

## BIOLOGY (Theory)

[Time allowed: 3 hours]

[Maximum marks:70]

### General Instructions:

- (i) *All questions are compulsory.*
- (ii) *This question paper consists of four sections A, B, C and D. Section A contains 8 questions of one mark each, Section B is of 10 questions of two marks each, Section C is of 9 questions, of three marks each and Section D is of 3 questions of five marks each.*
- (iii) *There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.*
- (iv) *Wherever necessary, the diagrams drawn should be neat and properly labelled.*

**Q9.** Explain the work carried out by Cohen and Boyer that contributed immensely in biotechnology. (2)

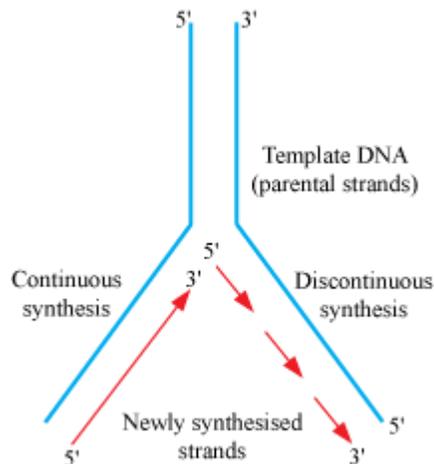
**Ans:** Stanley Cohen and Herbert Boyer conducted one of the first genetic engineering experiments. They invented the technique of DNA cloning. Cohen developed a method of removing plasmids from the cell and then reinserting them in other cells. Combining this process with that of DNA splicing enabled Boyer and Cohen to recombine segments of DNA in desired configurations and insert the DNA in bacterial cells, which could then act as manufacturing plants for specific proteins. Stanley Cohen and Herbert Boyer accomplished this in 1972.

**Q10.** (a) State the difference between meiocyte and gamete with respect to chromosome number.  
(b) Why is a whiptail lizard referred to as parthenogenetic? (2)

**Ans:** (a) The gamete contains haploid set of chromosomes while the meiocyte contains a diploid set.  
(b) Whiptail lizard is parthenogenetic because in this animal, an unfertilized egg develops into a new individual. This process of reproduction without fertilization is called parthenogenesis.

**Q11.** Draw a neat labeled sketch of a replicating fork of DNA. (2)

**Ans:** The replication fork of DNA



**Q12.** Some organisms suspend their metabolic activities to survive in unfavourable conditions. Explain with the help of any four examples. (2)

- Ans:**
1. In bacteria, fungi and lower plants, various kinds of thick-walled spores are formed which help them to survive unfavourable conditions – these germinate on availability of suitable environment.
  2. In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal – they germinate to form new plants under favourable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of ‘dormancy’.
  3. In animals, the organism, if unable to migrate, might avoid the stress by escaping in time. The familiar case of bears going into hibernation during winter is an example of escape in time. Some snails and fish go into aestivation to avoid summer-related problems (heat and desiccation).
  4. Under unfavourable conditions, many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

**Q13.** (a) State the role of DNA ligase in biotechnology.  
(b) What happens when *Meloidogyne incognita* consumes cells with RNAi gene? (2)

- Ans:**
- (a) **DNA ligase** enzyme is used to join two DNA fragments from their ends.
  - (b) When *Meloidogyne incognita* (parasite) consumes cells with RNAi gene, parasite cannot survive and this prevents infestation. The introduced RNAi gene DNA forms both sense and anti-sense RNA. Two strands being complementary to each other bend and form *ds* RNA, leading to RNAi. Thus, the mRNA of nematode is silenced and the parasite cannot survive there.

**Q14.** Where is sporopollenin present in plants? State its significance with reference to its chemical nature. (2)

- Ans:** Sporopollenin is present in exine of pollen grains in plants. It is one of the most resistant organic substances and can withstand high temperature, strong acids and alkali. No enzyme that degrades sporopollenin is so far known. This sporopollenin helps the pollen grain to be well

preserved.

- Q15.** Mention the importance of Lactic acid bacteria to humans other than setting milk into curd. (2)

**OR**

How do methanogens help in producing biogas?

**Ans:** Lactic acid bacteria is also used to produce acid called lactic acid which is an important industrial product. It is used in bakery products, beverages, meat products, confectionery, dairy products, etc.

**OR**

The group of organisms involved in biogas (methane) production are called methanogens. For example- *Methanobacterium*. These bacteria are found in cattle dung(gobar), anaerobic sludge during sewage treatment,etc. and grow anaerobically on cellulosic material and produce large amount of methane along with CO<sub>2</sub> and H<sub>2</sub>.

- Q16.** (a) Name the Protozoan parasite that causes amoebic dysentery in humans.  
(b) Mention two diagnostic symptoms of the disease.  
(c) How is this disease transmitted to others? (2)

- Ans:** (a) *Entamoeba histolytica* is a protozoan parasite in the large intestine of human which causes amoebiasis (amoebic dysentery).  
(b) Two diagnostic symptoms of amoebic dysentery are:  
(i) Abdominal pain and cramps  
(ii) Stools with excess mucous and blood clots.  
(c) The disease is transmitted by houseflies. They act as mechanical carriers and transmit the parasite from faeces of infected person to food products, thereby contaminating them. Drinking water and food contaminated by the faecal matter are the main source of infection.

- Q17.** (a) Highlight the role of thymus as a lymphoid organ.  
(b) Name the cells that are released from the above mentioned gland. Mention how they help in immunity. (2)

- Ans:** (a) Thymus is one the primary lymphoid organ of the immune system. Maturation of lymphocytes occurs in the thymus. T-cells produced in the bone marrow get matured in the thymus and are released from here.  
(b) T- cells do not themselves produce antibodies, but help B-cells to produce them. They are also responsible for cell-mediated immune response (CMI).

**Q18.** Why do clown fish and sea anemone pair up? What is this relationship called? (2)

**Ans:** Clown fish maintains a commensalistic relation with the sea anemone. In this interaction, one species benefits and the other is neither harmed nor benefited. Sea anemone has stinging tentacles that provide protection to clown fish from predators. The anemone does not appear to derive any benefit from the clown fish.

