

**PART - I (BOTANY)**

**SECTION - A**

**Note:** (i) Answer **all** the questions.

(ii) Choose and write the **correct** answer.

**[14 × 1 = 14]**

1. "The bird of paradise flower" refers to:
  - a) *Musa paradisiaca*
  - b) *Strelitzia reginae*
  - c) *Ravenala madagascariensis*
  - d) *Heliconia Sp*
2. Complete oxidation of one molecule of glucose yields :
  - a) 38 ATP
  - b) 36 ATP
  - c) 35 ATP
  - d) 24 ATP
3. Polyadelphous stamens are present in this plant:
  - a) Ricinus
  - b) Datura
  - c) Musa
  - d) Hibiscus
4. Monosomy is represented by :
  - a)  $2n - 1$
  - b)  $2n + 1$
  - c)  $2n - 2$
  - d)  $2n + 2$
5. An example for insectivorous plant is:
  - a) Drosera
  - b) Viscum
  - c) Monotropa
  - d) Vanda
6. The root hairs are produced from:
  - a) Pericycle
  - b) Endodermis
  - c) Cortex
  - d) Trichoblasts
7. Isobilateral leaf is present in:
  - a) grass
  - b) cucurbita
  - c) sunflower
  - d) bean
8. Which is the collateral host plant of pyricularia oryzae ?
  - a) *Oryza Sativa*
  - b) *Digitaria marginata*
  - c) *Arachis hypogea*
  - d) Citrus plant
9. Each restriction enzyme cleaves a molecule only at :
  - a) the ends of genes
  - b) methyl groups
  - c) nucleotide sequence
  - d) the time of DNA replication

10. Which of the following classification is a sexual system of classification?
  - a) Artificial system
  - b) Natural system
  - c) Phylogenetic system
  - d) Natural selection
11. The two protoplasts are fused with a fusogenic agent called:
  - a) polyethylene glycol
  - b) polyvinyl chloride
  - c) polyethane glycol
  - d) phosphoric ethane
12. Binomial name of "Thottal Chinungi" is
  - a) *Aegle marmelos*
  - b) *Cissus quadrangularis*
  - c) *Mimosa pudica*
  - d) *Solanum nigrum*
13. The term chromosome was introduced by :
  - a) Bridges
  - b) Waldeyer
  - c) Balbiani
  - d) Flemming
14. An example for synthetic auxin is:
  - a) IAA
  - b) PAA
  - c) ABA
  - d) NAA

**SECTION - B**

**Note :** Answer **any Seven** questions.

**[7 × 3 = 21]**

15. What is binomial nomenclature? Give an example.
16. What is atropine?
17. What is a protoxylem lacuna?
18. Draw Angular Collenchyma and label the parts.
19. Write the three significance of crossing over.
20. Define Bioremediation.
21. Write three differences between Photo respiration and Dark respiration.
22. Draw and label the structure of ATP.
23. What is a short day plant ? Give an example.
24. What are biopesticides ? Give an example.

**SECTION - C**

- Note :** i) Answer **any four** questions including question no. **25** which is **compulsory**.  
ii) Draw diagrams wherever necessary.  
**[4 × 5 = 20]**

25. Write the importance of herbarium.
26. Draw and label the parts of a transverse section of a dicot leaf.
27. Write the significance of ploidy.
28. What is plant tissue culture? Briefly mention the concepts of plant tissue culture.
29. Explain Ganong's respiroscope experiment.
30. Write the physiological effects of Gibberellin.

31. Write the benefits form biofertilizers.

**SECTION - D**

- Note :** i) Answer **any two** questions.  
ii) Draw diagrams wherever necessary.  
**[2 × 10 = 20]**

32. Discuss Bentham and Hooker's classification of plants (Explanation (or) Table).
33. Describe different types in vascular tissue system.
34. Give a brief account of single cell protein.
35. Describe the steps involved in Calvin's Cycle. (flow chart or explanation)

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**PART - II (ZOOLOGY)****SECTION - A**

- Note :** i) Answer **all** the questions.  
ii) Choose and write the **correct** answer.  
**[16 × 1 = 16]**

1. Which substance is used to remove nucleus from a cell?  
a) Colchicine      b) Cytochalasin B  
c) P.E.G.          d) DNA ligase
2. Which confers immunological competence on the lymphocyte during their stay in the organ?  
a) lymph node      b) thymus  
c) spleen          d) tonsils
3. The enzyme that is attached with genome of HIV :  
a) DNA ligase  
b) DNA polymerase  
c) Reverse transcriptase  
d) Alkaline phosphatase
4. Name the human disease due to autosomal dominant gene:  
a) sickle cell anaemia  
b) thalassemia  
c) SCID  
d) huntington's chorea

5. The book "Genetics and Origin of Species" to support modern synthetic theory of evolution was written by:  
a) Dobshansky  
b) Stebbins G.L.  
c) Hardy - Weinberg  
d) Hugo de Vries
6. In which variety "colour feature is used to distinguish the sex of birds"?  
a) Leghorn          b) Chittagong  
c) Plymouth rock   d) Brahma
7. Drooping eyelid is the characteristic symptom of :  
a) muscle fatigue  
b) muscle pull  
c) myasthenia gravis  
d) Alzheimer's disease
8. Name the fowl in which comb, wattle and tongue are purple in colour.  
a) Busra              b) Aseel  
c) Karaknath        d) Chittagong
9. Sound waves → vibrate tympanic membrane →  
a) vibration of oval window  
b) waves in perilymph  
c) movement in ear ossicle chain  
d) waves in endolymph

10. Area responsible for reabsorption of water, glucose, sodium phosphate and bicarbonates:
  - a) glomerulus
  - b) proximal convoluted tubule
  - c) collecting tube
  - d) Henle's loop
11. Partial albinism causes:
  - a) leucoderma      b) vitiligo
  - c) melanoma      d) dermatitis
12. Which is commonly considered as "biologist's paradise"?
  - a) Gulf of Mannar Biosphere Reserve
  - b) Nilgiri Biosphere Reserve
  - c) Nanda Devi
  - d) Great Nicobar
13. India's first power plant generating electricity from ocean energy is at:
  - a) Tamil Nadu      b) Vizhinjam
  - c) Gujarat      d) Andhra Pradesh
14. Which dairy breed has intelligent facial expression, docile and quiet ?
  - a) Gir      b) Sindhi
  - c) Ongole      d) Kangayam
15. The pathogenic form of amoebiasis is:
  - a) malignant      b) trophozoite
  - c) zoonoses      d) schizonts
16. Who developed the vaccine for rabies in man ?
  - a) Robert Koch      b) Joseph Lister
  - c) Louis Pasteur      d) Stanley
21. Differentiate between H and L chains of immunoglobulin.
22. Define differentiation.
23. What is a "Protein Data Bank"?
24. Define 'pedigree chart' and mention its usefulness.
25. What is meant by 'seeding clouds'?
26. Mention the characteristics of oreochromis mossambicus.
27. What are the advantages of artificial insemination?
28. Define Hardy - Weinberg law.

**SECTION - C**

**Note :** Answer **any three** questions including question No. **31** which is **compulsory**.

**[3 × 5 = 15]**

29. What is dislocation of joints ? Classify and explain.
30. What are the steps involved in the preparation of bacteriological media ?
31. Explain the genetic basis of organ transplants.
32. Mention the uses of bio-informatics.
33. Define 'polymorphism' with the classical example of sickle cell anaemia.

**SECTION - D**

**Note :** Answer **any two** questions. **[2 × 10 = 20]**

34. Write a detailed note on causes, symptoms, types of diabetes mellitus.
35. Describe the structure of hypophysis and describe the roles of hormones of neurohypophysis.
36. Explain management of hazardous wastes.
37. Write a detailed account of any five edible fishes of Tamil Nadu.



## ANSWERS

### PART - I (BOTANY)

#### SECTION - A

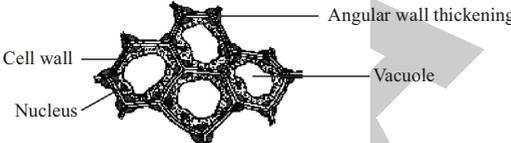
1. (b); 2. (a); 3. (a); 4. (a); 5. (a);  
6. (d); 7. (a); 8. (b); 9. (c); 10. (a);  
11. (a); 12. (c); 13. (b); 14. (b).

#### SECTION - B

15. The system of naming the plants on a scientific basis is known as Binomial nomenclature. According to it every species is given a name of two words.

**Example:** Binomial of mango is *Mangifera indica*. It was suggested by Carl Linnaeus. (Mangifera - genus name; indica - species name).

16. Atropine is a powerful alkaloid obtained from the roots of *Atropa belladonna*. It is used for relieving muscular pain.
17. In the mature vascular bundle of monocot stem, Xylem is arranged in shape of 'Y' and is endarch. The lowest protoxylem disintegrates and forms a cavity. This cavity is known as protoxylem lacuna.

18. 

19. The process, which produces recombination of genes by interchanging the corresponding segments between nonsister chromatids of homologous chromosomes is called crossing over.

#### Significance of Crossing Over :

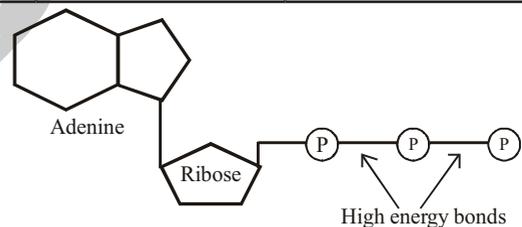
- (i) Crossing over leads to the production of new combination of genes and provides basis for obtaining new varieties of plants.
- (ii) It plays an important role in the process of evolution.
- (iii) The crossing over frequency helps in the construction of genetic maps of the chromosomes.

20. Bioremediation is defined as the use of living microorganisms to degrade environmental pollutants or prevent pollution. The contaminated sites are restored and future pollution is prevented.

21.

S. No.	Photorespiration	Dark respiration
1.	It takes place only in photosynthetic cells in the presence of light.	It takes place in all living cells in the mitochondria.
2.	It is light dependent.	It takes place in the presence and in the absence of light.
3.	It is the function of chloroplast, peroxisomes and mitochondria.	It is the function of mitochondria alone.

22.



23. The plants requiring light for a shorter period than their critical period are known as short day plants. e.g. tobacco and chrysanthemum.
24. Biological agents that are used for control of insects, weeds and pathogens produced from living organisms are called biopesticides. Micro-organisms such as viruses, bacteria, fungi, protozoa and mites may be used as biopesticides.

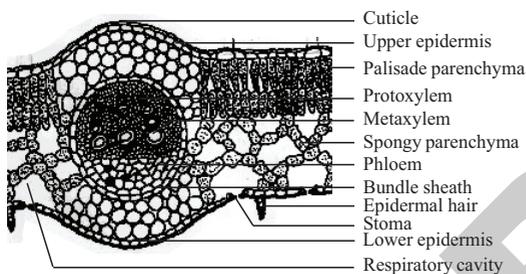
#### SECTION - C

25. i) Herbarium is a source of knowledge about the flora of a region or a locality or a country.
- ii) It is a data store in which the information on plants are available.
- iii) The type specimens help in the correct identification of plants.

- iv) It provides materials for taxonomic and anatomical studies.
- v) Typical pollen characters have been well emphasized in taxonomy. Morphological characters of the pollen remain unaltered even after storage upto nearly 200 years.
- vi) It is very much useful in the study of cytology, structure of DNA, numerical taxonomy, chaemotaxonomy, etc. It acts as a reservoir of gene pool studies.

Because of its importance, several herbaria have been established at the national and international centres.

26.



*T.S. of sunflower leaf*

- 27. (i) Polyploidy plays an important role in plant breeding and horticulture.
- (ii) Polyploidy has more vigorous effect than the diploids and results in the production of large sized flowers and fruits. Hence, it has economical significance.
- (iii) It plays significant role in the evolution of new species.
- (iv) Polyploidy results in the changes in the season of flowering and fruting.
- (v) Polyploids are vigorous invaders of new habitats.
- (vi) It leads to the formation of new varieties which show high resistance to disease and increase in yield.

## 28. Plant tissue culture

Growing the plant cells, tissues and organs on a artificial, synthetic medium under controlled conditions is called plant tissue culture. Plant tissue culture has become a major thrust area in plant biotechnology.

## Concept

The basic concept of plant tissue culture is totipotency, differentiation, dedifferentiation and redifferentiation.

### Totipotency

The inherent potential of any living plant cell to develop into entire organism is called totipotency. This is unique to plant cells.

### Differentiation

The meristematic tissue is differentiated into simple or complex tissues.

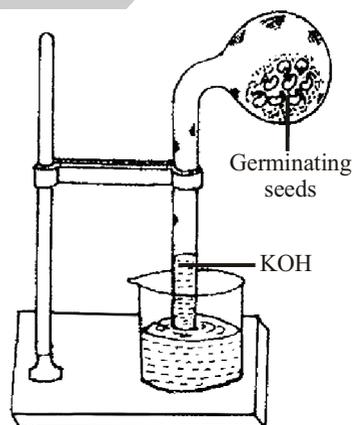
### Dedifferentiation

Reversion of mature tissue into meristematic state leading to the formation of callus is called dedifferentiation.

### Redifferentiation

The ability of the callus to develop into shoot or root or embryoid.

29.



**Ganong's respiroscope**

**Aim :** The aim of this experiment is to demonstrate liberation of carbondioxide during respiration.

**Apparatus required :** The respiroscope is a glass apparatus consisting of a bulb-like part with a bent neck and vertical tube. Germinating seeds are taken in the bulb and the mouth of the tube is kept immersed in the beaker containing KOH solution.

**Procedure :** The respiroscope is fixed in the vertical position with the help of a stand. Thus, the enclosed air in the bulb is

completely cut off from the atmosphere. The apparatus is kept undisturbed for few hours.

**Result and Inference :** It is observed that the level of KOH solution in the limb is raised. The KOH solution absorbs carbondioxide released by the seeds and a vacuum is created. It results in the raise of KOH level.

30. **Physiological effects of gibberellin are :**

1. Gibberellins produce extraordinary elongation of stem. The elongation of stem is caused by the cell division and cell elongation induced by gibberellic acid.
2. One of the most striking effects of gibberellins is the reversal of dwarfism in many genetically dwarf plants. For eg: 'Rosette' plant of sugar beet, when treated with GA undergoes marked longitudinal growth of axis attaining the normal size.
3. Rosette plants usually show reduced internodal growth. These plants exhibit excessive internodal growth when they are treated with gibberellin. This sudden elongation of stem followed by flowering is called bolting.
4. Many biennials usually flower during the second year of their growth. For flowering to take place, these plants should be exposed to cold season. Such plants could be made to flower without exposure to cold season in the first year itself, when they are treated with gibberellin.
5. Some of the light sensitive seeds can germinate by the treatment of gibberellic acid even in complete darkness. e.g. barley.
6. Gibberellin breaks dormancy in potato tubers.

31. 1. Biofertilizers are easy to produce in abundance and are available at low cost to the marginal farmers.
2. It increases soil fertility without causing any damage to the soil.
3. Application of biofertilizers increases yield upto 45 per cent and the left over

biofertilizers in the soil increases yield as long as the biofertilizer remains in the soil up to 3 to 4 years.

4. Azolla, which is a biofertilizer amends the soil with organic matter. Cyanobacteria in particular secrete growth promoting hormones like Indole 3-acetic acid, Indole butyric acid, etc.
5. Cyanobacteria grow well both in acidic as well as in alkaline soils. Since, cyanobacteria are potent neutralizers, they help in the neutralization of soil. The process of converting untenable, fallow land to cultivable soil is termed as soil reclamation. Blue green algae play a vital role in this conversion.
6. Symbiotic nitrogen fixing Rhizobium is a biofertilizer. It adds 50 to 150 Kg of nitrogen to soil per hectare. Azotobacter and Azospirillum secrete antibiotics which act as biopesticides.

### SECTION - D

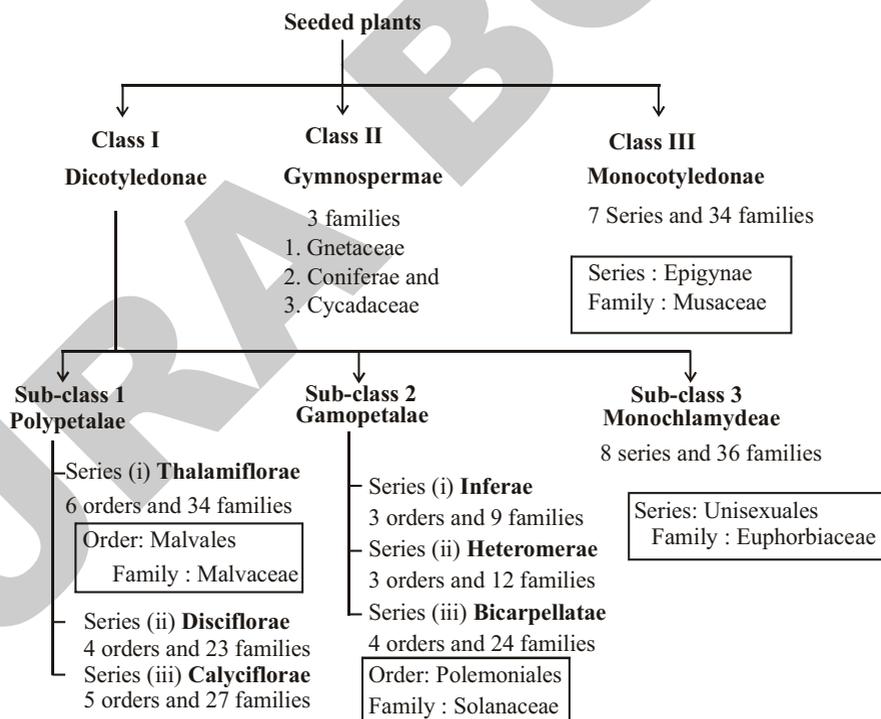
32. It is a natural system of classification and is based on important characters of the plant. According to it the seeded plants are divided into three classes **Dicotyledonae**, **Gymnospermae** and **Monocotyledonae**.

i) **Class I Dicotyledonae :** Seeds contain two cotyledons. Leaves show reticulate venation. Flowers are tetramerous or pentamerous. It includes three subclasses - **Polypetalae**, **Gamopetalae** and **Monochlamydeae**.

♦ **Sub - Class 1 Polypetalae :** Plants having flowers with free petals come under polypetalae. The flowers are with distinct calyx and corolla. It is divided into three series **Thalamiflorae**, **Disciflorae** and **Calyciflorae**.

- **Series (i) Thalamiflorae :** It includes plants having flowers with dome or conical thalamus. Ovary is superior.
- **Series (ii) Disciflorae :** It includes flowers having prominent disc shaped thalamus below the ovary. Ovary is superior.

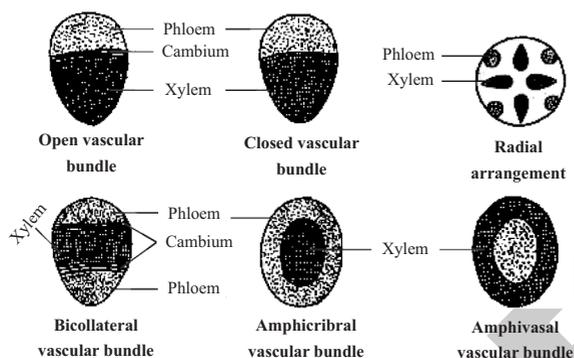
- **Series (iii) Calyciflorae** : It includes plants having flowers with cup shaped thalamus. Ovary is superior or inferior or sometimes half inferior.
  - ♦ **Sub - Class 2 Gamopetalae** : Plants having flowers with petals, which are partially or completely fused. The sepals and petals are distinct. Gamopetalae is divided into three series - Inferae, Heteromerae and Bicarpellatae.
    - **Series (i) Inferae** : The flowers are epigynous and ovary is inferior.
    - **Series (ii) Heteromerae** : The flowers are hypogynous and ovary is superior with more than two carpels.
    - **Series (iii) Bicarpellatae** : The flowers are hypogynous and ovary is superior with two carpels only.
  - ♦ **Sub - Class 3 Monochlamydeae** : Plants having flowers with single whorl of perianth come under Monochlamydeae. Flowers are incomplete. The sepals and petals are not distinguished and are called perianth. Tepals are present in two whorls. Sometimes both whorls are absent.
- ii) **Class II Gymnospermae** : The members of this class have naked ovules or seeds, Ovary is absent and Gymnospermae includes three families Gnetaceae, Coniferae and Cycadaceae.
- iii) **Class III Monocotyledonae** : Seeds contain only one cotyledon. Leaves show parallel venation. Flowers are trimerous having three members in various floral whorls. The plants have fibrous root system. It is divided into 7 series and 34 families.



**Outline of Bentham and Hooker's classification of plants**

33. **Vascular tissue system** : The vascular tissue system consists of xylem and phloem. The elements of xylem and phloem are always organized in groups. They are called vascular bundles. In dicot stem, the vascular bundle consists of cambial tissue in between xylem

and phloem. Such vascular bundle is called open vascular bundle. In monocot stem, cambium is absent in the vascular bundle, hence it is known as closed vascular bundle. In roots, xylem and phloem are arranged in an alternate manner on different radii. It is called radial arrangement. In stems and leaves, xylem and phloem are arranged at the same radius and form a vascular bundle together. Such vascular bundle is called conjoint vascular bundle.



Various types of vascular bundles

Depending upon the mutual relationship of xylem and phloem, conjoint vascular bundles are divided into three types. They are collateral, bicollateral and concentric. If xylem and phloem in a vascular bundle are arranged along the same radius with phloem towards the outside, such vascular bundle is called collateral vascular bundle. If phloem occurs on both the outer and inner sides of xylem, the bundle is called bicollateral. Bicollateral vascular bundles are most typically seen in Cucurbitaceae.

The bundle in which either phloem surrounds the xylem or xylem surrounds the phloem completely is known as concentric vascular bundle. This is of two types namely amphicribal and amphivasal. In amphicribal concentric vascular bundles, the phloem completely surrounds the xylem.

eg. *Polypodium*. In amphivasal concentric vascular bundles, the xylem completely surrounds the phloem. eg. *Acorus*. In roots, protoxylem vessels are present towards the periphery and the metaxylem vessels towards the centre. This arrangement of xylem is called exarch. In stem, protoxylem vessels are towards the centre, while metaxylem towards the periphery. This condition is known as endarch.

34. Microorganisms have been widely used for preparation of a variety of fermented foods e.g., cheese, butter, idlis, etc. In addition, some microorganisms have long been used as a human food, e.g., the blue green alga, Spirulina and the fungi commonly known as mushrooms. More recently, efforts have been made to produce microbial biomass using low-cost substrates and used as a supplemental food for human consumption or used as feed for animals. Cells from a variety of micro-organisms, like bacteria, yeasts, filamentous fungi and algae are used as food or feed are called single cell protein (SCP).
- 1) The following substrates are being studied for SCP production for future. They are alkanes, methane, methanol, cellulose, carbohydrates and waste materials.
  - 2) Natural resources like wood chips, rice husk, carrot and beet molasses, peas and coffee and industrial waste are sources of cellulose. It is used for the production of SCP.
  - 3) Large scale cultivation of yeast on molasses is widely used in manufacture of Baker's yeast containing mycoproteins which is used in the SCP production.

- 4) Domestic sewage is not suitable for large scale SCP production. But it is more important for methane production. The industrial wastewater from cellulose processing, coffee and starch production, and food processing have been used for SCP production.

#### Organisms used for SCP production :

Algae- *Chlorella*, *Spirulina* and *Chlamydomonas*.

Fungi- *Saccharomyces cerevisiae*, *Volvoriella* and *Agaricus campestris*.

Bacteria -*Pseudomonas* and *Alkaligenes*.

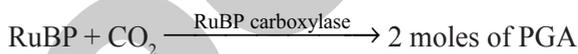
#### Uses of SCP :

- (i) It is a rich source of protein (60 to 72 per cent), vitamins, amino acids, minerals and crude fibres.
- (ii) It is a popular health food. Nowadays, Spirulina tablets are prescribed as enriched vitamin for most people.
- (iii) It provides valuable protein-rich supplement in human diet.
- (iv) It lowers blood sugar level of diabetics due to the presence of gamma-linolenic acid and prevents the accumulation of cholesterol in human body.

35. **Dark reactions :** The reactions that catalyze the reduction of  $\text{CO}_2$  to carbohydrates with the help of the ATP and  $\text{NADPH}_2$  generated by the light reactions are called dark reactions. The enzymatic reduction of  $\text{CO}_2$  by these reactions is also known as carbon fixation. These reactions that result in  $\text{CO}_2$  fixation take place in a cyclic way and were discovered by Melvin Calvin. Hence, the cycle is called Calvin cycle.

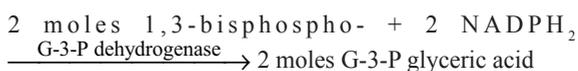
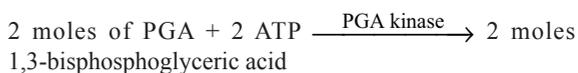
Fixation of carbondioxide in plants during photosynthesis occurs in three stages: (a) fixation, (b) reduction and (c) regeneration of RuBP.

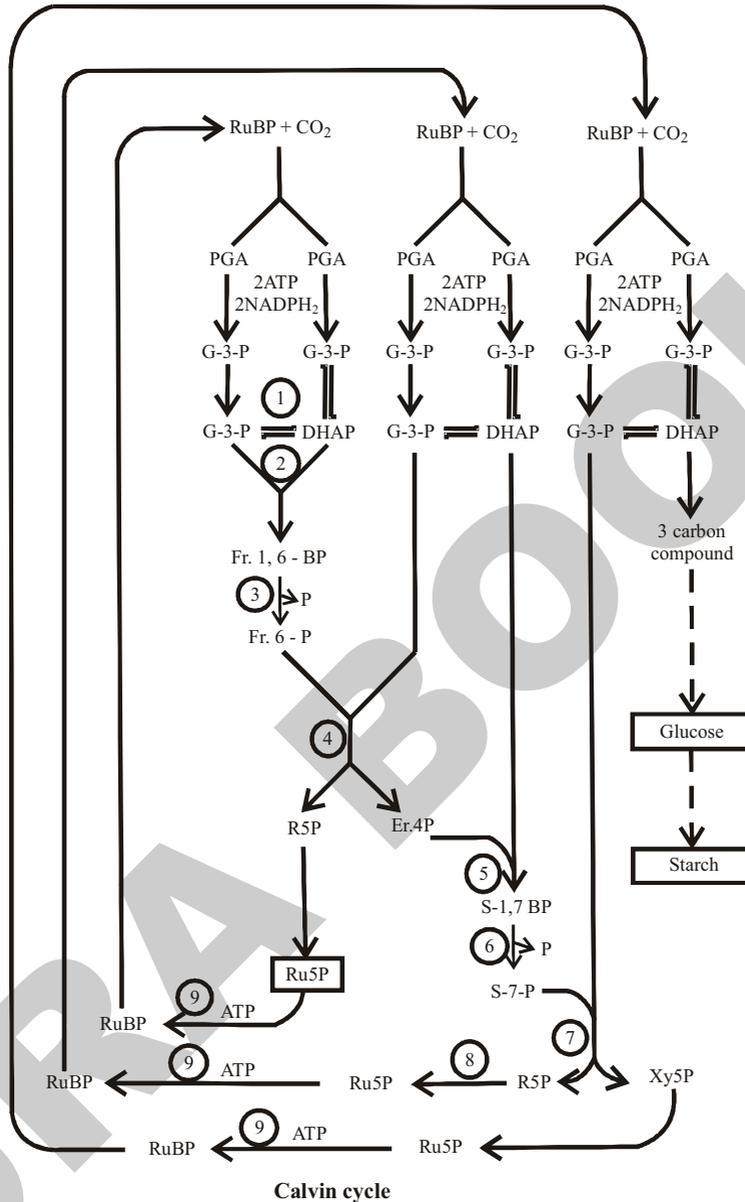
- (a) **Fixation:** The acceptor molecule of  $\text{CO}_2$  is a 5C compound called ribulose. 1,5-bisphosphate (RuBP). Fixation of a molecule of  $\text{CO}_2$  to RuBP is catalyzed by the enzyme RuBP carboxylase. The resulting 6C compound is highly unstable and gets cleaved to form two molecules of 3C compounds called phosphoglyceric acid (PGA).



- (b) **Reduction:** The two molecules of PGA are further reduced to glyceraldehyde-3-phosphates in two steps. First, two PGA molecules are converted to 1,3-bisphosphoglyceric acids by the enzyme PGA kinase. This reaction consumes two molecules of ATP in the ratio of one ATP for each molecule of 1,3-bisphosphoglyceric acid formed.

In the second step, the two molecules of 1,3-bisphosphoglyceric acid are reduced to glyceraldehyde-3-phosphates by the enzyme glyceraldehyde-3-phosphate dehydrogenase with the help of the light generated reducing power  $\text{NADPH}_2$ . So, two molecules of  $\text{NADPH}_2$  will be consumed during this reaction. To reduce one molecule of  $\text{CO}_2$  upto reduction two ATP and two  $\text{NADPH}_2$  are consumed.





(c) **Regeneration of RuBP:** The glyceraldehyde 3-phosphate molecules are converted to RuBP through a series of reactions, which generate 4C, 6C and 7C phosphorylated compounds as intermediates. For better and easy understanding of these reactions, a simplified scheme of Calvin's cycle considering three  $\text{CO}_2$  molecules fixation reactions is shown below:

The reactions of regeneration of RuBP are as follows:

- (i) Some of the Glyceraldehyde 3-phosphate molecules are converted to dihydroxy acetone phosphates.
- (ii) Glyceraldehyde 3-phosphate combines with dihydroxy acetone phosphate to form fructose 1,6-bisphosphate.
- (iii) Fructose 1,6-bisphosphate undergoes dephosphorylation to form fructose 6-phosphate.
- (iv) Fructose 6-phosphate combines with glyceraldehyde 3-phosphate obtained

- from the fixation of second molecule of  $\text{CO}_2$  to form Ribose 5-phosphate (R5P) and Erythrose 4-phosphate (Er4P).
- (v) Erythrose 4-phosphate combines with DHAP obtained from the second  $\text{CO}_2$  fixation, to form sedoheptulose 1,7-bisphosphate.
- (vi) Sedoheptulose 1,7-bisphosphate undergoes dephosphorylation to form sedoheptulose 7-phosphate.
- (vii) Sedoheptulose 7-phosphate combines with glyceraldehyde 3-phosphate obtained by the third  $\text{CO}_2$  fixation, to form two molecules of 5C compounds- ribose 5-phosphate and xylulose 5-phosphate (Xy5P).

- (viii) Ribose 5-phosphate and xylulose 5-phosphate molecules are transformed to ribulose 5-phosphate (Ru5P).
- (ix) Ru5P molecules are then phosphorylated by ATP to form RuBP molecules, which again enter into the cycle of  $\text{CO}_2$  fixation.



In the above illustration, three  $\text{CO}_2$  molecules are fixed and the net gain is a 3C called DHAP. These triose phosphate molecules combine to form hexose phosphates, which are used to form sucrose. For every carbon fixation, 3ATP and 2  $\text{NADPH}_2$  are consumed.



## PART - II (ZOOLOGY)

### SECTION - A

1. (b); 2. (b); 3. (c); 4. (d); 5. (a);  
6. (c); 7. (c); 8. (c); 9. (a); 10. (b);  
11. (a); 12. (a); 13. (b); 14. (b); 15. (b);  
16. (c).

### SECTION - B

17. Orthopedics deals with all bone deformities occurring in children as well as adults. The deformities may either be congenital or acquired. The former is caused by developmental abnormalities (teratogenic), the latter is caused by trauma or infections or by metabolic disorders.
18. (i) It dilates the coronary vessels.  
(ii) It increases systolic and diastolic blood pressure.  
(iii) It exerts a weakly inhibitory action upon the contractile activity of smooth muscle in the gastro intestinal tract.
19. Pathogenic microbes are provided with their own mechanisms to establish infection in the host animals and humans. Similarly the hosts body has a number of defense mechanisms to mount resistance against the invasion and to prevent infection of pathogens. The antimicrobial response of hosts may be natural, non-specific and specific.

Natural resistance includes species resistance, racial resistance and individual resistance.

20. Autoimmune diseases result when the immune system attacks and destroys 'self' cells and molecules. This condition can cause chronic and serious diseases.

Examples of autoimmune diseases are insulin-dependent diabetes, multiple sclerosis, rheumatoid arthritis etc. Multiple sclerosis is caused by antibodies that attack the myelin sheath of nerve cells.

21.

H chain	L chain
1. Large chains of polypeptide are called H chains.	smaller chains of polypeptide are called L chain.
2. One molecular weight is approximately 50,000.	The molecular weight is approximately 25,000.
3. They are structurally different for each class of Immunoglobulin	They are similar in all classes of Immunoglobulins.

22. In the development of multicellular animals the zygote represents the progenitor cell of the future embryo. Multitudes of cells arise

by mitotic divisions of the fertilized egg cell. These cells later become distinct cell types differing in form and function. The above process is called differentiation.

23. In proteomics, the amino acid sequences are read by automated sequencers and stored in computers as internationally available databases. The information regarding three-dimensional structure of protein is stored in another computerized database called Protein Data Bank.
24. Pedigree chart defines the history of a character in a family. It is drawn by using certain standard symbols. It is also called family tree.  
It helps to identify and visualise the course of genetic diseases in the progeny. eg : diseases like fibrosis.
25. Seeding clouds with dry ice or potassium iodide particles sometimes can initiate rain if water-laden clouds and conditions that favour precipitation are present.
26. 1. An exotic fish introduced in India from East coast of Africa in 1952.  
2. It is characterized by an anterior spinous dorsal fin and posterior soft dorsal fin.  
3. Maturity occurs even in two months old individuals.  
4. Female keeps the fertilized eggs guarded in its mouth.
27. Artificial insemination helps to eliminate the need for maintenance of herd sire, permits long distance transport of semen by air, avoids spreading of genital diseases and increase the rate of conception. Further, this method helps better recording, permits use of semen from injured and old bulls and provides a chance of detecting any genital abnormalities or pathological infection and inflammation in cows.
28. Hardy-Weinberg's law forms the foundation of population genetics and of modern evolutionary theory. According to this law "the relative frequencies of various kinds of genes in a large and randomly mating sexual population tend to remain constant from generation to generation in the absence of mutation, selection and gene flow or migration".

### SECTION - C

29. Dislocation is the total displacement of the articular end of the bone from the joint cavity. The normal alignment of the bones becomes altered. Various factors are attributed for bone and joint dislocations.  
Dislocations are classified as (i) Congenital, (ii) Traumatic, (iii) Pathological and (iv) Paralytic.
- (i) **Congenital Deformities** are due to genetic factors or factors operating on the developing foetus. These are also called teratogenic or teratologic disorder.
- (ii) **Traumatic Dislocation** is due to a serious violence. It occurs in the shoulder, elbow and hip.
- (iii) **Pathological Dislocation** is caused by some diseases-like tuberculosis. Tuberculosis of the hip may cause dislocation of the acetabulum.
- (iv) **Paralytic Dislocation** occurs when a remarkable imbalance occurs on the muscle power. e.g., Poliomyelitis.
30. The preparation of bacteriological media involves the following steps.
1. Each ingredient or the complete dehydrated medium is dissolved in the appropriate volume of distilled water.
  2. The pH of medium is determined.
  3. Agar is added and the medium (solid medium) is boiled to dissolve agar.
  4. The medium is dispersed in flasks or tubes.
  5. The medium is sterilized by autoclaving.
31. **Genetic basis of organ transplants :**  
Success of organ transplants (ie., Cornea, Kidney, Heart, Liver, Bone marrow) and skin grafts depends on a proper matching of histocompatibility antigens that occur in all cells of the body. Chromosome 6 of mouse contains a cluster of genes known as the major histocompatibility complex (MHC), which in humans is called human leukocyte antigen (HLA) complex. The alleles of HLA genes determine the histocompatibility ie., the compatibility between donor and recipient tissues in transplants.

**32. Scope of Bio-informatics.**

- (i) Bioinformatics helps to create an electronic database on genomes and protein sequences from single celled organisms to multicellular organisms.
- (ii) It provides techniques by which three-dimensional models of biomolecules could be understood along with their structure and function.
- (iii) It integrates mathematical, statistical and computational methods to analyze biological, biochemical and biophysical data.
- (iv) Bioinformatics deals with methods for starting, retrieving and analysing biological data such as nuclei acid (DNA/RNA) and protein sequences, structure, functions, pathways and genetic interactions.
- (v) The computational methods in bioinformatics extend information for probing not only at genome level or protein level but up to whole organism level, or ecosystem level of organization.
- (vi) It provides genome level data for understanding normal biological processes and explain the malfunctioning of genes leading to diagnosing of diseases and designing of new drugs.

33. Polymorphism is “the existence in a natural population of two or more alleles in frequencies too large to be explained by recurrent mutation”.

Thus a polymorphic population will have several alleles of a gene as a permanent feature of the species. The varied alleles are favoured and maintained in the population by genetical mechanisms.

A classical example for such a polymorphism could be the existence of a genetic disorder in humans, namely sickle-cell anaemia. This disease reduces the oxygen-carrying capacity of the blood and affects blood supply to various organs. This disorder is inherited as a Mendelian recessive. It is more frequent among American blacks than American whites. In spite of its harmful nature, the allelic gene responsible for the disorder

is maintained in the black population. According to the work of Allison (1955, 61), it was shown that in Africa the same allelic gene conferred an advantage that it protected the inheritors of such gene from malaria. Thus the connection between sickle-cell anaemia and malaria was established. Hence selection has encouraged the existence of such a polymorphic allele in the population.

**SECTION - D**

34. Diabetes mellitus is the metabolic disorder of carbohydrate metabolism caused by insufficient or nil production of the hormone insulin by the pancreas. Insulin is responsible for the absorption of glucose into cells for their energy needs and into the liver and fat cells for storage as glycogen reserve. Insulin deficiency may be due to (i) pancreatic disorders, (ii) defects in the synthesis of insulin from beta cells of Langerhans (in pancreas), (iii) destruction of beta cells and (iv) genetic defects etc.

**Symptoms**

1. The blood sugar level is more than 120 mg. in diabetic patients.
2. Untreated diabetes exhibits the following symptoms.
  - (a) **Polyurea** : Excretion of increased quantity of urine.
  - (b) **Polydipsia** : Excessive thirst leading to increased consumption of water.
  - (c) **Polyphagia** : Excessive appetite leads to increased intake of food. In spite of over eating, diabetic patients loses weight
3. Weakness and body pain are the common symptoms.
4. The body's inability to store or use glucose causes weight loss, insatiable hunger and fatigue.
5. Diabetes mellitus also results in abnormal (fat) metabolism.
6. Accelerated degeneration of small blood vessels.

### Types of Diabetes Mellitus are:

- (a) **Insulin-Dependent Type.** This type develops due to heavy viral infection which reduces the production of insulin.
- (b) **Non-insulin Dependent:** This is due to inadequate amount of insulin production. Obesity (over weight) is the major reason. This type usually of gradual onset and develops mainly in people over 40. Recently insulin resistant diabetes is commonly noticed and reported in younger persons too.

### Causes for Diabetes.

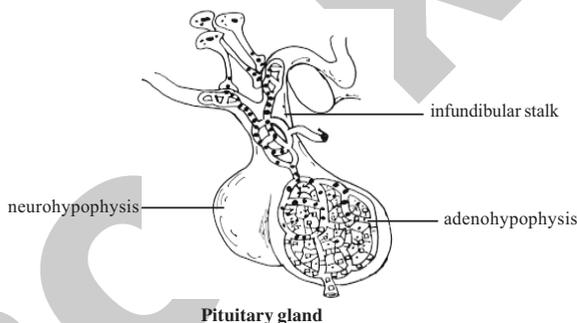
- (1) Diabetes tends to run in families, so it occurs in people who inherit the genes responsible for the insulin dependent form.
- (2) Viral infection that damages the pancreas causing the deficiency of insulin.
- (3) Obesity is the major cause leading to development of non insulin dependent diabetes.
- (4) Severe illness such as pancreatitis and thyrotoxicosis causes diabetes.
- (5) Overeating along with lack of physical exercise.

### The preventive measures comprise

- (1) Maintenance of normal body weight through adoption of healthy nutritional habits and physical exercise.
- (2) Correction of over nutrition and obesity may reduce the risk of diabetes and its complications.
- (3) Alcohol and smoking should be avoided.
- (4) Control of high blood pressure, elevated cholesterol and high triglyceride levels.
- (5) Susceptible persons can prevent diabetes by avoiding the risk factors.

When diabetes is detected, it must be adequately treated. In order to maintain blood glucose levels within the normal limits one should maintain ideal body weight. It is achieved by balanced diet, physical exercise, frequent checking of blood sugar, blood pressure. Maintenance of body weight and visual acuity are some prognostic tips.

35. The Pituitary gland is otherwise called the hypophysis. It is located at the base of the brain. It is approximately 1 cm long, 1-1.5 cm wide and 0.5 cm thick. It weighs about 500 mg. Anatomically the pituitary gland is divisible into anterior adenohypophysis and posterior neurohypophysis. The adenohypophysis consists of three lobes or zones namely, Pars intermedia, Pars distalis and Pars tuberalis.



### Hormones of Neurohypophysis:

The neurohypophysis or the posterior pituitary secretes oxytocin and vasopressin. Oxytocin contains a sequence of amino acid residues. The term oxytocin refers to rapid birth. This hormone directly stimulates the smooth muscles of uterus and causes the contraction, and helps in the delivery of foetus. Another major physiological role of oxytocin is the secretion of milk from the lactating breast. Oxytocin stimulates the myoepithelial cells, which surround the alveoli and ducts of mammary gland. The contraction of myoepithelial elements in turn expels the milk from the alveoli of the breast into the larger ducts or sinuses. From the sinuses, the milk is ejected out.

### The vasopressin:

It is otherwise called as the antidiuretic hormone (ADH). Its main function is the retention of water inside the body by acting on the renal tubules. ADH increases the permeability of the distal tubules and collecting ducts and promotes the reabsorption of water from the renal filtrate. It causes the constriction of all blood vessels and increases the blood pressure. It also helps in the retention of urea. ADH

deficiency leads to Diabetes insipidus. The symptoms of Diabetes insipidus are excretion of large volumes of dilute urine (polyurea), combined with an intense thirst leading to the consumption of large quantities of liquids (polydipsia).

### 36. Management of Hazardous wastes:

- ✘ These wastes remain dangerous for thousands of years.
- ✘ Radio active refuse, metallic compounds, organic solvents, acid, asbestos, organic cyanides, pathological hospital wastes and disposal of medical equipments and tools are the hazardous wastes.

### Methods for the disposal of wastes

#### 1. Land fills

- ✘ They are permanent wastes.
- ✘ They include radioactive wastes in secured lands (military).
- ✘ They are stored in deep underground.
- ✘ It is capped with impervious clay to prevent infiltration and percolation of water through the fill.
- ✘ Fill bottom is lined and provided with drainage system to have and remove any leakage that occurs.
- ✘ Monitoring the wells provides a final check.

#### 2. Deep-Well injection

- ✘ Drilling into dry, porous material below the ground water.
- ✘ Hazardous waste water or liquids repumped into the well.
- ✘ They are soaked into porous materials and made to remain separated indefinitely. But injected wastes are permitted.

#### 3. Surface impoundments

- ✘ Large quantity of water containing relatively small quantity of chemical wastes.
- ✘ Surface impoundments are simple excavated depressions into which liquid wastes are drained.
- ✘ Solid wastes settle and accumulate while water evaporates.

#### 4. Incineration

- ✘ Hazardous biomedical wastes are disposed off.
- ✘ Human anatomical wastes, microbiological and biotechnological wastes etc. are called Bio medical wastes.

#### 5. Bio-remediation

- ✘ Microbes and plants are used to clean environment.
- ✘ Heavy metals are reduced by the microbial activities.
- ✘ In phytoremediation plants are used to keep fresh environment.
- ✘ Genetically engineered microbes (GEMS) are currently produced in large scale to remove the hazardous radionuclides and heavy metals like Hg, chromium, cadmium etc.
- ✘ Certain plants like *Gibberellafusarium* were able to breakdown cyanide and reduce it to a non-toxic fonn.
- ✘ The bacteria pseudomonas nick named as superbugs are capable of degrading variety of toxic compounds and also degrade oil.

### 37. Edible Fishes Of Tamilnadu

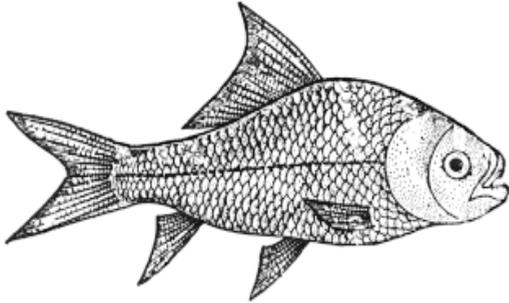
#### I. Fresh Water Fishes

Among the freshwater fishes, carps belonging to the order Cypriniformes form significant components of reservoir, riverine and culture fisheries. They have no teeth in any part of their mouths, however pharyngeal teeth may be present.

#### i. Indian Major Carps ('Kendai' meen)

a) *Catla catla* (catla) : Catla has a deep body with prominent head, large upturned mouth, non-fringed lips, devoid of barbels and a broad dorsal fin with 14-16 branched rays are the identifying features. It feeds on zooplankton of the pond surface using large gill rakers; however, young ones (15-20 mm) feed on zooplankton and phytoplankton. It grows to a maximum size of 1.8 m (45 kg).

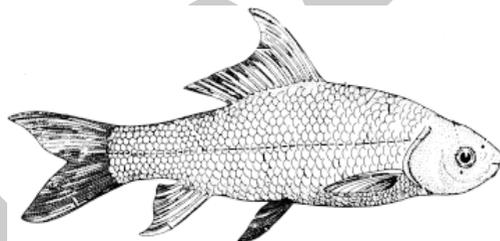
It is a fast growing species among the Indian major carps. First year growth is 35-45 cm and about 1.5 – 2.0 kg. It matures in the second year.



**Catla catla**

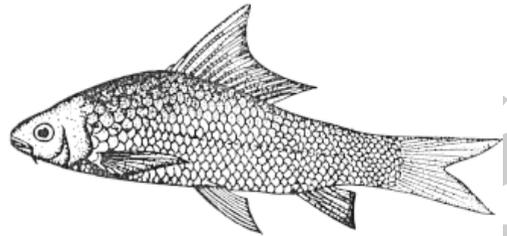
b) *Labeo rohita* (Rohu) : Of all the carps, this is considered as the tastiest fish. It has a small and pointed head, terminal small mouth with fringed lower lip. A dorsal fin with 12-13 branched rays and full reddish scales are its identifying features. It is a column feeder on phytoplankton, plant debris or decaying debris of aquatic plants; however, the young feed on zooplankton.

The maximum size attained is 1m. It is fairly fast growing species and first year growth is 35 – 40 cm and 900 g.



**Labeo rohita**

c) *Cirrhina mrigala* (Mrigal) : A linear body small head with blunt snout, subterminal mouth with thin non-fringed lips, dorsal fin with 12-13 branched rays and a bright silvery body having golden tinge are its identifying features.



**Cirrhina mrigala**

It is a bottom feeder on decaying organic and vegetable debris; however, its young feed on zooplankton. The maximum size attained is 0.9 m. Its growth in the first year is about 30 cm (700 g).

**(ii) Catfishes (Order: Siluriformes-‘Keluthi’)**

The catfish are air-breathing, or live-fishes as they are capable of directly breathing atmospheric air. They can live for a long time without water and can therefore be transported live and in fresh condition over long distances. The body is without scales and each of the upper and lower jaws possesses two pairs of long barbels in each. The mouth is non-protractile having jaws with teeth. Majority of the catfish are predatory and cannibalistic, feeding on all pond animals including fish fry.

**(iii) Murrels or Snakeheads (Order : Channiformes-‘Viral’ meen)**

These fish are also air-breathing and have a good demand. Elongated and cylindrical body, depressed head, large and protractile mouth are its identifying features. Murrels are suitable for culture in irrigation wells and shallow swamps.

- a) *Channa marulius* (Giant snakehead) : Dorsal and anal fins of this species are long and without spines. It reaches a maximum size of 1.2 m. It is suitable for culture in ponds along with tilapia, the young ones of which serve as food source to this species.
- b) *C. striatus* (Striped snake-head or Common murrel) : Stripes are present on its body. Attains a maximum size of 90cm.

