



MARCH -2023 (TS)

PREVIOUS PAPERS**IPE: MARCH-2023(TS)****Time: 3 Hours****SR BOTANY****Max. Marks: 60****SECTION-A****I. Answer ALL the following VSAQ:****10 × 2 = 20**

1. What are the physical properties of water responsible for the ascent of sap through xylem in plants?
2. What is a genophore?
3. What is point mutation? Give an example.
4. Define hydroponics.
5. What is meant by capping and tailing?
6. What is down-stream processing?
7. The proportion of nucleotides in a given nucleic acid are: Adenine 18%, uanine 30%, Cytosine 42%, and Uracil 10%. Name the nucleic acid and mention the number of strands in it.
8. What is green revolution? Who is regarded as Father of green revolution?
9. Which two species of sugarcane were crossed for better yield?
10. Name the scientists who were credited for showing the role of penicillin as an antibiotic.

SECTION-B**II. Answer any SIX of the following SAQs:****6 × 4 = 24**

11. Explain the steps involved in the formation of root nodule.
- 12*. Draw a neat labelled diagram of chloroplast.
13. Explain different types of cofactors.
14. What is ICTV? How are viruses named?
- 15*. Give a brief account of Bt cotton
16. Explain the Co-dominance with example.
17. Write short notes on seed dormancy.
18. How many types of RNA polymerases exist in cells? Write their names and functions.

SECTION-C**II. Answer any TWO of the following SAQs:****2 × 8 = 16**

19. Explain Calvin cycle.
20. Give a brief account of the tools of recombinant DNA technology.
21. Write a brief essay on microbes in sewage treatments?

ipe ts march-2023

SOLUTIONS

SECTION-A

1. What are the physical factors responsible for the ascent of sap through xylem in plants?

A: Physical factors responsible for the ascent of sap: [TS 17, 23]

- 1) **Cohesion:** It is due to mutual attraction between water molecules.
- 2) **Adhesion:** It is due to attraction of water molecules to the surface of tracheal elements.
- 3) **Transpiration pull:** It is due to driving force for upward movement of water.

2. What is a genophore? [TS 23][AP 19,22]

A: Genophore: The main genetic material of bacteria is called genophore (Bacterial chromosome).

3. What is point mutation? Give an example. [TS 19, 23]

A: 1) **Point mutation:** It is the mutation that occurs in a single base pair of DNA fragment.
2) **Ex:** Sickle cell anemia.

4. Define hydroponics. [TS 23][MAR-14]

A: Hydroponics: The technique of growing plants in a specified nutrient solution is known as hydroponics.

5. What is meant by capping and tailing? [TS 16,23][AP 17,23]

A: 1) **Capping:** Adding of an unusual nucleotide (methyl guanosine triphosphate) to the 5'-end of hnRNA is called Capping.
2) **Tailing:** Adding of adenylate residues (200-300) to the 3'-end in a template is called tailing.

6. What is down-stream processing?

[AP 16,17,19,19][TS 16,17,23]

A: Separation and purification of products before they are ready for marketing is called down streaming processing.

7. The proportion of nucleotides in a given nucleic acid are: Adenine 18%, Guanine 30%, Cytosine 42%, and Uracil 10%. Name the nucleic acid and mention the number of strands in it.

[TS 17,23] [AP 18]

A: (a) RNA (b) Only one strand

8. What is green revolution? Who is regarded as Father of green revolution?

[TS 15,17,20,23]

A: 1)The creation and utilisation of high yielding varieties in the field of agriculture, substantial and dramatic increase in agricultural production is called green revolution.

2)Norman Borlaug is regarded as Father of green revolution.

9. Which two species of sugarcane were crossed for better yield?

[TS 23]

A: Saccharum barberi and Saccharum officinarum were crossed to get better yield.

10. Name the scientists who were credited for showing the role of penicillin as an antibiotic.

A: 1) Alexander Fleming discovered Penicillin.

[TS 19,23]

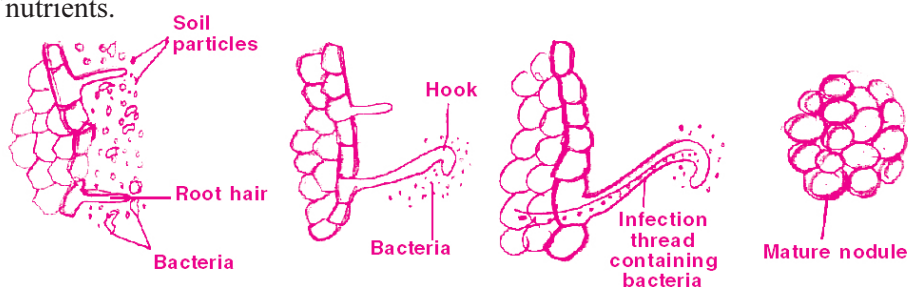
2) Ernest chain and Howard Florey established the role of penicillin as an antibiotic.

SECTION-B

11. Explain the steps involved in the formation of root nodule.

A: Steps involved in the formation of root nodule: [AP 17, 19,23][TS 16,17,20,23]

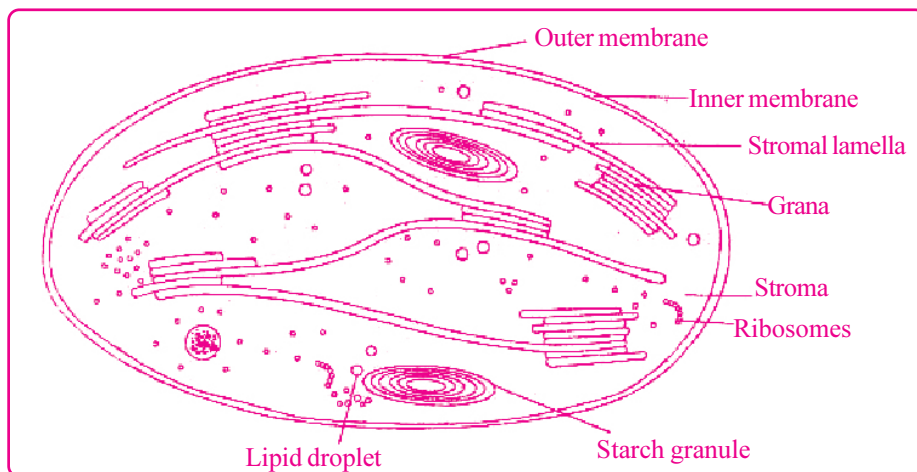
- 1) The roots of host Legume release sugars and amino acids.
- 2) These sugars attract Rhizobia.
- 3) They multiply, colonise and get attached to the epidermis of root hair cells.
- 4) The root hairs curl and bacteria spread into the cortex of the root.
- 5) Then an infection thread is produced.
- 6) It carries the bacteria into the cortex.
- 7) The bacteria initiate nodule formation in the cortex of the root.
- 8) Then the bacteria present in the cortical cells, stimulate the host cells to divide.
- 9) This leads to the differentiation of specialised nitrogen fixing cells, which form root nodule.
- 10) The nodule thus formed establishes a direct vascular connection with the host, for exchange of nutrients.



12*. Draw a neat labelled diagram of Chloroplast.

[TS 23][AP 22][IPE -14]

A:

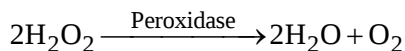


13. Explain different types of cofactors.**[TS 19,22,23][AP 16,22]****A:** The **non-protein** part of the holo enzyme is called **co-factor**.

The co-factors are three types: 1) Prosthetic groups 2) Co-enzymes 3) Metal ions.

1) Prosthetic groups: These are organic compounds which are tightly bound to the apoenzyme**Ex:** Peroxidase is the enzyme which breaks hydrogen peroxide into water and oxygen.

Prosthetic group of peroxidase is Haem part.

**2) Co-enzymes:** These are organic compounds, which are loosely attached to the apoenzyme.

These co-enzymes are derived from water soluble vitamins.

Ex: Both co-enzymes NAD and NADP contain the vitamin niacin.**3) Metal ions:** A number of enzymes require metal ions for their activity.

They form coordination bonds with side chains at the active site.

Ex: Zinc is the co-factor for the proteolytic enzyme carboxy peptidase.**14. What is ICTV? How are viruses named?****[AP 23] [TS 19,23]****A:** 1) **ICTV means – International Committee on Taxonomy of Viruses.**

2) It explains the classification and nomenclature of viruses.

3) ICTV has three hierarchial levels namely family, genus and species.

4) The family names end with the suffix Viridae

5) The genus names end with virus.

6) The species names are common english expressions describing their nature.

7) Sometimes viruses are named after the disease they cause. **Ex:** Polio virus.

8) According to ICTV, the virus that causes AIDS in man is classified as follows:

Family: Retroviridae, **Genes:** Lentivirus, **Species:** Human Immuno deficiency virus(HIV)**15*. Give a brief account of Bt cotton.****[AP 15,20][TS 16,17,18,20,22,23]****A:** 1) Bt cotton is a genetically modified organism (GMO) cotton variety, which produces an insecticide bollworm.

2) Bt cotton is created by using some strains of a bacterium, Bacillus thuringiensis (Bt in short form)

3) This bacterium produces proteins that kill certain insects such as lepidopterans (tobacco bud worm), coleopterans (beetles) and dipterans (flies, mosquitoes)

4) Bt forms protein crystals during a particular phase of growth. These crystals contain a toxic insecticidal protein.

- 5) Bt toxin protein exist as **inactive protoxins**, but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to **alkaline pH** of the gut which solublises the crystals.
- 6) The activated toxin binds to the surface of mid gut epithelial cells and create pores that cause cell swelling and lysis leading to death of an insect.
- 7) Specific Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into several crop plants.
- 8) Most Bt toxins are insect group specific. Hence, the toxin is coded by a gene named 'Cry'. For example, the protein encoded by the **genes Cry I Ac and Cry II Ab control the cotton bollworms and Cry I Ab controls corn borer.**

16. Explain the Co-dominance with example.

[TS 23]

A: 1) **Co-dominance:** It is the

phenomenon in which **both the genes are equally dominant.**

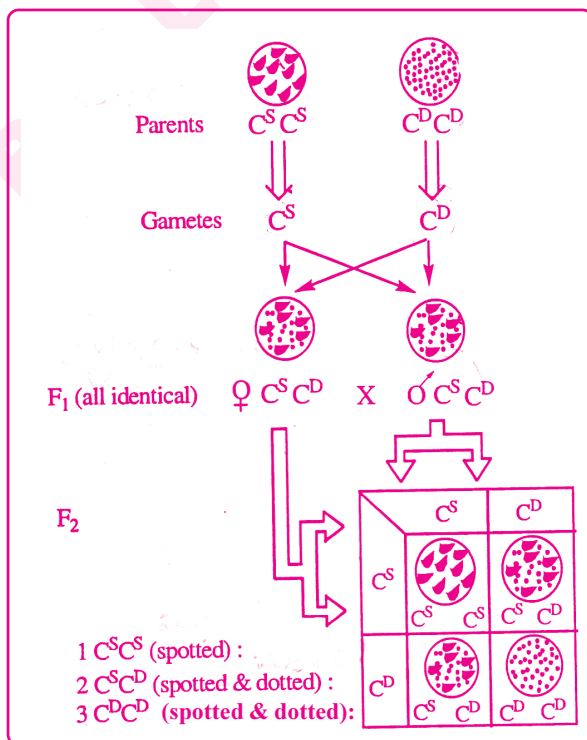
- 2) The character of both genes is well expressed in the next generation.

- 3) So, in F_1 generation, regeneration resemble both parents.

- 4) **Ex 1 :** Different types of red blood cells that determine ABO blood grouping in human beings.

- 5) **Ex 2:** Seed coat pattern and size in Lentil plants in North America.

- 6) A cross is made between pure - breeding spotted lentils and pure breeding dotted lentils.



- 7) It produced heterozygotes that are both spotted and dotted.
- 8) The F_1 hybrids show the phenotypic features of both parents.
- 9) It shows that neither the spotted nor the dotted allele is dominant or recessive to the other.

17. Write short notes on seed dormancy.**[TS 17,23]**

- A:**
- 1) **Seed dormancy:** The inability or delay of seed to germinate or grow is called seed dormancy.
 - 2) It may be due to either external factors or internal factors.
 - 3) Dormancy may be due to hard seed coat which prevents the uptake of water or oxygen.
 - 4) Certain seeds like tomato contain chemicals like lycopane which inhibit germination.
 - 5) Many seeds like polygonum will not germinate for weeks and months until they are exposed to low temperatures in moist conditions.
 - 6) The dormancy of such seeds can be lifted by stratification or prechilling treatment.
 - 7) The practice of layering the seeds in moist sand and peat during winter is called stratification
-

18. How many types of RNA polymerases exist in cells? Write their names and functions.

A: Three types of RNA polymerases in the nucleus:

[TS 17, 23]

- 1) **RNA Polymerase I :** It transcribes rRNAs (28S, 18S and 5.8S)
- 2) **RNA Polymerase II :** It transcribes the precursor of mRNA, the heterogeneous nuclear RNA (hnRNA).
- 3) **RNA Polymerase III:** It is responsible for transcription of tRNA, 5srRNA and snRNAs

SECTION-C

19. Explain Calvin cycle.(or)

Explain how Calvin worked out the complete biosynthetic pathway for the synthesis of sugar.
[TS 23]

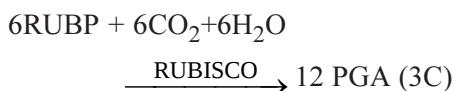
A: 1) Calvin cycle: It is the cyclic process which occurs in plants where CO_2 from air is converted into sugar. It was discovered mainly by Calvin.

2) C_3 Pathway: In C_3 pathway, the first stable product of CO_2 fixation was 3-PGA (3- Phosphoglyceric Acid).

Calvin cycle consists of 3 phases.

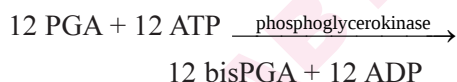
3) Calvin cycle Process:

i) Carbon Fixation Phase: During this phase, CO_2 combines with a five carbon compound RuBP (ribulose 1,5 biphosphate) to form 3-PGA.

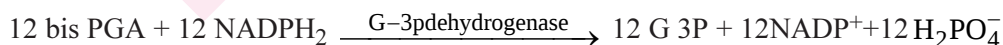


ii) Reduction phase: This is a two step reaction which forms Trioses (G-3-P).

Step1: This step consists of phosphorylation of ATP



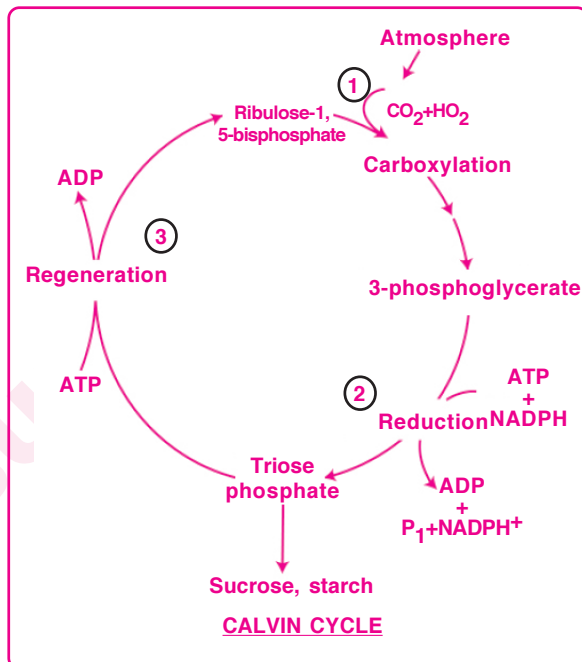
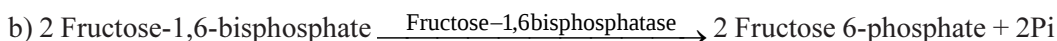
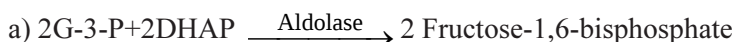
Step 2: This step consists of reduction of NADPH.



iii) Regeneration phase: During this phase, the CO_2 acceptor RuBP is formed again to continue the Calvin cycle.

The regeneration steps require one ATP for phosphorylation to form RuBP.

G-3P and DHAP (Dihydroxy acetone phosphate) are isomers and the inter conversion is catalysed by triose phosphate isomerase.



- c) $2 \text{ Fructose 6-phosphate} + 2\text{G-3-P} \xrightarrow{\text{Transketolase}} 2 \text{ Xylulose-5phosphate} + 2 \text{ Erythrose-4-phosphate}$
- d) $2 \text{ Erythrose-4-phosphate} + 2\text{DHAP} \xrightarrow{\text{Aldolase}} 2 \text{ Sedoheptulose-1,7-bisphosphate}$
- e) $2 \text{ Sedoheptulose-1,7-bisphosphate} \xrightarrow{\text{Sedoheptulose-1,7-bisphosphatase}} 2 \text{ Sedoheptulose-7-phosphate} + 2\text{P}_i$
- f) $2 \text{ Sedoheptulose-7-phosphate} + 2\text{G-3-P} \xrightarrow{\text{Transketolase}} 2 \text{ Xylulose -5-P} + 2 \text{ Ribose-5-phosphate}$
- g) $4 \text{ xylulose-5-P} \xrightarrow{\text{Ribose-5-phosphate epimerase}} 4 \text{ Ribulose -5- phosphate}$
- h) $2 \text{ Ribose-5-P} \xrightarrow{\text{Ribose-5-phosphate isomerase}} 2 \text{ Ribulose -5- phosphate}$
- i) $6 \text{ Ribulose -5- phosphate} + 6 \text{ ATP} \xrightarrow{\text{Ribulose-5-phospho kinase}} 6 \text{ Ribulose-1, 5-bisphosphate} + 6 \text{ ADP}$

20. Give a brief account of the tools of recombinant DNA technology.**[TS 17,19,20, 23][AP 15,17,19,20,23]****A: Tools of recombinant DNA technology:**

1) Restriction enzymes 2) Polymerase enzymes 3) Ligases 4) Vectors 5) Host organism

1) Restriction enzymes: Restriction enzymes belong to a larger class of enzymes called nucleases. These are two kinds

(i) Exonucleases: Exonucleases remove nucleotides from the ends of the DNA

(ii) Endonucleases: Endonucleases make cuts at specific positions within the DNA.

Each restriction endonuclease recognises a specific palindromic sequence in the DNA.

The palindrome in DNA is a sequence of base pairs, that reads the same on the two strands

Ex: EcoRI recognises 5¹ GAATTC 3¹ sites on the DNA and cuts in between G and A

5¹ G A A T T C 3¹

3¹ C T T A A G 5¹

2) Polymerase enzymes:

(i) In polymerase chain reaction multiple copies of gene of interest are synthesized by using primers and DNA polymerase.

(ii) In this process the replication of DNA is repeated many times and 1 billion copies can be produced.

(iii) Such amplification is achieved by Taq polymerase which remain active at high temperatures.

(iv) The amplified fragment, if desired, can now be used to ligate with a vector for further cloning.

3) Ligases: The enzyme DNA ligase, joins the ends of plasmid DNA with that of desired gene by covalent bonding. It regenerates a circular hybrid called rDNA.

4) Vectors: The DNA used as a carrier, for transferring a fragment of foreign DNA, into a suitable host called vector.

(i) Vectors used for multiplying the foreign DNA sequences are called cloning vectors.

(ii) Commonly used cloning vectors are plasmids, bacteriophages, cosmids, BAC, YAC.

Properties of cloning vectors:

(i) They must have low molecular weight

(ii) They must have unique cleavage site for the activity of restriction sites.

(iii) They must be able to replicate inside the host cell after its introduction.

(iv) They require a 'selectable marker' which helps in identifying and eliminating non transformants.

5) Host organisms: Competent host for transformation with r-DNA is made by treating host with Ca⁺² ions

21. Write a brief essay on microbes as biocontrol agents. (or) [TS MAY-22]
Write a brief essay on microbes in sewage treatments. [TS MAR-23]

A: Large quantities of waste-water are generated everyday in cities and towns. Municipal waste water is also called sewage. Before disposal into rivers and streams, the sewage is treated in sewage treatment plants (STPs) to make it less polluting. This treatment is carried out in two stages.

1) Primary Treatment:

- It involves physical removal of large and small particles through filtration and sedimentation.
- Initially floating debris is removed by sequential filtration.
- Then the grit (soil and small pebbles) is removed by sedimentation.
- The solids that settle form the primary sludge forms the effluent.
- The effluent from the primary setting tank is taken for secondary treatment.

2) 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 (masses of bacteria associated with fungal filaments to form mesh like structures.)
- While growing, these microbes consume the major part of the organic matter in the effluent and reduces the BOD.
- The effluent is then passed into a settling tank, where the bacterial flocks are allowed to sediment.
- This sediment is called activated sludge.
- A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum.
- The remaining part of the sludge is pumped into anaerobic sludge digesters.
- Here other kinds of bacteria grow anaerobically, digest the bacteria and fungi in the sludge.
- During this digestion, bacteria produce a mixture of gases such as methane, hydrogensulphide and carbondioxide.
- These gases form biogas which can be used as a source of energy as it is inflammable.
- The effluent from the secondary treatment plant is generally released into the natural water bodies like rivers and streams.