SOLUTIONS

1. Humans have innate immunity which includes all the defence elements with which an individual is born. When any microbial pathogens enter the gut of humans along with food, various types of barriers prevent the entry of foreign agents.

- Physical barriers: Mucus coating of the epithelium lining the gastrointestinal tract helps in trapping microbes entering our body.
- Physiological barriers: Acid in the stomach, saliva in the mouth prevent microbial growth.

2. Following are the two bioactive agents that can improve condition of coronary artery disease :

(i) Streptokinase, produced by the bacterium *Streptococcus* is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction.

(ii) Statins, produced by the yeast *Monascus purpureus* acts as blood-cholesterol lowering agents.

OR

Holistic approach ensures that various life forms that inhabit the field, their life cycles, patterns of feeding and the habitats that they prefer are extensively studied and considered. Bicontrol method of eradication of pests will disrupt predator-prey relationships, where beneficial predatory and parasitic insects which depend upon flora and fauna as food or hosts, may not be able to survive.

3. The given structure represents morphine. Following are the three physical properties of morphine.

(i) It is white in colour

(ii) It is odourless compound

(iii) It is crystalline in nature

4. At collection points A and B, the BOD level is high due to high organic pollution caused by sugar factory and sewage discharge.

At the collection point C, the water was released after secondary treatment/ biological treatment where vigorous growth of useful aerobic microbes into flocs consume the major part of the organic matter present in the river water or effluent due to sugar factory and sewage discharge.

5. Introduction of population B and C into same area as of population A will lead to competition between the individuals of population A, B and C for resources. The resources for growth will become finite and limiting, and population growth will become realistic. Eventually the 'fittest' individuals will survive and reproduce.

6. The relationship between the plant and pollinator is called mutualism. Fig depends on wasp for pollination, and wasp depends on fig for food and shelter. With the decline in population of figs, wasp loses its source of food and shelter.

OR

Regulators are able to maintain a constant body temperature and constant osmotic concentration despite changes in the external environment. Therefore, regulators will have better chances of survival during the increase in global temperature.

Birds and mammals perform homeostasis mostly through thermoregulation and osmoregulation. Therefore, they can easily adapt or survive to the changing ambient environment.

7. Transformation of normal cells into cancerous neoplastic cells may be induced by following physical, chemical or biological agents causing DNA damage:

- Ionising radiations like X-rays and gamma rays.
- Non-ionizing radiations like UV.
- Chemical carcinogens present in tobacco smoke.
- Cellular oncogenes (c-onc) or proto-oncogenes, when activated under certain conditions cause cancer. Viruses with oncogenes can transform normal cells to cancerous cells.

OR

If the person has sustained high fever (39° to 40°C), weakness, stomach pain, constipation, headache and loss of appetite, then it is typhoid.

If the person has fever, chills, cough and headache; and the lips and fingernails turn gray to bluish, then it is pneumonia.

If the person has chills and high fever recurring every three to four days then it is malaria.

8. Following are the responses produced by immune system when recognition of an antigenic protein of a pathogen or exposure to a pathogen occurs:

(i) When our body encounters an antigenic protein or a pathogen for the first time, it produces a response which is of low intensity and our body retains memory of the first encounter.

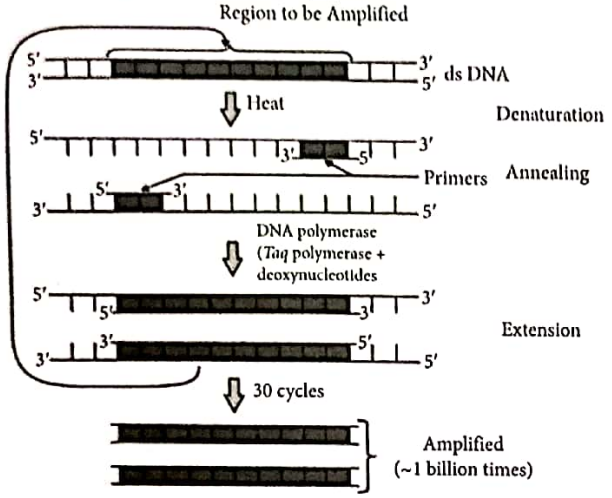
(ii) The subsequent encounter with the same pathogen elicits a highly intensified response carried out with the help of two special types of lymphocytes present in our blood, B-lymphocytes, and T-lymphocytes.

The B-lymphocytes produce an army of proteins in response to these pathogens into our blood to fight with them. These proteins are called antibodies. The T-cells themselves do not secrete antibodies but help B-cells produce them.

9. The three steps involved in the process of PCR are :

- Denaturation : The DNA strands are heated at temperature of 94°C and the strands are separated.
- Annealing : The primers anneal to the complementary strands
- Extension : The DNA polymerase facilitates the extension of the strands.

The flow chart represents the series of steps were undertaken for finding the gene of interest using polymerase chain reaction (PCR).



10. (a) When a large habitat is broken into small fragments due to various activities, mammals and birds requiring large territories and certain animals with migratory habitats are badly affected, leading to population decline.

(b) Alien-species invasion-Nile perch introduced in Lake Victoria eventually led to the extinction of an ecologically unique assemblage of more than 200 species of Cichild fish.

(c) Yes; humans have overexploited natural resources for their 'greed' rather than 'need' leading to extinction of these animals. Sustainable harvesting could have prevented extinction of Steller's sea cow and passenger pigeon or even more exitincted animals.

11 (a) India's history of religious and cultural traditions emphasised the protection of nature. In many cultures, tracts of forest are set aside, all the trees and wildlife within are venerated and given total protection. Sacred groves in many states are the last refuges for a large number of rare and threatened plants.

(b) Area A will have more species richness and a steeper slope.

12. (a) Band III corresponds to 2500 base pairs, and Band IV corresponds to 100bp.

(b) The fragments will resolve according to their size. The shorter sequence fragments would move farthest from well as seen in band IV (100 bp) which is lighter as compared to band III which is heavier being 2500 base pairs.

The significance of electrophoresis is to purify the DNA fragments for use in constructing recombinant DNA by joining them with cloning vectors.

13. (a) The main objective of this action is that the two different DNA molecules will have compatible ends to recombine.

(b) Restriction enzyme cuts the DNA of the vector and then ligates the gene of interest into the DNA of the vector.

(c) If the given DNA fragment was cut with *Bam*H1, 2 fragments will be produced in the end with the given polarity.

↓

5′ ATTTTGAGGATCCGTAATGTCCT 3′

3′ TAAAACTCCTAGGCATTACAGGA 5′

↑

(d) *Bam*HI site will affect tetracycline antibiotic resistance gene, hence the recombinant plasmids will lose tetracycline resistance due to inactivation of the resistance gene.

Recombinants can be selected from non-recombinants by plating into a medium containing tetracycline, as the recombinants will not grow in the medium because the tetracycline resistance gene is cut.

OR

(a) Farm land II shows better managment practices and use of agro chemicals.

If I had to cultivate, I would personally prefer Bt crop, because the use of pesticides is highly reduced for Bt crops.

(b) In Bt cotton a *cry* gene has been introduced from bacterium *Bacillus thuringiensis* (Bt) which causes synthesis of a toxic protein. This protein becomes active in the alkaline gut of bollworm feeding on cotton, punching holes in the lining causing death of the insect.

However; a non Bt crop will have no effect on the cotton bollworm and the yield of cotton will decrease as non Bt will succumb to pest attack.

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