
Reason : The antibody production is accelerated and more intense during secondary immune response.
- (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) Both assertion and reason are false.

7

Read the following and answer any four questions from 7(i) to 7(v) given below:

Aditya went to his hometown located in countryside along with his parents during his summer vacations. His grand parents' house is surrounded by farmland from all sides. Lots of crops were growing nearby and Aditya was very excited to visit the crop fields. He sought permission from his mother to play in farmland along with his friends and then went to play in the fields. On returning back he had running nose, watering eyes and continuous sneezing which was very frequent. The symptoms worsened with time.

Based on the above information, answer the following questions.

- (i) What could be the possible reason for Aditya's condition?
- (a) Allergy
 - (b) Infection
 - (c) Malnutrition
 - (d) Genetic disorder
- (ii) How can allergy be diagnosed in a person?
- (a) Presence of large amount of IgE antibodies in the blood
 - (b) Presence of large number of bacteria in the blood
 - (c) Presence of bilirubin and bilirubin pigments in the stool
 - (d) Presence of sickle shaped RBCs in the blood
- (iii) The symptoms which Aditya developed on account of being allergic are consequence of
- (a) inflammation of membrane lining the nose and conjunctiva
 - (b) swelling up of tissue surrounding bronchioles of lungs
 - (c) dilation of all arteries so that large amount of fluid passes from blood to tissues.
 - (d) all of these.
- (iv) Name the type of allergy that Aditya developed.
- (a) Asthma
 - (b) Anaphylaxis
 - (c) Hay fever
 - (d) Urticaria
- (v) **Assertion** : Hay fever is the form of allergy due to pollens of grasses and other plants.
Reason : Hay fever symptoms are due to release of histamines and often respond well to treatment with antihistamines.
- (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) Both assertion and reason are false.

8

Read the following and answer any four questions from 8(i) to 8(v) given below:

Reema, Jai and Ankit are suffering from autoimmune diseases of adrenal cortex, joints and thyroid gland, respectively. Their immune system failed to recognise self and non-self and started destroying their body's own proteins. They are seeking proper medical help for their conditions but their condition cannot be cured completely.

Based on the above information, answer the following questions.

(i) Select the option that correctly identifies autoimmune diseases of Reema, Jai and Ankit.

Reema	Jai	Ankit
(a) Diabetes	Grave's disease	Rheumatic fever
(b) Pernicious anaemia	Multiple sclerosis	Myasthenia gravis
(c) Addison's disease	Rheumatoid arthritis	Hashimoto's thyroiditis
(d) Systemic lupus erythematosus	Severe combined immunodeficiency disease	AIDS

(ii) Reema's autoimmune condition is characterised by

- (a) undersecretion of insulin
- (b) destruction of RBCs and low RBC count
- (c) undersecretion of adrenal cortex hormones
- (d) low production of intrinsic factor required for absorption of B_{12} .

(iii) What do you think is the major cause of Jai's condition?

- (a) Deterioration of myelin sheath around nerve cells leading to loss of precise muscle control.
- (b) Destruction of heart cells leading to weakening of entire heart wall.
- (c) Destruction of beta cells leading to undersecretion of insulin.
- (d) Deposition of immune complexes of IgM, IgG and complement in joints thereby inflaming joints, destroying articular cartilage and fusing bones.

(iv) How do you think Ankit's condition got diagnosed?

- (a) Low level of thyroid hormone and elevated levels of TSH in Ankit's blood.
- (b) Presence of antibodies against thyroid peroxidase (TPO antibodies) in Ankit's blood.
- (c) Elevated erythrocyte sedimentation rate (ESR), reduced C-reactive protein (CRP) in Ankit.
- (d) Both (a) and (b)

(v) **Assertion :** Immunosuppressive drugs often reduce the severity of autoimmune disorders.

Reason : Monoclonal antibodies have been successfully used in the treatment of autoimmune disease.

- (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) Both assertion and reason are false.

9

Read the following and answer any four questions from 9(i) to 9(v) given below:

Siddharth is a chain smoker. He got into this habit in early adolescence due to peer pressure and gradually got addicted to this habit. Its now almost 20 years he is into the habit of smoking. Since few months he is experiencing pain in chest, shortness of breath, wheezing and chronic cough with phlegm. He sought advice of a medical practitioner who diagnosed him with lung cancer.

Based on the above information, answer the following questions.

(i) What do you think is the possible carcinogen responsible for Siddharth's lung cancer?

- (a) Nitrosamines
- (b) Benzo(a)pyrene
- (c) Hydrazine
- (d) All of these

(ii) How is lung cancer diagnosed?

- (a) Computerised tomography scan
- (b) sputum cytology
- (c) Biopsy of lung tissue
- (d) All of these

(iii) From which of the following type of cancer is Siddharth suffering from?

- (a) Sarcoma (b) Carcinoma
(c) Lymphoma (d) Leukemia

(iv) Select the correct statement.

- (a) Surgery, radiotherapy and chemotherapy can be used to treat lung cancer.
(b) Chemotherapy involves the exposure of cancerous parts to X rays which destroy rapidly growing cancer cells.
(c) Surgical removal of lung cancer tissue is suggested at advanced stage 4.
(d) Monoclonal antibodies can effectively treat lung cancer and can cure it completely.

(v) **Assertion** : Lung cancer if not treated at an early stage can spread to other initial organs of the body.

Reason : Cancer cell have uncontrolled proliferation and ability to invade new sites (metastasis).

- (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) Both assertion and reason are false

10

Read the following and answer any four questions from 10(i) to 10(v) given below:

A group of teenagers was involved in drug abuse. They used syringes and needles to inject drugs. They indulged in this habit when they became adults. Administration of drug through needles became a piece of cake for them. Raj was the most active drug abuser amongst them and used to take drugs in high profile parties. In a span of time he started losing weight and suffered persistent diarrhoea. He developed constant low grade fever and used to catch opportunistic infection. When he consulted a doctor, he got himself tested for HIV in his blood and finally diagnosed with AIDS.

Based on the above information, answer the following questions.

(i) Select the incorrect statement.

- (a) AIDS is a disorder of cell mediated immune system of the body.
(b) AIDS is caused by Human Immunodeficiency virus.
(c) AIDS infections were detected in India for the first time in prostitutes of Chennai, Tamil Nadu in 1986.
(d) December 10 is recalled as World AIDS Day.

(ii) How do you think Raj got AIDS infection?

- (a) Through transfusion of HIV infected blood
(b) Sexual intercourse with an infected partner
(c) Sharing towel with infected friend
(d) Use of contaminated needles and syringes to inject drugs

(iii) How AIDS can be diagnosed?

- (a) ELISA test (b) Ames test (c) Pap's test (d) Widal test

(iv) How can AIDS be prevented?

- (a) Blood tests of blood donor before transfusion to check for the presence of AIDS virus.
(b) Use of disposable needles and syringes for injecting medicines and vaccination
(c) Having protected sex by use of condoms
(d) All of these

- (v) Select the correct statement for AIDS virus.
- (a) It is rhomboid in shape with a diameter of 10-15 cm.
 - (b) Its genome consists of ds DNA.
 - (c) It consists of reverse transcriptase enzyme.
 - (d) Its envelope consists of lipid bilayer and three protein coats.

ASSERTION & REASON

For question numbers 11-35, 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) Both assertion and reason are false.
11. **Assertion** : Skin forms the first line of defence.
Reason : It is a non-specific defence.
12. **Assertion** : Some diseases that attack in childhood do not attack again.
Reason : Memory cells plays an important role.
13. **Assertion** : Immunoglobulin functions as antibody.
Reason : Different immunoglobulins molecules have different antigen binding properties.
14. **Assertion** : Inflammatory response is produced in the body after some infections.
Reason : This is one type of defence mechanism.
15. **Assertion** : Spleen can be thought of as an immunologic conference centre.
Reason : Spleen helps only in digestion.
16. **Assertion** : Dendritic cells originate in the bone marrow.
Reason : Dendritic cells are found in neuron.
17. **Assertion** : Immunity means all capacity of human body to resist almost all types of organisms or toxins that tend to damage the tissues and organs.
Reason : Spleen is the only organ involved in immunity.
18. **Assertion** : SCID is the first genetic disorder to be combated with gene therapy.
Reason : SCID is a type of allergy.
19. **Assertion** : Passive immunity is of short life span.
Reason : Passive immunization is promptly available.
20. **Assertion** : Allergy is an immunity disorder.
Reason : Allergy is confined to a person only.
21. **Assertion** : Psychotropic drugs affect behaviour and mental activities.
Reason : Tranquilizer, a psychotropic drug decrease tension and anxiety.
22. **Assertion** : Cancer patients are given chemotherapeutic treatments.
Reason : Chemotherapeutic agents are used to destroy malignant cells.
23. **Assertion** : Tranquilizers are used to treat schizophrenia.
Reason : Tranquilizers are antipsychosis drugs.

24. **Assertion** : Brown sugar is morphine-derivative.
Reason : Morphine is the principal opium alkaloid.
25. **Assertion** : Smack is a by-product of heroin synthesis.
Reason : Heroin is an opium alkaloid.
26. **Assertion** : A cholera patient is given glucose, electrolytes and water.
Reason : These plasmolyse the disease causing germs.
27. **Assertion** : It is considered advantageous to give the polio vaccine orally.
Reason : The oral polio vaccine prevents reinfection by causing intestinal immunity.
28. **Assertion** : There is no chance of transmission of malaria to man on the bite of a male *Anopheles* mosquito.
Reason : It carries a non-virulent strain of *Plasmodium*.
29. **Assertion** : Interferons are a type of antibodies produced by body cells infected by bacteria.
Reason : Interferons stimulate inflammation at the site of injury.
30. **Assertion** : Smoking causes oxygen deficiency in the body.
Reason : Carbon monoxide when inhaled while smoking, combines with haemoglobin to form chemically stable compound.
31. **Assertion** : *Streptococcus pneumoniae* and *Haemophilus influenzae* are responsible for causing infectious disease in human beings.
Reason : A healthy person acquires the infection by inhaling the droplets/aerosols released by an infected person.
32. **Assertion** : Mucous membrane immobilises the micro-organisms in the body.
Reason : Microorganisms and dust particles entering the respiratory tract are trapped in the mucus.
33. **Assertion** : Subsequent encounter with the same pathogen elicits a highly intensified anamnestic response.
Reason : This is based on the fact that our body appears to have memory of the first encounter.
34. **Assertion** : Cornea is considered as an immunologically privileged site.
Reason : A transplanted cornea is rarely rejected.
35. **Assertion** : Proto-oncogenes are cellular genes required for normal growth.
Reason : Under normal conditions they could lead to the oncogenic transformation of the cell.

HINTS & EXPLANATIONS

1. (i) (b) : Riya is suffering from polio that is caused by an *Enterovirus*, called *Poliovirus*.
(ii) (a)
(iii) (c) : Polio virus enters the body *via* alimentary canal (faecal oral route)
(iv) (a) : Riya has contracted polio which is transmitted through faecal oral route, as urine and faeces of the patient contain polio virus.
(v) (b)
2. (i) (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.
(ii) (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.
(iii) (b)
(iv) (a) : Leprosy is a bacterial infection that spreads through prolonged contact with the infected person. Whooping cough spreads through droplet infection. Botulism spreads through faecal oral route.

(v) (b)

3. (i) (c) : Ravi must have suffered from a non-communicable disease which cannot be spread from one person to another. Anaemia is caused by deficiency of iron and lead to general weakness and associated problems. It can be corrected by proper diet and dietary supplements. Down's syndrome is also a non-communicable disease but it is not cured completely. It is a genetic disorder and is congenital.

(ii) (d) : Non-communicable diseases are non-contagious.

(iii) (d)

(iv) (c)

(v) (d) : Diabetes mellitus is a non communicable disease that has no cure. It is caused by deficiency of insulin hormone.

4. (i) (c) : Blood sugar level fluctuations in person X indicate that sugar level never exceed the normal limit and sufficient secretion of insulin at required times removes any extra sugar from blood and converts it into glycogen for future use. This implies that person X is normal and healthy.

(ii) (a) : Elevated blood sugar levels in person Y indicate that he is suffering from diabetes mellitus.

(iii) (d)

(iv) (d)

(v) (d) : Type I diabetes or insulin dependent diabetes mellitus or juvenile diabetes is an autoimmune disorder caused by failure of beta cells to produce adequate amount of insulin. Type II diabetes or non insulin dependent diabetes mellitus involves failure of insulin to facilitate the movement of glucose into body cells.

5. (i) (d) : In active immunity, person's own cells produce antibodies in response to infection or vaccination. A person who has recovered from an infection develops natural active immunity whereas artificial active immunity is the resistance induced by vaccines. When ready-made antibodies are directly injected into a person to protect the body against foreign agents, it is called passive immunity.

(ii) (b)

(iii) (c) : Active immunity provides relief only after long period. It is long lasting.

(iv) (c) : Administration of antidiphtheric serum in a patient provides artificial passive immunity.

(v) (a)

6. (i) (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.

(ii) (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.

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

(iv) (d)

(v) (a)

7. (i) (a) : Aditya most probably had developed some sort of allergy due to pollens of grasses, trees and other plants.

(ii) (a) : Allergies mainly involve IgE antibodies and chemicals like histamine and serotonin from mast cells. IgE antibodies are produced in response to an antigen, coat mast cells and basophils.

(iii) (a) : The allergy which Aditya developed is characterised by inflammation of membrane lining the nose and conjunctiva leading to running nose, watering eyes and constant sneezing.

(iv) (c)

(v) (b)

8. (i) (c) : Addison's disease is an autoimmune disorder affecting adrenal cortex. Rheumatoid arthritis is autoimmune disorder of joints and Hashimoto's thyroiditis is autoimmune disorder affecting thyroid gland.

(ii) (c) : Addison's disease is characterised by under-secretion of adrenal cortex hormone, weakness, nausea, weight loss, low blood sodium, low blood volume and pressure, darkened skin pigmentation, etc.

(iii) (d) : In rheumatoid arthritis, the cells of immune system mistakenly send antibodies to the lining of joints where they attack the tissue surrounding joints. This causes thin layers of cells (synovium) covering joints to become sore and inflamed, releasing chemicals that damage nearby bones, cartilage, tendons, ligaments. These chemical gradually cause the joints to lose shape and alignment consequently fusing the bones.

(iv) (d)

(v) (b) : Immunosuppressive drugs like, corticosteroid, azathioprine and cyclophosphamide are often given to reduce the severity of autoimmune disorders. But this treatment suppress overall immune response so the patients are at great risk of having other diseases. Monoclonal antibodies may be used in the treatment of autoimmune diseases.

9. (i) (d) : Carcinogen in tobacco smoke include polynuclear aromatic hydrocarbons, β -naphthylamine, benzo(a)pyrene, nitrosamines, hydrazine, etc.

(ii) (d) : A CT scan can reveal small lesion in lungs. Examination of sputum under microscope reveals the presence of lung cancer cells. A sample of lung tissue is obtained through some invasive procedure and careful analysis of cancer cells is done in lab to reveal the type of lung cancer.

(iii) (b)

(iv) (a) : Chemotherapy involves administration of certain anticancer drugs which kill cancer cells. Monoclonal antibodies coupled to appropriate radioisotopes can detect cancer specific antigens and hence cancer.

(v) (a) : Cancer cells have lost the ability of contact inhibition and so proliferate in an uncontrolled manner. They detach from their source organ and invade fresh sites, this is called metastasis.

10. (i) (d) : Every year, December 1 is designated as World AIDS Day.

(ii) (d)

(iii) (a) : ELISA test, also called EIA for enzyme immunoassay is used to detect HIV antibody. It checks for certain proteins that the body makes in response to HIV.

(iv) (d)

(v) (c) : HIV is spherical with a diameter of 90-120 nm. Its genome consists of single stranded RNA. The envelope consists of a lipid bilayer derived from host cell membrane and projection knob like glycoproteins. It contains two protein coats.

11. (b) : Skin acts as the first line of defence because it provides a protective covering to the body against the entry of microorganisms. Its action is not specific to a particular organism. Skin forms the first-line of defence because –

- It forms the hard, keratinized outer layer of the body and form effective barrier for most bacteria and viruses.
- The secretion of oil and sweat glands make the surface pH acidic which does not let microorganisms to survive for long.

– The salts and fatty acids present in perspiration contain lysosomes that destroy the bacterial cell wall.

– It contains friendly bacteria, also release acids and other metabolic wastes which also inhibit the multiplication of organisms.

12. (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-nonsel 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.

13. (b) : Immunoglobulins are a complex heterogeneous mixture of proteins that are produced by plasma cells in response to an immunogen. It generally assume one of two roles - (i) plasma membrane bound antigen receptors on the surface of B cell, or (ii) as antibodies free in cellular fluids functioning to intercept and eliminate antigenic determinants. It exhibit two fundamental types of structural variation. Subtle structural differences in their antigen combining sites, or variable regions, account for their unique antigen binding specificities. Structural differences outside their antigen combining sites, in the so-called constant regions, correlate with the different effector functions mediated by antibodies, such as complement activation or binding to one or more of the antibody Fc receptors expressed on monocytes and granulocytes. The variable and constant regions of antibodies arise from distinct structural domains. Each antibody class is distinguished by certain effector functions and structural features including a unique heavy (H) chain isotype, designated α (IgA), δ (IgD), ϵ (IgE), γ (IgG), or μ (IgM).

14. (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.

15. (c) : The spleen is an immunologic filter of blood. It is made up of B-cells, T-cells, macrophages, dendritic cells, natural killer cells and red-blood cells. In addition to capturing foreign materials (antigens) from the blood that passes through the spleen, migratory macrophages and dendritic cells bring antigens to the spleen *via* blood stream. An immune response is initiated when the macrophages or dendritic cells present the antigen to the appropriate B or T-cells. This organ can be thought of as an immunological conference centre. In the spleen, B-cells become activated and produce large amounts of antibody.

16. (c) : Dendritic cells are immune cells and form part of the immune system. They are present in those tissues which are in contact with the environment; in the skin (where they are often called Langerhans cells) and the lining of nose, lungs, stomach and intestines. They have long spiky arms, called dendrites, hence the name. (Neurons also have dendrites, but dendritic cells have nothing to do with neurons).

17. (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.

18. (c) : Severe combined immunodeficiency (SCID) represents a group of rare, sometimes fatal, congenital disorders characterized by little or no immune response. The defining feature of SCID, commonly known as "bubble boy" disease, is a defect in the specialized white blood cells (B-and T-lymphocytes) that defend us from infection by viruses, bacteria and fungi. SCID is caused by a defect in the gene that codes for the enzyme adenosine deaminase on chromosome number 20. Lack of the enzyme adenosine deaminase (ADA), means that the substrates for this enzyme accumulate in the cells. Immature lymphoid cells of the immune system are particularly sensitive to the toxic effects of these unused substrates, so fail to

reach maturity. As a result, the immune system of the afflicted individual is severely compromised or completely lacking. Lack of this enzyme makes the body defenseless against infections. SCID is the first genetic disorder to be combated with gene therapy.

19. (b) : Passive immunity is resistance based on antibodies preformed in another host. Administration of antibody against diphtheria, tetanus, botulism, etc. makes large amounts of antitoxin immediately available to neutralize the toxins. Likewise, preformed antibodies to certain viruses can be injected during the incubation period to limit viral multiplication. The main advantage of passive immunity is the prompt availability of large amounts of antibody (as it is formed from another host), disadvantages are the short life span of these antibodies and possible hypersensitivity reactions of globulin from another species are used.

20. (b) : Allergy is 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. The foreign substance or allergen on first contact functions as mild antigen. It produces antibodies which remain attached with the mast cell. Lysis of mast-cells occur which releases histamine as allergy mediator.

21. (b) : Psychotropic drugs either induce sleep or produce calming effect. These drugs inhibit the mental activity for sometime depending upon the amount of drug consumed by the person. A drug which reduces mental tension and produce calmness without inducing sleep or depressing mental-faculties is generally called tranquilizer.

22. (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.

23. (a) : 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, Butyrophenones, Pimozide, Reserpine, etc.

24. (b) : Morphine is a derivative of the opium. It is the principal opium alkaloid and a strong analgesic. Diacetyl morphine hydrochloride is brown sugar/smack and is more powerful analgesic than morphine.

25. (c) : Heroin is diamorphine or diacetylmorphine - $C_{17}H_{17}(OC_2H_3O)_2NH$, which is also called smack. Opium is semisynthetic opiate (opium-derivative) which is most dangerous of all the opiates. Heroin is formed from acetylation of morphine.

26. (c) : Cholera is an acute infectious disease which is caused by *Vibrio cholerae*. The stools and the vomit of a cholera patient are full of cholera germs and these may get into a healthy person when contaminated food or drink is taken by mouth. Since a large quantity of fluid and salts are rapidly lost through stools and vomit, therefore, the most important treatment is to replace the lost fluid and salts equally rapidly.

27. (a)

28. (c) : There is no chance of transmission of malaria to man on the bite of a male *Anopheles* mosquito. The mouthparts of male mosquito is organised in such a manner that they cannot suck the human blood. They feed mainly on the leaf and fruit juices. Thus spreading malaria through male *Anopheles* is next to impossible.

29. (d) : Interferons are not antibodies. These are natural proteins produced by the cells of the immune systems of most animals in response to challenges by foreign agents such as viruses, bacteria, parasites

and tumor cells. Interferons belong to the large class of glycoproteins known as cytokines. In human body there are three types of interferon - α , β and γ . Interferon alpha and beta are produced by many cell types, including T-cells and B-cells and are important components of the antiviral response. They stimulate both macrophages and NK (Natural Killer) cells. They both are also active against tumors. Interferon gamma is involved in the regulation of the immune and inflammatory response. Interferon gamma has had some antiviral and antitumor effect but these are generally weak, however, it potentiates the effect of interferon alpha and interferon beta.

30. (a)

31. (b)

32. (a): Innate immunity is 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 traps microbes and prevents their entry in our body.

33. (a)

34. (a): Some transplanted tissues do not stimulate an immune response. For example, a transplanted cornea is rarely rejected because lymphocytes do not circulate into the anterior chamber of the eye, that's why this site is considered as immunologically privileged site.

35. (c): Proto-oncogenes are cellular genes required for normal growth. If they are muted or overexpressed, they may become oncogenes that contribute to the malignant transformation of the cell.