ISC Solved Paper 2022 Semester-2
Biology
Class-XII

(Maximum Marks : 40)

(Time allowed : One and a half hours)

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*Candidates are allowed an additional **10 minutes** for only reading the paper.*
*They must **NOT** start writing during this time.*

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*Internal choices have been provided in **one** question in **Section B***
*and **one** question in **Section C**.*
The intended marks for questions or parts of questions are given in brackets [ ].

SECTION A [7 Marks]

*Answer **all the** questions.*

1. (i) Give the biological name of the causative agent of typhoid. [1]

***(ii) Hybrids are usually superior to their parents. This phenomenon is called: [1]**
- **(a)** Hybrid depression
- **(b)** Inbreeding depression
- **(c)** Heterosis
- **(d)** Transgenesis

***(iii) Assertion (A):** Motor vehicles equipped with catalytic converter should use unleaded petrol.
Reason (R): The catalyst used in the catalytic converter gets inactivated by the lead in the petrol. **[1]**
- **(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) Give one significant contribution of S. Cohen. [1]

***(v) Expand the term CNG. [1]**

(vi) Cancer causing agents are called _____. [1]

(vii) Why is the pyramid of energy never inverted? [1]

Ans. (i) *Salmonella typhi*
Explanation: Typhoid fever, or enteric fever, is a potentially fatal multisystemic infection produced primarily by *Salmonella enterica* serotype *typhi*.

(iv) Contribution of S. Cohen: Discovered first artificial recombinant DNA.
Explanation: Stanley Cohen & Herbert Boyer (1972) isolated the antibiotic resistance gene by cutting out a piece of DNA from a plasmid which was responsible for conferring antibiotic resistance. They also isolated first restriction endonuclease, Hind II.

(vi) Cancer causing agents are called carcinogens.
Explanation: Normal cells can be transformed into cancerous cells by physical, chemical or biological agents which are called carcinogens.

(vii) Pyramid of energy is never inverted because when energy flows from first trophic level to the next trophic level, some energy is always lost as heat at each step. Thus, for next level, energy is always less forming a upright pyramid.

SECTION B [16 Marks]

2. A person in good health visits a garden where flowers are in bloom. While returning from the garden, he suddenly starts sneezing and wheezing. [2]
- **(i) Name and define the response of the person's immune system in the above case.**
- **(ii) State the type of antibody which is produced against such a response.**

Ans. (i) Allergy. It is the exaggerated response of the immune system to certain antigens present in the environment. **[1]**

(ii) Immunoglobulin E (IgE). **[1]**

3. Write the role of 'ori site' and 'restriction sites' in the cloning vector pBR322. [2]

Ans. Role of ori site: It is the site of initiation for DNA replication. This is a sequence from where replication starts. A piece of DNA linked to ori can replicate within the host cells and also controls the copy number of the linked DNA.
Role of restriction Site: It is the site for recognition of restriction enzymes. This is a sequence which contains 6–8 base pairs of DNA which binds to a

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*** Out of syllabus**

particular restriction enzyme. pBR322 contains multiple restriction sites.

4. Define: **[2]**

***(i) Allen's rule**

(ii) Standing crop

Ans. (ii) Standing crop: Each trophic level has a certain mass of living material at a particular time called as the standing crop. It is measured as the mass of living organisms (biomass) or the number in a unit area.

5. (i) The Net Primary Productivity of a terrestrial ecosystem is 1500 Kg per meter square per year and the respiratory loss of the ecosystem is 1200 Kg per meter square per year. Calculate the gross primary productivity of the given ecosystem. **[2]**

OR

(ii) In an ecosystem, a food chain follows the following pattern:

Grass → Insects → Snake → Peacock.

If 2000 J of energy is available at the level of producers in this food chain, how much energy would be available to the peacock?

Ans. (i) Given that,

R = 1200 Kg/m^2/yr

NPP = 1500 Kg/m^2/yr

Since, $GPP - R = NPP$

where,

NPP = Net Primary Productivity

GPP = Gross Primary Productivity

R = Respiration Losses

Hence $GPP = NPP + R$

Thus, GPP = 1500 + 1200

= 1700 Kg/m^2/yr

OR

(ii) According to 10% law, only 10% of the energy is transferred to each trophic level from the lower trophic level.

In the given food chain,

Energy available to Grass = 2000 J

Energy available to Insect = 10% of 2000 J = 200 J

Energy available to Snake = 10% of 200 J = 20 J

Thus, Energy available to Peacock = 10% of 20 J = 2 J

***6. Explain the significance of bagging and emasculation in the process of artificial hybridisation of plants.** **[2]**

7. What is PCR? Explain the steps involved in PCR technique. **[2]**

Ans. PCR: Polymerase Chain Reaction (PCR) is the synthesis of multiple copies of the gene of interest *in vitro* using two sets of primers and the enzyme DNA polymerase.

Steps involved in PCR:

(a) Denaturation: Here, the double stranded DNA is denatured using high temperature to form single strand which act as a template for DNA synthesis.

(b) Annealing of Primers: Two sets of primers are annealed or hybridized at low temperature using suitable enzymes based on the length and the sequence of the primers.

(c) Extension of Primers: The primers are extended by adding nucleotides complementary to the template by *Taq* DNA polymerase.

8. What is Ti plasmid? Name the organism in which is found. **[2]**

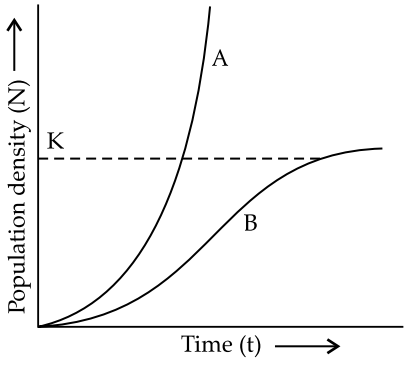
Ans. Ti plasmid is the tumor inducing plasmid that is modified into a cloning vector which is not pathogenic to the plants but is able to use the mechanisms to deliver genes of our interest into plants.

Ti plasmid is found in *Agrobacterium tumefaciens*.

***9. In an ecosystem, is the climax stage achieved more quickly during the primary succession or during the secondary succession? Give a reason to justify your answer.** **[2]**

SECTION C [12 Marks]

10. The following diagram represents the population growth curves of two different species A and B, living together in an area. Answer the following questions based on it. **[3]**



*** Out of syllabus**

(i) What type of growth-patterns are exhibited by the species A and B?

(ii) Give mathematical equations to represent the growth curves of species A and species B, separately.

(iii) In the diagram, what does the horizontal line K represent?

Ans. (i) Species 'A' shows exponential growth pattern while Species 'B' shows logistic growth pattern.

(ii) Species 'A' is represented by equation dN/dt=rN.

Species 'B' is represented by equation dN/dt=rN(K-N)/K.

(iii) K represents the carrying capacity. In nature, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible. It is called carrying capacity (K).

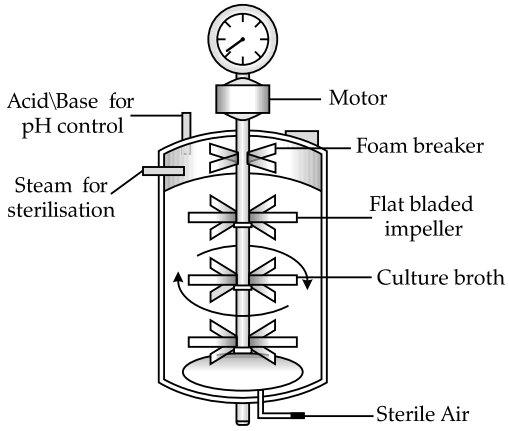
***11. With reference to inbreeding of cattle, answer the following questions: [3]**

(i) Define inbreeding.

(ii) Suggest one advantage and one disadvantage of this process.

12. Draw a well-labelled diagram of a stirred-tank bioreactor. [3]

Ans. Diagram of a stirred-tank bioreactor:



***13. (i) (a) What is *eutrophication*?**

(b) Explain the consequences of eutrophication on the life of plants and animals in an aquatic ecosystem. [3]

OR

(ii) (a) Define biogeochemcial cycle.

(b) Give a graphic outline of phosphorus cycle in an ecosystem.

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