

Question Paper Code. 57/3/3

SECTION A

Note : Choose the correct option from the choices given in each of the following questions :

1. Hormones released in human females only during pregnancy are

- (A) hCG, hPL, Progesterone
- (B) Relaxin, hCG, hPL
- (C) hCG, hPL, Oxytocin
- (D) hPL, Thyroxine, hCG

Ans. B / Relaxin, hCG, hPL

[1 Marks]

2. Nematode specific genes were introduced into the tobacco host plant by using the vector

- (A) Plasmid
- (B) Bacteriophage
- (C) pBR 322
- (D) *Agrobacterium*

Ans. D / *Agrobacterium* = 1

[1 Mark]

3. The principle of vaccination is based on the property of

- (A) Specificity
- (B) Diversity
- (C) Memory
- (D) Discrimination between 'self' and 'non-self'

Ans. C / Memory =1

[1 Mark]

OR

Opioids act as

- (A) Depressants
- (B) Pain killers
- (C) Euphoria providers
- (D) Stimulants

Ans. A / Depressants =1

[1 Mark]

4. One of the ex situ conservation methods for endangered species is

- (A) Biosphere reserves
- (B) National parks
- (C) Cryopreservation
- (D) Wildlife sanctuaries

Ans. C / Cryopreservation = 1

[1 Mark]

OR

Ozone gas is continuously formed in the stratosphere by

- (A) Action of UV rays on nascent oxygen
- (B) Reaction of oxygen with water vapour
- (C) Action of UV rays on molecular oxygen
- (D) Action of UV rays on water vapour

Ans. C / Action of UV rays on molecular oxygen = 1

[1 Mark]

5. Introduction of an alien DNA into a plant host cell is achieved by making them

- (A) Competent with bivalent ions
- (B) Using microinjections
- (C) Using gene gun
- (D) Using lysozymes and chitinase

Ans. C / Using gene gun = 1

[1 Mark]

SECTION B

6. Why are humming birds not found in the Polar region ?

Ans. Have large surface area relative to their volume, tend to lose body heat very fast when there is cold outside, they have to expend much energy, to generate body heat through metabolism. = $\frac{1}{2} \times 4$

[2Marks]

7. Spirulina is a rich source of proteins. Mention the two ways by which large scale culturing of these microbes is possible.

Ans. Grown in waste water from potato processing plants (starch rich) / straw / molasses / animal manure / sewage (any two) // bioreactor, using any two above mentioned materials = 1+1

[2 Marks]

8. State what are biofertilizers. Name any three sources of biofertilizers.

Ans. Organism that enrich the nutrient quality of the soil = $\frac{1}{2}$

Bacteria, fungus and cyanobacteria = $\frac{1}{2} \times 3$

[2 Marks]

9. How does EcoRI specifically act on DNA molecule ? Explain.

Ans. Inspects the length of a DNA sequence, finds its specific recognition sequence as $\frac{5'GAATTC 3'}{3'CTTAAG 5'}$, binds to the DNA, and cut each of the two strands of the double helix at specific points as shown in their sugar-phosphate backbones = $\frac{1}{2} \times 4$

[2Marks]

10. Name and explain the technique that can be used in developing improved crop varieties in plants bearing female flowers only.

Ans. Artificial hybridization = $\frac{1}{2}$

The female flower buds are bagged before the flower open, when stigma becomes receptive pollination is carried out using the desired pollen, and flower is rebagged (and fruits are allowed to develop) = $\frac{1}{2} \times 3$

[2Marks]

OR

When are the non-flowering plants said to be homothallic and monoecious; and heterothallic and dioecious ? Give an example of each.

Ans. Homothallic and monoecious : bisexual condition / having both male and female reproductive structures on the same plant, eg. *Chara* and several fungi or any other suitable example = $\frac{1}{2} \times 2$

Heterothallic and dioecious: unisexual condition / having either male or female reproductive structures present in different plants, example *Marchantia* or any other suitable example = $\frac{1}{2} \times 2$

[2Marks]

11. (a) Explain the cause responsible in a human to have sex chromosomes as 'XXY' in stead of 'XX' or 'XY'.

(b) List any two ways such individuals are different from the normal being.

Ans. a) Failure of segregation of chromatids during cell division cycle/ nondisjunction/ aneuploidy, resulting in gain of an extra X chromosome in a male after fertilization

= $\frac{1}{2} \times 2$

b) Development of breasts/ gynaecomastia, sterile individuals = $\frac{1}{2} \times 2$

[2Marks]

12. How is the mechanism of evolution explained by de Vries ?

Ans. Large difference arising suddenly in a population, because of mutation, in a single step / saltation, random and directionless = $\frac{1}{2} \times 4$

[2Marks]

SECTION C

13. (a) Write the scientific name of methanogen bacteria. Where are these bacteria generally found? Explain their role in biogas production.

(b) Name the components of biogas

Ans. a) *Methanobacterium* = $\frac{1}{2}$

found in the anaerobic sludge / rumen of cattle, they grow anaerobically on cellulosic material and cause its breakdown (into methane CO_2 and H_2)

= $\frac{1}{2} \times 2$

b) methane, CO_2 , H_2 = $\frac{1}{2} \times 3$

[3 Marks]

14. Majority of angiosperms have hermaphrodite flowers, but self-pollination is discouraged by them. Explain any three outbreeding devices that they have developed to achieve this?

Ans. i) Pollen release and stigma receptivity not synchronised, either pollen released before the stigma is receptive or otherwise.

ii) Anther and stigma are placed at different position, stigma cannot come in contact with the pollen of the same flower.

iii) In some plant flowers are unisexual, male flower and female flower born on different plant.

iv) Self incompatibility, it is a genetic mechanism and prevents self pollen from fertilising the ovule by inhibiting pollen germination or pollen tube growth in the pistil (any three)

(each point to be) = $\frac{1}{2} \times 2$

[3Marks]

15. Differentiate between the pattern of inheritance in humans of the blood diseases, haemophilia and thalassemia.

Ans. Haemophilia

Thalassemia

1. Sex linked recessive disorder

1. Autosomal recessive disorder

2. heterozygous female carrier may transmit it both to her son and daughter

2. Transmitted from both the carrier parents

3. males are generally affected but female are rarely affected

3. both sexes can be affected

(both corresponding points to be written for credit)

= 1×3

[3 Marks]

16. "Cotton bollworms enjoy feeding on cotton plants, but get killed when feed on Bt cotton plant." Justify the statement.

Ans. Once a bollworm feeds on Bt cotton plant the inactive protoxin produced by *Bacillus thuringiensis*, is converted into an active form of toxin, due to the alkaline pH of the gut which solubilise the

crystals, the activated toxin binds to the surface of its midgut epithelial cells, create pores that cause cell swelling and lysis, and eventually cause death of the insect = $\frac{1}{2} \times 6$

[3 Marks]

OR

- (a) Mention the cause of ADA deficiency in humans.**
- (b) How is gene therapy carried out to treat the patients suffering from this disease ?**
- (c) State the possibility of a permanent cure of this disease.**

Ans. a) Caused due to the deletion of the gene for adenosine deaminase = $\frac{1}{2}$

b) lymphocytes from the blood of the patient are grown in a culture medium outside the body, a functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes which are subsequently returned to the patient, patient requires periodic infusion of such genetically engineered lymphocytes = $\frac{1}{2} \times 3$

c) if the gene isolated from bone marrow cells producing ADA, is introduced into cells at early embryonic stages it could be a permanent cure = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

17. (a) Compare the mechanism of sex determination in humans with that of honey bees, with respect to chromosome number.

(b) How is the gamete formation comparable in the above two cases ?

Ans. Ans. a) In honeybee union of a sperm and an egg develops as a female (queen or worker), and an unfertilised egg develops as a male (drone) by means of parthenogenesis, the females are diploid / having 32 chromosomes and males are haploid / having 16 chromosomes , in humans- both male and female in individuals have 23 pair of chromosomes / diploid / female 44+ XX and males 44+ XY = $\frac{1}{2} \times 4$

b) In humans gametes are formed by meiosis, in honeybee female gametes are formed by meiosis and male gametes by mitosis = $\frac{1}{2} \times 2$

[3 Marks]

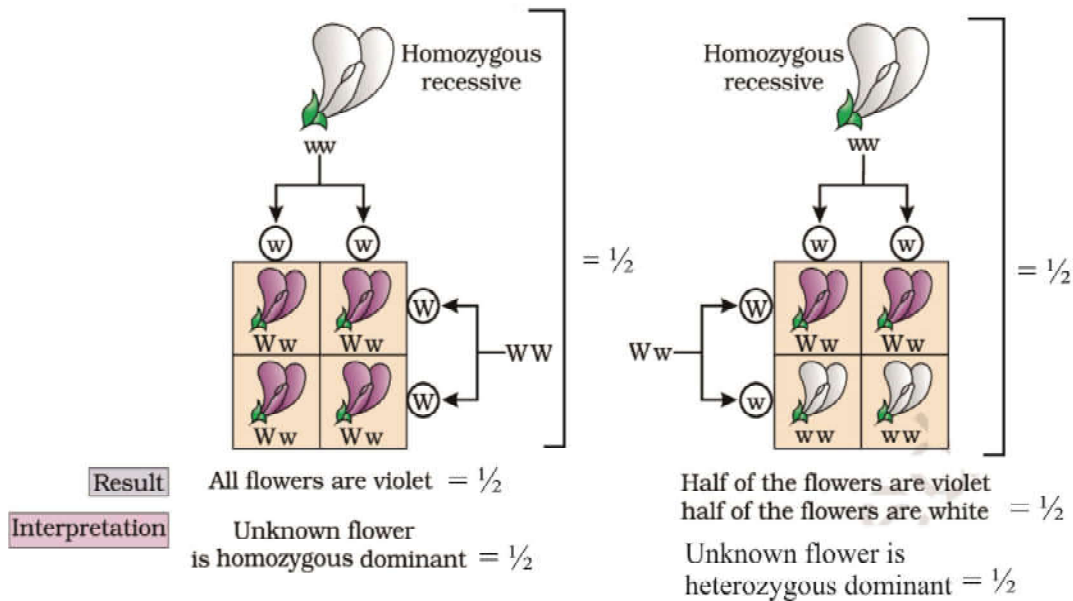
18. You are asked to find the genotype of a pea plant bearing violet flowers, growing in your school garden. Give your explanation to get the solution.

Ans. Carry a test cross / cross the violet flower bearing plant with the white flower bearing plant / cross the violet flower bearing plant with the homozygous recessive plant = 1

If the progeny has 100% violet flowers , the unknown genotype is homozygous dominant = $\frac{1}{2} + \frac{1}{2}$

If the progeny has 50% violet flower and 50% white flower , then the unknown genotype is heterozygous dominant = $\frac{1}{2} + \frac{1}{2}$

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[3Marks]

19. Mention the chemical nature of an antibody and name the type of cells they are produced by. Write the difference between active and passive immune responses on the basis of antibodies.

Ans. Made up of proteins / peptide, B-lymphocytes = $\frac{1}{2} + \frac{1}{2}$

Active immunity - due to exposure to antigens / pathogens / vaccination / immunisation leads to production of antibodies by the individual, slow process = $\frac{1}{2} + \frac{1}{2}$

Passive immunity - Ready-made antibodies are directly given to protect the body of an individual against foreign agents, fast process/ provide immediate immunity = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

OR

Name the cells that act as HIV factory in humans when infected by HIV. Explain the events that occur in these infected cells.

Ans. Macrophages = $\frac{1}{2}$

Once the virus enters the human body the virus / viral genome infects macrophages where its RNA genome replicates, to form viral DNA, with the help of the enzyme reverse transcriptase, this viral DNA gets incorporated into host cell's DNA, and directs the infected cells to produce virus particles = $\frac{1}{2} \times 5$

[3 Marks]

20. Explain the solutions found by Ahmed Khan, a Bengaluru based plastic sack manufacturer, after realising the problems created by plastic wastes.

Ans. Polyblend a fine powder was made from recycled modified plastic, this was mixed with the bitu-

men to lay roads which proved to enhance the bitumen's water repellent properties, and helped to increase road life by the factor of three = 1×3

[3 Marks]

21. (a) Name the process that makes the detritus become part of the soil in the nutrient cycle.
- (b) Write the factors responsible for controlling the rate of this process.
- (c) Mention the condition when the rate would be faster.

Ans. a) Decomposition = $\frac{1}{2}$

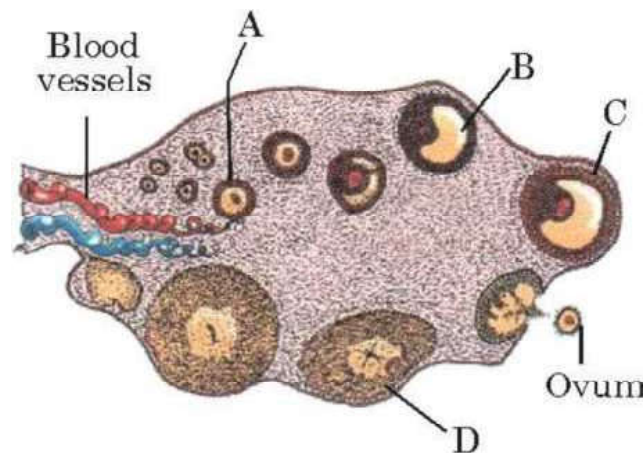
b) Rate of decomposition is controlled by the chemical composition of the detritus, climatic condition where the detritus is present = $\frac{1}{2} + \frac{1}{2}$

c) rate of decomposition is faster when detritus is rich in nitrogen, water soluble substances (sugar), warm and moist environment = $\frac{1}{2} \times 3$

[3Marks]

SECTION D

22. Study the transverse section of human ovary given below and answer the questions that follow :



- (a) Name the hormone that helps in the growth of A \rightarrow B \rightarrow C.
- (b) Name the hormone secreted by A and B.
- (c) State the role of the hormone produced by D

Ans. a) Gonadotropins // FSH and LH = 1

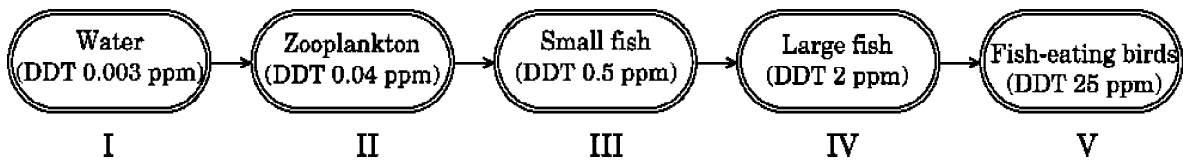
b) Estrogen = 1

c) Maintenance of uterine endometrium = 1

[3 Marks]

23. Indiscriminate use of chemicals, pesticides and weedicides by humans are polluting our water bodies, which in turn are harming the living organisms. Study the flow chart and an-

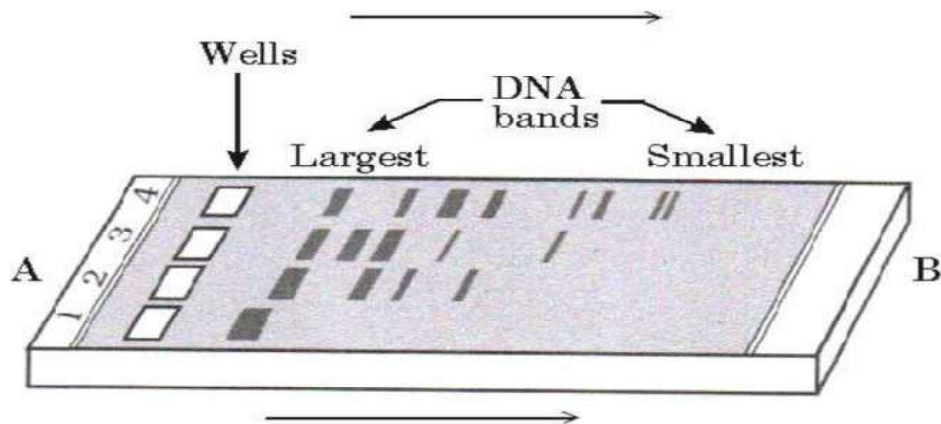
swer the questions based on it



- Why does the concentration of DDT seem to be considerably high in the top consumer ?
- How would the organisms at the highest level be affected ?
- Name the phenomenon observed

- Ans. a) DDT cannot be metabolised or excreted so gets accumulated by an organism , increase in concentration at successive trophic levels $=\frac{1}{2} \times 2$
- b) Disturb calcium metabolism in fish eating birds / causes thinning of egg shell , premature breaking of eggs leading to population decline $=\frac{1}{2} \times 2$
- c) Biomagnification =1 [3 Marks]

24. Given below is the diagram representing the observations made for separating DNA fragments by Gel electrophoresis technique. Observe the illustration and answer the questions that follow :



- Why are the DNA fragments seen to be moving in the direction A → B ?
- Write the medium used on which DNA fragments separate.
- Mention how the separated DNA fragments can be visualised for further technical use.

- Ans. a) Because the DNA fragments are negatively charged =1
- b) Agarose gel =1
- c) After staining DNA with ethidium bromide, followed by exposure to UV rays $=\frac{1}{2} \times 2$

[3 Marks]

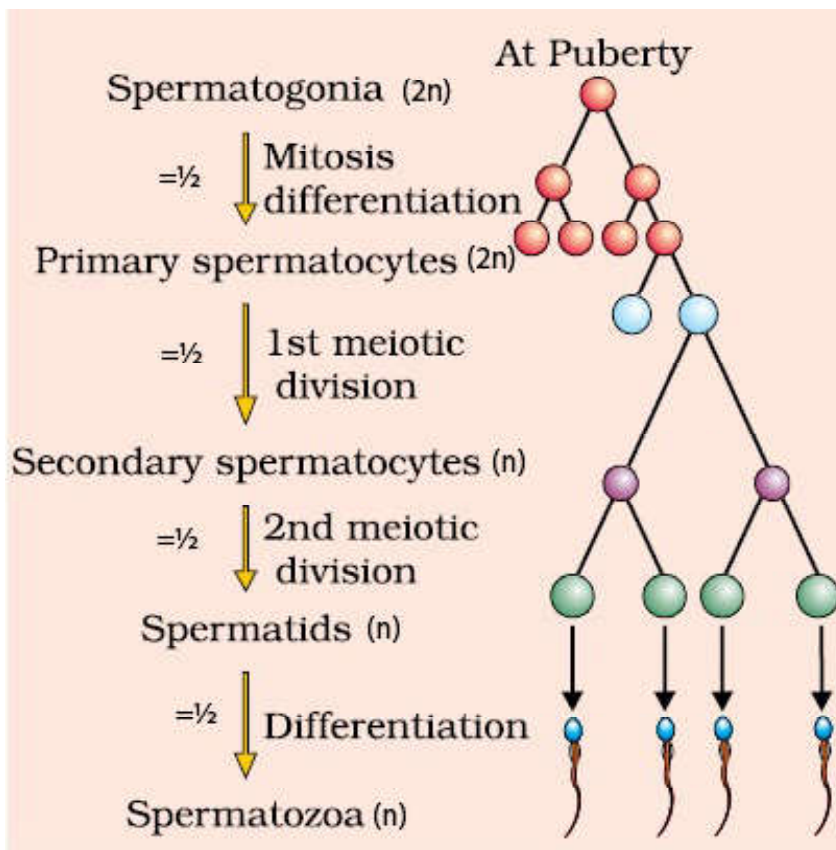
SECTION E

25. (a) When does the process of spermatogenesis begin in human males ? Describe the process of spermatogenesis.
- (b) Explain the role of gonadotropin in this process.

Ans. a) At puberty $=\frac{1}{2}$

The spermatogonia (sing. spermatogonium) present on the inside wall of seminiferous tubules multiply by mitotic division and increase in numbers, some of the spermatogonia ($2n$) called primary spermatocytes periodically undergo meiosis, a primary spermatocyte completes the first meiotic division (reduction division) leading to formation of two equal haploid cells called secondary spermatocytes, the secondary spermatocytes undergo the second meiotic division to produce four equal haploid spermatids, the spermatids are transformed into spermatozoa (perms) by the process called spermiogenesis $=\frac{1}{2} \times 5$

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($\frac{1}{2}$ marks to be awarded for ploidy)

- b) LH acts at the Leydig cells and stimulates synthesis and secretion of androgens / testosterone, which stimulates the process of spermatogenesis, FSH acts on the Sertoli cells, and stimulates secretion of some factors which help in the process of spermiogenesis $=\frac{1}{2} \times 4$

[5 Marks]

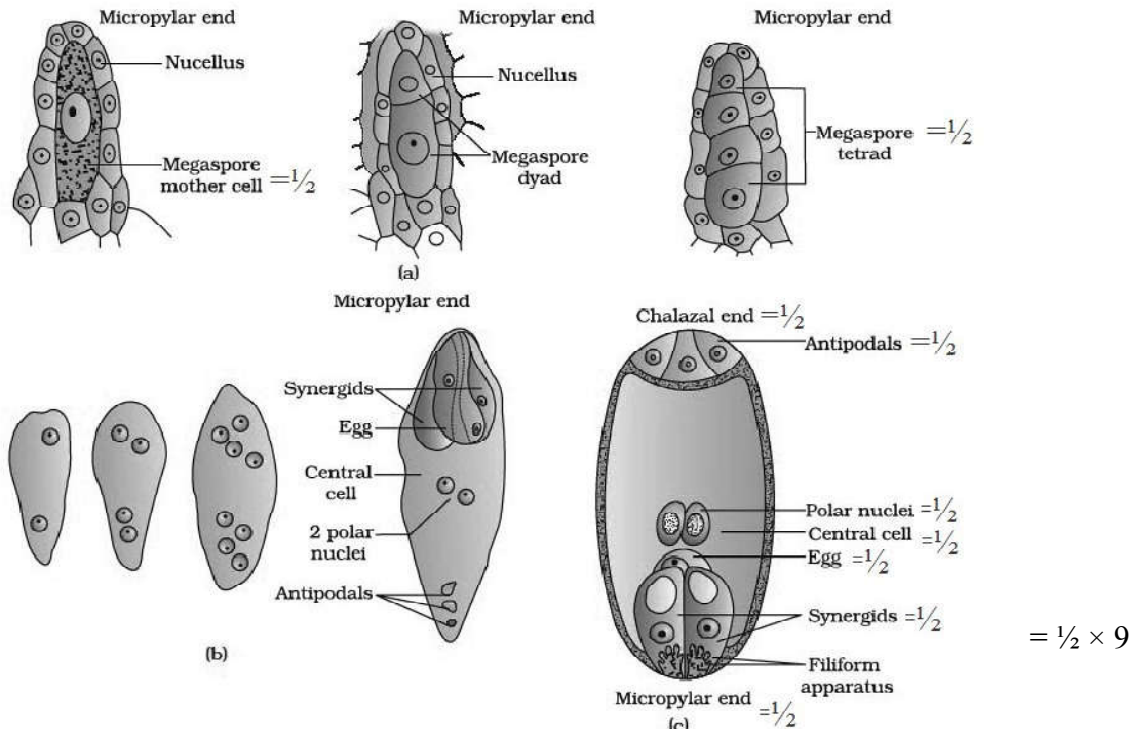
OR

Where does megasporogenesis occur in the ovule of an angiosperm? Describe the process up to the development of a mature embryo sac.

Ans. a) Occurs in the nucellus (towards the micropylar end) = $\frac{1}{2}$

A single megaspore mother cell (MMC) undergoes meiotic division, results in the production of four megaspores, one of the megaspores is functional while the other three degenerate, this type of megasporogenesis is monosporic, the nucleus of the functional megaspore divides mitotically to form the 8-nucleate stages of the embryo sac, six of the eight nuclei are surrounded by cell walls, the remaining two polar nuclei remain in the large central cell, the three cells at the micropylar end are the two synergids and one egg cell, three cells at the chalazal end are called the antipodals (a typical angiosperm embryo sac at maturity is 8-nucleate and 7-celled) = $\frac{1}{2} \times 9$

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[5 Marks]

26. (a) According to ecologists, tropical regions in the world account for greater biological diversity. Justify.
- (b) Why are habitat loss and alien species invasion considered as the causes of biodiversity loss? Explain with the help of an example of each.

- Ans. a)** (i) have remained relatively undisturbed for millions of years / had a long evolutionary time for species diversification =1
(ii) environment less seasonal / more constant and predictable / such constant environment promotes niche specialization =1
(iii) more solar energy available in the tropics contributes to higher productivity and greater diversity =1

b) habitat loss

Amazon rain forest is being cut for cultivating soyabeans / degradation of habitat by pollution / human activities leading to clearing of forests for commercial or tourism purpose =1 (any other relevant example)

Alien species invasion-

The Nile perch introduced into Lake Victoria in East Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake / Recent illegal introduction of the African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers / lantana / water hyacinth / carrot grass / causes threat of our indigenous species =1

(any other relevant example)

[5 Marks]

OR

- (a) **What is an ecological succession ?**
(b) **Differentiate between primary and secondary succession. Why is secondary succession faster than primary succession ? Explain with suitable examples.**
(c) **What are pioneer species ? Give examples of pioneer species in Xerarch and Hydrarch successions respectively.**

Ans. a) The gradual and fairly predictable change in the species composition of a given area is called ecological succession =1

b) Primary succession

Starts in an area where
no living organisms
ever existed /
bare rock / newly created pond /
reservoir / bare area

Secondary succession

Areas that somehow
lost all the living organisms
that existed there /
abandoned farmlands /
flooded field area / burnt forest =1

Secondary succession is faster since some soil or sediment is already present =1

eg. abandoned lands/ burnt or cut forests/ lands that have been flooded = $\frac{1}{2}$

c) The species that invade a bare area are called pioneer species = $\frac{1}{2}$

Xerarch- lichens , Hydrarch- phytoplanktons = $\frac{1}{2} \times 2$

[5 Marks]

27. (a) Name the type of DNA that forms the basis of DNA fingerprinting and mention two features of this DNA.

(b) Write the steps carried out in the process of DNA fingerprinting technique, and men-

tion its application.

Ans. a) Satellite DNA / repetitive DNA = $\frac{1}{2}$

These sequences normally do not code for any proteins, these sequence show high degree of polymorphism = $\frac{1}{2} \times 2$

b) (i) isolation of DNA,

(ii) digestion of DNA by restriction endonucleases,

(iii) separation of DNA fragments by electrophoresis,

(iv) transferring (blotting) of separated DNA fragments to synthetic membranes such as nitrocellulose or nylon,

(v) hybridisation using labelled VNTR probe,

(vi) detection of hybridised DNA fragments by autoradiography = $\frac{1}{2} \times 6$

Application - Forensic science / determining population and genetic diversities / paternity test = $\frac{1}{2}$

[5 Marks]

OR

Explain the role of different genes in a lac operon, when in a 'Switched On' state.

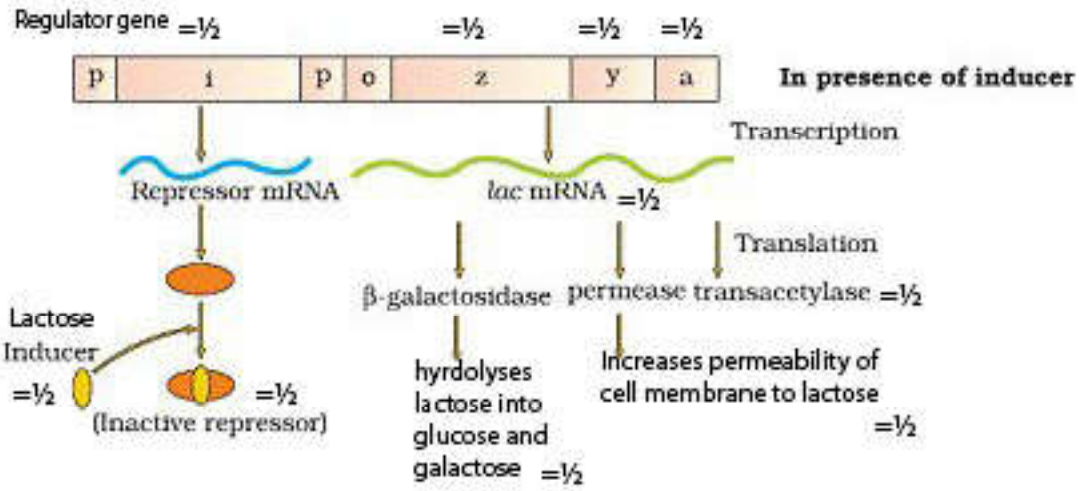
Ans. The regulator gene produces repressor, inactivated in the presence of inducer, that is lactose, RNA polymerase then gets access to the promoter gene and transcription proceeds = $\frac{1}{2} \times 4$

z gene codes for beta-galactosidase (β -gal), responsible for the hydrolysis of the disaccharide lactose into galactose and glucose = $\frac{1}{2} \times 2$

y gene codes for permease, which increases permeability of the cell to β -galactosides / lactose = $\frac{1}{2} \times 2$

a gene encodes enzyme transacetylase = 1

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[$\frac{1}{2} \times 10 = 5$ Marks]