

# SOLUTIONS

1. Snail and fish are two intermediate hosts on which the human liver fluke depends on to complete its life cycle. Liver fluke causes parasitic infection called fascioliasis.

2. 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.

OR

*Rhizobium* is a soil bacterium which either lives freely in soil or lives in symbiotic association with roots of leguminous plants. The bacterium forms nodules on roots of leguminous plants where it lie in groups. When it occurs freely in soil, it cannot fix nitrogen. Nitrogen fixing ability develops only when it is present inside root nodules. Hence, *Rhizobium* is categorised as symbiotic bacterium. It acts as a biofertiliser as it helps plants in obtaining their nitrogen nutrition.

3. (a) Heroin is obtained by acetylation of morphine which is extracted from the latex of poppy plant *Papaver somniferum*.

(b) Some of the effects of heroin on the human body are as follows :

(i) It act as a depressant and slows down body functions. It also induces drowsiness and lethargy.

(ii) Other effects include indigestion, reduced vision, decreased weight, sterility and total loss of interest in work.

4. *Nucleopolyhedrovirus*, a genus of baculoviruses are useful in controlling many insects and other arthropods. They are species specific narrow spectrum bioinsecticides with no side effects on plants, mammals, birds, fish and non-target insects. Therefore, they serve as an important component of integrated pest management programme in dealing with ecological sensitive areas. These properties are useful in organic farming .

5. Some organisms can tolerate a wide range of temperature variations, e.g., most mammals and birds. They are called eurythermals while other organisms

live within narrow range of temperature because of their requirement of nearly constant temperature throughout the year, e.g., polar bear, lizards, amphibians, and are called stenothermals.

6. Mangrove plants are halophytes found growing in saline marshes. They have following adaptations to face excess salt and excess water in their rooting medium.

(i) Salt secretion : Some mangroves have salt secreting glands over their leaves to exclude excess salt.

(ii) Supporting roots : For proper anchorage in swampy areas. E.g., Stilt roots, prop roots, etc.

(iii) Pneumatophores : Lenticel bearing aerial roots which develop upright and helps in gaseous exchange.

OR

Bats fly in darkness without using their eye sight for finding their path and location of food by adaptation known as echolocation or principle of sonar. They produce high frequency sounds which are converted into echoes after striking various objects. The echoes are detected and analysed by the bats to know the objects.

7. (a) Given figure shows an antibody molecule, and A is antigen binding site.

(b) An antibody molecule consists of four peptide chains, two small light chains and two longer heavy chains. Hence, an antibody is represented as  $H_2L_2$ .

(c) Antibodies (IgA, IgM, IgE) are found in body fluids like blood plasma and lymph and the word 'humor' pertains to fluid, thus, the response is called humoral immune response.

OR

The malarial parasite, *Plasmodium* enters the human body as sporozoites (infectious form) through the bite of infected female *Anopheles* mosquito (vector). From the human blood sporozoites enter liver cells and multiply here 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.

8. Differences between the role of B-lymphocytes (B-cells) and T-lymphocytes (T-cells) in generating immune responses are :

	B-lymphocytes (B-cells)	T-lymphocytes (T-cells)
(i)	Origination and maturation takes place in the bone marrow.	Origination in bone marrow and maturation in the thymus.
(ii)	B-cells form humoral or antibody mediated immune system (AMIS).	T-cells form cell-mediated immune system (CMIS).
(iii)	They defend against viruses and bacteria that enter the blood and lymph.	They defend against pathogens including protists and fungi that enter the cells.
(iv)	Plasma cells formed by division of B-cells produce antibodies and provide immunity against foreign substances.	T-lymphocytes produce different types of T-cells, e.g., killer T-cells react against cancer cells, suppressor cells inhibit immune system.

9. Recombinant DNA technology can be used to obtain foreign-gene-products. It involves following steps :

- (i) Isolation of genetic material (DNA) using enzymes.
- (ii) Identification and cutting of DNA from specific location using restriction enzymes and separating the fragments of DNA using gel electrophoresis to obtain gene of interest.
- (iii) Amplification of gene of interest using PCR.
- (iv) Adding or ligation of gene of interest into suitable vector using ligase enzymes. This produces a recombinant DNA molecule.
- (v) Insertion of recombinant DNA into the host cell or organism.
- (vi) Selection of recombinants from non-recombinants cells.

(vii) Culturing recombinant cell under suitable conditions and obtaining the desired foreign-gene-product.

10. Non-native or alien species are often introduced inadvertently by man for their economic and other uses. They often become invasive and drive away the local species. For example:

(i) Water hyacinth (*Eichhornia crassipes*) was introduced in Indian waters to reduce pollution but it turned out to be a problematic species. It has clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals.

(ii) Nile Perch (a predator fish) was introduced in Lake Victoria of East Africa. It killed and eliminated ecologically unique assemblage of over 200 native species of small cichlid fish.

(iii) African catfish *Clarias gariepinus* introduced for aquaculture in India pose threat to indigenous catfishes.

11. Conservation of biodiversity is protection, uplift and scientific management of biodiversity so as to maintain it at its optimum level and derive sustainable benefits for the present as well as future generations. There are two types of conservation strategies – *in-situ* (on site) and *ex-situ* (offsite).

*In-situ* conservation is conservation and protection of the whole ecosystem and its biodiversity at all levels in their natural habitat in order to protect the threatened species. It involves hotspots and protected areas. Hotspots are areas of high endemism and high level of species richness. Protected areas are ecological/biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed through legal or other effective measures. Protected areas include national parks, sanctuaries and biosphere reserves.

*Ex-situ* conservation is conservation of threatened plants and animals in places outside their natural homes under full protection and supervision. It includes offsite collections and gene banks.

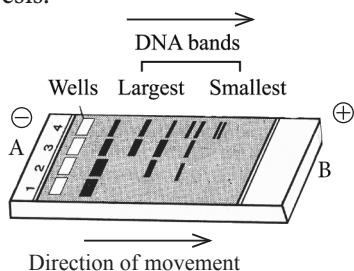
12. Competent host is essential for biotechnology experiment. Since DNA is a hydrophilic molecule, it cannot pass through membranes, so the bacterial cells must be made capable to take up DNA *i.e.*, made competent.

This can be achieved by :

(i) Treatment of DNA with divalent cation of  $\text{CaCl}_2$  or rubidium chloride. Treating them with a specific concentration of a divalent cation, increases the efficiency with which DNA enters the bacterium through pores in its cell wall.

(ii) Heat shock treatment of DNA : Recombinant DNA (rDNA) can then be forced into such cells by incubating the cells with recombinant DNA on ice, followed by placing them briefly at  $42^\circ\text{C}$  (heat shock) and then putting them back on ice. This enables the bacteria to take up the recombinant DNA.

13. (a) DNA fragments are separated through gel electrophoresis.



(b) Progress of restriction enzyme digestion can be checked by gel electrophoresis. The cut segments move faster towards the positive electrode or anode because DNA is negatively charged. The desired genes are identified and separated.

(c) Basic steps to perform gel electrophoresis are :

- (i) Pouring the gel
- (ii) Preparing the sample
- (iii) Loading the DNA samples into the well
- (iv) Running the gel (exposing it to electric field)
- (v) Staining the gel with EtBr (Ethidium bromide) followed by exposure to UV light.

OR

(a) Molecular probes are labelled DNA segments, RNA segments, antibodies and antigens. They are used to detect disorder through presence of complementary structure in defective genes, pathogen, their antigens or antibodies produced against them.

(b) Three types of blotting are :

(i) Southern blotting : DNA segments are diagnosed by hybridising them with radioactively labelled DNA or RNA proteins.

(ii) Northern blotting : RNA is identified by labelled DNA or RNA probes.

(iii) Western blotting : Protein is identified with help of labelled antibody.

(c) PCR is used to detect HIV in suspected AIDS patients, and to study proneness to breast cancer.



# Self Evaluation Sheet

Once you complete **SQP-4**, check your answers with the given solutions and fill your marks in the marks obtained column according to the marking scheme. Performance Analysis Table given at the bottom will help you to check your readiness.



Q. No.	Chapter	Marks Per Question	Marks Obtained
1	Human Health and Diseases	2	
2	Microbes in Human Welfare / Microbes in Human Welfare	2	
3	Human Health and Diseases	2	
4	Microbes in Human Welfare	2	
5	Organisms and Populations	2	
6	Organisms and Populations / Organisms and Populations	2	
7	Human Health and Diseases / Human Health and Diseases	3	
8	Human Health and Diseases	3	
9	Biotechnology : Principles and Processes	3	
10	Biodiversity and Conservation	3	
11	Biodiversity and Conservation	3	
12	Biotechnology : Principles and Processes	3	
13	Biotechnology : Principles and Processes / Biotechnology : Principles and Processes	5	
<b>Total</b>		<b>35</b>	.....
		<b>Percentage</b>	.....%

## Performance Analysis Table

If your marks is

	<b>&gt; 90% TREMENDOUS!</b>	➤ You are done! Keep on revising to maintain the position.
	<b>81-90% EXCELLENT!</b>	➤ You have to take only one more step to reach the top of the ladder. Practise more.
	<b>71-80% VERY GOOD!</b>	➤ A little bit of more effort is required to reach the 'Excellent' bench mark.
	<b>61-70% GOOD!</b>	➤ Revise thoroughly and strengthen your concepts.
	<b>51-60% FAIR PERFORMANCE!</b>	➤ Need to work hard to get through this stage.
	<b>40-50% AVERAGE!</b>	➤ Try hard to boost your average score.