

Question Paper Code 57 (B)

SECTION A

1. How is sporopollenin in the exine beneficial to the pollen grain ?

Ans. Protection against drastic environmental conditions / can withstand high temperatures and strong acids and alkali = 1  
[1 mark]

2. Mention the two favourable conditions that break dormancy of seeds.

Ans. Adequate moisture/ oxygen/ suitable temperature (any two) =  $\frac{1}{2} + \frac{1}{2}$   
[1 mark]

3. How many mitotic divisions occur in the formation of the embryo sac in flowering plants ? State the characteristic feature of these mitotic divisions.

Ans. Three (mitotic divisions) , free nuclear =  $\frac{1}{2} + \frac{1}{2}$   
[1 mark]

4. Write the technical term and the type of pollination when pollen grains are transferred from the anther to the stigma of another flower of the same plant.

Ans. Geitonogamy, cross pollination =  $\frac{1}{2} + \frac{1}{2}$   
[1 mark]

5. Why did Mendel use true-breeding pea lines in his artificial/cross pollination experiments ?

Ans. Inheritance of stable traits, and expression in several generations =  $\frac{1}{2} + \frac{1}{2}$   
[1 mark]

6. Name the disorder in a human having XO type of sex chromosomes.

Ans. Turner's syndrome = 1  
[1 mark]

7. Name the bond that links the nitrogenous base and pentose sugar in a nucleoside.

Ans. N-glycosidic bond = 1  
[1 mark]

8. Mention the significance of elution in gel electrophoresis.

Ans. Separated bands of DNA cut out from agarose gel and extracted from gel piece = 1  
[1 mark]

9. Write the scientific name of the source organism for 'cry' genes.

Ans. *Bacillus thuringiensis* = 1  
[1 mark]



10. Write one difference between eurythermal and stenothermal organisms.

Ans. Eutherms survive in wide range of temperature, while stenotherms are restricted to narrow range of temperature =  $\frac{1}{2} + \frac{1}{2}$

[1 mark]

For questions number 11 to 14, two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is *not* the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Both Assertion (A) and Reason (R) are false.

11. (a) **Assertion (A):** In Griffith's experiment, R-strain bacteria had somehow been transformed by the heat-killed S-strain bacteria.

**Reason (R):** Some non-transforming principle from heat-killed S-strain enabled R-strain to become virulent.

Ans. C // Assertion is true but reason is false = 1

[1 mark]

OR

(b) **Assertion (A):** The possibility of a female becoming a haemophilic is extremely rare.

**Reason (R):** Mother of such a female is unviable in the later stage of life.

Ans. C // Assertion is true but reason is false = 1

[1 mark]

12. **Assertion (A) :** Transgenic mice are used in testing the safety of vaccines before they are used on humans.

**Reason (R) :** If successful and found to be reliable, mice could replace monkeys.

Ans. A-Assertion is true and reason is the correct explanation of assertion = 1

[1 mark]

13. **Assertion (A) :** Organisms living in oceans, lakes and rivers do also face water-related problems, very much like those living on land.

**Reason (R) :** The quality (chemical composition, pH) and salinity is important for aquatic organisms.

Ans. A // Assertion is true and reason is the correct explanation of assertion = 1

[1 mark]

14. **Assertion (A) :** Adaptation of the organism is always morphological changes only that enable it to survive and reproduce in its habitat.

**Reason (R) :** Because only morphological changes inherited.

4 - B - 2021



Ans. D // Both assertion and reason are false =1

[1 mark]

*Questions no. 15 and 16 contains five sub-parts each. You are expected to answer any four sub-parts in each of these questions.*

15. Read the following passage and answer any *four* questions from 15 (i) to 15 (v) given below :

The predator-prey relationship is the interaction between two species and their consequent effect on each other. In this relationship, the predator species feeds on the other species called the prey species. Prey may be a plant or an animal and therefore the predator is either a herbivore or a carnivore respectively. Some examples of predator and prey are lion and zebra, bear and fish, fox and rabbit, bear and berry, rabbit and lettuce, grasshopper and leaf. Predator and prey share the same environment and therefore tend to evolve together. To ensure that they get to eat and survive, the predators have evolved various means like speed, stealth, camouflage, a good sense of smell, sight or hearing, immunity to the prey's poison and produce poison (to kill the prey). In turn prey too have evolved with adaptations that ensure their safety and protection. Some of these adaptive features are speed, camouflage, a good sense of smell, sight or hearing, thorns, poison (to spray when approached or bitten), etc. An example of camouflage : in the snowy environment, the polar bear is white to avoid being noticed. Another example is the Galapagos tortoise which feeds on the branches of cactus plant that also grow in the Galapagos islands. On one of the islands, where long-necked tortoises live, the branches are higher off the ground. On the other hand, where short-necked tortoises live, the branches are lower down. The cacti which are the prey may have evolved high branches so that the tortoises, the predators, cannot reach them.

(i) Which one of the following does *not* have a predator-prey relationship ?

- (A) Lion and zebra
- (B) Bear and fish
- (C) Fox and rabbit
- (D) Cow and deer

Ans. i) D // Cow and deer

(ii) Biological control methods are adopted from which of the following population interactions ?

- (A) Mutualism
- (B) Competition
- (C) Predation
- (D) Commensalism

Ans. ii) C // Predation

(iii) Which one of the following adaptations have the predator and prey *not* evolved with for their survival ?

5 - B - 2021



- (A) Speed
- (B) Camouflage
- (C) A good sense of smell, sight or hearing
- (D) Change their choice of food

Ans. iii) D // change their choice of food

(iv) Which one of the following exhibits the correct predator-prey relationship ?

- (A) Bear and lettuce
- (B) Rabbit and leaf
- (C) Grasshopper and berry
- (D) Galapagos tortoise and cactus

Ans. iv) D // Galapagos tortoise and cactus

(v) Assertion (A) : Predator and prey do not evolve together.

Reason (R) : As they share the same environment, they tend to face extinction.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is *not* the correct explanation of the Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Both Assertion (A) and Reason (R) are false.

Ans. v) D // Both assertion and reason are false

(Any four) = 1×4

[1 × 4 = 4 marks]

16. Read the following passage and answer any *four* questions from 16(i) to 16(v) given below :

Down's Syndrome was first identified and described by John Langdon Down. It is a chromosomal disorder, caused due to failure of segregation of chromatids during cell division resulting in gain of an extra copy of chromosome 21 in an ovum or a sperm. When such an ovum (or a sperm) is fertilised with a respective normal gamete, the zygote produced will have three copies of chromosome 21 instead of two. This is called trisomy of 21<sup>st</sup> chromosome. The resulting zygote will have 47 chromosomes instead of 46 and will develop into a person with Down's Syndrome.

Statistical data shows that the incidence of Down's Syndrome is seen in 600 to 1000 live births in all races and economic groups. The physical features and medical problems associated with Down's Syndrome can vary widely from child-to-child. Most people with Down's Syndrome have IQs that fall in the mild to moderate range of mental retardation. They may have delayed language development and slow motor development. Some common physical signs of Down's Syndrome are flat face with an upward slant of the eye, short neck and abnormally shaped ears, small hands and feet, deep crease in the palm of the hand; poor muscle tone, loose ligaments and white spots on the iris of the eye.

6 - B - 2021



(i) Down's Syndrome is a congenital anomaly associated with :

- (A) X-chromosome
- (B) autosomal chromosome
- (C) cytoplasm
- (D) Y-chromosome

Ans. i) B // autosomal chromosome

(ii) Down's Syndrome is named after :

- (A) Schleiden and Schwann
- (B) Gregor Mendel
- (C) John Langdon
- (D) Sutton and Boveri

Ans. ii) C // John Langdon

(iii) The number of chromosomes in each cell of a person with Down's Syndrome is :

- (A) 45
- (B) 46
- (C) 44
- (D) 47

Ans. iii) D // 47

(iv) Affected Down's Syndrome persons have :

- (A) dark spots on the iris of the eye.
- (B) early language development.
- (C) low muscle tone.
- (D) normal IQs.

Ans. iv) C // Low muscle tone

(v) Assertion (A) : Trisomy of chromosome 21 results in Down's Syndrome.

Reason (R) : Trisomy of chromosome 21 occurs when a zygote is formed as a result of fusion of three cells, each with one copy of chromosome 21.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is *not* the correct explanation of the Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Both Assertion (A) and Reason (R) are false.

Ans. v) C // Assertion (A) is true, but Reason (R) is false.

(Any four) =  $1 \times 4$

( $1 \times 4 = 4$  marks)

7 - B - 2021



## SECTION B

17. Name any two copper-releasing IUDs and their functions.

Ans. Cu T, Cu 7, multiload 375 (any two) =  $\frac{1}{2} \times 2$

Suppress sperm motility, fertilising capacity of sperm =  $\frac{1}{2} \times 2$

[ $\frac{1}{2} \times 4 = 2$  marks]

18. (i) Name the pattern of inheritance in snapdragon with respect to flower colour.

(ii) Write the genotype of snapdragon plants bearing pink flowers and red flowers.

Ans. (i) Incomplete dominance, = 1

(ii) Pink – Rr,

Red – RR =  $\frac{1}{2} \times 2$

[1 + 1 = 2 marks]

19. Write the full form of LAB. How is it beneficial to us ?

Ans. Lactic acid bacteria, LAB produces acids, that coagulate and partially digest milk proteins, increase Vitamin B12 =  $\frac{1}{2} \times 4$

[2 marks]

20. (a) What is a plasmid? State its importance in biotechnology.

Ans. Autonomously replicating, circular extra chromosomal DNA =  $\frac{1}{2} \times 2$

Acts as a cloning vector / it delivers a piece of alien (foreign gene) into the host cell = 1

[1 + 1 = 2 marks]

OR

(b) Explain the role of selectable markers in pBR322.

Ans. Helps in identifying and eliminating non-transformants, and selectively permitting the growth of transformants = 1 + 1

[2 marks]

21. How does 'EcoRI' act on the DNA segment? Explain.

Ans. Find specific recognition sequence in DNA, cuts DNA between the bases when the sequence GAATTC is present / palindromic nucleotide sequence producing sticky ends

[1 + 1 = 2 marks]

22. (a) How is the insulin produced by 'r-DNA' technology different from proinsulin produced in our body?

Ans. Insulin produced by r - DNA technology have polypeptide chains 'A' & 'B' linked by di-sulphide bond, Pro-insulin - has an additional 'C' peptide = 1 + 1

[2 marks]

OR

(b) Expand ELISA. State the principle on which ELISA test is based.

8 - B - 2021



Ans. Enzyme Linked Immuno Sorbent Assay , antigen - antibody interaction = 1 + 1

[2 marks]

**23. How does addiction to drugs occur ? What happens when drugs are abruptly discontinued ?**

Ans. Drugs – temporary feeling of well being , with repeated use the tolerance level of the receptors present in our body increases , consequently the receptors respond only to higher doses of drugs leading to greater intake and addiction.

When drugs are abruptly discontinued body manifests characteristics unpleasant withdrawal syndrome =  $\frac{1}{2} \times 4 = 2$

[2 marks]

**24. “Tropics account for greater biological diversity than temperate regions.” Give two reasons in support of this statement.**

- Ans. - Speciation is generally a function of time unlike temperate regions subjected to frequent glaciations in the past tropical latitudes have remained relatively undisturbed for millions of years and thus had a long evolutionary time for species diversification
- Tropical environments unlike temperate ones are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity
- There is more solar energy available in the tropics which contributes to higher productivity this in turn might contribute indirectly to greater diversity

(Any two) = 1 + 1

[2 marks]

**25. Write the scientific name of the source plant marijuana is obtained from. How does its intake affect the human body ?**

Ans. *Cannabis sativa* , effects cardiovascular system = 1 + 1

[2 marks]

### SECTION C

**26. Name the male accessory glands in the human body and mention the role played by them.**

Ans. Paired seminal vesicles, a prostate and paired bulbourethral glands =  $\frac{1}{2} \times 3$

Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium , helps in the lubrication of the penis. =  $\frac{1}{2} \times 3$

[ $1\frac{1}{2} + 1\frac{1}{2} = 3$  marks]

**27. Write the scientific name of the organism T.H. Morgan used for his experiments. How did he explain linkage and recombination of genes ?**

Ans. *Drosophila melanogaster* = 1

Linkage describes the physical association of genes on a chromosome , recombination describes the generation of non-parental gene combinations = 1 + 1

[1 + 1 = 2 marks]

**28. “Microbes are used for production of enzymes.” Mention any three such enzymes and their functions.**

9 - B - 2021



- Ans. - Lipases are used in detergent formulations and are helpful in removing oily stains = 1  
 The bottled juices are clarified by the use of pectinases and proteases = 1  
 - Streptokinase produced by the bacterium is used as a 'clot buster' = 1

[1 × 3 = 3 marks]

**29. Describe PCR technique and mention its role in biotechnology experiments.**

- Ans. - The DNA polymerase enzyme extends the primers (Two sets), using the nucleotides provided in the reaction and the genomic DNA as template,  
 - The process of replication of DNA is repeated many times, by the use of a thermostable DNA polymerase,  
 - Polymerase Chain Reaction helps in synthesising in vitro, multiple copies of the gene (or DNA) of interest

[1/2 × 6 = 3 marks]

**30. Describe Gause's 'Competitive Exclusion Principle'. Site an example supporting the principle.**

- Ans.. Two closely related species competing for the same resources cannot co-exist indefinitely, and the competitively inferior one will be eliminated eventually = 1/2 + 1/2

The Abingdon tortoise in Galapagos Islands became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats.// On the rocky sea coasts of Scotland, the larger and competitively superior barnacle *Balanus* dominates the intertidal area, and excludes the smaller barnacle *Chathamalus* from that zone. (any one example) = 1 + 1

[1 + 2 = 3 marks]

OR

**Differentiate between the two growth models of population. Which one of the two is more realistic and why?**

Ans. **Exponential growth**

- 1 When resources in the habitat are unlimited each species has the ability to realise fully its innate potential to grow in number

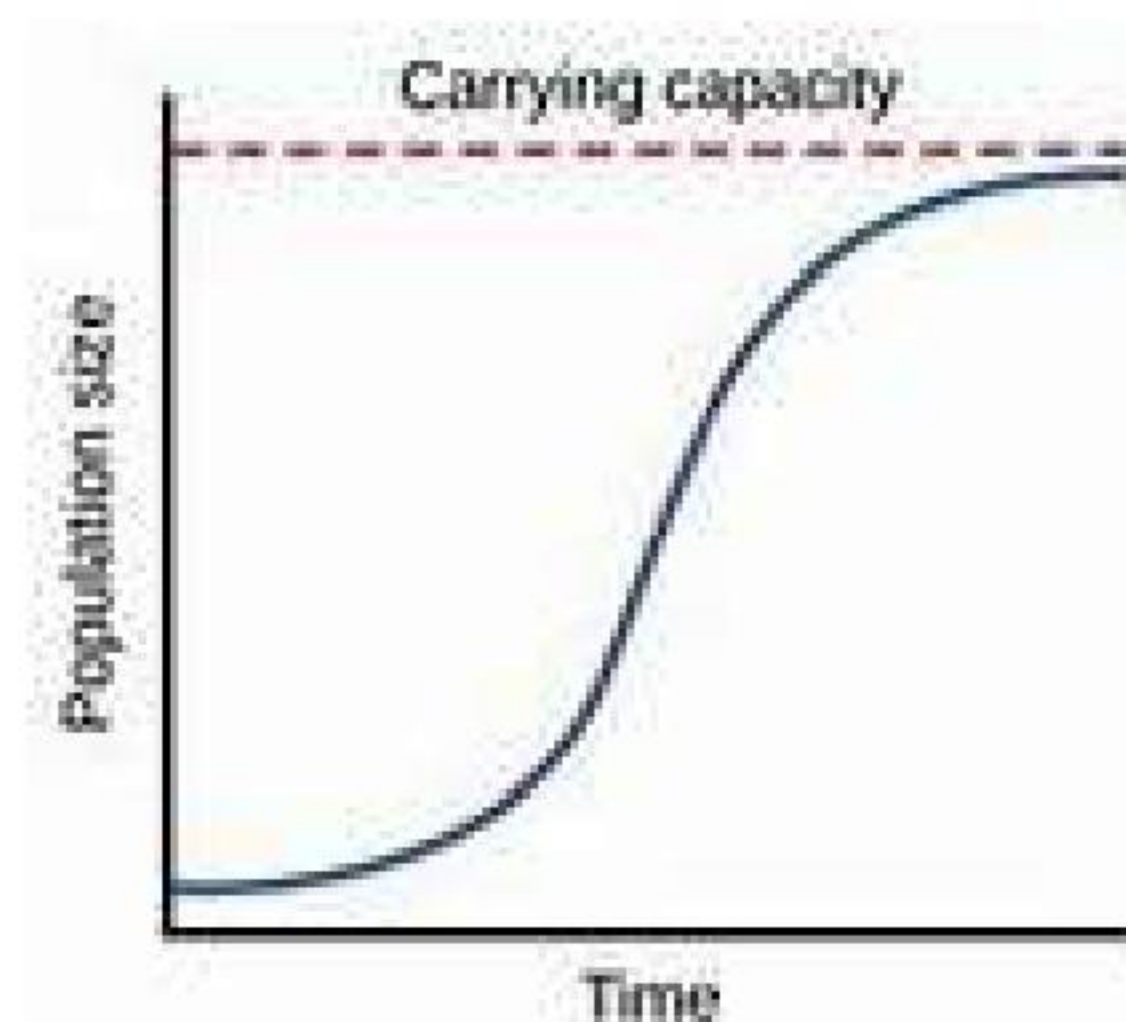
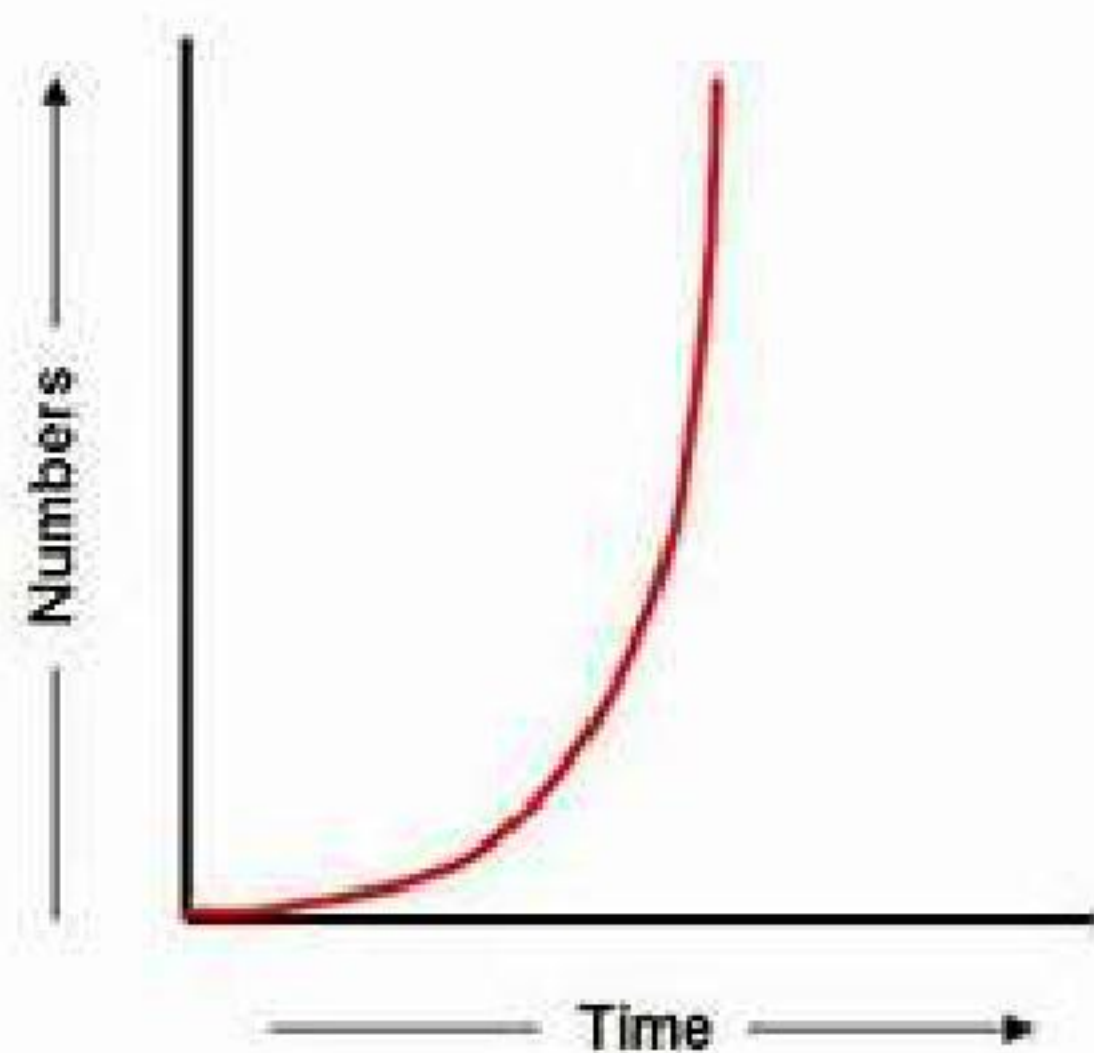
- 2 Then the population grows in an exponential or geometric fashion

**Logistic growth**

No population of any species in nature has its disposal unlimited resources to permit exponential growth

This leads to competition between individuals for limited resources eventually the 'fittest' individual will survive and reproduce

3



(Any two) = 1 × 2 = 2

10 - B - 2021





the logistic growth model is considered a more realistic one, because resources are always limited  
=  $\frac{1}{2} + \frac{1}{2}$

[2 + 1 = 3 marks]

### SECTION D

**31. At what age does the process of oogenesis begin in a human female? Describe the process up to ovulation.**

Ans. Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary (no more oogonia are formed and added after birth) =  $\frac{1}{2}$

These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage called primary oocytes, each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle, the primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles, the secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum, the primary oocyte within the tertiary follicle grows in size and completes its first meiotic division, It is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body, the tertiary follicle further changes into the mature follicle or Graafian follicle, the Graafian follicle now ruptures, to release the secondary oocyte (ovum) from the ovary by the process called ovulation =  $\frac{1}{2} \times 9$

[ $\frac{1}{2} + 4\frac{1}{2} = 5$  marks]

OR

(i) **Where do microsporogenesis and megasporogenesis occur in a flower? Differentiate between the two processes.**

(ii) **Why is megasporogenesis termed as monosporic?**

(iii) **Describe double fertilisation in angiosperms.**

Ans. i) Microsporogenesis occurs in the microsporangium of the anthers, Megasporogenesis occurs within the ovule =  $\frac{1}{2} + \frac{1}{2}$

In microsporogenesis the PMC gives rise to microspore tetrad, in megasporogenesis the MMC gives rise to one megaspore = 1

ii) Only one megaspore is functional while other three degenerate, the functional megaspore develops into female gametophyte =  $\frac{1}{2} + \frac{1}{2}$

iii) The pollen tube releases the two male gametes into the cytoplasm of the synergid, One of the male gametes fuses with the nucleus of the egg cell thus completing the syngamy and a diploid cell zygote is formed, The other male gamete fuses with the two polar nuclei located in the central cell to produce a triploid primary endosperm nucleus (PEN) termed triple fusion, Since two types of fusions syngamy and triple fusion take place in an embryo sac the phenomenon is termed double fertilization =  $\frac{1}{2} \times 4$

[1 + 1 + 1 + 2 = 5 marks]

11 - B - 2021



32. Name the scientists who proved that DNA replication is semiconservative. Explain the process of DNA replication in prokaryote.

Ans. (Matthew) Meselson, (Franklin) Stahl =  $\frac{1}{2} + \frac{1}{2}$

The replication originates at definite regions are termed as origin of replication, the replication occur within a small opening of the DNA helix, referred to as replication fork, the DNA-dependent DNA polymerases catalyse polymerisation only in one direction that is 5' to 3', on the template with polarity 3' to 5' the replication is continuous, while on the other template with polarity 5' to 3' it is discontinuous, the discontinuously synthesised fragments are later joined, by the enzyme DNA ligase =  $\frac{1}{2} \times 8$

[1 + 4 = 5 marks]

OR

Why is the Lac operon referred to as negative regulation? Explain the working of the operon in the presence of its inducer.

Ans. Lactose inactivates the repressor so its negative regulation = 1

The lac operon consists of one regulatory i gene (repressor gene) codes for the repressor of the lac operon, three structural genes z y and a, The z gene codes for beta-galactosidase ( $\hat{\alpha}$ -gal) which is primarily responsible for the hydrolysis of the disaccharide lactose into galactose and glucose, they gene codes for permease which increases permeability of the cell to  $\hat{\alpha}$ -galactosides, the a gene encodes a transacetylase, the repressor protein binds to the operator region of the operon and prevents RNA polymerase from transcribing the operon, In the presence of an inducer such as lactose or allolactose the repressor is inactivated by interaction with the inducer, this allows RNA polymerase access to the promoter and transcription proceeds =  $\frac{1}{2} \times 8$

[1 + 4 = 5 marks]

33. (a) (i) Write the mode of transmission and specific symptoms of any *three* of the following diseases :

- I. Malaria
- II. Typhoid
- III. Filariasis
- IV. Ringworm

(ii) What is a Vaccine? Write the basis on which it works to provide protection against a disease.

Ans. a) I Malaria – bite of female Anopheles mosquito carrying Plasmodium, chill and high fever =  $\frac{1}{2} \times 2$

II Typhoid- food and water (contaminated with *Salmonella typhi*), sustained high fever, stomach pain and constipation =  $\frac{1}{2} \times 2$

III Filariasis- through the bite of female mosquito vectors, chronic inflammation of lymphatic vessel of lower limbs =  $\frac{1}{2} \times 2$

IV Ringworm- soil or by using towels or clothes of infected person, scaly lesions on skin and itching =  $\frac{1}{2} \times 2$

(Any three) =  $1 \times 3$



- ii) Vaccine is a preparation of antigenic proteins of pathogen , or inactivated / weakened pathogen , vaccination is based on the property of ‘memory’ of the immune system , the antibodies produced in the body against these antigens =  $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

**OR**

- (b) **Describe the treatment that the sewage generated in our cities undergoes before its water can be released into natural water bodies.**

**Ans.** Primary treatment -involves physical removal of particles from the sewage through filtration and sedimentation, the supernatant forms the effluent and the effluent from the primary settling tank is taken for secondary treatment or Biological treatment , 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 , while growing these microbes consume the major part of the organic matter in the effluent , this significantly reduces the BOD (biochemical oxygen demand) of the effluent, the effluent is then passed into a settling tank where the bacterial ‘flocs’ are allowed to sediment and sediment is called activated sludge , a small part of the activated sludge is pumped back into the aeration tank to serve as the inoculums, other kinds of bacteria which grow anaerobically digest the bacteria and the fungi in the sludge and produces biogas , the effluent from the secondary treatment plant is generally released into natural water bodies =  $\frac{1}{2} \times 10$

[5 marks]



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