

# केंद्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर

Kendriya Vidyalaya Sangathan Regional Office Raipur



## BIOLOGY



**Class - XII**

**Question Bank Term- II 2021-22**

# केंद्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर

Kendriya Vidyalaya Sangathan Regional Office Raipur

## MESSAGE FROM DUPUTY COMMISSIONER



It gives me immense pleasure to bring out the study material for 2<sup>nd</sup> Term in different subject of Classes X and XII for Raipur Region. All of us know that in the 1<sup>st</sup> Term Examination questions were objective but in 2<sup>nd</sup> Term questions will be subjective so once again to get our children acquainted and familiarized with the new scheme of examination and types of questions, it is of utmost significance that an extensive study material should be provided to our children. This question bank is in complete consonance with CBSE Circular Number 51 and 53 issued in the month of July 2021. It will help students to prepare themselves better for the examination. Sound and deeper knowledge of the Units and Chapters is must for grasping the concepts, understanding the questions. Study materials help in making suitable and effective notes for quick revision just before the examination.

Due to the unprecedented circumstances of COVID-19 pandemic the students and the teachers are getting very limited opportunity to interact face to face in the classes. In such a situation the supervised and especially prepared value points will help the students to develop their understanding and analytical skills together. The students will be benefitted immensely after going through the question bank and practice papers. The study materials will build a special bond and act as connecting link between the teachers and the students as both can undertake a guided and experiential learning simultaneously. It will help the students develop the habit of exploring and analyzing the **Creative & Critical Thinking Skills**. The new concepts introduced in the question pattern related to case study, reasoning and ascertain will empower the students to take independent decision on different situational problems. The different study materials are designed in such a manner to help the students in their self-learning pace. It emphasizes the great pedagogical dictum that '*everything can be learnt but nothing can be taught*'. The self-motivated learning as well as supervised classes will together help them achieve the new academic heights.

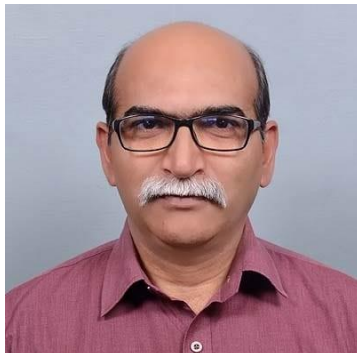
I would like to extend my sincere gratitude to all the principals and the teachers who have relentlessly striven for completion of the project of preparing study materials for all the subjects. Their enormous contribution in making this project successful is praiseworthy.

Happy learning and best of luck!

Vinod Kumar  
(Deputy Commissioner)

केंद्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर  
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**KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION**  
**QUESTION BANK, CLASS-XII BIOLOGY**

S.N.	TERM	CHAPTER NUMBER	PAGE	CHAPTER NAME
1	II	CHAPTER-8	1-4	HUMAN HEALTH AND DISEASE
2		CHAPTER-10	5-9	MICROBES IN HUMAN WELFARE
3		CHAPTER-11	10-18	BIOTECHNOLOGY: PRINCIPLES AND PROCESSES
4		CHAPTER-12	19-24	BIOTECHNOLOGY AND ITS APPLICATIONS
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6		CHAPTER-15	29-33	BIODIVERSITY AND ITS CONSERVATION
7	Model question	All chapters		Three

# Term II

## CHAPTER-8 : HUMAN HEALTH AND DISEASE

### SHORT ANSWER QUESTION (2 MARKS QUESTION)

Q.1 Thymus of a new born child was degenerating right from birth due to a genetic Disorder. Predict its two impacts on the health of the child.

Ans- Thymus provides micro-environment for the development and maturation of T-lymphocytes, and provides immunity.

Q.2 Certain diseases are spread by mosquitoes and two such diseases are spread by a mosquito which bites in the day time. Both the diseases are caused by viruses.

- a) Name the mosquito.
- b) Name the diseases with one symptom of each.

Ans— *Aedes*

b) Dengue—muscular pain, Chikungunya –very high fever.

Q.3 A child gets colostrum and polio drop both as an infant. Compare their mode of action with respect to our immune system.

Ans- Colostrum provides passive immunity to child. Polio drop/ vaccine provide active immunity.

Q 4. Differentiate between – 02 MARKS EACH

- a) Antigen and Antibody
- b) Active and Passive immunity.
- c) Benign tumour and Malignant.
- d) Innate and Acquired immunity.
- e) B lymphocytes and T lymphocytes.

Q. 05 Name the symptoms of the disease caused by *Epidermophyton*. Write any two symptoms of this disease

Q. 06. How do saliva and tear prevent microbial growth?

Q, 07 How do viral infected cell protect the body tissue from further infection?

### SHORT ANSWER QUESTION (3MARKS QUESTION)

Q.1 A person shows strong unusual hypersensitive reactions when exposed to certain substances present in the air, identify the condition. Name the cells responsible for such reactions. What precaution should be taken to avoid such reactions.

ANS- The condition is called allergy. Mast cell responsible for such reaction.

Precaution---- 1. Use drug like antihistamine, adrenaline and steroid.

2. Avoid contact with substances to which a person is hypersensitive.

Q.2 Many microbial pathogens enter the gut of humans along with food. What are the preventive barriers to protect the body from such pathogens? What type of immunity do you observe in this case?

ANS- Preventive barriers to protect the body from such pathogens

i) The mucus coating of the epithelium lining of the gut helps in trapping microbes entering the body.

ii) Saliva in the mouth and HCL in gastric juice secreted by stomach prevent microbial growth. It is innate immunity.

Q.3 Tarun was one of the best boys in the class. In spite of his efforts he was not doing well in class. His father wanted him to qualify for medical sciences. He got frustrated with his results and started misbehaving with parents and friends in school. His friends started neglecting him. The school authorities counseled Tarun but to no effect. His parents were upset and took him to a rehabilitation Centre. After a few months he came back recovered.

a) What is drug abuse?

b) Name some commonly abused drugs and their source.

c) What should be the attitude of his parents after his return?

d) **ASSERTION:** Drugs like Barbiturates and Benzodiazepines normally used as medicine to help the patients to cope up with mental illness.

**REASON:** When these substances are taken for a purpose other than medical use, constitute the drug abuse.

a) Assertion and reason both are correct statement and reason is correct explanation for assertion.

b) Assertion and reason both are correct statement and reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

ANS---a) Intake of drugs for a non –medical purpose in the dose, strength, frequency and the way of taking which impairs mental and physical functions of human being is drug abuse.

b) **OPIUM:** From plant *Papaver somniferum* Its derivatives include morphine, codeine, heroin, smack (brown sugar)

**Cocaine:** From *Erythroxylon coca* its derivatives include Crack, Caffeine

**LSD:** From fungi *Claviceps purpurea*

c) Parents should be compassionate and more caring towards the child. Behave normally. (ANY other may be included) open added question.

d) Assertion and reason both are correct statement and reason is not correct explanation of the assertion.

Q4. Fill in the spaces/ blanks in the following flow chart.

(i) Mosquito bites a healthy human and injects sporozoites.

(ii) Sporozoites reach the \_\_\_\_a\_\_\_\_ through \_\_\_\_b\_\_\_\_

(iii) Reproduces \_\_\_\_c\_\_\_\_ burst the cells and release into blood

(iv) Enter the \_\_\_\_d\_\_\_\_

(vi) Some of them form \_\_\_\_f\_\_\_\_ that are picked up by a mosquito when it bites.

ANS- a. liver, b. blood, c. asexually, d. haemozoin, e. gametocytes.

Q.5 Fill in the blank columns in the given table.

Disease	Causal organism	Medium of transfer	Symptoms
Amoebiasis	Causal <i>Entamoeba histolytica</i>	A a	Diarrhoea
Typhoid	B b	Contaminated food and water	Sustained high fever
C c	<i>Plasmodium</i>	Bite of infected female anopheles' mosquito	Chill and high fever

a---- Contaminated food

b----*Salmonella typhi*

c---Malaria

Q. 6 What is cancer? Explain three main types of cancer. Name at least two danger signals of cancer.

### LONG ANSWER QUESTION (5MARKS QUESTION)

Q.1 In India horoscopes of girl and boy are matched before fixing marriage. But Smita was against this, rather wanted future groom's blood to be tested for HIV. When asked for HIV test, the groom and his parents disagreed and left immediately.

- Was Smita wrong in wanting the future groom's HIV blood test done?
- Write the name of test for AIDS?
- Why did Smita wanted to get the boy's HIV test done?
- Which cell and tissue are affected by the HIV?
- Which enzyme converts RNA to DNA?

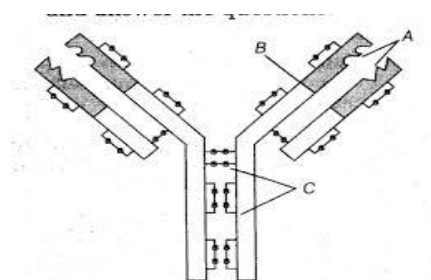
ANS— a) No, Smita was not wrong.  
 b) ELISA-Enzyme linked immune sorbent assay.  
 c) HIV cause AIDS. It can spread through sexual contact. If the boy is HIV positive, she may get the virus, her future baby may also suffer from AIDS.  
 d) T helper cell and macrophage.  
 e) Reverse transcriptase.

Q.2 HIV, after infection takes few months to many years to exhibit its symptoms till then its prevention is a challenging task. Describe any two methods of early diagnosis of the deadly disease AIDS. How does HIV complete its life cycle? Also give illustrative diagram.

Ans.- Correct explanation of ELISA test and PCR. Correct explanation with supportive illustrative diagram of HIV life cycle.

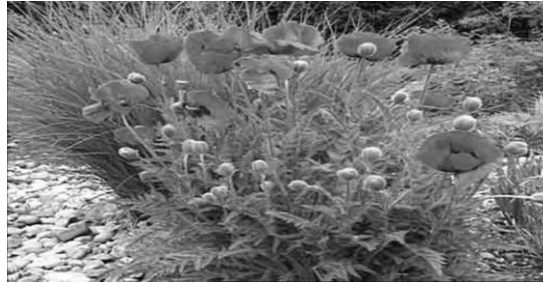
### DIAGRAM BASED QUESTION

1. Identify the molecule and name A, B and C in the figure



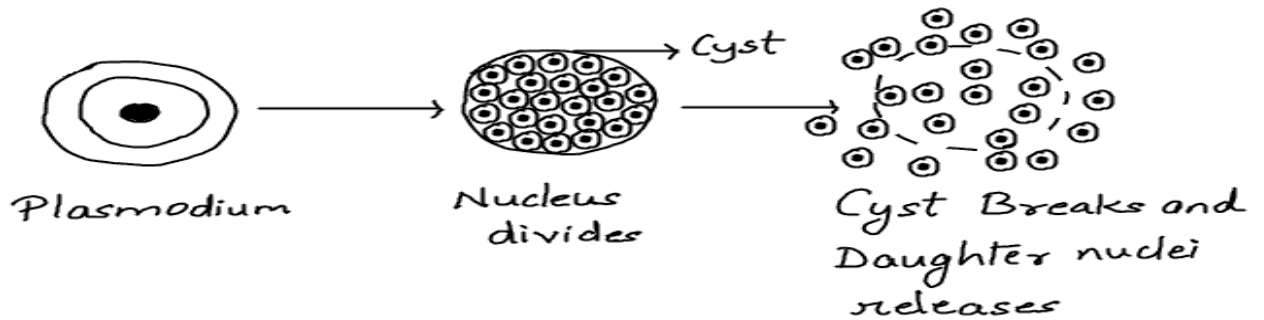
Ans. A= antigen binding site, B= Heavy chain, C= disulphide bonds.

2. Identify the plant and name the drug obtain from this plant.



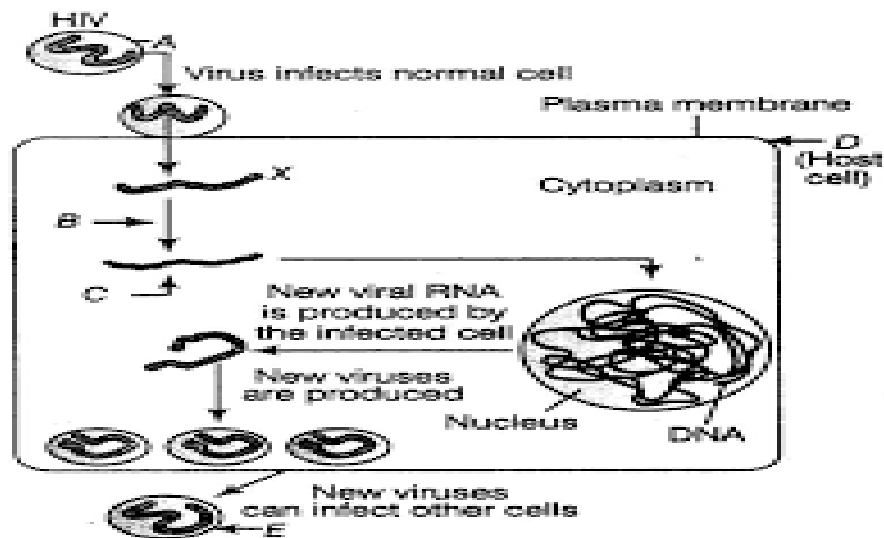
Ans. Opium (*Papaver somniferum*), morphine.

3. Which type of mode of reproduction is visible in the following figure also mention in which host of *Plasmodium* does this process take place?



Ans. Plasmodium undergoes multiple fission in the liver cells and erythrocytes of human host.

4. Identify and label the X, B and C in the following figure.



Ans. X= Viral RNA, B= formation of DNA from RNA by enzyme reverse transcriptase, C= Viral DNA

## CHAPTER-10: MICROBES IN HUMAN WELFARE

### 1 Fill in the blanks

e	Name of the Microbe	Product	Purpose
(a)	<i>Monascus purpureus</i>		Lowers blood cholesterol
(b)		Streptokinase	Removes clots from blood vessels
(c)	<i>Clostridium butylicum</i>	Lipase	
(d)		Cyclosporin-A	Immunosuppressive drug

### 2. Microbes are also used for commercial and industrial production of certain chemicals like organic acid, alcohol and enzymes.

Examples of acids producers are *Aspergillus niger* (a fungus) of citric acids, *Acetobacter aceti* (a bacterium of acetic acid); *Clostridium butylicum* (a bacterium) of butyric acid and *Lactobacillus* (a bacterium) of lactic acid.

A bioactive molecule, cyclosporinA, that is used as an immunosuppressive agent in organ transplant patients, is produce by the fungus *Tricoderma polysporum*. Statins produce by the yeast. *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

#### i) Which of the following is used in detergent formulations & are helpful in removing only oily stains from the laundry?

- a) Lipases b) Proteases c) Pectinases d) Statins

#### ii) \_\_\_\_\_ is a clot buster.

- a) Streptokinase b) Cyclosporin c) *Monascus purpureus* d) Statins

#### iii) Sara faced myocardial infraction which led to a heart attack, at the time she was rushed to the hospital. Which medicine should have been administered to her at that time?

- a) Cyclosporin A b) Streptokinase c) *Monascus purpureus* d) Statins

#### iv) *Aspergillus niger* is used for production of \_\_\_\_\_.

- a) acetic acid b) butyric acid c) lactic acid d) citric acid.

#### v) \_\_\_\_\_ is used in production of breads & ethanol.

- a) Yeast b) Virus c) Blue green algae d) Spirogyra

**Answer 21 :- i-(a), ii-(a), iii-(b), iv-(a), v-(a)**

3. The Primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structure). While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD of the effluent. BOD refers to the amount of the oxygen that would be consumed if all organic matter in 1liter of water were oxidized by bacteria. The BOD test measures the rate of oxygen by micro-organisms in a sample of water.

#### i) BOD stands for: -

- a) Biological Oxygen Demand b) Bio Oxygen Demand  
c) Biochemical Oxygen Demand d) Biogeo Oxygen Demand

#### ii) The greater BOD of waste water, more is its \_\_\_\_\_

- a) cleanliness b) CO<sub>2</sub> potential c) polluting potential d) water level

#### iii) The purpose of biological treatment of waste water is to

- a) reduce BOD b) increase BOD c) reduce sedimentation d) increase sedimentation

#### iv) The masses of bacteria held together by slime and fungal filament to form mesh-like structure is called as

- a) primary sludge b) flocs c) activated sludge d) anaerobic sludge

#### v) \_\_\_\_\_ is the first step of sewage treatment.

- a) Precipitation b) Chlorination c) Sedimentation d) Aeration



4. Milk starts to coagulate when Lactic Acid Bacteria (LAB) is added to milk as a starter.

Mention two benefits that LAB provides.

Answer -

- 1) LAB checks the growth of disease-causing microbes.
- 2) LAB converts milk into curd and also increases nutritional quality by increasing vitamin B12.

5. Give the scientific name of the source organism from which the first antibiotic was produced.

Answer: -*Penicillium notatum*

6. Name a microbe used for statin production. How do statins lower blood cholesterol levels?

Answer: -Microbe: *Monascus purpureus* Mechanism: Statins are competitive inhibitors of enzymes required for cholesterol synthesis. Therefore, play role in decreasing cholesterol level in the body.

7. 'Swiss cheese' is characterized by the presence of large holes. Name the bacterium responsible for it.

Answer: -*Propionibacterium sharmanii*

8. Name the enzyme which is used as clot buster" to remove blood clot from blood vessels of patients.

Answer: - Streptokinase.

9. Name the first antibiotic manufactured & also names its source microorganism.

Answer: -Penicillin obtained from *Penicillium notatum*.

## 2 Marks Questions

1. Name two alcoholic drinks produced in each of the following ways.

(i) by distillation and (ii) without distillation.

Answer: - (i) Whisky, brandy, rum by distillation  
(ii) Wine, beer without distillation

2. Lactic Acid Bacteria (LAB) is commonly used in the conversion of milk into curd.

(Mention any two other functions of LAB that are useful to humans).

Answer: - (i) LAB in human intestine synthesizes Vitamin B12.  
(ii) LAB in human stomach checks the growth of harmful microbes.

3. How do mycorrhizae function as biofertilizers? Explain with example.

Answer: -Mycorrhiza are fungi associated with the roots of plants. Many members of genus *Glomus* form mycorrhiza. These fungal symbionts absorb water and minerals like phosphorus from the soil and provide them to the plant.

4. What are bio fertilisers? A farmer is advised to add a culture of bacterium in the soil before sowing the crop. Name the bacterium in the culture. How is this bacterium useful to the crop?

Answer: -Bio fertilisers are organisms that enrich the nutrient quality of the soil. *Azotobacter* / *Azospirillum* (free living) This bacterium fixes atmospheric nitrogen into organic forms, which is used by the plants as nutrient

5. What for *Nudeopolyhedro* viruses (NVP) are being used nowadays?

Answer: -*Nudeopolyhedro* viruses are being used to kill insects and other arthropods pests of crops. The viruses have no effect on plants and non-target animals. Thus, used in biological control of pests.

6. How has the discovery of antibiotics helped mankind in the field of medicine?

**Answer:** - Antibiotics have helped mankind in treating most of the deadly bacterial and fungal diseases of humans

**7. What is the relationship between BOD and organic matter in sewage?**

**Answer:** - The greater the BOD of wastewater more is the amount of organic matter in sewage.

**8. Name two gases produced during secondary treatment by sewage.**

**Answer:** - 1. Carbon dioxide and 2. Hydrogen sulphide.

**9. Expand the 'LAB'. How are LABs beneficial to humans? (Write any two benefits)**

**Answer:** - LAB-Lactic Acid Bacteria Benefits:

Found in curd. They improve the nutritional quality of food.

Yogurt is prepared from milk by *Lactobacillus*.

**10. What is cyclosporin A? What is its importance?**

**Answer:**-Cyclosporin A. It is an eleven-membered cyclic oligopeptide obtained through the fermentative activity of fungus *Trichoderma polysporum* Importance. It has antifungal, anti-inflammatory, and immunosuppressive properties. It inhibits the activation of T-cells and therefore, prevents rejection reactions in organ transplantation.

**11. Your advice is sought to improve the nitrogen content of the soil to be used for the cultivation of a non-leguminous terrestrial crop.**

(i) Recommend two microbes that can enrich the soil with nitrogen.

(ii) Why do leguminous crops not require such enrichment of the soil?

**Answer (i):** -*Azospirillum*, *Azotobacter*, *Anabaena*, *Oscillatoria* (Any two)

**Answer (ii):** - Leguminous crops do not require such enrichment of the soil because they have a symbiotic association with *Rhizobium* bacteria which traps nitrogen directly from the atmosphere and provides it to the plant and in turn gets food and shelter.

**12. Give examples to prove that microbes release gases during metabolism.**

**Answer:** - 1. Large holes in 'Swiss Cheese' are due to the production of a large amount of CO<sub>2</sub> by a bacterium named *Propionibacterium Sharmaine*.

2. The puffed-up appearance of dough is due to the production of CO<sub>2</sub> gas by yeast, *Saccharomyces cerevisiae*.

3. Methane, H<sub>2</sub>S, and CO are produced during microbial digestion of organic compounds in the case of secondary treatment of sewage.

4. The dung of the cattle produces methane gas in the biogas plants.

**13. Why is a slurry of cattle dung (gobar) added to bio-wastes in the tank of a gober gas plant for the generation of biogas?**

**Answer:** -Slurry consisting of excreta dung of cattle commonly called gober is rich in methanogen bacteria. It is used for the generation of biogas. These bacteria called methane bacterium grow anaerobically and break down.

### 3 Marks.

**1. The three microbes are listed below. Name the product produced by each one of them and mention their use.**

(i) *Aspergillus niger*                      (ii) *Trichoderma polysporum*                      (iii) *Monascus purpureus*

**Answer:** - (i) *Aspergillus niger* produces citric acid. Citric acid is used as a flavouring agent and as a food preservative.

(ii) *Trichoderma polysporum* produces a bioactive molecule cyclosporin A. It is used as Animmuno suppressive agent in organ transplant patients.

(iii) *Monascus purpureus* produces statins. Statins are capable of competitive inhibition of enzymes required for cholesterol synthesis. Hence, it is used as blood cholesterol-lowering agents.

2. (i) A patient had suffered myocardial infarction and clots were found in his blood vessels. Name a 'clot buster' that can be used to dissolve clots and the microorganism from which it is obtained. molecular drug is administered to oppose kidney rejection by the body. What is-
- (ii) A woman had just undergone a kidney transplant. A bioactive the bioactive molecule? Name the microbe from which this is extracted.
- (iii) What do doctors prescribe to lower the blood cholesterol level in patients with high blood cholesterol? Name the source organism from which this drug can be obtained.

**Answer:** - (i) Streptokinase- 'Clot buster' can be used to dissolve clots. It is obtained from the bacteria *Streptococcus*

(ii) The bioactive molecule is Cyclosporin A which is used as an immunosuppressive agent in organ transplantation. It is produced by the fungus *Trichoderma polysporum*.

(iii) Doctors prescribe Statins to lower blood cholesterol. It is obtained from the fungus *Monascus purpureus*.

### 3. Draw the well labelled diagram of the Biogas plant.

**Answer:** - Fig 10.8(Page No-186: -Refer NCERT Book).

## 5 Marks

### 4. Microbes can be used to decrease the use of chemical fertilizers. Explain how this can be accomplished.

**Answer:** -1. Rhizobium bacteria present in the root nodules of leguminous plants (pea family) forms a symbiotic association and fixes atmospheric nitrogen into organic forms as nitrates/nitrites which are used by the plant as nutrient.

2. Free-living bacteria in the soil *Azospirillum* and *Azotobacter* can fix atmospheric nitrogen thus enriching the nitrogen content of the soil.

3. Many members of the genus *Glomus* (Fungi) form mycorrhizal symbiotic associations with higher plants. In these, the fungal symbiont absorbs phosphorus from soil and passes it to the plant.

### 5. Describe the primary and secondary treatment of domestic sewage before it is released for reuse.

**Answer:** - Treatment of domestic sewage. The municipal wastewaters are treated in Effluent Treatment Plant (ETP) prior to disposal in water bodies.

It consists of 3 steps: primary, secondary, and tertiary.

1. Primary treatment. It includes physical processes, such as sedimentation, floatation, shredding (fragmenting and filtering). These processes remove most of the large debris.

2. Secondary treatment. It is a biological method. Activated sludge method. Sewage, after primary treatment, is pumped into aeration tanks or oxidation ponds. Here, it is mixed with air and sludge containing algae and bacteria. Bacteria consume organic matter. The process results in the release of CO<sub>2</sub> and the formation of sludge or bio solid. Algae produce oxygen for the bacteria. The water, which is now almost clear of organic matter, is chlorinated to kill microorganisms.

3. Tertiary treatment. It involves removal of nitrates and phosphates. The water, after the above treatment, is then released. It can be reused.

### 6. Given below is a list of six micro-organisms. State their usefulness to humans.

- |                                 |   |
|---------------------------------|---|
| (i) <i>Nucleopolyhedrovirus</i> | (ii) <i>Saccharomyces cerevisiae</i>      |
| (iii) <i>Monascus purpureus</i> | (iv) <i>Trichoderma polysporum</i> .      |
| (v) <i>Penicillium notatum</i>  | (vi) <i>Propionibacterium sharmanii</i> . |

**Answer:-** Name of Micro-organisms & Uses

- |                                      |                               |
|--------------------------------------|-------------------------------|
| (i) <i>Nucleopolyhedrovirus</i>      | Used in biocontrol of insects |
| (ii) <i>Saccharomyces cerevisiae</i> | Bread making, Ethanol making  |

- (iii) *Monascus purpureus*  
Produces Statin used as blood cholesterol-lowering agent
- (iv) *Trichoderma polysporum*  
Preparation of cyclosporin having antifungal, anti-inflammatory, immuno-suppressive properties
- (v) *Penicillium notatum*  
Production of antibiotic, Penicillin
- (vi) *Propionibacterium sharmanii*  
Preparation of large-holed swiss cheese.

## 7. Explain biological control of pests and plant pathogens with examples.

**Answer:** - The very familiar beetle with red and black markings the Ladybird, and Dragonflies are useful to get rid of aphids and mosquitoes, respectively.

The bacterial disease will kill the caterpillars, but leave other insects unharmed. Because of the development of the methods of genetic engineering in the last decade or so, scientists have introduced B. thuringiensis toxin genes into plants. Such plants are resistant to attack by insect pests. Bt-cotton is one such example which is being cultivated in some states of our country.

Biological control of plant pathogens: A biological control developed for use in the treatment of plant disease is the fungus *Trichoderma*. *Trichoderma* sp. are free-living fungi that are very common in soil and root ecosystems. They are effective biocontrol agents of several plant pathogens.

*Baculoviruses* are pathogens that attack insects and other arthropods. The majority of baculoviruses used as biological control agents are in the genus *Nucleopolyhedrovirus*. These viruses are excellent candidates for species-specific, narrow spectrum insecticidal applications.

They have been shown to have no negative impacts on plants, mammals, birds, fish, or even on non-target insects. This is especially desirable when beneficial insects are being conserved to aid in an overall IPM (integrated pest management) program, or when an ecologically sensitive area is being treated.

## 8. How do biofertilizers enrich the soil?

**Answer:** - Biofertilizers play a vital role to solve the problems of soil fertility and soil productivity.

1. *Anabaena/Azolla*, a cyanobacterium, lives in symbiotic association with the free-floating water fern, Azolla. The symbiotic system Azolla-Anabaena complex is known to contribute 40-60 mg N ha<sup>-1</sup> perrice crop. In addition to this, a cyanobacteria add organic matter, secretes growth-promoting substances like auxins and vitamins, mobilizes insoluble phosphate, and thus improves the physical and chemical nature of the soil.

2. Rhizobium Leguminosorum and Azospirillum fix atmospheric nitrogen as nitrates and nitrites.

3. Mycorrhizae formed by an association of bacteria and roots of higher plants increase soil fertility.

## **CHAPTER: 11 BIOTECHNOLOGY: PRINCIPLES AND PROCESSES**

### **KEYPOINTS:**

1.	Recombinant DNA	Artificially made DNA strand, formed by the combination of two or more gene sequences.
2.	ori	Origin of replication, site from where replication starts
3.	Plasmid	Autonomously replicating circular extrachromosomal DNA found in bacteria
4.	Restriction Enzymes	Enzymes which cuts the DNA at specific sites
5.	Vectors	A vector is usually a piece of DNA that carries a sequence of DNA (gene of interest) and introduces it into a new cell.
6.	Gene Cloning	To produce multiple copies of gene in a host cell
7.	Nucleases	A class of enzymes which breaks the nucleic acids in to small fragment by hydrolysing the sugar phosphate backbone
8.	Exonucleases	They remove nucleotides from the ends of the DNA
9.	Endonucleases	Enzymes that cleave the phosphodiester bond within a polynucleotide chain (DNA)
10.	Palindromic Nucleotide Sequences	A sequence of Base pairs that read same on the two strands when orientation of the reading frame kept the same
11.	DNA Ligase	Joins the DNA from two different sources to make recombinant DNA
12.	Gel Electrophoresis	A technique which is used to separate DNA fragments based on their sizes under electric field.
13.	Selectable Markers	These are the genes which are used to select transformants and recombinants. Eg Antibiotic Resistant genes
14.	Transformants	A cell that has received additional genetic material
15.	Recombinants	cell that contains a combining genetic material with different origins
16.	Lysozyme	Enzyme which breakdown bacterial cell wall.
17.	Cellulase	Enzyme which breakdown plant cell wall made of cellulose
18.	Chitinase	Enzyme which breakdown fungal cell wall made of chitin
19.	PCR	Polymerase Chain Reaction used to produce multiple copies of the gene
20.	Recombinant protein	A protein made from the recombinant DNA in a host cell
21.	Bioreactors	A large vessel in which raw materials are biologically converted into specific products
22.	Downstream Processing	A series of processes like separation and purification of the product before it is ready for marketing.

### **Case Based Question:**

**Read the passage given below and answer the following questions**

1. *When I come to the laboratory of my father, I usually see some plates lying on the tables. These plates contain colonies of **bacteria**. These colonies remind me of a city with many inhabitants. In each bacterium there is a king. He is very long, but skinny. The king has many servants. These are thick and short, almost like balls. My father calls the king DNA, and the servants' enzymes . . . My father has discovered a servant who serves as a pair of scissors. If a foreign king invades a bacterium, this servant can cut him in small fragments, but he does not do any harm to his own king.*  
—Sylvia (10 years old), daughter of Werner Arber (as quoted in Konforti, 2000)

Swiss microbiologist Werner Arber was one of the recipients of the 1978 Nobel Prize in Physiology or Medicine, an award he earned for his discovery (with Stuart Linn) of restriction enzymes. Arber discovered restriction enzymes while studying a phenomenon known as host-controlled restriction of bacteriophages (also known at the time as host-controlled modification of bacteriophages).

Bacteriophages are viral particles that invade bacteria and replicate their own DNA independently of the bacterial chromosomal DNA. Prior to Arber's work, researchers Salvador Luria and Mary Human had shown that various phages were host specific, with each phage surviving and flourishing only in one host bacterial strain and growing poorly in others (Luria & Human, 1952). Those phages that grew poorly were said to be "restricted" by their host. Arber wanted to know why.

Arber proposed that bacterial cells (in this case, *E. coli*) were able to protect themselves against foreign DNA through some sort of enzymatically catalysed genetic defence mechanism (Arber & Linn, 1969). Specifically, he theorized that only those bacteriophages that had previously been in contact with the same bacterial strain could successfully infect new host cells, and that the previous exposure somehow modified the phage DNA in a way that protected it from restriction. Phages with unmodified DNA, on the other hand, were immediately broken down by enzymes. This occurred because the host cell enzymes recognized these phages as foreign, cleaving their DNA and restricting their growth. Arber further proposed that there were specific sites in the genome at which restriction activities occurred.

**(Source: Restriction Enzymes By: Leslie A. Pray, Ph.D. © 2008 Nature Education)**

1. 'Servant with scissors' refers to
  - a) Bacteriophages      b) Bacterial      c) Restriction enzymes      d) DNA
2. The growth of the Phages were stopped in the host cell because the enzymes in the bacterial cells
  - a) Restricted the growth of the bacteria by degrading their DNA.
  - b) Hydrolyse the phage DNA
  - c) Cleaves the phage DNA at the specific sites
  - d) All of the above.
3. Bacteriophages refers to the
  - a. Bacteria that kills virus      b. Virus that attack bacterial cells
  - c. Viruses      d. A special type of DNA found in few bacterial cells.
4. **Assertion:** Restriction endonucleases cut the DNA at the specific sites called restriction sites.  
**Reason:** All restriction enzymes have same restriction sites.
  - 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 correct but the reason is incorrect
  - d) Both Assertion and reason are incorrect.

**Ans: 1- c; 2- c; 3- b; 4- c**

2. **Read the passage given below and answer the following questions** **Polymerase chain reaction (PCR)** is a common laboratory technique used to make many copies (millions or billions!) of a particular region of DNA. The key ingredients of a PCR reaction are *Taq* polymerase, primers, template DNA, and nucleotides (dNTPs). The ingredients are assembled in a tube, along with cofactors needed by the enzyme, and are put through repeated cycles of heating and cooling that allow DNA to be synthesized.

The basic steps are:

1. **Denaturation** (96° C): Heat the reaction strongly to separate, or denature, the DNA strands. This provides single-stranded template for the next step.
2. **Annealing** (55- 65°C): Cool the reaction so the primers can bind to their complementary sequences on the single-stranded template DNA.
3. **Extension** (72 °C): Raise the reaction temperatures so *Taq* polymerase extends the primers, synthesizing new strands of DNA.

**(Source: Khan Academy)**

1. DNA polymerase used in PCR is called *Taq* polymerase because
  - a. It can polymerise DNA at higher temperature
  - b. It polymerises DNA in 3' to 5' direction
  - c. It is isolated from bacterium *Thermus aquaticus*

- d. All of the above
2. Which of the following is incorrectly matched pair?
  - a. PCR Primers- short pieces of Single stranded DNA
  - b. Extension- 3' to 5'
  - c. Denaturation- Breaks the hydrogen bond to make DNA single stranded
  - d. dNTPs- for the synthesis of DNA strand
3. The results of PCR reactions are usually made visible by
  - a. Gel electrophoresis
  - b. DNA fingerprinting
  - c. Southern blotting
  - d. DNA sequencing
4. Assertion: RT-PCR test is used to detect Corona virus in the given sample.  
Reason: Corona virus replicates by reverse transcription.
  - 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 correct but the reason is incorrect
  - d) Both Assertion and reason are incorrect.

Ans: 1- c; 2- b ;3- a;4- a

### 3. Read the passage given below and answer the following questions:

A researcher is performing an experiment to produce the multiple copies of the gene of interest in a host cell. He used pUC18 plasmid vector to transfer the gene of interest in the host cell. pUC18 is a genetically engineered plasmid, characterized by specific features. The vector contains a gene for Ampicillin resistance and an insert of the bacterial lacZ gene. A polylinker site with a number of restriction enzyme sequences is located within the lacZ gene.

The product of a functional lacZ gene is an enzyme called  $\beta$ -galactosidase, which breaks down a chromogenic substrate called X-GAL(5-bromo-4-chloro-3-indolyl-beta-D-galactopyranoside). Thus, when bacterial cells containing pUC18 plasmids are grown on an agar based medium containing X-GAL, the substrate is broken down. Bacterial cells containing pUC18 plasmids give rise to Blue colonies. He inserted the gene of interest into the polylinker site causes disruption of lacZ gene, which is no longer functional. Recombinant pUC18 plasmids can be identified using lacZ gene as a selectable marker. This is done by growing bacterial cells containing the recombinant plasmid on an agar-based medium containing X-GAL. The disrupted lacZ gene is not expressed, hence, it doesn't code for production of  $\beta$ -galactosidase. Consistently, the bacterial cells with the recombinant cannot break down X-GAL, and give rise to white colonies.

- Q1. The role of selectable marker is to
- i. Make the host cell competent.
  - ii. Show resistance against antibiotics
  - iii. Select recombinants from non-recombinants
  - iv. Transform the cell.
- Q2. In the above experiment the lacZ gene was disrupted by the insertion of gene of interest, which is further used to select recombinants. This method is known as
- a. Insertional activation
  - b. Insertional inactivation
  - c. Insertional disruption
  - d. Loss of resistance
- Q3. The enzyme responsible for the breakdown of X-GAL is  $\beta$ -galactosidase. The cells containing pUC18 plasmid will produce \_\_\_\_a\_\_\_\_ colonies because \_\_\_\_b\_\_\_\_.
- a. Blue colonies, X-GAL is blue in colour

- b. White colonies,  $\beta$ -galactosidase degrades X-GAL
- c. White colonies,  $\beta$ -galactosidase becomes inactive
- d. Blue colonies,  $\beta$ -galactosidase degrades X-GAL

Q4. Assertion: The insertion of gene of interest within the lacZ gene stops the production of the enzyme  $\beta$ -galactosidase.

Reason: The recombinants produce white colonies.

- 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 correct but the reason is incorrect
- d) Both Assertion and reason are incorrect.

**Ans: 1- c; 2- b; 3- d; 4- a**

#### **4. Read the passage given below and answer the following questions:**

By definition, a bioreactor is a vessel in which a biological reaction or change takes place. The biological systems involved include enzymes, microorganisms, animal cells, plant cells, and tissues. The bioreactor is a place where an optimum external environment is provided to meet the needs of the biological reaction system so that a high yield of the bioprocess is achieved. Obviously, there are complicated interactions between the biological system and the physical and chemical aspects of this process. A variety of bioreactor types and configurations have thus been exploited and developed along with the advances in the understanding of biological systems. In addition, it is necessary to control the bioreactor's operating parameters in order to favour the desired functions of the living cells or enzymes. Dissolved oxygen concentration, pH, temperature, mixing, and supplementation of nutrients all need to be controlled and optimized.

Because of the rapid advances in recombinant DNA technology and genome sequencing, the same product or biological process may be achieved by different biological systems: microorganisms, plant cells, animal cells, or enzymes. With the understanding of the biological system and its requirements on its physical and chemical environment, a proper bioreactor type can be selected.

(Source: Si-Jing Wang, Jian-Jiang Zhong, in Bioprocessing for Value-Added Products from Renewable Resources, 2007)

##### **Q1. The bioreactors are used for**

- a. Large scale production of the desired gene product
- b. Growing microbes in laboratories
- c. PCR reactions
- d. Downstream processing

##### **Q2. Which of the following is correctly matched?**

- a. Stirrer- Maintains temperature
- b. Sampling ports- for adding nutrients
- c. Nutrient medium-nutrition for microbes
- d. pH control system- Oxygen supply.

##### **Q3. Stirred Bioreactors are better because they have**

- a. better aeration and mixing properties
- b. foam control system
- c. better temperature and pH control systems
- d. All of the above.

##### **Q4. Assertion: Bioreactors are used for the large-scale production of the desired products.**

**Reason: Bioreactor designing only needs complete information of biological systems.**

- 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 correct but the reason is incorrect
- d) Both Assertion and reason are incorrect.

**Ans: 1- a; 2- c; 3- d; 4- c**



## SHORT ANSWER QUESTIONS.

**Q1. Which enzyme is commonly called as 'molecular scissor' of genetic engineering? Give one example also.**

Ans: Restriction enzyme. E.g.: *EcoR1*

**Q2. Which enzyme you would use to isolate DNA from the fungal cell and why?**

Ans: Chitinase, because fungal cell wall is made of chitin which is digested by the enzyme chitinase only.

**Q3. Which dye is used to make DNA visible under UV light? Why this dye should be handled very carefully?**

Ans: Ethidium Bromide or EtBr. This dye should be handled very carefully because it is carcinogenic in nature.

**Q4. What do you mean by direct gene transfer? Suggest one method for this.**

Ans. Direct gene transfer means the vector less gene transfer. Electroporation /microinjection/ Gene gun method or biolistic.

**Q5. Name the technique used to amplify the DNA? List the steps involved in this.**

Ans: Polymerase chain reaction (PCR). The three steps are:

- a. Denaturation                      b. annealing and                      c. Extension

**Q6. A researcher added DNA polymerase in the reaction mixture used for PCR to make multiple copies of the DNA. At the end of the reaction he observed that DNA amplification did not occur. What is the reason behind his failure?**

Ans. In PCR Taq polymerase enzyme is used for the process of polymerisation because it is a thermostable DNA polymerase and do not get denatured at high temperature used during PCR reaction. He failed because he used DNA polymerase which got denatured during PCR reaction.

**Q7. What do you mean by the term 'competent' in competent cells? Why the cells made competent?**

Ans. The term 'competent' means to make the bacterial cell capable of taking up foreign DNA. The cells made competent because DNA is a hydrophilic molecule cannot pass through the cell membrane as its interior is hydrophobic.

**Q8. Name the methods which are useful to introduce foreign DNA in animal cell and plant cells, respectively.**

Answer: Animal cell: Microinjection  
Plant cell: Biolistics or gene gun

**Q9. *Agrobacterium tumefaciens* is referred to as Natural Genetic Engineer of plant. Why?**

Ans *Agrobacterium tumefaciens* is a pathogen to several dicot plants. It can transform normal cell into tumour cell by transferring a piece of DNA called T- DNA. This is called natural Genetic Engineer because gene transfer occurs naturally without involving any human effort.

**Q10. What does H, in, d and II refer in the enzyme *Hind II*.**

Ans. The first letter written in capital denotes the genus of the source organism from which enzyme was isolated H= *Haemophilus*. The next two letters written in small denotes the species of the source organism from which enzyme was isolated, in= influenza The letters refer to the name of the strain of bacteria. The Roman numerical II denotes the order of discovery of the enzyme from that particular organism.

**Q11. Name and explain the technique with which the DNA is forced into (i) a bacterial cell (ii) a plant cell (iii) an animal cell.**

Ans. (i) **Bacterial Cell:** Chemical treatment with a specific concentration of divalent cations such as Calcium, which increases the efficiency with which DNA enters the bacterium through pores in its cell wall. Recombinant DNA can then be forced into such cell by incubating the cells recombinant DNA on ice, followed by placing them briefly at 42°C (Heat Shock)) and then

putting them on ice.

**(ii) Plant Cell:** Plant cells are bombarded with high velocity micro-particles of gold and tungsten coated with DNA. This is called Biolistic or gene gun.

**(iii) Animal Cell:** Recombinant DNA is directly injected into the nucleus of the animal cell. This method is known as microinjection.

**Q12. Cloning vectors are used to transfer gene of interest in the host cell in recombinant DNA technology. Mention any three features of vectors that are most suitable for this purpose.**

**Ans.** i) Have origin of replication (Ori)  
(ii) Have a selectable marker  
(iii) Have at least one recognition site.

**Q13. Observe the given sequence of nitrogenous bases on a DNA fragment and answer the following question –**

5' –GAATTC – 3'

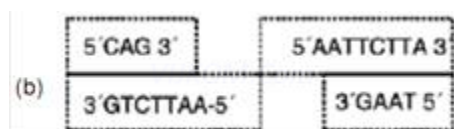
3' –CTTAAG – 5'

(a) Name a restriction enzyme which can recognize this DNA sequence.

(b) Write the sequence after digestion.

(c) Why are the ends generated after digestion called sticky ends?

**Ans.** (a) EcoRI



(c) These are named sticky ends, because they form hydrogen bonds with their complementary cut parts

**Q14. A selectable marker is used in the selection of recombinants on the basis of their ability to produce colour in presence of chromogenic substrate.**

(a) Mention the name of mechanism involved.

(b) Which enzyme is involved in production of colour?

(c) How is it advantageous over using antibiotic resistant gene as a selectable marker?

**Ans** (a) Insertional inactivation

(b)  $\beta$ -galactosidase.

(c) Selection of recombinants due to inactivation of antibiotics resistance requires simultaneous plating on two plates having different antibiotics.

**Q15. Enlist the characteristics that must be possessed by a good cloning vector. Ans. The important properties which a good vector must possess are: -**

i) **Size:** - The vector must have small size so that it is easier to purify & isolate.

ii) **Origin of replication:** - This is a sequence of base pairs where replication starts. Any piece of DNA linked to this sequence can be made to replicate within its host cell & thus, controls the copy number of linked DNA.

iii) **Selectable Marker:** - A marker is a gene which helps in selecting those host cells which contain the vector & eliminating the non – transformants. Common Selectable marker include gene encoding resistance to antibiotics.

iv) **Cloning Sites:** - The vector should have a few or at least one unique recognition site to link the foreign. Presence of a particular recognition site enables the particular restriction enzyme to cut the vector.

## Long Answer Questions

1. The development of bioreactors is required to produce large quantities of products.

(a) Give optimum growth conditions used in bioreactors.

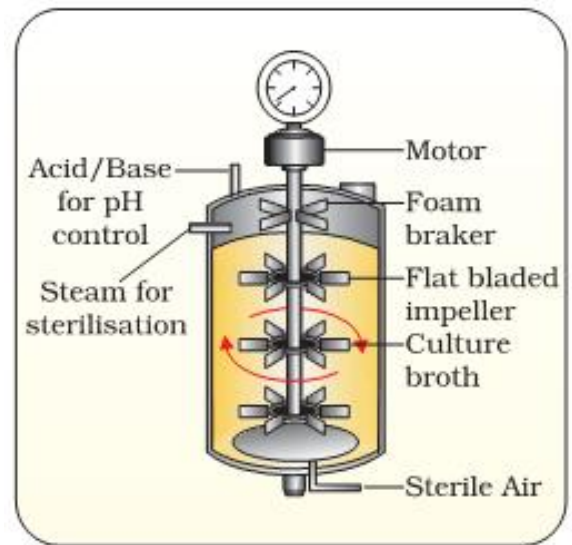
(b) Draw a well labelled diagram of simple stirred – tank bioreactor.

(c) How does a simple stirred – tank' bioreactor differ from sparged stirred – tank' bioreactor?

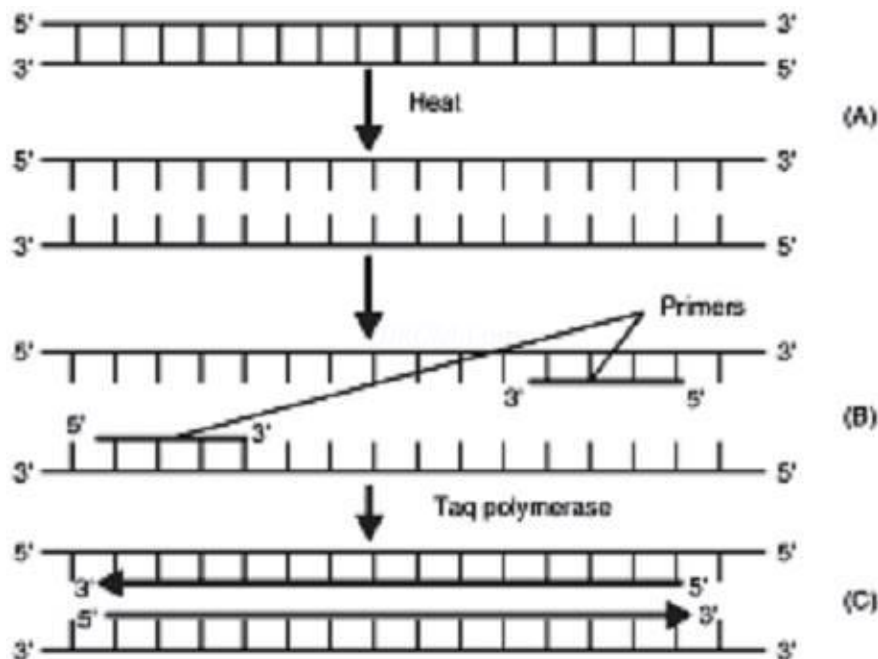
Ans. (i) Temperature, pH, susbtrates, salts, vitamins and oxygen.

(ii) (a) simple stirred–tank bioreactor

(iii) The stirrer facilitates even mixing and oxygen availability throughout simple–stirred tank bioreactor, whereas in case of sparged stirred-tank bioreactor, air is bubbled throughout the reactor for proper mixing.



2. In the given figure, one cycle of polymerase chain reaction (PCR) is shown-



(a) Name the steps A, B and C.

(b) Give the purpose of each of these steps.

(c) State the advantage of bacterium *Thermus aquaticus* in this process.

(d) Why are primers used in PCR.

Ans. (a) A- Denaturation; B- Annealing; C- Extension

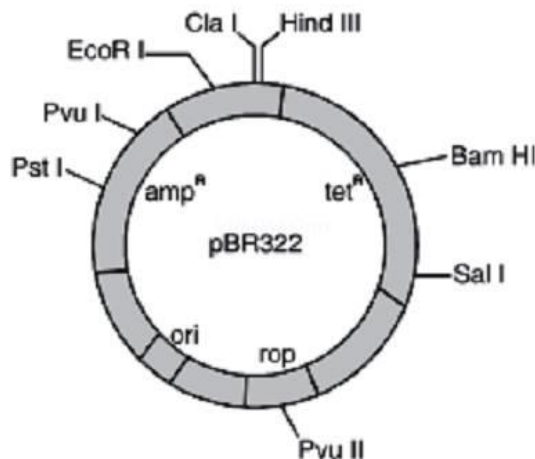
(b) Denaturation – Heat denatures DNA to separate complementary strands.

Annealing: Primers hybridises to the denatured DNA strands.

Extension: Extension of primers resulting in synthesis of copies of target DNA sequence.

(c) Enzyme Tag polymerase is isolated from the bacterium *Thermus aquaticus*. This enzyme induces denaturation of double stranded DNA at high temperature.

- (d) Just like human and bacterial DNA polymerase, Taq Polymerase can't initiate the process of polymerisation. It can only extend the existing nucleotide strand. Therefore DNA primers are added in PCR.



3. Study the figure of vector pBR322 given below in which foreign DNA is ligated at the Bam HI site of tetracycline resistance gene.

Answer the following questions :

- Mention the function of rop.
- What will be the selectable marker for this recombinant plasmid and why?
- Explain transformation.

Ans. (a) 'rop' codes for the proteins involved in the replication of plasmid

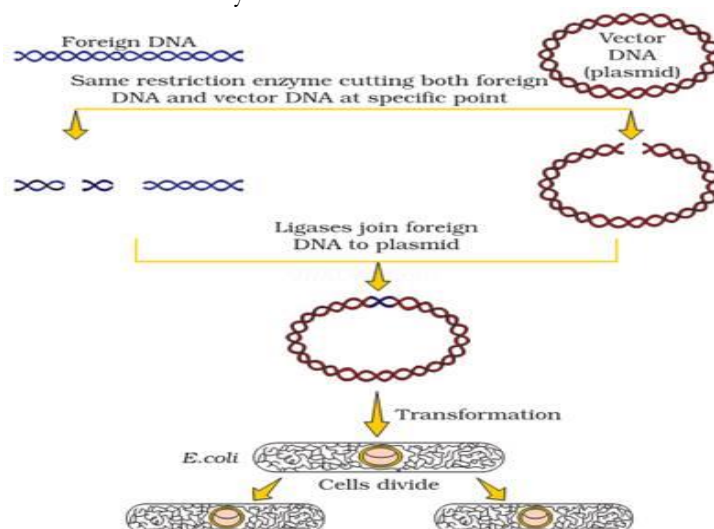
(b) Selectable marker – ampicillin resistance gene. It will help distinguishing transformants from non-transformants after plating them on ampicillin containing medium.

(c) Transformation – It is the phenomenon by which the DNA isolated from one type of cell and introduced into another type and is able to bring about some of the properties of former to the later.

4. Describe the various steps involved in Recombinant DNA technology with the help of a well labelled. Diagram?

Ans. i) Identification of DNA with desirable Genes

- Cutting the gene of interest and vector with the same restriction enzymes so that complimentary ends are formed. Ligase is added to make the recombinant DNA
- Insertion of Recombinant DNA into host cell:- Recipient cells after making them competent to receive takes up DNA in its surrounding. Recombinant DNA is introduced into suitable host cell by vector – based or vector – less method.



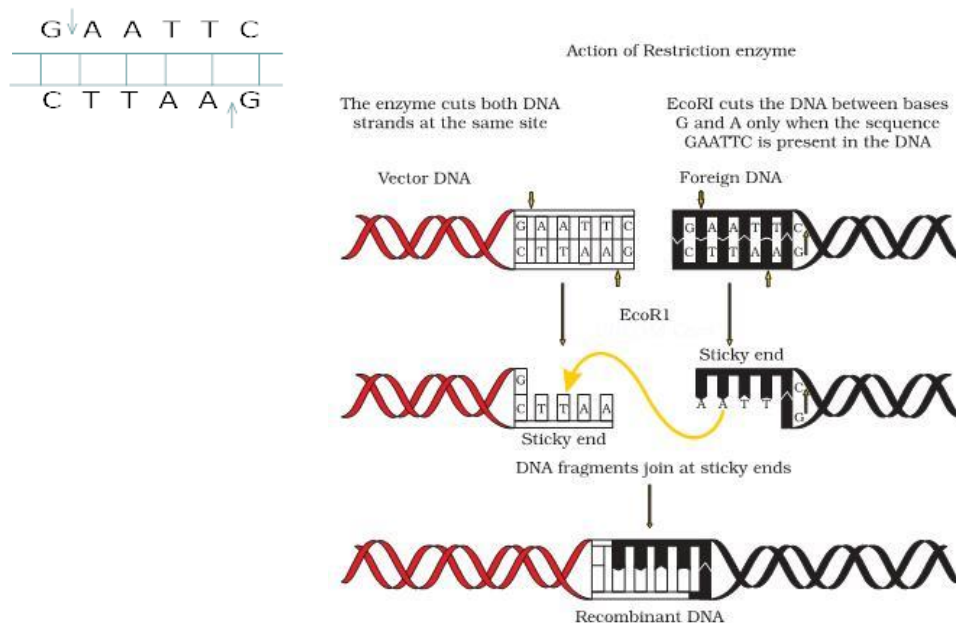
iv) Selection & Screening :- If a recombinant DNA bearing gene for resistance to an antibiotic is **transferred** into E-coli the host – cell become **transformed** into ampicillin – resistant cells. Due to this amp gene one is able to select a **transformed** cell in the presence of ampicillin. This amp resistant gene is called selectable marker.

v) Obtaining the foreign Gene product :- After having cloned the gene of interest & having optimized the conditions to induce expression of the target protein, one has to consider producing it on large scale.

5. **What are Restriction enzymes? Why do bacteria have these restriction enzymes? Show diagrammatically a restriction enzyme its recognition & the product it produces?**

**Ans.** Restriction enzymes are endonucleases which recognize a specific sequence within DNA and cut the DNA within that sequence at a specific point. In bacteria, these restriction enzymes modify & cut the foreign DNA entering into the bacterial cell& thus, provides immunity to bacterial cell.

Name of Restriction enzyme- EcoRI Substrate DNA on which it acts



## CHAPTER-12: BIOTECHNOLOGY AND ITS APPLICATIONS

### CASE BASED QUESTIONS-

1. Read the passage and answer any 4 questions that follow -

Diabetes is a hyperglycemic metabolic disorder resulting from insufficient production of insulin, with consequent metabolic dysfunctions. Of four types, and affecting more than 415 million people, it is a forefront public health peril globally.

Escherichia coli remains the best bacterium prototype for rDNA experiments. Cleavage of the signal polypeptide in Islets of Langerhans produced proinsulin yields proinsulin, the enzymatic removal of the link chain in which gives Human insulin (humulin); a 51 amino-acids polypeptide of mass 5808Da. In 1978, humulin was first produced in Escherichia coli, eliminating zoonotic cross-transfer/autoimmune-diseases risk. It is also more economical. The manufacturing process can be from separate A and B polypeptide chains, or from proinsulin. An amino acid sequencer manufactures the sequences, which are cloned onto a plasmid. The bacteria are transfected, and placed in fermentation tanks. The insulin molecules are stored in inclusion bodies, and solubilization (by chemicals and enzymes) and refolding yield the final insulin.

- 1.1 How was insulin prepared traditionally?
  - a. From slaughtered hens
  - b. From slaughtered pigs
  - c. From slaughtered horses
  - d. From Slaughtered cattle and pigs
- 1.2 What are the shortcomings of insulin obtained from slaughtered animals?
  - a) Insufficient in quantity and contain antibodies which can cause allergy.
  - b) Insufficient in quantity and contain antigens which can cause allergy.
  - c) Sufficient in quantity and contain antigens which can cause allergy.
  - d) None of the above.
- 1.3 How did Eli Lily prepared insulin?
  - a) By tissue culture technique
  - b) By r-DNA technology
  - c) By artificial hybridisation
  - d) By gene therapy
- 1.4 What is the difference between proinsulin and insulin structurally?
  - a) No difference
  - b) Proinsulin has an extra C-peptide which is absent in insulin.
  - c) Insulin has an extra C-peptide which is absent in proinsulin.
  - d) Proinsulin in inactive form and insulin is active form.
- 1.5 How is chain A and chain B of insulin held together?
  - a) By hydrogen bonds
  - b) By electrostatic bonds
  - c) By disulphide bonds
  - d) By Vander walls forces

**Ans-1.1 d) From slaughtered cattle and pigs**

**1.2 b) Insufficient in quantity and contain antigens which can cause allergy.**

**1.3 b) By r-DNA technology**

**1.4 b) Proinsulin has an extra C-peptide which is absent in insulin.**

**1.5 c) By disulphide bonds**

2. Animals with manipulated genetic material (carrying recombinant DNA) are known as transgenic animals. Transgenic technology provides a method to rapidly introduce new genes into animals without cross breeding. It is a powerful technique for studying fundamental problems of mammalian development. Transgenic technology has been developed and found perfect in the laboratory on mice. The three most common gene transfer techniques namely: DNA microinjection, ES-cell mediated and

Retrovirus mediated gene transfer are the most important to have enabled to produce transgenic cattle, sheep, goat, pig and other animals. Transgenic animals have the potential of agricultural applications like improved growth rate and carcass composition, improved resistance to disease, increased milk yield, improved wool production and so on. The scientific outlook of right and wrong opinions about transgenic animals is called ethics of transgenic animals. These ethical and animal welfare issues surround transgenic animal technology and be only minimized or avoided through awareness creation about the merit of this technology.

- 2.1 Which option does not indicate that humans are benefitted from transgenic animals?
- for study of diseases
  - to determine vaccine safety
  - to test safety of drugs
  - to determine the safety of human alpha lactalbumin

2.2 Which of the following is a r-DNA vaccine?

- Cancer
- cystic fibrosis
- Hepatitis B
- Tuberculosis

2.3 Name the vector which is most commonly used to produce transgenic animals.

- Retrovirus
- Ti plasmid
- YAC
- BAC

2.4 Transgenic animals are-

- Those animals whose entire genetic makeup is manipulated.
- Those animals where a foreign gene is not incorporated
- Mice
- Those animals in which a foreign gene which is beneficial for mankind is incorporated.

2.5 Name the organization set up by Indian Government to check safety of introducing transgenic animals for human services.

- WHO
- NBRI
- CDRI
- GEAC

**Ans- 2.1 d) to determine the safety of human alpha lactalbumin**

**2.2 c) Hepatitis B**

**2.3 a) Retrovirus**

**2.4 d) Those animals in which a foreign gene which is beneficial for mankind is incorporated.**

**2.5 d) GEAC**

3. Read the following and answer any four questions from 3(i) to 3 (v) given below:

Golden rice was engineered from normal rice by Potrykus and Beyer in the 1990s. The typical golden colour is due to the production of  $\beta$ -carotene a precursor of Vitamin-A. Golden rice differs from its parental strain by the addition of three  $\beta$ -carotene genes. These included two genes from daffodil plant and third from a bacterium. The incorporation of these genes allows the rice plant to modify certain metabolic pathways in its cells to produce  $\beta$ -carotene.

(i) Due to genetic modification golden rice plants produce and store  $\beta$ -carotene In

- Stem
- seed
- leaves
- all of these.

(ii) Transfer of genes to produce golden rice is achieved by

- Agrobacterium
- pBR322
- $\lambda$ -phage
- gene gun

(iii) In golden rice two genes were taken from

- Narcissus sp.
- Erwinia
- Oryza sativa
- None of these

(iv) Golden rice is helpful to fight against disease caused by the deficiency of

- Vitamin B<sub>12</sub>
- Vitamin C
- Vitamin A
- Vitamin D

(v) Golden rice was genetically engineered by

- Fire and Mello
- Potrykus and Beyer
- Banting and Best
- Kohler & Milestein

**Ans :- 3 (i) – Seed**

**(ii) Agrobacterium**

**(iii) Narcissus sp.**

(iv) Vitamin A

(v) Ptrykus and Beyer

**4. Read the following and answer any four questions from 4 (i) to 4 (v) given below:**

Transgenic animals can serve as factories that in some cases, may produce large amount of proteins more efficiently. Transgenic mice have been engineered to express human antibodies by introducing large segment of human DNA encoding human immunoglobulin genes. Intransgenic large animals such as cow or sheep proteins of pharmaceutical value can be produced in large quantities in milk which is later purified. Transgenesis can be used to alter many phenotypic properties including growth rate, fat composition, milk production, hair texture, etc.

- (i) The production of transgenic animals includes
- (a) Identification and separation of desired gene
  - (b) Combining the desired gene with appropriate vector
  - (c) Introduction of vector in cells, tissues or embryos
  - (d) all of these.
- (ii) In transgenic animals, *il*, cow and sheep proteins of pharmaceutical value are produced in large quantities in the
- (a) Blood
  - (b) accumulated fat
  - (c) mammary glands
  - (d) none of these.
- (iii) Mouse is mostly preferred animal for studies on gene transfer because
- A) short oestrous cycle
  - B) long gestation period
  - C) Short generation time
  - D) Production of one or two offspring per pregnancy
- (a) both(A)and(C)
  - (b) both(A)and(B)
  - (c) only D
  - (d) both(C)and(D)
- (v) Transgenic genes alter many phenotypic properties including
- (a) Growth Rate
  - (b) Fat composition
  - (c) Milk production
  - (d) All of these
- (vi) Assertion (A) : Transgenic mice have been engineered to express human antibodies.  
Reason (R) : Large segment of human DNA encoding human immunoglobulin have been transfer to mice.
- A - Both A and R are true and R is the correct explanation of A.
  - B - Both A and R are true but R is NOT the correct explanation of A.
  - C - A is true but R is false.
  - D - A is false but R is true.

- Ans :- 4
- (i) All of these
  - (ii) Mammary gland
  - (iii) Short oestrus cycle.
  - (iv) Both C and D
  - (v) Option A



## Short Answer -

1. Name the insect pest that is killed by the products of cry IAc gene. Explain how the gene makes the plant resistant to the insect pest.

Ans- Cotton bollworm is killed by products of cry IAc gene.

- (a) cry gene produces Cry protein in inactive crystalline form. After ingestion by the insect, it becomes active due to the alkaline pH of the gut which solubilise the crystals.
- (b) The activated toxin binds to the surface of mid gut epithelial cells thus creating pores which cause cells swelling and lysis, leading to death of the insects.

2. (a) Why do the toxic insecticidal proteins secreted by *Bacillus thuringiensis* kill the insect and not the bacteria itself?  
(b) Name the specific type of gene that is incorporated in a cotton plant to protect the plant against cotton boll worm infestation.

Ans – (a) The Bt toxin protein exists as inactive protoxins but once an insect ingests the inactive toxin is converted into an active form due to the alkaline pH of the gut which solubilise the crystals. Therefore, it does not kill the bacteria.

- (b) cry I Ac / cry II Ab

3. Explain the process of RNA interference.

Ans – RNA interference takes place in all eukaryotic organisms as a method of cellular defense. It involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA.

4. Name the process involved in the production of nematode-resistant tobacco plants, using genetic engineering. Explain the strategy adopted to develop such plants.

Ans – The process involved in the production of nematode-resistant plants is RNA interference or RNAi. Using *Agrobacterium* vectors, nematode -specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and antisense RNA in the host cells. These two RNA's being complementary to each other are formed a double stranded RNA (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the nematode. The consequence was that the parasite could not survive in a transgenic host expressing specific interfering RNA. The transgenic plant thus protected itself from the parasite.

5. Name the vector used for introducing the nematode specific gene in tobacco plant.

Ans- Ti plasmid of *Agrobacterium tumefaciens*

6. a) List any four beneficial effects of GM plants.

Ans – (i) Four beneficial effects of GM plants.

- (ii) Increased tolerance against a biotic stress (cold, drought, salt, heat).
- (iii) Reduced reliance on chemical pesticides (pest-resistant crops).
- (iv) Reduced post-harvest losses.
- (v) Increased efficiency of minerals used by plants (this prevents early exhaustion of fertility of soil).
- (vi) Enhanced nutritional value of food, e.g., vitamin 'A' enriched rice (golden rice). (Any four)

7. (a) Name the source from which insulin was extracted earlier. Why is this insulin no more in use by diabetic people?

- (b) How did Eli Lilly synthesize the human insulin? Mention one difference between this insulin and the one produced by the human pancreas.

Ans–(a) Earlier, insulin was extracted from pancreas of slaughtered cattle and pig. This insulin is not in use as some patients developed allergic reaction to this foreign protein

- (b) Eli Lilly prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them separately in plasmids of *E. coli* to produce A and B chains. Chains A and B

were produced separately, extracted and combined by creating disulfide bonds to form human insulin. Insulin in human pancreas is synthesized as a pro hormone containing the C peptide which is removed in mature hormone. The r DNA insulin does not contain C peptide and is directly prepared in mature form.

8. (a) Mention the cause and the body system affected by ADA deficiency in humans.
- (b) Name the vector used for transferring ADA-DNA into the recipient cells in humans. Name the recipient cells.
- (c) Mention a possible permanent cure for a ADA deficiency patient.
- (d) Name the deficiency for which first clinical gene therapy was given.
- (e) What is gene therapy? Name the first clinical case where it was used.

Ans – (a) The cause is the deletion of gene responsible for producing ADA. The immune system is affected and one suffers from SCID.

(b) A retroviral vector is used, recipient cells are lymphocytes.

(c) A possible permanent cure would be gene therapy. In this, c-DNA coding for ADA enzyme is introduced using retroviral vector in lymphocytes of the patient at early embryonic stage.

(d) Adenosine deaminase (ADA) deficiency.

(e) Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo. Normal functional genes are inserted into an individual's cells and tissues to treat disease.

9. Why is proinsulin so called? How is insulin different from it?

Ans – Proinsulin is called so because it is an inactive form of insulin.

Insulin	Proinsulin
1. It is made up of two short polypeptide chains A and B linked by disulphide bridges.	1. Along with the two polypeptide chains in insulin. It contains an extra stretch called C peptide.
2. It is functional.	2. It is non-functional.

10. (a) Suggest any two possible treatments that can be given to a patient exhibiting adenosine deaminase deficiency.

(b) Why do children cured by enzyme-replacement therapy for adenosine deaminase deficiency need periodic treatment?

Ans – (a) (i) Enzymes replacement therapy (in which functional ADA is injected)

(ii) Bone marrow transplantation

(iii) Gene therapy / Culturing the lymphocytes followed by introduction of functional ADA cDNA into it & returning it into the patient's body (Any two)

(b) ERT is not a permanent cure so periodic injections of ADA enzyme are required.

11. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

(b) Name the ailments the two girls were suffering from?

(c) Why the treatment did provided to girl A required repeated visits?

(d) How was the girl B cured permanently?

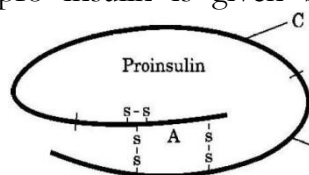
Ans - (a) Adenosine deaminase (ADA) deficiency

(a) In Enzyme Replacement Therapy functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited

time period

(b) As there is no permanent cure at the age of five.

12. Insulin in the human body is secreted by pancreas as pro hormone/pro insulin. The schematic polypeptide structure of pro insulin is given below. This pro insulin needs to undergo



processing before it becomes functional in the body. Answer the questions that follow

- (a) State the change the pro insulin undergoes at the time of its processing to become functional.  
(b) Name the technique the American company Eli Lilly used for the commercial production of human insulin.  
(c) How are the two polypeptides of a functional insulin chemically held together?

Ans(a) 'C' Peptide is removed

(b) r-DNA technology / Recombinant DNA Technology

(c) Disulphidebonds.

13. What are transgenic animals? How was the first transgenic cow found to be more useful than the normal cow, for humans?

Ans. -Animals having undergone DNA manipulation (to express an extra / foreign gene)-(Rosie)

Produced human protein - enriched milk / 2.4 gm protein per litre which contained human alpha – lactalbumin , and was nutritionally more balanced (product) for human babies than natural cow milk.

14. Expand GEAC. Why has the Indian Government set up the organization named GEAC? Give any two reasons. (3)

Ans – GEAC- Genetic Engineering Approval Committee

To check the validity of GM crops

To check safety of introduction of GM organism for public services.

15. Explain the role of transgenic animals in (i) Vaccine safety and (ii) Biological products with the help of an example each. (2)

Ans - (i) Vaccine safety- Transgenic mice are developed to test safety of polio vaccine before being used on humans.

(ii) Human protein ( $\alpha$ -1-antitrypsin) is used to treat emphysema.

16. Name and briefly explain various techniques for early diagnosis of diseases. (3)

Ans- r-DNA technology, PCR and ELISA are some techniques for early diagnosis of diseases. PCR is used for detection of HIV in suspected AIDS patient, to detect mutations in genes in suspected cancer patients. ELISA is used for detection of antigens of pathogens or antibodies synthesized by body against the pathogen. r-DNA technology can be used to produce clone of mutated gene and then it can be hybridized with probe made of normal gene, followed by its detection using autoradiography.

## CHAPTER 13: ORGANISMS AND POPULATION

### (2) Marks questions

1. What is the significance of temperature to living organisms?  
Ans: It affects the kinetics of enzymes and through it the metabolic activity and other physiological functions of the organism.
2. How the levels of thermal tolerance of different species determine to a large extent their geographical distribution?  
Ans: A few organisms can tolerate and thrive in a wide range of temperatures (they are called *eurhythermal*), but, a vast majority of them are restricted to a narrow range of temperatures (such organisms are called *stenothermal*).
3. List different ways by which organisms try to maintain their homeostasis.  
Ans: Regulate, Conform, Migrate, Suspend.
4. How do kangaroo rat in North American deserts is capable of meeting all its water requirements?  
Ans: In the absence of an external source of water, the kangaroo rat in North American deserts is capable of meeting all its water requirements through its internal fat oxidation (in which water is a by-product). It also has the ability to concentrate its urine so that minimal volume of water is used to remove excretory products.
5. Name four population attributes.  
Ans: sex ratio, age distribution, birth rate, death rate.
6. Name four basic processes which cause fluctuations in population density in a given habitat during a given period.  
Ans: Natality, Mortality, Immigration, Emigration.
7. Name one animal and one plant which breed only once in their lifetime.  
Ans: Animal- Pacific salmon fish Plant- Bamboo
8. What is 'competitive release'?  
Ans: A species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species, is found to expand its distributional range dramatically when the competing species is experimentally removed.
9. Explain mutualism in *mycorrhizae*.  
Ans: the *Mycorrhizae* are associations between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates.

### 3 MARKS QUESTIONS

10. What role does light play for animals?  
Ans: For many animals light is important in that they use the diurnal and seasonal variations in light intensity and duration (photoperiod) as cues for timing their foraging, reproductive and migratory activities.
11. Explain the process of migration with suitable example.  
Ans: The organism can move away temporarily from the stressful habitat to a more hospitable area and return when stressful period is over. Many animals, particularly birds, during winter undertake

long-distance migrations to more hospitable areas. Every winter the famous Keolado National Park (Bharatpur) in Rajasthan host thousands of migratory birds coming from Siberia and other extremely cold northern regions.

12. Writs the integral form of the exponential growth equation.

Ans:  $N_t = N_0 e^{rt}$  where

$N_t$  = Population density after time  $t$

$N_0$  = Population density at time zero

$r$  = intrinsic rate of natural increase

$e$  = the base of natural logarithms (2.71828)

13. What do you understand by co-evolution in parasitism?

Ans: Many parasites have evolved to be host-specific (they can parasitize only a single species of host) in such a way that both host and the parasite tend to co-evolve; that is, if the host evolves special mechanisms for rejecting or resisting the parasite, the parasite has to evolve mechanisms to counteract and neutralise them, in order to be successful with the same host species.

14. In accordance with their life styles, which special adaptations parasites evolved?

Ans: In accordance with their life styles, parasites evolved special adaptations such as the loss of unnecessary sense organs, presence of adhesive organs or suckers to cling on to the host, loss of digestive system and high reproductive capacity.

### **5 MARKS QUESTIONS**

15. How soil affects the type of animals in any particular geographic area?

Ans: Various characteristics of the soil such as soil composition, grain size and aggregation determine the percolation and water holding capacity of the soils. These characteristics along with parameters such as pH, mineral composition and topography determine to a large extent the vegetation in any area. This in turn dictates the type of animals that can be supported.

16. How do mammals regulate their body temperature to maintain homeostasis?

Ans: We maintain a constant body temperature of 37°C. In summer, when outside temperature is more than our body temperature, we sweat profusely. The resulting evaporative cooling, similar to what happens with a desert cooler in operation, brings down the body temperature. In winter when the temperature is much lower than 37°C, we start to shiver, a kind of exercise which produces heat and raises the body temperature.

17. Considering the benefits of a constant internal environment to the organism, why conformers had not evolved to become regulators?

Ans: Thermoregulation is energetically expensive for many organisms. This is particularly true for small animals like shrews and humming birds. Heat loss or heat gain is a function of surface area. Since small animals have a larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside; then they have to expend much energy to generate body heat through metabolism. During the course of evolution, the costs and benefits of maintaining a constant internal environment are taken into consideration. Some species have evolved the ability to regulate, but only over a limited range of environmental conditions, beyond which they simply conform.

18. Read the following paragraph and answer the questions:

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. 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’. 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. Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

Explain following terms with example:

- a) Sporulation
- b) Dormancy
- c) Hibernation
- d) Aestivation
- e) Diapauses

Ans: a) 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’.

b) 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.

c) Some Snails and fish go into *aestivation* to avoid summer-related problems-heat and desiccation.

d) Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter *diapause*, a stage of suspended development.

**19.** Read carefully following case and answer the questions:

Some organisms possess adaptations that are physiological which allow them to respond quickly to a stressful situation. If you had ever been to any high altitude place (>3,500m Rohtang Pass near Manali and Leh you must have experienced what is called altitude sickness. Its symptoms include nausea, fatigue and heart palpitations. This is because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen. But, gradually you get acclimatised and stop experiencing altitude sickness. How did your body solve this problem? The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of hemoglobin and by increasing breathing rate.

a) What is Altitude sickness?

Ans : At high altitude place (>3,500m Rohtang Pass near Manali and Leh people experience *altitude sickness*. Its symptoms include nausea, fatigue and heart palpitations. This is because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen.

b) How do people get acclimatised to it?

Ans: Gradually people get acclimatised and stop experiencing altitude sickness. The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of haemoglobin and by increasing breathing rate.

**20.** Illustrate age pyramid.

Ans: A population at any given time is composed of individuals of different ages. If the age distribution (per cent individuals of a given age or age group) is plotted for the population, the resulting structure is called an age pyramid. For human population, the age pyramids generally show age distribution of males and females in a diagram. The shape of the pyramids reflects the growth status of the population - (a) whether it is growing, (b) stable or (c) declining. (fig 13.4)

**21.** What is Verhulst-Pearl Logistic Growth?

*Ans:* A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and deceleration and finally an asymptote, when the population density reaches the carrying capacity. A plot of N in relation to time (t) results in a sigmoid curve. This type of population growth is called *Verhulst-Pearl Logistic Growth* (Figure 13.6) and is described by the following equation:

$$\frac{dN}{dt} = rN \frac{(K-N)}{K}$$

Where N = Population density at time t

r = Intrinsic rate of natural increase

K = Carrying capacity

**22.** How do The Mediterranean orchids *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee?

*Ans:* The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee. One petal of its flower bears an uncanny resemblance to the female of the bee in size, colour and markings. The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another flower, it transfers pollen to it and thus, pollinates the flower.

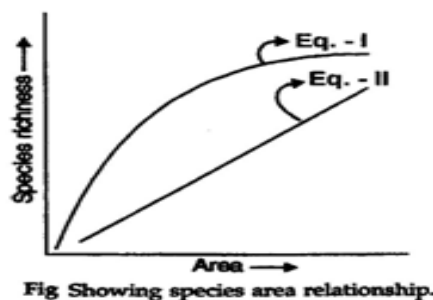
## CHAPTER-15: BIODIVERSITY AND ITS CONSERVATION

### Short Answer Type Questions

1. Expand the following abbreviations

1. ICFRE      2. IUCN      3. UNEP      4. WWF

2. The great German naturalist and geographer Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit. In fact, relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola.



Now find out correct equations shown in the graph.

Given below are three statements (A-E) each with one or two blanks. Select the option which correctly fills up the blanks. Statements:

- A. The tropics (between \_\_\_\_\_ I \_\_\_\_\_) harbour more species than temperate and polar regions.  
B. For example, Columbia situated near \_\_\_\_\_ II \_\_\_\_\_, has about 1400 species of birds, while New York (41°N) has 105 species, Greenland (71°N) has about 56 species and India (in the equator region) has \_\_\_\_\_ III \_\_\_\_\_ species.  
C. The number of species of vascular plants in tropics is about \_\_\_\_\_ IV \_\_\_\_\_ times more of that of temperate forests.  
D. The \_\_\_\_\_ V \_\_\_\_\_ rain forest in Brazil, South America has the greatest biodiversity on earth.  
E. Since the origin of life on earth and evolution, there have been five episodes of mass extinction, but the current rate of extinction (6 mass extinction - due to human activities) is \_\_\_\_\_ VI \_\_\_\_\_ times faster than them, due to human activities:

Options:

- (1) I - 0°N to 90°S, II - equator, III - 1200, IV - five, V - Amazonian, VI - 100 - 1000  
(2) I - 23.5°N to 23.5°S, II - equator, III - 10000, IV - ten, V - Amazonian, VI - 100 - 1000  
(3) I - 23.5°N to 23.5°S, II - equator, III - 1200, IV - ten, V - Amazonian, VI - 100 - 1000  
(4) I - 23.5°N to 23.5°S, II - equator, III - 1200, IV - ten, V - Amazonian, VI - 100 - 10000

### Short Answer Type Questions

- There are about 20,000 species of ants 3, 00,000 species of beetles and 28,000 species of fishes in the world.
  - Which organization is dealing with the population of organisms in the world?
  - What are the causes of bio-diversity losses?
- Anil said: "Mosquitoes are harmful, Snakes are poisonous, and Insects damage crops. It is high time to destroy all these organisms for the welfare of human beings".
  - Can you agree with this statement?
  - As a biology student, how can you convince this person about the importance of each and every organism in the nature?
- Amazonian rain forests have the greatest bio diversity on earth. Give 3 hypotheses to explain the reason for this.
- "The bio logical wealth of our planet has been declining rapidly and the accusing finger is clearly pointing to



human activities.”

- a. Mention any two human activities leading to the loss of bio diversity.
- b. Mention the different ways to conserve bio diversity.
5. Introduction of exotic species is one of the major threats of bio diversity. Cite any two examples.
6. Classify the following words in to two categories and give suitable titles. Genetic resource centres, National parks, Botanical gardens, Sanctuaries, Bio sphere reserves, Gene banks, Cultural landscapes, Zoological parks, Natural monuments, sacred forests.

## Case Based Question

1. Read the following and answer any four questions given below:

Non-native or alien species are often introduced in advertently for their economic and other uses. They often become invasive and drive away the local species. Exotic species have proved harmful to both aquatic and terrestrial ecosystems. For example, water hyacinth (*Eichhornia crassipes*) was introduced in Indian waters to reduce pollution. It was clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals.

- (i) Island water ecosystem are the most vulnerable due to

- (a) small size (b) small number of species  
(c) Increases reproductive capacity (d) both (a) and (b).

- (ii) Which of the following is not an alien species?

- (a) Lantana camara (b) Periplaneta americana  
(c) Nile Perch (d) Yucca moth

- (iii) Second major cause of species extinction is

- (a) Habitat loss and fragmentation (b) over exploitation  
(c) Alien species invasion (d) co-extinction.

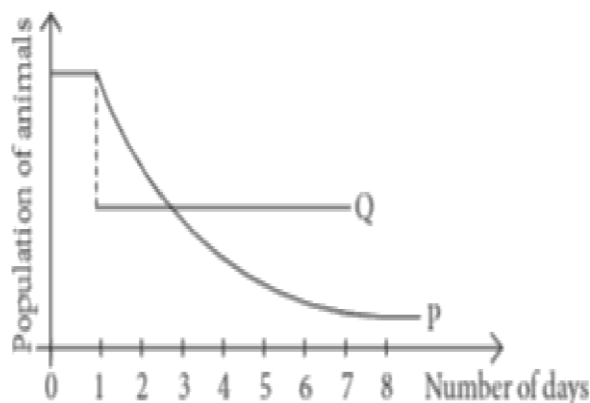
(iv) **Assertion** : *Eichhornia crassipes* drains off oxygen from water and can be seen growing in standing water.

**Reason** : *Eichhornia crassipes* is an indigenous species of India.

- (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.

- (v) The population of species P in a certain community was constant until a population species Q from a distant

Land was subsequently introduced into that community. The interaction between the two populations is reflected in the graph below.



What could be the possible reason for the decrease in the population of species P over a number of days?

- (a) Species Q Is a predator of species P,
- (b) Species I } is a prey species which wiped out the population of species P.
- (c) Species P and Q compete for space but feeds on different food.
- {d) None of these.

## 2. Read the following and answer any four questions given below:

IUCN maintains a Red Data book or Red List which is a catalogue of taxa facing risk of extinction. The IUCN Red List (2004) documents the extinction of 784 species in the last 500 years. Some examples of recent extinctions include the dodo, quagga, Thylacine and Stellers sea cow. The last twenty years alone have witnessed the disappearance of 27 species. Red List has eight categories of species.

- (I) Dodo, an extinct taxon, belongs to which country?  
(a) Mauritius (b) Africa (c) Australia (d) Russia
  - (ii) To which of the following categories of IUCN, *Berberis nilghiriensis* belongs?  
(a) extinct (b) Extinct and wild (c) Endangered (d) Critically endangered
  - (iii) Steller's sea cow and passenger pigeon became extinct due to  
(a) alien species invasion (b) over-exploitation (c) coextinctions (d) intensive agriculture.
  - (iv) Bali, Javan and Caspian are  
(a) Species of tiger (b) species of cheetah  
(c) Subspecies of cheetah (d) subspecies of tiger.
  - (v) Select the correct term for the following definitions (i, ii, iii, iv)  
(a) The taxon is liable to become extinct if not allowed to realise its full biotic potential by providing protection from exotic species/human exploitation/habitat deterioration/depletion of food.  
(b) The taxon has been completely eliminated or died out from earth; e.g., Dodo.  
(c) The taxon is facing a high risk of extinction in the wild in the near future due to decrease in its habitat, excessive predation or poaching.  
(d) They are species with naturally small populations, either localised or thinly scattered, which are always at risk from pests/pathogens/predators/exotic species.
- | (i)            | (ii)    | (iii)      | (iv)       |
|----------------|---------|------------|------------|
| (a) Threatened | Extinct | Endangered | Rare       |
| (b) Endangered | Extinct | Threatened | Rare       |
| (c) Extinct    | Rare    | Threatened | Endangered |
| (d) Threatened | Extinct | Rare       | Endangered |

## 3. Read the follows and answer any four questions given below:

Excessive exploitation of species, whether a plant or animal reduces the size of its population so it becomes vulnerable to extinction. Such as Dodo and passenger pigeon have become extinct due to over exploitation by humans. Thus the world is facing accelerated rates of species extinctions, largely due to human interference.

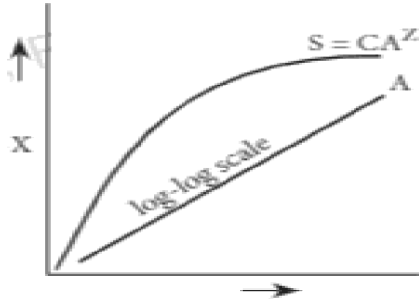
- (i) which of the following cause of biodiversity loss is not included in evil quartet ?  
(a) Coextinction (b) Pollution  
(c) Alien species invasion (d) Habitat loss and fragmentation
- (ii) Identify the species that is become extinct due to over exploitation  
(a) Stellar sea cow (b) tween moth (c) *Blattaorientalis* (d) Nile Perch
- (iii) Factors which make species susceptible to extinction are  
(a) large population size (b) lack or genetic variability  
(c) lower status of trophic level (d) ability to switch over to alternate foods.
- (iv) **Assertion** : Pollution reduces spies biodiversity:  
**Reason** : Spill over of oil in sea causes death of several marine animals.

- (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.
- (v) \_\_\_\_\_ is the first major cause of species extinction.

(a) Co extinction (b) Over exploitation (c) Habitat destruction (d) Alien species invasion

4. Read the follows and answer any four questions given below:

Within a region, species richness increases with increasing explored area, but only upto a limit. The given Figure explains this relationship.



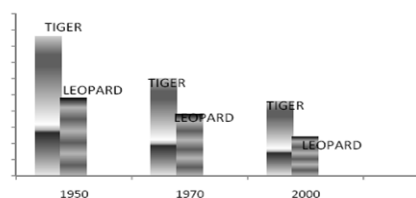
- (i) What does the given figure show?  
 (a) Rivet-popper hypothesis (b) Species-area relationship  
 (c) Proportionate number of species of major taxa (d) n-ecological diversity
- (ii) Equation for relationship (A) between species richness and area is  
 (a)  $\log S = \log C + Z \log A$  (b)  $\log C = \log S + Z \log A$   
 (c)  $Z \log A = \log S + \log C$  (d)  $\log S = \log C + \log A$
- (iii) What is the value of slope of line or regression coefficient Z for frugivorous birds?  
 (a) 0.1-0.2 (b) 1.15 (c) 0.01 -0.1 (d) 0.6-1.2
- (iv) The shape of curve for relationship between species richness and areas for wide variety of taxa is  
 (a) Straight line (b) parabola (c) rectangular hyperbola (d) bell shaped.
- (v) Who gave this concept of increase in species richness with increasing offered area?  
 (a) Humboldt (b) Odum (c) Edward Wilson (d) Paul Ehrlich

5. This is a board seen in front of a national park.



- a. Evaluate the quotation in the board and state your opinion.  
 b. Write any four reasons for extinction of animals.  
 c. Name three animals extinct recently.  
 d. What is the significance of IUCN red list?

6. The given bar diagram shows the population of Asiatic leopard and tiger for the last 50 years in India.



Analyse the figure, whether the population of tiger and leopard increasing or decreasing. Find reason.

- Does the decreasing population of the organisms affect the stability of the ecosystem?  
If yes state how?
- Suggest measures for protecting the population of these organisms.

### **ASSERTION & REASON**

For question numbers 1-10, two statements are given-cue labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- Both assertion and reason are true and reason is the correct explanation of assertion.
  - Both assertion and reason are true but reason is not the correct explanation of assertion.
  - Assertion is true but reason is false.
  - Both assertion and reason are false.
- Assertion:** - The rate of extinction of organisms have increased in recent years.  
**Reason:** - Human activities like deforestation, industrialisation, etc., have destroyed the natural habitat of plants and animals.
  - Assertion:-** Species diversity **decreases** as we ascend towards high mountains.  
**Reason:** Due to drop in temperature, no seasonal variability occurs in high mountains.
  - Assertion:-** Communities with more species tend to be more stable than those with less species.  
**Reason: Communities** with more species is not able to resist occasional disturbances.
  - Assertion:** Dodo, Passenger pigeon, Steller's sea cow have become extinct due to over exploitation.  
**Reason:** Excessive exploitation of a species, whether animal or plants reduces size of its population so that it becomes vulnerable to extinction.
  - Assertion.** • Maximum biodiversity occurs in temperate areas.  
**Reason:** Temperate areas have favourable conditions for speciation and for supporting variety and number of organisms.
  - Assertion:** The introduction of Nile perch in Lake Victoria caused cichlids to become extinct.  
**Reason:** Nile perch is an indigenous species of East Africa.
  - Assertion** • Coral reefs are found in temperate forests  
**Reason:** Minimum diversity of biota are found in the reefs.
  - Assertion.** • Many endemic species are seen to flourish in sacred forests.  
**Reason** • Sacred forests are undisturbed forest patches and biodiversity rich areas.
  - Assertion:** Buffer zone surrounds the core area and limited human activities like resource use strategies, research and education are allowed here.  
**Reason** • There is no biotic interference except in buffer zone.
  - Assertion.** • Alpha diversity refers to species diversity present in a given community or habitat.  
**Reason:** Alpha diversity is expressed by species richness and species evenness in a community or habitat.

Sample Paper 1.  
**KENDRIYA VIDYALAYA SANGATHAN , REGIONAL OFFICE RAIPUR**  
**CLASS-XII TERM-2**  
**SUBJECT – BIOLOGY (044)**  
**BLUE PRINT**

UNIT	2 marks(SA-1)	3 marks(SA-2)	5 marks(LA/Situation based/Case based/CCT)	TOTAL
UNIT-8(Ch-8,10)	4(8)	2(6)		6(14)
UNIT-9(Ch-11,12)		2(6)	1(5)	3(11)
UNIT-10(Ch-13,15)	2(4)	2(6)		4(10)
<b>TOTAL</b>	<b>6(12)</b>	<b>6(18)</b>	<b>1(5)</b>	<b>13(35)</b>

TIME – 2 HOURS

MM-35

**INSTRUCTIONS-**

- The question paper consists of 13 questions divided in to 3 sections- A,B,C.
- Section A has 6 questions of two marks each. Section B has 6 questions of 3 marks each. Section C has 1 question of 5 marks each .All questions are compulsory. However internal choice is given in some questions. Attempt only one of the options in such questions.
- Draw neat and well labeled diagram wherever necessary.

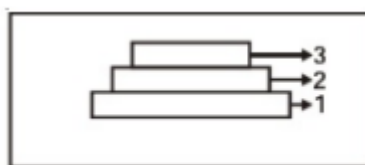
**SECTION-A (2 MARKS QUESTIONS)**

- Given below is a list of some microorganisms. State their usefulness to humans.  
 (a) *Nucleopoly hedrovirus* (b) *Monascus purpureus*  
 (c) *Trichoderma polysporum* (d) *Propionibacterium sharmanii*
- Apart from surgery, suggest two widely used methods to control cancer. How do biological response modifiers like alpha interferons effective in controlling cancer?

**OR**

Differentiate between pneumonia and common cold on basis of causal organism and symptoms.

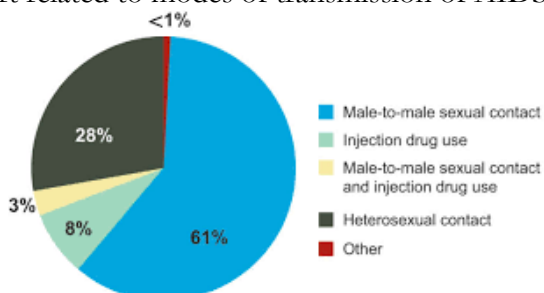
- Differentiate between in situ and ex situ approaches of conservation of biodiversity.
- Label the three different tiers in the given pyramid.
  - Mention the kind of population growth described by the pyramid.



**OR**

Heat gain or heat loss is a surface phenomenon. Why conformers are not able to regulate their body temperature/ osmotic balance? What will be the surface area to volume ratio for conformers?

- Study the following pie chart related to modes of transmission of AIDS virus.

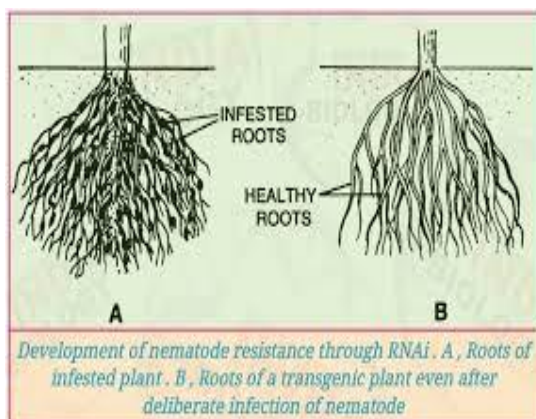


How does the AIDS virus make the immune system weak once it enters the body by any of the above means? State one way by which the transmission of AIDS virus can be drastically reduced.

6. Biogas is a well established, sustainable source and widely-popular source of energy globally by virtue of its production from waste, and available cattle dung. Mention the products obtained from biogas plant and their uses.

### **SECTION-B (3 MARKS QUESTIONS)**

7. There are five different types of antibodies produced in body in response to different antigens. A baby was fed on colostrum when he/she was born. Thereafter he was regularly vaccinated with different vaccines as per the schedule. At the age of two years, he once developed severe allergy due to some unknown source. Now the parents of the child are curious to know about various kinds of immunity and antibodies developed in the body of their child. Explain each in brief.
8. The government has said that drains flowing in the rivers have been plugged. Due to the reduction in the amount of filth, aquatic beings are healthier. Sewage treatment is done in various stages of which biological treatment is very important to reduce the organic load. Explain how biological treatment of sewage is done? What is the impact of biological treatment on DO and BOD of sewage water?
9. Root knot disease caused by a nematode causes major losses to cash crop Tobacco. Name the process involved in the production of nematode-resistant tobacco plants, using genetic engineering. Explain the strategy adopted to develop such plants.



**OR**

Explain how Eli Lilly prepared GE insulin? How and why is it better than traditional insulin?

10. Diagrammatically explain the process which will help to amplify DNA obtained from the blood droplets obtained from crime scene so that DNA finger printing could be done.
11. If in a population of size 'N', the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be

$$dN/dt = (b - d) \times N$$

The equation given above can also be represented as

$$dN/dt = r \times N$$

- (a) Write any one significance of calculating 'r' for any population.
- (b) In a pond there are 100 frogs, 20 more were born in a year. Calculate the birth rate of this population.
- (c) Mention two different ways giving suitable example of each, other than absolute counting by which the population density can be determined.

12. Name the interaction exhibited between the fig tree and female wasps. Give and explain two more examples of same interaction which is also beneficial to humans. Explain how the biodiversity be affected if fig trees are eliminated from the ecosystem?

### **SECTION-C (5 MARKS QUESTIONS)**

13. Biochemical reactors usually produce a large number of intermediate and final products, including pharmaceuticals, food and beverages. The simplest bioreactor model needs only two “reacting” components: biomass and substrate. The biomass consists of cells that consume the substrate. The bioreactor provides optimal conditions for the growth of biomass. Continuous culture gives credible results in short duration.



- 13.1 What is done in continuous culture that it is preferred over batch culture in bioreactors? (1)  
13.2 Mention four factors which must be controlled to get maximum yield in short duration. (2)  
13.3 Explain with steps, what is done after the biochemical phase in a bioreactor gets completed? (2)

**OR**

Vaccination continues to be the most important and cost-effective way to control animal and human infectious disease. A variety of plant species have been genetically modified to accumulate vaccine antigens for human and animal health and the first vaccine candidates are approaching the market. The regulatory burden for animal vaccines is less than that for human use and this has attracted the attention of researchers and companies, and investment in plant-made vaccines for animal infectious disease control is increasing. The dosage cost of vaccines for animal infectious diseases must be kept to a minimum, especially for non-lethal diseases that diminish animal welfare and growth, so efficient and economic production, storage and delivery are critical for commercialization.

- 13.4 What are the advantages of getting vaccines from transgenic animals than from fermentation of pathogenic antigens? Mention two points. (1)  
13.5 Transgenic organisms are also used to check the safety of vaccines and chemicals. Explain why giving a suitable example? (2)  
13.6 Explain how r-DNA technology helps in early diagnosis of diseases caused by gene mutation? (2)

.....

### TERM -2 MARKING SCHEME

QUESTION NO.	VALUE POINT	MARKS ALLOCATED
1	a- biocontrol agent b- Statins c-Cyclosporin A d- Swiss cheese	$\frac{1}{2} \times 4$
2	Chemotherapy and radio therapy. Alpha interferon help the immune system to recognise and destroy the cancerous cells	$\frac{1}{2} + \frac{1}{2} + 1$
2 Optional	Common cold caused by Rhinoviruses and symptoms are running nose, sneezing, infection confined to upper respiratory tract. Pneumonia is caused by bacteria- <i>Streptococcus pneumoniae</i> , infection reaches lungs, difficulty in breathing, tips of nails and toes turn bluish.	1+1
3	Two points of difference	1+1
4	1 pre reproductive, 2 reproductive, 3 post reproductive, expanding	$\frac{1}{2} \times 4$
4 Optional	The conformers cannot spend energy to maintain constant body temperature or osmotic balance. Their surface area is more as compared to volume , so it becomes difficult to regulate.	1+1
5	HIV enters the macrophages and T lymphocytes and destroys them while replicating in them making the immune system weak. Body becomes susceptible to multiple infections. By avoiding sexual contact with many (male or female) partners/ by using condoms.	$\frac{1}{2} \times 3$  $\frac{1}{2}$
6	Biogas- used as fuel for cooking and lighting homes Spent slurry used as manure	1*2
7	Colostrum has IgA antibody which provides passive acquired immunity Vaccines develop IgG antibodies and provide active acquired immunity Allergy is due to IgE antibodies	1+1+1
8	Aerobic treatment, anaerobic treatment- explanation DO rises and BOD decrease after biological treatment	1+1 $\frac{1}{2} + \frac{1}{2}$
9	RNA interference, Using Agrobacterium vectors, nematode - specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and antisense RNA in the host cells. These two RNA's being complementary to each other are formed A double stranded RNA (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the nematode. The consequence was that the parasite could not survive in a transgenic host expressing specific interfering RNA. The transgenic plant thus protected itself from the parasite	$\frac{1}{2} + 2.5$



9 optional	Eli Lilly prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them separately in plasmids of <i>E. coli</i> to produce A and B chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin. GE insulin does not cause allergy as it has no antigens	2  $\frac{1}{2}+1/2$
10	3 STEPS- denaturation, primer annealing, elongation and repeating of cycles in desired number of times with diagram.	1+1+1
11	To know the role of biotic and abiotic factors on increase or decrease in population, $20/100=0.2$ / frog/year in pond, pug marks, fecal pellets, percentage cover(any 2)	1+1+1/2+1/2
12	Mutualism, legumes with <i>Rhizobium</i> to increase soil fertility, gut bacteria with humans to help in digestion, both population density and biodiversity will reduce	1+1/2+1/2+1/2+1/2
13	The fresh nutrient medium is added at regular intervals in bioreactor and spent medium is regularly extracted. Oxygen/ aeration, pH, temperature, foam formation or any other factor DOWN STREAM PROCESSING which involves separation and purification, addition of preservatives, quality controls	1 $\frac{1}{2}*4$ $\frac{1}{2}*4$
13 optional	Can get vaccines at lower cost , in large quantities. Transgenic mice are used to check the safety of polio vaccine. The transgenic animals have genes which makes them more sensitive to toxic substances. Ass DNA or RNA, tagged with a radioactive molecule/probe is allowed to hybridise to its complementary DNA in a clone of cells, flowed by detection using autoradiography. The clone having the mutated gene will hence not appear on the photographic film as the probe will not have complementarity with the mutated gene	$\frac{1}{2}*2$ 1+1  2

Sample Paper 2  
**KENDRIYA VIDYALAYA SANGATHAN , REGIONAL OFFICE RAIPUR**  
**CLASS-XII TERM-2**  
**SUBJECT – BIOLOGY (044)**

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S.No.	UNIT	SA – 2 marks	SA – 3 marks	LA – 5 marks	TOTAL
1	Biology in Human Welfare	4(8)	2(6)		6(14)
2	Biotechnology		2(6)	1(5)	3(11)
3	Ecology	2(4)	2(6)		4(10)
	<b>TOTAL</b>	<b>6(12)</b>	<b>6(18)</b>	<b>1(5)</b>	<b>13(35)</b>

MM – 35

TIME ALLOWED – 2 hrs.

**General Instructions :-**

1. All questions are compulsory.
2. The question paper has three sections and 13 questions. All questions are compulsory.
3. Section A has 6 questions of 2 marks each, section B has 6 questions of 3 marks each , and section C has a case – based question of 5 marks.
4. 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.
5. Wherever necessary, neat and properly labelled diagrams should be drawn.

**Section A :-**

1. A child has badly affected by measles at the age of 6 years , and the same child again had measles at the age of 10 years, Give appropriate terms for both responses , which immune response will be more stronger and why?
2. Why mother's milk considered as the most appropriate food for a new born infant? Which type of immunity is obtained by infant from mother's milk?  
Or  
What is metastasis? Which particular affected organ has this property?
3. Immediate after a road accident an injured person brought to a nearby clinic. What is the first immediate relief treatment will be given by the doctor? Why it is administered?
4. How does the application of the fungal genus – Glomus , to the agricultural field increase the farm output?
5. Monarch butterflies are highly distasteful to predator , accepted as preventive measure from predation. How Monarch butterflies adopted this technique to get protected?
6. A transformed bacteria has been cultured in bioreactor. Regarding its pattern of growth , which type of growth depicted by this bacteria ?  
Or  
It has been found that a giant polar bear found in the extreme cold polar region whereas a tiny humming bird not found over there in the polar region. Justify the statement.

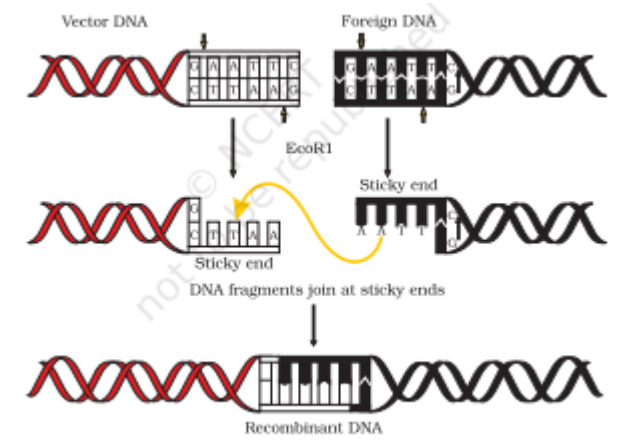
**Section B :-**

7. A person has reported HIV positive and HIV virus cause AIDS disease. With reference to HIV virus give answers of following questions :-
  - a. At first , to which cell does the HIV virus cause infection in earlier stage and later stage?
  - b. Although the host cell has DNA , then how the viral genome incorporate with human DNA?

- c. Due to low immunity, AIDS person often get infected by a bacteria. Name the same.  
Or  
Regarding innate immunity, human being have four types of barriers to resist the entry of antigens. Explain any three of them with suitable example.
8. For experimental and water treatment purpose three water samples have been collected from three different sources of water. Now after their BOD test, it finds out 20mg/L, 8 mg/L, 400mg/L respectively. Now on the basis of above finding, give answers of following questions: -
- Which sample of water has not treated at all? How you find out?
  - Which sample of water has been treated by both stages physical and biological both?
  - How primary effluent is different from secondary effluent?
9. For recombinant DNA technology, an artificial cloning vector pBR322 is widely used. from the diagram depicted below give the answer of following questions: -



- What is selectable marker? How many selectable markers found in this cloning vector?
  - How many restriction sites are present in it? What is the significance of restriction site?
  - Which is the site from where replication process gets started?
10. What is sixth episode of extinction? What is evil quartet? Which evil quartet have maximum influence for the sixth episode of extinction?
11. Name the plant which found over Himalaya ranges that exhibit Genetic diversity? Which chemical substance is obtained from this plant? Apart from this plant, how many types of rice and mango varieties exhibit genetic diversity?
12. In recombinant DNA technology, following stages involve splitting and ligation of host DNA and foreign DNA. Give answer of the following questions: -
- Why to cut off a DNA restriction endonuclease enzyme used, not normal endonuclease?
  - What are sticky ends? What is the significance of sticky ends?
  - How the palindromic sites can be identified?



## SECTION-C

### Case – Study based Questions: -

RNA –i

Often tobacco plants are infected by soil borne nematode called as *Meloidogyne incognita*. This nematode causes a great loss in the tobacco production. In order to stop the result of infection biotechnology has invented advanced method called RNA interference. Where the RNA of nematode has been silenced and further translation of nematode RNA not allowed. For the same first of all a nematode RNA introduced in the cell of tobacco root and the DNA is designed in such a way that both of its sense and anti-sense strand start transcription. As a result, a ds – RNA synthesized. Now by the help of a protein DICER, the ds RNA cut off in to si – RNA. and when the nematode cause infection to the tobacco root, the nematode DNA start transcription. Now another protein called RISC (RNA interfering silencing complex) get bind the si – RNA and nematode m – RNA. That check the further translation.

To deliver the foreign DNA vector like agro bacterium or transposons can be used.

1. Name the nematode that causes infection to the tobacco root.
2. At very early stage which step has been taken up in tobacco root cells?
3. What is the function of si – RNA?
4. Enumerate the role of vector in RNA –i?
5. In order to protect the tobacco plant, how the ds– RNA helpful?

## MARKING SCHEME

### Section A :-

1. A child has badly affected by measles at the age of 6 years, and the same child again had measles at the age of 10 years, give appropriate terms for both responses, which immune response will be stronger and why?

**Ans.** Primary immune response and secondary immune response. Secondary immune response will be much stronger than primary immune response because it exhibits by the antibodies which prepared and stored in the form of memory cells in secondary lymphoid organs.

2. Why mother's milk considered as the most appropriate food for a new born infant? Which type of immunity is obtained by infant from mother's milk?

**Ans.** As it supplies IgA, so it considered as ideal source of food. Passive immunity is obtained by the infant.

Or

**What is metastasis? Which particular affected organ has this property?**

**Ans.** Invasion of cancerous cells or tissue to the healthy parts is called as metastasis and it found in malignant tumour.

3. Immediate after a road accident an injured person brought to a nearby clinic. What is the first immediate relief treatment will be given by the doctor? Why it is administered?

**Ans.** Tetanus antitoxin, as it is ready made antibody which check the action of antigens.

4. How does the application of the fungal genus – Glomus, to the agricultural field increase the farm output?

**Ans.** It helps to nitrogen fixation and supply the nitrogen to the host plant.

5. Monarch butterflies are highly distasteful to predator, accepted as preventive measure from predation. How Monarch butterflies adopted this technique to get protected?

**Ans.** Because the female Monarch laid eggs over the distasteful leaves and the larvae feed upon the leaves of distasteful leaves, so by this way the adult monarch butterfly also become distasteful to its predators.

6. A transformed bacterium has been cultured in bioreactor. Regarding its pattern of growth, which type of growth depicted by these bacteria?

**Ans.** Earlier the bacteria had Logistic growth which proceed only up to carrying capacity, but after arrival into bioreactor the bacteria shown exponential growth, because as now there is no competition and high availability of resources.

Or

**It has been found that a giant polar bear found in the extreme cold polar region whereas a tiny humming bird not found over there in the polar region. Justify the statement.**

**Ans.** According to Allen's Rule, the surface area of the polar bear is too less and the surface area of humming bird is too high for temperature loss. So humming bird not found over polar region.

### Section B: -

7. A person has reported HIV positive and HIV virus cause AIDS disease. With reference to HIV virus give answers of following questions: -

a. At first, to which cell does the HIV virus cause infection in earlier stage and later stage?

**Ans.** Macrophages followed by helper T cells.

b. Although the host cell has DNA, then how the viral genome incorporates with human DNA?

**Ans.** By reverse transcriptase enzyme RNA prepare DNA, and now viral DNA incorporated with host DNA.

- c. Due to low immunity, AIDS person often gets infected by a bacterium. Name the same.

Ans. Toxoplasma.

Or

Regarding innate immunity, human being has four types of barriers to resist the entry of antigens. Explain any three of them with suitable example.

- Ans.
- Physical Barrier: - skin
  - physiological barrier: - saliva, tear, hydrochloric acid.
  - cellular barrier: - Leucocyte.

8. For experimental and water treatment purpose three water samples have been collected from three different sources of water. Now after their BOD test, it finds out 20mg/L, 8 mg/L, 400mg/L respectively. Now on the basis of above finding, give answers of following questions: -

- a. Which sample of water has not treated at all? How you find out?

Ans. Sample with 400 mg/l because of maximum BOD or presence of high number of bacterial populations.

- b. Which sample of water has been treated by both stages physical and biological both?

Ans. Sample with 8 ml/l, because the BOD significantly down.

- c. How primary effluent is different from secondary effluent?

Ans. The water generated after primary treatment called primary effluent and the water that produced after secondary treatment called secondary effluent.

9. For recombinant DNA technology, an artificial cloning vector Pbr322 is widely used. from the diagram depicted below give the answer of following questions: -



- a. What is selectable marker? How many selectable markers found in this cloning vector?

Ans. The part of cloning vector which help us to differentiate between the transformant and non-transformants. 2 selectable markers called ampicillin resistant and tetracycline resistant gene.

- b. How many restriction sites are present in it? What is the significance of restriction site?

Ans. 8, it facilitates to cut the cloning vector by the help of restriction endonuclease.

- c. Which is the site from where replication process gets started?

Ans. ORI is the part from where replication gets started.

10. What is sixth episode of extinction? What is evil quartet? Which evil quartet have maximum influence for the sixth episode of extinction?

Ans. Sixth episode refer to the current rate of extinction that is 100 to 1000 times faster than pre-human times. (1), there are four main reasons which greatly damage the biodiversity, combinedly called as evil quartet. (1), out of them the habitat loss and fragmentation are most influencing over the loss of biodiversity. (1)

11. Name the plant which found over Himalaya ranges that exhibit Genetic diversity? Which chemical substance is obtained from this plant? Apart from this plant, how many types of rice and mango varieties exhibit genetic diversity?

Ans. Rauwolfia vomitoria (1), Reserpine (1), rice – 50000 and mango – 1000 varieties (1)

12. In recombinant DNA technology, following stages involve splitting and ligation of host DNA and foreign DNA.

Give answer of the following questions: -

a. **Why to cut off a DNA restriction endonuclease enzyme used, not normal endonuclease?**

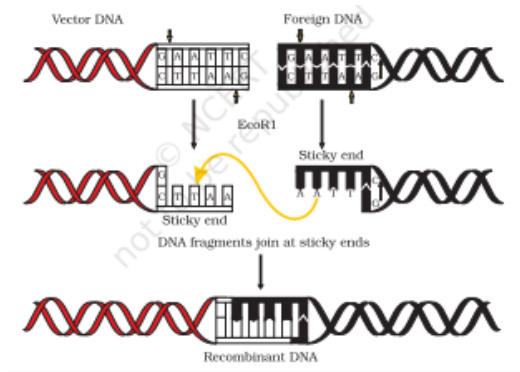
Ans. Restriction endonuclease cleave DNA in the palindromic sites, whereas normal endonuclease cut DNA randomly.

b. **What are sticky ends? What is the significance of sticky ends?**

Ans. After cut off of DNA few nucleotides remain unpaired, which called as sticky ends. It is significant because it helps to determine appropriate sequence of genome.

c. **How the palindromic sites can be identified?**

Ans. The sequence of nucleotide in both the polarity of DNA, if same that particular location is called as palindromic site.



## SECTION C

Case – Study based Questions - (1 mark each)

RNA –i

Often tobacco plants are infected by soil borne nematode called as *Meloidogyne incognitia*. This nematode cause a great loss in the tobacco production. In order to stop the result of infection biotechnology has invented advanced method called RNA interference. Where the RNA of nematode has been silenced and further translation of nematode RNA not allowed. For the same first of all a nematode RNA introduced in the cell of tobacco root and the DNA is designed in such a way that both of its sense and anti-sense strand start transcription. As a result, a ds – RNA synthesized. Now by the help of a protein DICER, the ds RNA cut off in to si – RNA and when the nematode cause infection to the tobacco root, the nematode DNA start transcription. Now another protein called RISC (RNA interfering silencing complex) get bind the si – RNA and nematode m – RNA. That check the further translation.

To deliver the foreign DNA vector like agrobacterium or transposons can be used.

1. **Name the nematode that cause infection to the tobacco root.**

Ans. *Meloidogyne incognitia*

2. **At very early stage which step has been taken up in tobacco root cells?**

Ans. Entry of nematode DNA in the cell of tobacco root and designed in such a way that both sense and antisense strand start transcription.

3. **What is the function of si – RNA?**

Ans. It get combine with m RNA of nematode with the help of RISC.

4. **Enumerate the role of vector in RNA –i?**

Ans. Vector like agrobacterium help to successfully deliver the gene of interest into host cell.

5. **In order to protect the tobacco plant, how the ds – RNA helpful?**

Ans. Ds – RNA if formed, now it not able to perform translation, by this way no protein synthesis takes place, hence tobacco plant can be saved.

**Sample Paper 3.**  
**KENDRIYA VIDYALAYA SANGATHAN, REGIONAL OFFICE RAIPUR**  
**CLASS-XII TERM-2**  
**SUBJECT – BIOLOGY (044)**  
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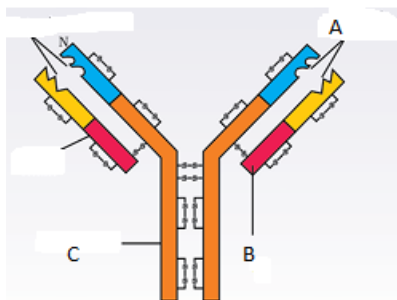
UNIT	2 marks (SA-1)	3 marks (SA-2)	5 marks (LA/Situation based/Case based/CCT)	TOTAL
UNIT-8(Ch-8,10)	4(8)	2(6)		6(14)
UNIT-9(Ch-11,12)		2(6)	1(5)	3(11)
UNIT-10(Ch-13,15)	2(4)	2(6)		4(10)
<b>TOTAL</b>	<b>6(12)</b>	<b>6(18)</b>	<b>1(5)</b>	<b>13(35)</b>

**General Instructions:**

- All questions are compulsory.
- The question paper has three sections and 13 questions. All questions are compulsory.
- Section–A has 6 questions of 2 marks each; Section–B has 6 questions of 3 marks each; and Section–C has a case-based question of 5 marks.
- 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.
- Wherever necessary, neat and properly labelled diagrams should be drawn.

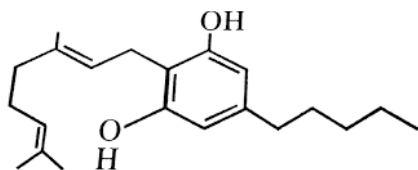
**SECTION- A**

1. a) Label the parts 'A' and 'C' in the following diagram.



b) Which antibody is released during allergic reaction.

**OR**



- Identify the compound chemical structure is shown above.
- Name the source of the above compound.
- Name the parts used.
- Name the body parts it affects.

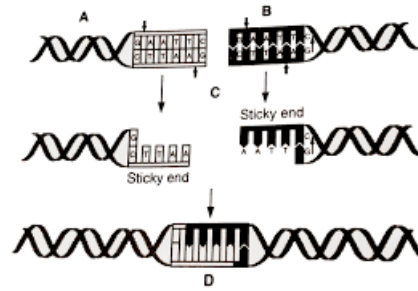
2. Name the blank space A, B, C and D from the table given below

Microbes	Scientific name	Product	Medical application
Fungus	<b>A</b>	<b>B</b>	Organ transplantation
Yeast	<b>C</b>	<b>D</b>	blood-cholesterol



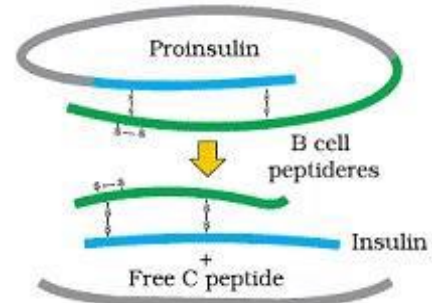
3.

- What is A and B?
- Which restriction enzyme does this?
- Name the technology where is it used.



4.

- What was the source of the above in ancient days?
- Why is it not used now a days?
- Name the American company that extracted it artificially?
- Name the technique used to prepare this.

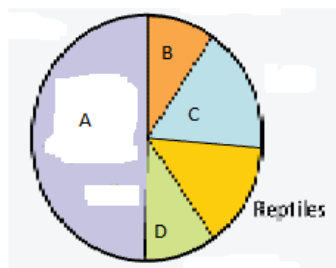


5. Name the type of interaction seen in each of the following examples:

- Monarch butterfly and bird
- Abingdon tortoise and the goat
- Ophrys and bee
- Cattle egret and the grazing cattle

6. Describe 'The Evil Quartet'.

**OR**



Given figure describes proportionate number of species of major taxa of vertebrates.

- Which group of vertebrates represent maximum number of taxa marked as 'A'?
- In the above figure, which groups of vertebrates represent 'B', 'C' and 'D' respectively?

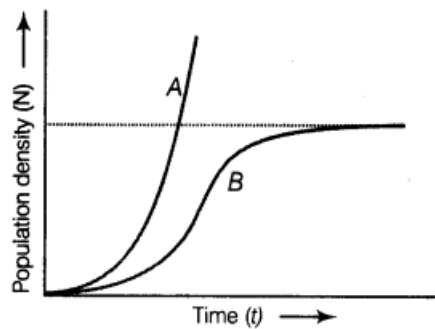
### SECTION- B

- Explain metastasis? Why is it fatal?
  - The lymphocytes are of two types B cells & T cells. Why are they called so?
  - A person is injured by snakebites and required an urgent immune response, what should be done?
- Explain the different steps involved in the secondary treatment of sewage.
- List the three steps involved in PCR.
  - Name the source organism of Taq polymerase. Explain the specific role of this enzyme in PCR.
- Gene expression can be controlled with the help of RNA molecule. Explain the method with an example.

**OR**

- What is gene therapy?
- Name the deficiency for which first clinical gene therapy was given.
- Why is the enzyme essential for human body?
- Mention the cure for this deficiency.

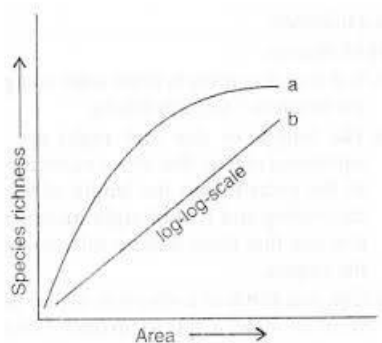
11.



Study the graph given below and answer the questions that follow:

- Write the equations for 'A' and 'B'.
- Write the status of food and space in the curve's 'A' and 'B'.
- In the absence of predators, which one of the two curves would appropriately depict the prey population?
- Time has been shown on X- axis and there is a parallel dotted line above it. Give the significance of this dotted line.

12.



The above graph shows the Species- area relationship. Answer the questions as directed:

- Name the naturalist who studied the kind of relationship shown in the graph. Write the observations made by him.
- Write the equations of 'a' and 'b'.
- What kind of slope will be observed for frugivorous birds and mammals in a tropical forest?

## SECTION- C

### CASE STUDY BASED QUESTIONS

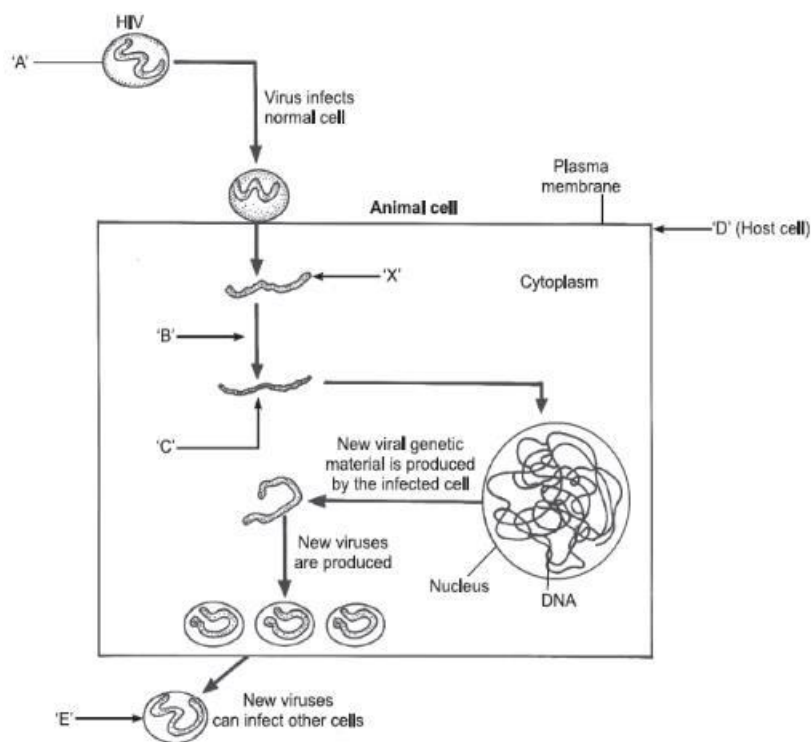
- The terms "biological control" and its abbreviated synonym "biocontrol" have been used in different fields of biology, most notably entomology and plant pathology. In entomology, it has been used to describe the use of live predatory insects, entomopathogenic nematodes, or microbial pathogens to suppress populations of different pest insects. In plant pathology, the term applies to the use of microbial antagonists to suppress diseases as well as the use of host-specific pathogens to control weed populations. In both fields, the organism that suppresses the pest or pathogen is referred to as the biological control agent (BCA). More broadly, the term biological control also has been applied to the use of the natural products extracted or fermented from various sources. These formulations may be very simple mixtures of natural ingredients with specific activities or complex mixtures with multiple effects on the host as well as the target pest or pathogen. And, while such inputs may mimic the activities of living organisms, non-living inputs should more properly be referred to as biopesticides or biofertilizers, depending on the primary benefit provided to the host plant. The various definitions offered in the scientific literature have sometimes caused confusion and controversy. For example, members of the U.S. National Research Council considered modern biotechnological developments and

referred to biological control as “the use of natural or modified organisms, genes, or gene products, to reduce the effects of undesirable organisms and to favor desirable organisms such as crops, beneficial insects, and microorganisms”,

- What does it mean “Biocontrol”? 1
- Name the organisms which are used in Biocontrol methodology. 1
- What are the advantages of Biocontrol technique? 3

OR

Study the diagram showing replication of HIV in humans and answer the following questions accordingly:



- Write the chemical nature of the coat ‘A’. 1
- Name the enzyme ‘B’ acting on ‘X’ to produce molecule ‘C’. Name ‘C’. 2
- Write about methods of treatment of this disease. 1
- Name the cell which is destroyed by HIV virus. 1

### MARKING SCHEME

QUESTION NO.	VALUE POINT	MARKS ALLOCATED
1	a.A- antigen binding site C. Heavy Chain b/ IgE	1/2*4
Or	b) Cannabinoids, b. <i>Cannabis sativa</i> c, Leaf d. Brain	1/2*4
2	A <i>Trichoderma polysperum</i> b. Cyclosporin A, c. <i>Monascus purpurus</i> d. Statin	1/2*4
3	A. A. Vector DNA B. Foreign DNA B. EcoRI C. Recombinant DNA	1+1
4	a. Slaughter (Cattle/ Pig) b. Allergy	1/2*4

	c. Eli Lilly d. R-DNA Technology	
5	a. Predation b. Competition c. Mutualism d. Commensalism	$\frac{1}{2} \times 4$
6	Habitat Loss and Fragmentation Over exploitation Invasion of Alien Species Co-Extension	$\frac{1}{2} \times 4$
or	a. Fishes. B. Mammals, c. Birds d. Amphibia	$\frac{1}{2} \times 4$
7	a. Cancerous cell detached from origin site and develop at new site. Malignant- spread any part. b. B- Cell produce and mature in Bone marrow T-cell mature at thymus c. cannot produce antibody, need passively	1+1+1
8	Secondary is biological Aerobic- flocs used to consume organic matter—BOD reduced— anaerobic treatment—effluent released to natural bodies.	1*3
9	Denaturation, Annealing, Extension <i>Thermus aquaticus</i> Heat Stable enzyme	1*3
10	RNA interference Principle Methods Example	1*3
11	a. A exponential $\frac{dN}{dt} = rN$ b logistic $\frac{dN}{dt} = r \left\{ \frac{K-N}{K} \right\}$ b. A Unlimited B Limited c. A d. Carrying Capacity	$\frac{1}{2} \times 6$
12	a. Alexander von Humbolt b. $S = CA^Z$ $\log S = \log C + Z \log A$ c. Steeper slope	1+1+1
13	Definition Organism any two Any three advantages	1 $\frac{1}{2} \times 2$ 3
Or	Protein coat Reverse transcriptase Viral DNA Prevention Treatment antiretroviral drugs T helper cell	1 $\frac{1}{2} \times 4$ $\frac{1}{2} \times 4$