

ISC SEMESTER 2 EXAMINATION
SAMPLE PAPER - 5
BIOLOGY PAPER 1 (THEORY)

Maximum Marks: 35

Time allowed: One and a half hour

*Candidates are allowed an additional 10 minutes for **only** reading the paper.*

*They must **NOT** start writing during this time.*

*Internal choices have been provided in **one** question in **Section B**
and **one** question in **Section C**.*

Section-A

Question 1

- (i) Which part of our body is infected by *Salmonella Typhi*?
- (ii) The function of operator gene depends on:
 - (a) Structural genes.
 - (b) Promoter gene.
 - (c) Regulator gene.
 - (d) Inducer gene.
- (iii) **Assertion:** All immunoglobulin molecules have a basic structure composed of four polypeptide chains.
Reason: The polypeptide chains consist of two identical heavy and light chain connected by disulphide bonds.
 - (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) Both assertion and reason are false.
- (iv) Why colchicine is used in plant breeding programmes?
- (v) The act of laying eggs in the nest of host and allowing the host to incubate the eggs is called _____.
- (vi) Expand the term GFC.
- (vii) Name one tribe in India that resides in the extreme cold temperature.

Section-B

Question 2

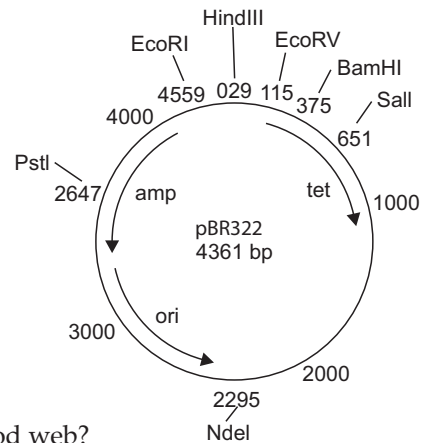
What are interferons?

Question 3

The figure given below is a pBR322 vector.

Which foreign DNA has to be introduced in amp^R region?

- From the restriction enzymes given below, which one should be used and why: PvuI, EcoRI, BamHI, Pst I.
- Give reason why the other three enzymes cannot be used.



Question 4

Why food chain in the environment operative in the form of the food web?

Question 5

- Distinguish between primary sludge and activated sludge.

OR

- Why are the pyramids upright in most of the ecosystem?

Question 6

In an agricultural field, there is a prevalence of the following organisms and crop diseases which are affecting the crop yield badly:

- | | |
|-----------------|---------------------------|
| (i) White rust | (ii) Jassids |
| (iii) Black rot | (iv) Leaf and stripe rust |

Recommend the varieties of crops the farmers should grow to get rid of the existing problem and thus improve the crop yield.

Question 7

Explain gene therapy in brief.

Question 8

Why selectable marker is essential in a cloning vector?

Question 9

What is the cultural and religious importance of biodiversity?

Section-C

Question 10

Compare with given reasons the J-shaped and S-shaped models of population growth of a species.

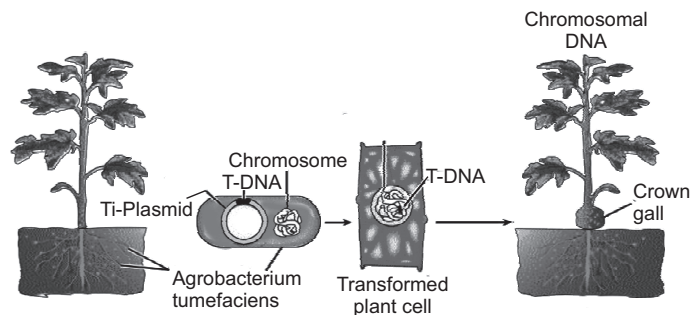
Question 11

What is called transplantation? Describe different types of transplants.

Question 12

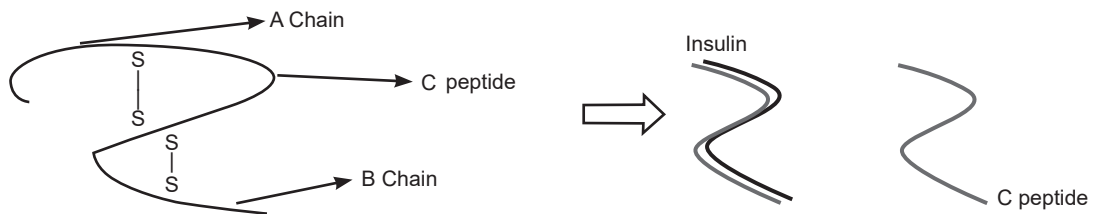
Based on the figure below answer the following questions:

- Give the characteristics of the bacterium *Agrobacterium tumefaciens*.
- Give importance of *Agrobacterium tumefaciens* in RDT.
- Name the disease caused by this bacteria.
- What happens on infection of plants with the bacteria?



OR

Analyse the following given diagram and answer the questions based on it:



- What does the above diagram represent?
- What does the insulin contain?
- What is the use of C-peptide in the diabetic patients?

Question 13

Define population growth and factors affecting population growth and write the formula of population growth.



Answers

Section-A

Answer 1.

- (i) Intestine
- (ii) (c) Regulator gene
- (iii) (b) Both assertion and reason are true but reason is not the correct explanation of assertion.

Explanation :

Immunoglobulins are heterodimeric proteins composed of two heavy (H) and two light (L) chains. They can be separated functionally into variable (V) domains that binds antigens and constant (C) domains that specify effector functions such as activation of complement or binding to Fc receptors.

- (iv) Colchicine causes doubling of the chromosome number. It is used to produce dihaploid plants from haploid cultures to achieve homozygous lines more rapidly in the breeding programme.
- (v) Brood parasitism
- (vi) Grazing Food Chain
- (vii) Drokpa tribe residing in Dras region of Jammu and Kashmir.

Section-B

Answer 2.

Interferon are named after their ability to “interfere” with viral replication within host cells.

1. IFNs are divided into three classes: type I IFN, Type II IFN and type III IFNs.
2. IFNs activate immune cells (natural killer cells and macrophages), increase recognition of infection and tumour cells by up-regulating antigen presentation to T lymphocytes, and increase the ability of uninfected host cells to resist new infection by a virus.

Answer 3.

- (i) Pst I enzyme can be used to introduce in ampR region.
- (ii) The ampR gene region does not have any restriction site of any other enzyme.

Answer 4.

Foodchain in the environment is operative in the form of food web due to following reasons:

1. Detritus food chain is connected to the grazing food chain on some level.
2. A number of animals e.g. cockroaches and crows are omnivorous.
3. In nature one animal depends on many types of animals for food and feeds at different trophic levels.

Answer 5.

- (i) **Primary sludge:** It includes all solid substances which got settled after primary treatment. It traps lots of microbe and debris.

Activated sludge: Its sediments formed from effluent after secondary treatment. It contains bacteria flocs.

OR

- (ii) Producers are always more in number and biomass than the herbivores, and the herbivores are more in number and biomass than the carnivores. Also, the energy at the lower trophic level is always more than at the higher trophic level. So all the pyramids are upright in most of the ecosystem.

Answer 6.

Here are the hybrid variety:

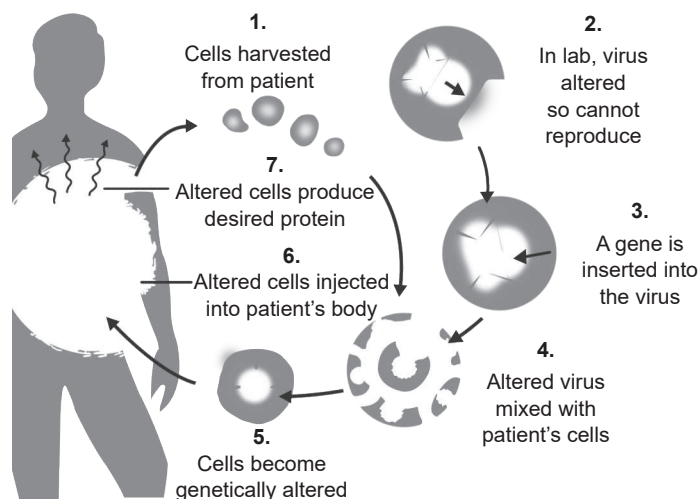
- (i) **White rust:** Pusa Swarnim.
- (ii) **Jassids:** Pusa sem 3
- (iii) **Black rust:** Pusa Subhra
- (iv) **Leaf and stripe rust:** Himgiri.

Answer 7.

Gene therapy is an experimental technique in which genes are introduced into individuals cells or tissues, to cure some hereditary diseases in which a defective allele of a gene is replaced with normal one. The technique of gene therapy was initiated in 1972.

Gene therapy can be of two types based on the types of cells treated.

1. **Somatic gene therapy:** The gene is transferred to the somatic cells of the body and the effect of the gene will not be transferred to future generations.
2. **Germline gene therapy:** The genes are transferred to germ cells of body and the altered effect will be transferred to future generations.



Answer 8.

Selectable markers like antibiotic resistance or beta-galactosidase gene help in the identification of transformed cells from the non-transformed cells.

Answer 9.

Biodiversity is not only important because we obtain useful things from it but beyond the material need. It also plays a significant role in our cultural life. Biodiversity is source of inspiration, some people admire its intrinsic beauty, it motivates poets, writers etc.

It also gives a religious identity in terms of festivals and rituals, we have. In terms of religion as well, some plants are considered sacred like tulsi and peepal. Similarly, many animals are worshipped and have religious values described in the scriptures.

Section-C

Answer 10.

Comparison between J-shaped and S-shaped models of population growth of a species as follows:

J-shaped population growth	S-Shaped population growth
1. This occurs when resources are unlimited in a habitat.	This occurs in S-shape manner when resources are limited in the habitat.
2. This seldom achieved steady-state or stationary phase.	Stationary or steady-state achieved.
3. Ultimately population crashes due to mass mortality.	Population seldom crashes.
4. The growth curve is characterized by initial lag phase followed by acceleration phase.	The growth curve initially depicts a lag phase followed by acceleration phase, deceleration phase and an upper asymptote that represents the carrying capacity.

Answer 11.

Transplantation means the replacement of a diseased organ or tissue of an individual with the living healthy organ or tissue from another individual.

There are four different types of transplants:

1. **Autograft:** It is a most successful transplant. In this case, one's tissue is grafted to another part of the body. Example: Skin grafted from one part of the body to another part during surgery.
2. **Isograft:** It is also a highly successful grafting method. In this case, donor and recipient are genetically identical. Example: graft between identical twins.
3. **Allograft:** Success of this transplant process depends on the degree of the matching. Transplant is between individuals of the same species but different MHC /HLA. Success depends on matching and immunosuppressive drugs like cyclosporine A to suppress graft rejection.
4. **Xenograft:** This process rejection rate is very high. It is done between two different animals of different species. This type of transplant is used only when human grafts are not available.

Answer 12.

- (i) *Agrobacterium tumefaciens* is a Gram negative, rod shaped bacterium.
- (ii) The bacteria has the ability to transfer its Ti plasmid to the plant genome. *A. tumefaciens* is exploited by many plant biologists in molecular and genetic studies to introduce DNA into plants.
- (iii) *Agrobacterium tumefaciens* is the causative agent of crown gall, a disease of dicotyledonous plants characterised by a tumorous phenotype.
- (iv) During infection by *A. tumefaciens*, a piece of DNA is transferred from the bacterium to the plant cell. This piece of DNA is a copy or segment called the T-DNA (transferred DNA). It is carried on a specific plasmid, the Ti-plasmid (tumour-inducing). The T-DNA is delimited by 25-bp direct repeats that flank the T-DNA. These borders are the only cis elements necessary to direct T-DNA processing. Any DNA between these borders will be transferred to a plant cell.

OR

- (i) It represents the maturation of pro-insulin into insulin.
- (ii) Insulin contains two short polypeptide chains that is chain A and chain B that are linked together with di-sulphide bridges.
- (iii) It is useful for monitoring residual beta cell function in the human body under insulin therapy.

Answer 13.

Population growth: It refers to the increase in a number of people that live in a particular geographical area which may be a country, state or city.

Factors affecting population growth:

1. **High birth rate:** High birth rate or we can say low death rates can increase population growth.
2. **Immigration:** When a person from another geographical area invades the population growth increases.
3. **Good health services:** Good health or maternity services decreases the infant mortality rate so, it increases the population growth rate.
4. **Food production:** Good food supply can increase the population growth rate.
5. **Good hygiene conditions:** It reduces the risk of diseases so population growth is increased.

Formula:

$$\text{Growth rate} = \frac{\text{Number of births (b)} - \text{Number of deaths (d)}}{\text{Average population in a time interval}}$$