

Question Paper Code. 57/3/2

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

SECTION A

1. 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]

2. 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) Stimulant

Ans. A / Depressants = 1

[1 Mark]

3. After spermiogenesis, the sperm heads get embedded in which of the following cells ?

(A) Leydig cells

(B) Sertoli cells

(C) Germinal epithelium

(D) Seminal vesicle

Ans. (B) / Sertoli cells

[1Mark]

4. 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]

5. 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]

SECTION B

6. 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) = $\frac{1}{2} \times 3$

[2 Marks]

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]

7. (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]

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

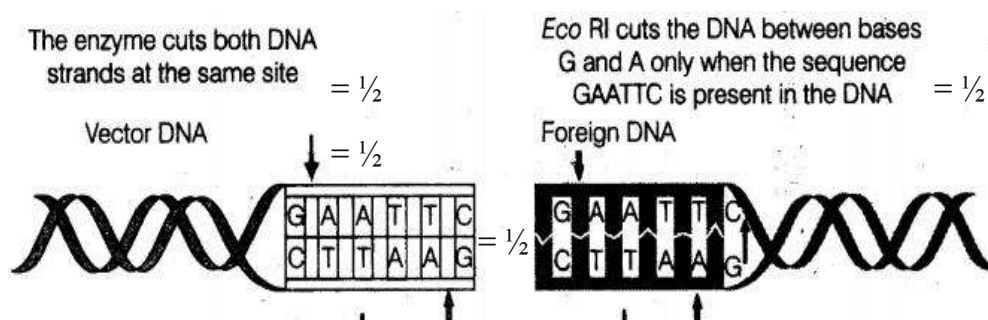
Ans. Grown in waste water from potato processing plants (starch rich) /straw / molasses / animal manure/ sewage (any two) // bioreactor, using any two above mentioned materials = 1+1

[2Marks]

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 sugar-phosphate backbones = $\frac{1}{2} \times 4$

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[2Marks]

10. Name any two autotrophic microbes and state how they serve as biofertilizers.

Ans. *Anabaena / Nostoc / Oscillatoria* (any two) = $\frac{1}{2} + \frac{1}{2}$ (any other relevant example) Fix atmospheric nitrogen, add organic matter to the soil = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

11. How is the study of fossils an evidence of evolution of life forms which have taken place on the Earth? Explain giving two reasons.

Ans. A study of fossils in different sedimentary layers indicate that different types of organisms existed in different geological period, the life-forms varied over time and certain life forms are restricted to certain geological time span = 1 x 2

[2 Marks]

12. How is the normal human body temperature of 37°C maintain during (i) Summer, and (ii) Winter? Explain.

Ans. (i) In summer we sweat (profusely), evaporation causes cooling = $\frac{1}{2} \times 2$

(ii) We start to shiver a kind of exercise, which produces heat = $\frac{1}{2} \times 2$

[2 Marks]

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. Explain double fertilization in an angiosperm.

Ans. After entering one of the synergids the pollen tube releases the two male gametes, one of the male gametes moves towards the egg cell, fuses with its nucleus thus completing the syngamy and forms a diploid zygote, the other male gamete moves towards the two polar nuclei in the central cell and triple fusion occur, resulting in formation of primary endosperm nucleus, syngamy and triple fusion occurring in the embryo sac is double fertilization = $\frac{1}{2} \times 6$

[3 Marks]

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

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

- 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 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]

17. Differentiate between Dominance, Incomplete dominance and Co-dominance with the help of a suitable example of each.

Ans. Dominance	Incomplete Dominance	Co-dominance
In heterozygous condition one allele of the trait dominates the other one	In heterozygous condition one allele is not completely dominating the other and an intermediate phenotype is expressed.	In heterozygous condition both the alleles are equally expressed
Eg. In pea heterozygous tall plant / Tt condition- T	Eg. In Heterozygous Rr condition of snapdragon	Eg. In heterozygous $I^A I^B$ condition both alleles I^A

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 = $\frac{1}{2}$

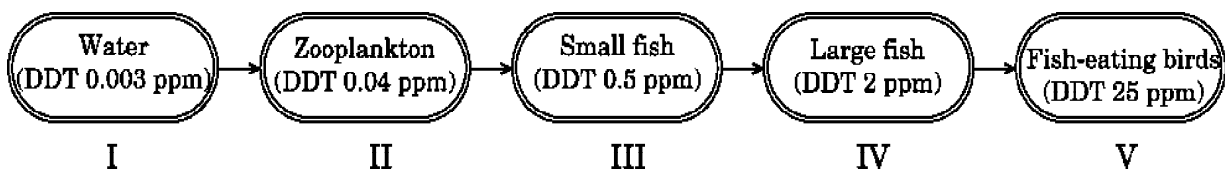
b) lymphocytes from the blood of the patient are grown in a culture medium outside the body, a functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes which are subsequently returned to the patient, patient requires periodic infusion of such genetically engineered lymphocytes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

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]

SECTION D

22. **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 answer the questions based on it.**



(a) **Why does the concentration of DDT seem to be considerably high in the top consumer ?**

(b) **How would the organisms at the highest level be affected ?**

(c) **Name the phenomenon observed.**

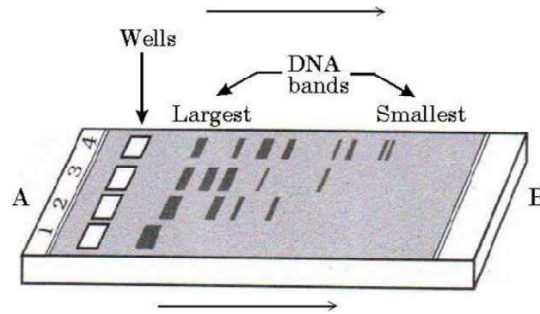
Ans. a) DDT cannot be metabolised or excreted so gets accumulated by an organism , increase in concentration at successive trophic levels = $\frac{1}{2} \times 2$

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]

23. **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.

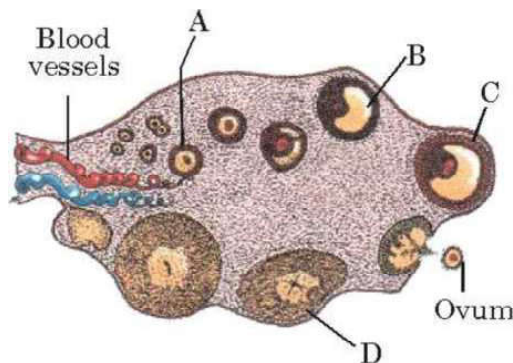
Ans. a) Because the DNA fragments are negatively charged =1

b) Agarose gel =1

c) After staining DNA with ethidium bromide, followed by exposure to UV rays = $\frac{1}{2} \times 2$

[3 Marks]

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



- Name the hormone that helps in the growth of A → B → C.
- Name the hormone secreted by A and B.
- 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]

SECTION E

25. Name the type of DNA that forms the basis of DNA fingerprinting and mention two features of this DNA. Write the steps carried out in the process of DNA fingerprinting technique, and mention 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 = $\frac{1}{2}$

[5Marks]

OR

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

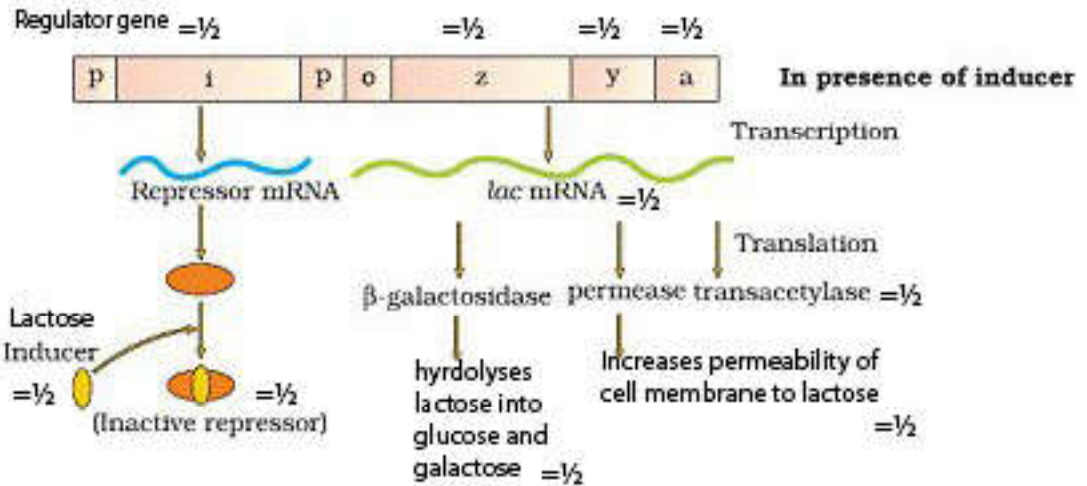
Ans. The regulator gene produces repressor, inactivated in the presence of inducer, that is lactose, RNA polymerase then gets access to the promoter gene and transcription proceeds = $\frac{1}{2} \times 4$

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]

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 / water hyacinth / lantana / carrot grass / causes threat to 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. Where does fertilization occur in the oviduct of a human female ?

Describe the process of fertilization.

Ans. • Ampullary isthmus junction / ampullary region of oviduct =1

- Sperm comes in contact with the zona pellucida layer of the ovum , induces changes in the membrane, blocks the entry of additional sperms/ it ensures entry of one sperm, secretion of acrosome help the sperm enter into the cytoplasm of the ovum , induces the completion of the meiotic division of the secondary oocyte, the unequal second meiotic division results in the formation of a smaller second polar body and a larger haploid ovum (ootid), the haploid nucleus of the sperm and that of the ovum fuse together, to form the diploid zygote = $\frac{1}{2} \times 8$

[5 Marks]

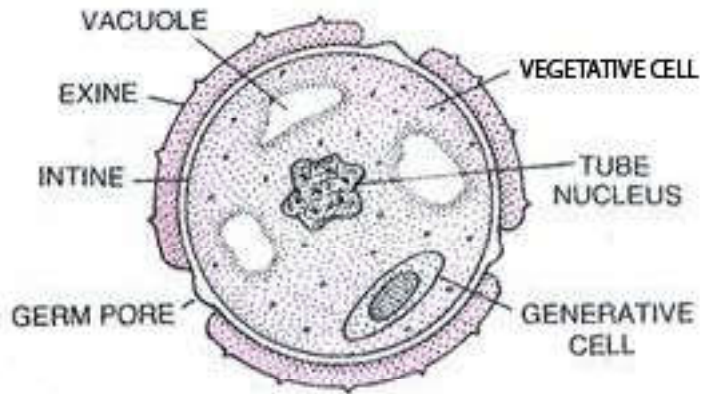
OR

- (a) Where does microsporogenesis occur in an angiosperm ? Describe the process of microsporogenesis.
- (b) Draw a labelled diagram of the two-celled male gametophyte of an angiosperm. How is the three-celled male gametophyte different from it ?

(a) Microsporangium / sporogenous tissue / PMC = $\frac{1}{2}$

Each cell of the sporogenous tissue acts as microspore mother cell, undergoes meiosis forming tetrad of haploid microspore, as the anthers mature the tetrad dissociates and develop into pollen grains = $\frac{1}{2} \times 3$

(b)



(any five) = $\frac{1}{2} \times 5$

Three celled male gametophyte has one vegetative cell and two male gametes (instead of a generative cell) = $\frac{1}{2}$

[5 Marks]