

# PRACTICE PAPER

# 1\*

Time allowed : 2 hours

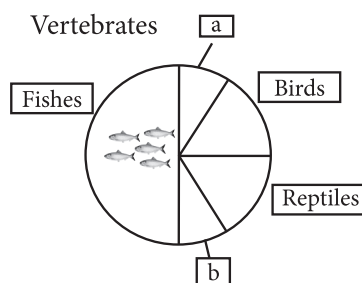
Maximum marks : 35

## General Instructions :

- (i) All questions are compulsory.
- (ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 15 questions in the question paper.
- (iii) Section-A has 06 questions of 1 mark each and 01 case-based question. Section-B has 4 questions of 2 marks each. Section-C has 2 questions of 3 marks each and Section-D has 2 questions of 5 marks each.
- (iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- (v) Wherever necessary, neat and properly labeled diagrams should be drawn.

## SECTION - A

1. Differentiate between pro-insulin and mature insulin.
2. What are the two major causes of loss of biodiversity?
3. Write the level of biodiversity represented by a mangrove. Give another example falling in the same level.
4. Identify 'a' and 'b' in the figure given below representing proportionate number of major vertebrate taxa.



5. **Assertion :** Rennet and fruit extract of *Withania somnifera* have antagonistic functions.  
**Reason :** Rennet is obtained from calf's stomach and is used for curdling of milk.
  - (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) Assertion is false but reason is true.
6. **Assertion :** Dendritic cells originate in the bone marrow.  
**Reason :** Dendritic cells are found in neuron.
  - (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) Assertion is false but reason is true.

OR

**Assertion :** Brown sugar is morphine-derivative.

**Reason :** Morphine is the principal opium alkaloid.

- (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) Assertion is false but reason is true.

**7. Read the following passage and answer the questions from 7(i) to 7(v) given below:**

Some bird species follow army ants which walk on the forest floor. As the army ant colony travels on the forest floor, they stir up various flying insect species. As the insects flee, the birds following the ants catch the fleeing insects.

- (i) Which population interaction is seen between the army ants and birds?
  - (a) Commensalism      (b) Amensalism      (c) Mutualism      (d) Predation
- (ii) The type of interaction between birds and insects is
  - (a) commensalism      (b) amensalism      (c) mutualism      (d) predation.
- (iii) Which of the following is predator in the given passage?
  - (a) Bird      (b) Insect      (c) Ant      (d) Both (a) and (b)
- (iv) An advantage of interaction between birds and insects is
  - (a) it serves as conduit for energy transfer across trophic level
  - (b) it checks population of organisms of lower trophic level
  - (c) birds help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species
  - (d) all of these.
- (v) Read the given statements and select the correct option.
 

**Statement A :** Interaction between army ants and birds results in negative effect on the growth and survival of both the populations.

**Statement B :** Birds keep insects' population under control.

  - (a) Statement A is correct but statement B is incorrect.
  - (b) Statement A is incorrect but statement B is correct.
  - (c) Both statements A and B are correct.
  - (d) Both statements A and B are incorrect.

### SECTION - B

8. What are sticky ends? State their significance in recombination DNA technology.

**OR**

Explain the procedure by which PCR aids in early detection of cancer.

- 9. Name a genus of baculovirus. Why are they considered good biocontrol agents?
- 10. (a) Highlight the role of thymus as a lymphoid organ.  
(b) Name the cells that mature in the above mentioned organ. Mention how they help in immunity.
- 11. Mention the term used to describe a population interaction between an orchid growing on a forest tree.

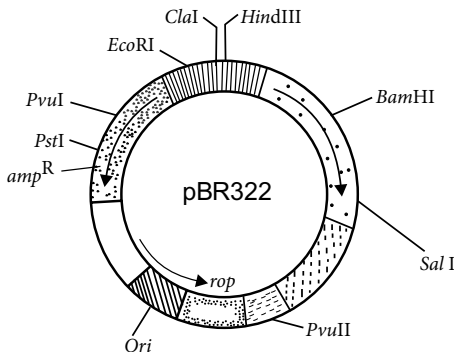
### SECTION - C

- 12. (a) Mention important functions of activated sludge in a sewage treatment plant.  
(b) What is the role of flocs in sewage treatment?
- 13. Explain the process of RNA interference.

OR

Refer to the given figure and answer the following questions.

- (i) Name the organism in which the vector is inserted to get the copies of the desired gene.
- (ii) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.
- (iii) Name and explain the role of a selectable marker shown in the vector.



## SECTION - D

14. (a) Spleen acts as a lymphoid organ. Justify the statement.
- (b) Differentiate between the following:
  - (i) Innate and acquired immunity
  - (ii) B - lymphocytes and T - lymphocytes
- (c) What are antigen presenting cells? Mention its types.

OR

How sewage water is treated before it could be discharged into natural water bodies?

15. Describe by diagrammatic representation of the process of recombinant DNA technology.

OR

- (a) Describe the different steps in one complete cycle of PCR.
- (b) State the purpose of such an amplified DNA sequence.

## ANSWERS

1. Pro- insulin contains an extra stretch called the C peptide which is not present in the mature insulin.
2. (i) Habitat destruction  
(ii) Alien species invasion
3. Ecological diversity is found in mangrove. Rainforests also show same level of biodiversity.
4. (a) Mammals (b) Amphibians
5. (d) : Rennet is obtained from calf's stomach and is a commercially available form of enzyme rennin. Rennet is used for curdling of milk to initiate the process of cheese formation. The same function can be carried out with the help of fruit extract of *Withania somnifera*. Thus, rennet and fruit extract of *Withania somnifera* have similar functions and are not antagonistic.

6. (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).

OR

- (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.
7. (i) (a) : The relationship is commensalism as two organisms live together without any physiological dependence.

(ii) (d): The interaction between birds and insects is predation, where birds capture, kill and eat up insects.

(iii) (a) (iv) (d)

(v) (d): The interaction between army ants and birds is commensalism in which two organisms live together without any physiological dependence between them. One is benefitted and other is neither harmed nor benefitted.

8. Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites, but between the same two bases on the opposite strands. This leaves single stranded portions at the ends. These overhanging stretches on each strand are called sticky ends. They form hydrogen bonds with their complimentary counterparts and facilitate the action of DNA ligase enzyme.

OR

A single stranded DNA or RNA is tagged with a radioactive molecule (probe) that allowed to hybridise to its complementary DNA in a clone of cells which is followed by detection using autoradiography. The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complementarity with the mutated gene. Hence, cancer induced mutation can be detected.

9. *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.

10. (a) Thymus is a primary lymphoid organ where the maturation of T-lymphocytes takes place. Thymus is quite large in size at the time of birth but it atrophies with age.

(b) T-lymphocytes are produced in bone marrow, and they mature and are released from thymus. T cells provide cell-mediated immunity and defend against pathogens including protists and fungi that enter the cells.

11. The population interaction is commensalism between an orchid growing on a forest tree in which orchid is benefitted and forest tree remains unaffected.

12. (a) A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the activated sludge is pumped into large tanks called anaerobic sludge digesters. The anaerobic bacteria present in this tank, digest the organic mass and aerobic bacteria and fungi in sludge and produce mixture of gases like methane, hydrogen sulphide and CO<sub>2</sub> which constitute biogas.

(b) Flocs are masses of aerobic bacteria held together by slime and fungal filaments to form mesh like structures.

These microbes digest a lot of organic matter converting it into microbial biomass and releasing a lot of minerals to reduce the biochemical oxygen demand or BOD.

13. Different steps involved in RNA interference are as follows:

(i) Double stranded RNAs are processed into approximately 21-23 nucleotide RNAs with two nucleotides. An RNase enzyme called dicer cuts the dsRNA molecules (from a virus, transposon, or through transformation) into small interfering RNAs (siRNAs).

(ii) Each siRNA complexes with ribonucleases (distinct from dicer) to form an RNA-induced silencing complex (RISC).

(iii) The siRNA unwinds and RISC is activated.

(iv) The activated RISC targets complementary mRNA molecules. The siRNA strands act as guides where the RISCs cut the transcripts in an area where the siRNA binds to the mRNA. This destroys the mRNA.

(v) When mRNA of the parasite is destroyed no protein is synthesised. It results in the death of the parasite in the transgenic host.

OR

(i) *Escherichia coli*

(ii) Origin of replication (*ori*) is a sequence from where replication starts and is also responsible for controlling the copy number of the inserted gene.

(iii) The given vector contains *amp*<sup>R</sup> as selectable marker. It helps in selecting transformants (host cells containing vector) and eliminating non-transformants. Host cells containing *amp*<sup>R</sup> are resistant to antibiotic ampicillin.

14. (a) Spleen acts as a secondary lymphoid organ where mature B and T lymphocytes undergo proliferation and differentiation. In spleen, lymphocytes develop immune response and become effector cells.

(b) (i) Differences between innate and acquired immunity are as follows:

S.No.	Innate Immunity	Acquired Immunity
(i)	This includes all the defence elements with which an individual is born.	This immunity is acquired after the birth.
(ii)	It consists of various types of barriers that prevent the entry of foreign agents.	It consists of specialised cells (T-cells and B-cells) and antibodies that circulate in the body fluid.
(iii)	It remains throughout life.	It can be short lived or long - lived.

(ii) Differences between the B-lymphocytes (B-cells) and T-lymphocytes (T-cells) are :

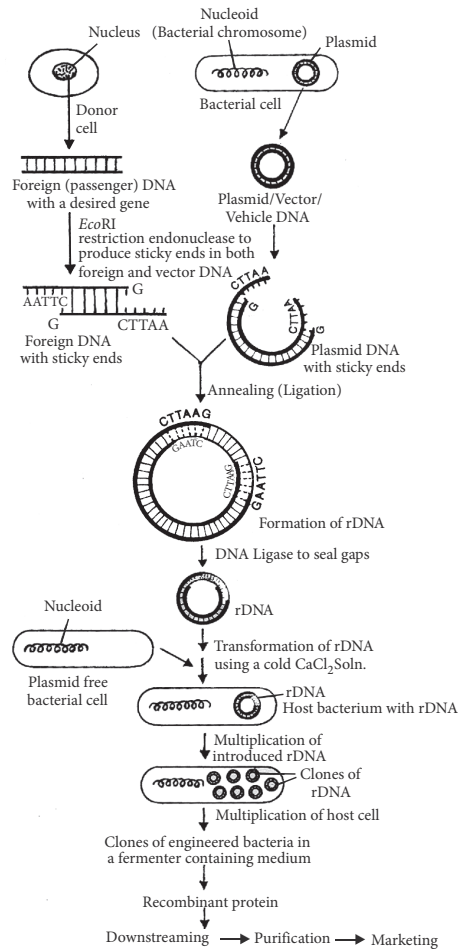
S.No.	B-lymphocytes (B-cells)	T-lymphocytes (T-cells)
(i)	B-cells form humoral or antibody mediated immune system (AMIS).	T-cells form cell-mediated immune system (CMIS).
(ii)	They defend against viruses and bacteria that enter the blood and lymph.	They defend against pathogens including protists and fungi that enter the cells.
(iii)	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.

(c) The cells that engulf antigens and present their fragments to T-cells are called antigen presenting cells (APCs). There are three types of APCs found in the body :  
 (i) Macrophages, (ii) Dendritic cells, (iii) B-cells.

OR

Sewage water can be purified by passing it through sewage treatment plants with the action of microorganisms. A sewage treatment plant separates solids from liquids by physical processes and purifies the liquid by biological processes. There are three stages of this treatment; primary, secondary and tertiary. Primary treatment is physical, secondary is biological and tertiary is chemical. Primary treatment phase of sewage treatment removes floating and suspended solids from sewage through two processes of filtration and sedimentation. First floating matter is removed through sequential filtration. The filtrate is kept in large open settling tanks where grit settles down. Aluminium or iron sulphate is added in certain places to flocculation and settling down of solids. The sediment is called primary sludge while the supernatant is called effluent. The primary sludge traps a lot of microbes and debris. It is subjected to composting or land fill where anaerobic digestion removes the organic matter. During secondary treatment, the primary effluent is taken to aeration tanks. A large number of aerobic heterotrophic microbes grow in the aeration tank. They form flocs. Flocs are masses of bacteria held together by slime and fungal filaments to form mesh-like structures. The microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. As a result the BOD of the waste matter is reduced to 10-15% of raw sewage, it is passed into settling tank. In settling tank, the bacterial flocs are allowed to undergo sedimentation. The effluent or supernatant is generally passed into natural water bodies and sediment of settling tank is called activated sludge.

15. Diagram showing various steps of recombinant DNA technology is given below:



OR

(a) 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 – 96°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.

(b) Applications of PCR are :

- (i) Diagnosis of pathogens
- (ii) Diagnosis of specific mutations
- (iii) DNA fingerprinting
- (iv) In prenatal diagnosis
- (v) In gene therapy.

