

SOLUTIONS

1. Roundworms are nematodes which are responsible for helminthic diseases in humans.

Two human diseases caused by helminths are :

(i) Ascariasis - It is caused by *Ascaris lumbricoides* and spreads through contaminated fruits, water, vegetables, etc.

(ii) Filariasis - It is caused by *Wuchereria bancrofti* and *W. malayi*. It is transmitted through the bite of female *Culex* mosquito.

2. For the production of curd, a small amount of curd as a starter is added to fresh milk at suitable temperature. Curd contains millions of lactic acid bacteria (LAB). These bacteria grow in milk and convert the lactose sugar of milk in lactic acid. Lactic acid coagulates and partially digests milk protein casein. This causes curdling of milk and it changes to curd, which also improves its nutritional quality by increasing vitamin B₁₂ content.

OR

Streptokinase (Tissue Plasminogen Activator or TPA) is an enzyme obtained from cultures of some haemolytic bacterium *Streptococcus* which is modified genetically to function as clot buster. It has fibrinolytic effect hence, it helps in clearing blood clots inside the blood vessels through dissolution of intravascular fibrin.

Cyclosporin A is obtained from fungus *Trichoderma polysporum* whereas statin is obtained from yeast *Monascus purpureus*.

Cyclosporin A has immunosuppressive properties. It inhibits activation of T cells and therefore prevents rejection of transplants.

Statin inhibits cholesterol synthesis and is therefore used in lowering blood cholesterol.

3. (a) Allergy is a hypersensitive response to foreign substances, coming in contact with or entering the body. It is characterised by sneezing, watery eyes, difficulty in breathing, etc.

(b) Two unique characteristics of system involved in allergic response are :

- (i) The body will produce IgE antibodies.
- (ii) The body will release chemicals like histamine and serotonin from the mast cells.

4. Secondary treatment of the sewage is also called biological treatment because microbes are used to digest the organic matter in the sewage water. The steps involved in the process are :

(i) Primary effluent is passed into aeration tank where liquid is constantly agitated and air is pumped into it.

(ii) Large number of aerobic heterotrophic microbes grow in aeration tank and form flocs.

(iii) Microbes digest organic matter, convert it into microbial biomass and reduce BOD.

(iv) In settling tank, the bacterial flocs are allowed to undergo sedimentation. The effluent is passed into natural waters like rivers and streams. It can also be further treated with chemicals to purify it.

(v) The sediment is called activated sludge. A part of this sludge is passed into anaerobic sludge digester where anaerobic microbes digest the organic mass as well as anaerobic microbes.

(vi) During digestion, microbes produce methane, H₂S and CO₂. These gases form biogas that can be used as a source of energy.

5. Bears undergo hibernation during winters to escape extreme cold. It is characterised by low body temperature, slow breathing and heart rate and low metabolic rate. However, diapause is a stage of suspended development or growth occurring in many insects and other invertebrates during which metabolism is greatly decreased. Diapause is often triggered by seasonal changes and regulated by inborn rhythm.

6. The organism in which osmotic concentration of body fluids and body temperature changes according to ambient conditions is called conformer. E.g., in aquatic animal *Asterias*, the osmotic concentration of body fluids changes according to the osmotic concentration of the surrounding water.

OR

Commensalism is the interaction between clown fish and sea anemone. The clown fish lives among the stinging tentacles of sea anemone and gets protection from its predators which stay away from the stinging tentacles. The sea anemone does not appear to derive any benefit by hosting the clown fish.

7. AIDS virus, HIV enters into macrophages after entering into human body. Macrophages act as HIV factory in humans. Events that occur in infected cells are:

- (i) After the entrance of the virus into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of reverse transcriptase enzyme.
- (ii) Viral DNA gets incorporated into the host cell's DNA and directs the infected cells to produce viruses.
- (iii) Simultaneously, HIV virus enters into helper T lymphocytes where it replicates and produces more viruses. This is repeated so that the number of helper T lymphocytes decreases in the body of the infected person.
- (iv) Due to decrease in the number of helper T lymphocytes in the body, the person starts suffering from infections and gets immune deficiency and he/she is unable to protect himself/herself against these infections.

OR

Yes, it is always better to prevent the adolescents from being getting addicted to harmful drugs, rather than cure them for addiction.

Six steps that could be taken in this regard are:

- (i) A child should not be pushed unduly to perform beyond his/her threshold limits in studies, sports or any other activities.

- (ii) Educating and counselling him/her to face problems and stresses and accept disappointments and failures as part of life.

- (iii) Parents and teachers can identify the danger signs and take appropriate steps to diagnose the disease and its underlying causes, so that proper remedial steps can be taken.

- (iv) Help can/should be sought from qualified psychologists and psychiatrists.

- (v) The individual can seek help from parents and teachers.

- (vi) Help can also be sought from close and trusted friends; this would help to vent the feelings and anxiety and guilt.

8. Two types of immunity with which human baby is born include-

- (i) Innate immunity - It is inherited by an organism from the parents and protects it from birth throughout

the life. It is not specific to particular pathogen and consists of four types of barriers - physical, physiological, cellular and cytokine.

- (ii) Natural passive immunity - It is passively transferred from mother to fetus through placenta, as IgG antibodies can cross placental barrier to reach the fetus.

9. Polymerase chain reaction (PCR) is a technique of synthesising multiple copies of the desired gene (DNA segment) *in vitro*. The basic requirements of PCR are DNA template, two oligonucleotide primers usually 20 nucleotides long, dNTPs and DNA polymerase which is stable at high temperature (usually *Taq* polymerase). Working mechanism of PCR is as follows :

- (i) Denaturation : the target DNA (DNA segment to be amplified) is heated to high temperature (94°C). Heating results in the separation of two strands of DNA. Each of the two strands of the target DNA now act as template for synthesis of new DNA strand.

- (ii) Annealing : During this step, two oligonucleotide primers hybridise to each of single stranded template DNA in presence of excess of synthetic oligonucleotides.

- (iii) Extension : During this step, the enzyme DNA polymerase synthesises the DNA segment between the primers. *Taq* DNA polymerase, isolated from a thermophilic bacterium *Thermus aquaticus*, is used in most of the cases. This step requires presence of deoxynucleotide triphosphates (dNTPs) and Mg^{2+} and occurs at 72°C.

10. Four techniques where principles for *ex-situ* biodiversity conservation has been employed are:

- (i) *In vitro* fertilisation - Egg are fertilised in *in vitro* conditions.

- (ii) Cryopreservation - Cells, embryos, tissues are preserved at -196°C.

- (iii) Seed banks - Storing viable seeds at low temperature, and germinating them to obtain fresh seeds.

- (iv) Tissue culture - Production of large number of plants through callus culture, pollen grain culture, embryoids, etc.

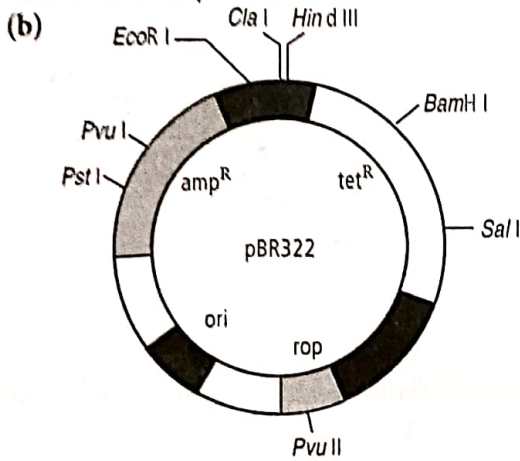
11. (a) Sixth extinction, *i.e.*, the current species extinction is 100 - 1000 times faster than extinctions in pre-human times.

(b) Human activities like settlements, hunting, over-exploitation and habitat destruction are mainly responsible for 'Sixth extinction.'

(c) This disaster can be overcome by the following ways:

- (i) Planting large number of trees on roadsides and where space is available.
- (ii) Avoid introduction of invasive alien species.
- (iii) Conserving biodiversity by maintaining National parks, zoos, etc.
- (iv) Deforestation and fragmentation of forested areas should be stopped.

12. (a) X is called palindromic sequence because sequence of base pairs is same when read forward (left to right) or backward (right to left) from a central axis of symmetry. Arrows represent recognition/restriction site identified by *EcoRI*.



rop genes code for the proteins involved in the replication of the plasmid. Plasmid pBR322 has a variety of unique recognition sites for restriction endonucleases. Two unique sites, *Pst* I and *Pvu* I are located within the *amp^R* gene and *Bam* HI, *Sal* I are within *tet^R* gene.

13. (a) In gel electrophoresis, DNA molecules migrate in the direction of electrode bearing opposite charge on the basis of size. The smaller the fragment, the farther it moves.

(b) Nowadays the most commonly used medium or matrix is agarose which is a polysaccharide extracted from sea weeds.

(c) The separated DNA fragments can be seen only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiations as bright orange coloured bands.

(d) The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution. These purified DNA fragments are used in constructing recombinant DNA by linking them with cloning vectors in presence of DNA ligase.

OR

(a) Both the girls A and B were suffering from SCID (Severe Combined Immune Deficiency) syndrome produced by the deficiency of enzyme Adenosine deaminase (ADA).

(b) The treatment provided to girl A required repeated visits because enzyme replacement therapy is not a permanent cure. This is because these patients do not have functional T-lymphocytes, therefore they cannot provide immune response against invading pathogens.

(c) The girl B was treated by the transplanted stem cells that are injected into the bloodstream. They will then become healthy white blood cells that replenish immune functions - essentially building a whole new, functional immune system for the girl B. The immune system regains complete function and hence girl B was permanently cured.

