

[Time : 3 hours]

BIOLOGY (With Answer)

[Marks : 150]

PART - I (BOTANY) (MARKS : 75)

SECTION - A

Note: (i) Answer **all** the questions.(ii) Choose and write the **correct** answer.**[14 × 1 = 14]**

- The Rice Tungro Virus is transmitted by :
a) Mosquitoes b) Aphids
c) Leaf hoppers d) Ants
- The two protoplast are fused with fusogen called:
a) Polyethylene glycol
b) polyvinyl chloride
c) polyethane glycol
d) phosphoric ethane
- The first order in Bentham and Hooker's classification of plant is:
a) Malvales b) Polemoniales
c) Ranales d) Rosales
- Which prevents the accumulation of cholesterol in human body?
a) Fat b) Single Cell Protein
c) Vitamin d) Carbohydrates
- The strongest painkiller obtained from Papaver Somniferum is:
a) Quinine b) Morphine
c) Digoxin d) Ephedrine
- In paddy the haploid set of chromosome number is:
a) 12 b) 23
c) 40 d) 631
- The essential component for the formation of chlorophyll :
a) Mg b) Fe c) Cl d) Mn
- In Ricinus Communis the stamens are:
a) Polyadelphous b) Diadelphous
c) Dimorphic d) Monadelphous
- Dark respiration is the function of:
a) peroxisomes b) mitochondria
c) chloroplast d) ribosomes
- The Binomial System was introduced by:
a) Carolus Linnaeus
b) Camp and Gilly

- c) Casparay
d) Gaspard Bauhin

- Nullisomy is represented by :
a) $2n-1$ b) $2n+1$ c) $2n+2$ d) $2n-2$
- Which of the following hormones delays the ageing in plants?
a) Auxins b) Gibberellins
c) Cytokinin d) Ethylene
- In mature sieve elements the pores in the sieve plate are blocked by a substance called:
a) Cutin b) Callose
c) Suberin d) Lignin
- Phloem parenchyma is absent in:
a) Dicots b) Monocots
c) Gymnosperms d) Pteridophytes

SECTION - B

Note : Answer **any Seven** questions.**[7 × 3 = 21]**

- What is called nomen ambiguum?
- What is cladode? Give an example.
- Differentiate Sclereids from Fibres.
- What are called passage cells?
- Draw t-RNA and label its parts.
- Define SCP.
- Define respiratory quotient.
- What is a growth inhibitor? Give an example.
- Write three differences between photo respiration and dark respiration.
- What are biomedicines? Give an example.

SECTION - C

Note : i) Answer **any four** questions including question no. **25** is **compulsory**.

ii) Draw diagrams wherever necessary.

[4 × 5 = 20]

- Bring out the importance (significance) of Herbarium.
- Describe the vascular bundle in Monocot stem.

27. Describe the special types of chromosomes with diagram.
28. How is DNA cut?
29. Write the differences between cyclic photophosphorylation and non-cyclic photophosphorylation.
30. State any five physiological effects of Gibberellin.
31. Write any five aims of plant breeding.

SECTION - D

- Note :** i) Answer **any two** questions.
ii) Draw diagrams wherever necessary.
- [2 × 10 = 20]**
32. Describe Daturametel in botanical terms. Draw the floral diagram and write the floral formula.
 33. Write an Essay on xylem tissues.
 34. Explain the basic techniques of plant tissue culture. (Diagram not necessary)
 35. Explain photorespiration or C₂ cycle (Flow chart or explanation).

PART - II (ZOOLOGY)**(MARKS : 75)****SECTION - A**

- Note :** i) Answer **all** the questions.
ii) Choose and write the **correct** answer.

[16 × 1 = 16]

1. Which of the following fowls is noted for its pugnacity?
 - a) Chittagong
 - b) Busra
 - c) Aseel
 - d) Karaknath
2. The region of brain which secretes cerebrospinal fluid is:
 - a) Vermis
 - b) Flocculus
 - c) Choroid plexus
 - d) Medulla oblongata
3. The state of Corneal epithelium being wrinkled and keratinised is called:
 - a) Cirrhosis
 - b) Xerophthalmia
 - c) Dementia
 - d) Osteomalacia
4. The book 'philosophie-Zoologique' was written by:
 - a) Charles Darwin
 - b) Jean Baptiste de Lamarck
 - c) Mc Dougall
 - d) G.J. Mendel
5. Sometimes an allergen may cause a sudden, violent and fatal reaction in a sensitive individual; this is called:
 - a) Haematopoiesis
 - b) Cytotoxic cells
 - c) Anaphylaxis
 - d) Multiple sclerosis
6. Which is considered as dairy breeds?
 - a) Sindhi and Gir
 - b) Kangayam and Gir
 - c) Hariana and Ongole
 - d) Malvi and Siri
7. Pain during urination and a yellow discharge from the urethra of male are the symptoms of:
 - a) Gastroenteritis
 - b) Venereal syphilis
 - c) Plague
 - d) Gonorrhoea
8. During contraction of the muscles, the ATP molecules bind with the active site of:
 - a) myosin filament
 - b) myofibrils
 - c) nerve ending
 - d) actin filament
9. The most abundant green house gas is:
 - a) Methane
 - b) Carbon-dioxide
 - c) Trifluoromethyl penta fluoride
 - d) Chlorofluoro carbon
10. The virus which causes smallpox is:
 - a) Para virus
 - b) Hepatitis B virus
 - c) Variola virus
 - d) Oncogenic virus

11. In human chromosome karyotyping the chromosomes X and Y belong to groups :
a) B and C
b) C and D
c) C and G
d) G and D
12. Which is called hyper glycaemic hormone?
a) Insulin b) Adrenalin
c) Glucagon d) Thyroxine
13. Which one of the following chemotherapeutic agent is secreted by the leucocytes and fibroblasts:
a) Ampicillin b) Interferon
c) Imidazole d) Amantidine
14. Which would be the future alternative fuel option?
a) Hydel power
b) Hydrogen
c) Thermal power
d) Solar power
15. The autosomal dominant gene causes :
a) Sickle cell anemia
b) Thalassaemia
c) Agammaglobulinemia
d) Huntington's chorea
16. The diluting fluid used to count RBC is :
a) Turk's solution
b) Toisson solution
c) Lymphatic solution
d) Hayem's solution
20. What are the main three functions of free antibodies?
21. Distinguish between paratope and epitope.
22. Mention any two uses of karyotyping of human chromosome.
23. Write the significance of superbugs.
24. What is c-DNA library (complementary DNA)?
25. List out the names of other three bio-reserves in India, except Tamil Nadu.
26. What are the precautions and first-aid for milk fever?
27. Mention any three advantages of auto-analyser.
28. Define the germplasm theory.

SECTION - C

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

[3 × 5 = 15]

29. Give an account of steps involved in Root-canal treatment.
30. Write the symptoms of AIDS, defined by WHO.
31. Write the unique features of adaptive immunity.
32. Write the scope of Bio-informatics.
33. Describe polymorphism.

SECTION - D

Note : Answer **any two** questions.

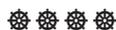
[2 × 10 = 20]

34. Explain the mechanism of breathing with neat labelled diagrams.
35. Describe the functioning of human forebrain.
36. Discuss 'Ozone' a natural sun-block.
37. Describe the preparation of fish pond and management of fish farm.

SECTION - B
Note : Answer **any eight** questions.

[8 × 3 = 24]

17. What are the causes of Obesity?
18. State the functions of corpus luteum.
19. Write the symptoms of cholera.



ANSWERS

PART - I (BOTANY)

SECTION - A

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

SECTION - B

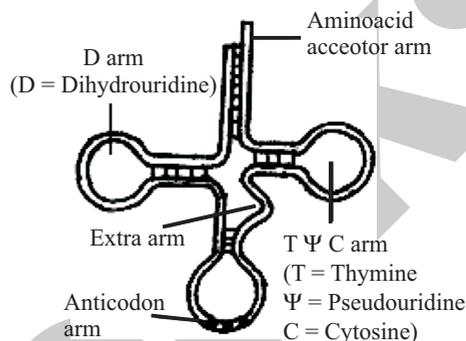
15. According to ICBN, if naming the plant is from a source of error, it is regarded as ambiguous name. It is also called **nomen ambiguum** and is completely ignored from use.
16. If the stem is modified into a green flattened structure to perform photosynthesis, it is called cladode. e.g., *Euphorbia sp.*
- 17.

Sclereids	Fibres
1. They are a type of Sclerenchyma and are short.	They are a type of Sclerenchyma cells which are longer and narrow with pointed ends.
2. They have numerous pits.	They have less number of pits.
3. The pits may be simple or branched.	The pits are simple
4. They are divided into various types such as Brachy-sclereids, macrosclereids and osteosclereids.	Fibres are not classified into many types.
5. Sclereids are found in bark, pith, fleshy portion of fruits. Seed coats etc. eg. Seed coat of Pisum	They are supporting tissues that provide mechanical strength to the plants and protect them from strong winds.

18. In roots the endodermal cells which are opposite to the protoxylem elements are thin-walled without Casparian strips. These

cells are called passage cells. Their function is to transport water and mineral salts from the cortex to the xylem elements.

19.



Structure of tRNA

20. The cells from a variety of microorganisms such as bacteria, yeasts, filamentous fungi and algae that are used as food or feed are called single cell protein (SCP). e.g. *Spirulina* (algae) *chlorella*.
21. Respiratory quotient is defined as “the ratio between the volume of carbon dioxide given out and oxygen consumed during respiration”. This depends upon the nature of respiratory substrate and its rate of oxidation.
- $$\text{Respiratory quotient} = \frac{\text{Volume of CO}_2 \text{ evolved}}{\text{Volume of O}_2 \text{ consumed}}$$
22. Some organic substances produced in the plant inhibit the plant growth. These substances are called growth inhibitors. They include the inhibitors of elongation in roots, stems and leaves. For example, ethylene is a potent inhibitor of bud growth.
- 23.

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

24. Medicinal plants have curative properties due to the presence of certain chemical substances like alkaloids, glycosides, corticosteroids, essential oils, etc. These medicinally valuable compounds obtained from the medicinal plants are called 'Biomedicines'.
eg. solanin got from *Solanum nigrum*

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.

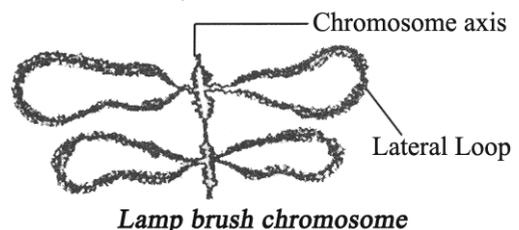
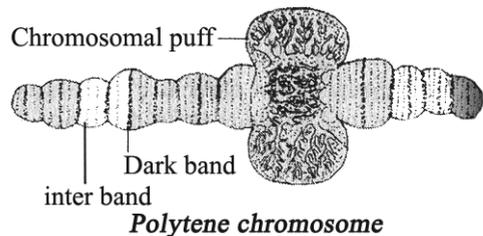
26. In monocot stem, the vascular bundles are numerous and are scattered in the parenchymatous ground tissue. Each vascular bundle is surrounded by a sheath of sclerenchymatous cells. The vascular bundles are conjoint, collateral, endarch and closed. They are closely arranged in the peripheral portion. Towards the centre, the bundles are comparatively large in size and loosely arranged. They are skull-shaped.

Xylem vessels are arranged in the form of 'Y' i.e., two large metaxylem vessels form the arms of 'Y' and one or two protoxylem vessels at the base. The lowest protoxylem disintegrates and forms a cavity called protoxylem lacuna.

Phloem consists of sieve tubes and companion cells. Phloem parenchyma is absent in monocot stem.

27. In Eukaryotic organisms certain chromosomes are found only in certain special tissues and are not seen in other tissues. These chromosomes are larger in size and are called giant chromosomes. In certain plants, they are found in the suspensors of the embryo. There are two types of giant chromosomes: (i) polytene chromosome and (ii) lamp brush chromosome.

Polytene chromosomes were observed by C.G. Balbiani in 1881 in the salivary glands of *Drosophila*. The characteristic feature of polytene chromosome is that along the length of the chromosome there is a series of dark bands alternate with clear zones called interbands. The polytene chromosome has extremely large puff called Balbiani ring. It is also known as chromosomal puff. As this chromosome occurs in the salivary gland it is known as salivary gland chromosomes.



Special types of chromosomes

Lamp brush chromosomes were first observed by Flemming in 1882. It looked like brushes. They occur at the diplotene stage of meiotic prophase in oocytes of *Salamandor* and in giant nucleus of the unicellular alga *Acetabularia*. The highly condensed chromosome forms the chromosomal axis, from which lateral loops of DNA extend as a result of intense RNA synthesis.

28. All bacteria produce at least one type of restriction enzymes. They are meant to help the recombinant researchers to enable them to cut the DNA but to help in the very survival of the bacterial species against the invading bacterial viruses. The restriction enzymes can chop up and render harmless invading viral DNA. Restriction enzymes cleave DNA at very specific places along its length. The restriction enzyme ECORI (E. coli Restriction Enzyme I) produced by the intestinal bacterium E.coli recognizes the following sequence.

Two DNA molecules with sticky ends, (ends that are staggered or uneven), tend to join with other molecules with a complementary sequence of nucleotides in the ends. With the same enzyme, DNA fragments are cut with the matching sequence of nucleotides which complements with the sticky ends.

29.

Cyclic photophosphorylation	Non Cyclic photophosphorylation
1 It is associated with PS I.	It is associated with both PS I and PS II.
2 The electron expelled from chlorophyll molecule is cycled back.	The electrons are not cycled back but compensated by the electrons from photolysis of water.
3 Photolysis of water and evolution of oxygen do not take place.	Photolysis of water and evolution of oxygen take place.

4 Photophosphorylation takes place at two places.	Photophosphorylation takes place only at one place.
5 NADP ⁺ is not reduced.	NADP ⁺ is reduced to NADPH ₂ .

30. Physiological effects of gibberellin are :
- Gibberellins produce extraordinary elongation of stem. The elongation of stem is caused by the cell division and cell elongation induced by gibberellic acid.
 - 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.
 - 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.
 - 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.
 - Some of the light sensitive seeds can germinate by the treatment of gibberellic acid even in complete darkness. e.g. barley.
 - Gibberellin breaks dormancy in potato tubers.
31. The first and foremost aim in plant breeding is to create useful variation in the crop plant. This can be achieved by the following measures.
- Bringing wild food crops to cultivation. (wheat, oats and many cereal crops were once wild plants which had now been domesticated).

2. Obtaining genes from desirable plants or related species (eg. as seeds from various parts of the world).
3. Introduction of plants from nearby regions or even from other countries for improvement of the crop. (eg. cauliflower, tomato, potato and soybeans).
4. By employing certain plant breeding techniques, new varieties are developed. eg. maize, sorghum, cotton and sunflower.
5. Auto and Allopolyploid breeding.
6. By inducing mutations using physical and chemical mutagens.

SECTION - D

32. *Daturametel in botanical terms*

Habit : Large, erect and stout herb.

Root : Branched tap root system.

Stem : The stem is hollow, green and herbaceous with strong odour.

Leaf : Simple, alternate, petiolate, entire or deeply lobed, glabrous showing unicostate reticulate venation and exstipulate.

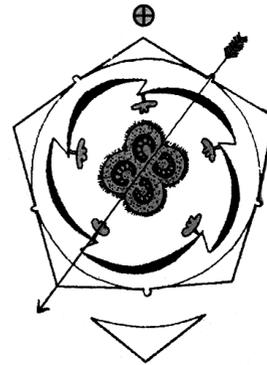
Inflorescence : Solitary and axillary cyme.

Flower : Flowers are large, greenish white, bracteate, ebracteolate, pedicellate, complete, dichlamydeous, pentamerous, regular, actinomorphic, bisexual and hypogynous.

Calyx : Sepals 5, green, gamosepalous showing valvate aestivation. Calyx is mostly persistent and odd sepal is posterior in position.

Corolla : Petals 5, greenish white, gamopetalous, plicate (folded like a fan) showing twisted aestivation, funnel shaped with wide mouth and 10 lobed.

Androecium : Stamens 5, free from one another epipetalous, alternate the petals and are inserted in the middle of the corolla tube. Anthers are basifixed, ditheous with long filament, introrse and longitudinally dehiscent.



Floral diagram

Floral formula:



33. Xylem is a complex tissue that is mainly responsible for the conduction of water and mineral salts from roots to other parts of the plant. The primary xylem is derived from procambium and secondary xylem is derived from vascular cambium. Earlier formed xylem elements are called protoxylem and later formed xylem elements are called metaxylem. Xylem is made up of four kinds of cells - tracheids, vessels or tracheae, xylem fibres and xylem parenchyma.

Tracheids :

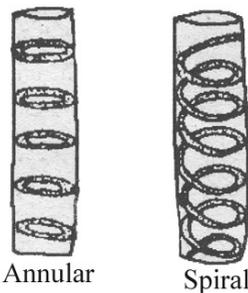
1. They are elongated with blunt ends and lignified secondary wall.
2. The pits are simple or bordered.
3. There are different types of cell wall thickening due to deposition of secondary wall substances. They are annular (ring like), spiral (spring like), scalariform (ladder like), reticulate (net like) and pitted (uniformly thick except at pits).
4. Tracheids are imperforate cells. They are chief water conducting elements in gymnosperms and pteridophytes and also give mechanical support to the plants.

Vessels : They are perforated at the end walls. The perforated plates at the end wall separate the vessels. Due to dissolution of entire end

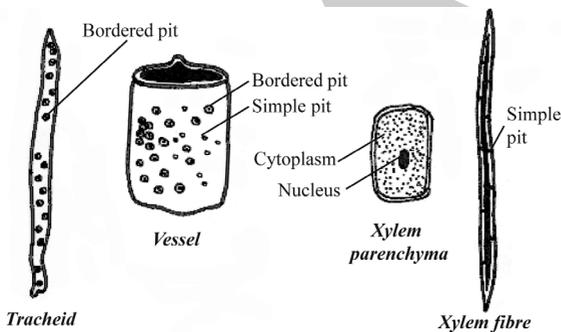
wall, a single pore is formed in the perforation plate. This is called simple perforation plate eg: *Mangifera*.

If the perforation plate has many pores. It is called multiple perforation plate. eg: *Liriodendron*.

The secondary wall thickenings may be annular, spiral, scalariform, reticulate, or pitted as in tracheids. They are the chief water conducting elements in angiosperms and are absent in pteridophytes and gymnosperms. The main function of vessel is conduction of water and minerals and also gives mechanical strength to the plant.



Types of secondary wall thickenings in tracheids



Xylem fibres or libriform fibres : The fibres of sclerenchyma associated with the xylem are called xylem fibres. They give additional mechanical support to the plant. They are dead cells and have lignified walls with narrow lumen.

Xylem parenchyma : The parenchyma cells associated with the xylem are called xylem parenchyma.

Xylem parenchyma is the only living tissue amongst the constituents of xylem.

The cell wall is thin and made up of cellulose. The cells store food reserves in the form of starch and fat. They also assist in conduction of water.

34. Growing the plant cells, tissues and organs on an artificial, synthetic medium under controlled conditions is called plant tissue culture. The basic concept of tissue culture is totipotency, differentiation, dedifferentiation and redifferentiation.

Basic techniques of plant tissue culture :

- (i) **Culture vessels:** The culture vessels used for plant tissue studies includes Erlenmeyer flask (conical flask), petri plates and culture tubes (25 × 150 mm).
- (ii) **Culture medium:** The important media used for all purpose experiment are Murashige and Skoog medium (MS medium), Gamborg medium (B5 medium), White medium (W medium), Nitsch medium. The culture medium is closed with cotton plug or aluminium foil sheet. The pH of the medium is adjusted to 5.8 (acidic range).
- (iii) **Sterilization:** Sterilization is the technique employed to get rid of the microbes such as bacteria and fungi in the culture medium and plant tissues. So, it is important to sterilize the culture medium and plant tissue. The culture medium can be sterilised by keeping it in an autoclave and maintaining the temperature of 121°C for 15 minutes. The plant tissue (inoculum) is to be surface sterilised.

Chemical sterilization: By treating the inoculum in any one of the chemical sterilizant such as Sodium hypochlorite, Calcium hypochlorite, Mercury chloride for 15 to 20 minutes followed by repeated washing in sterile water upto 3 to 5 times.

- (iv) **Inoculation:** Transfer of explant (root, stem, leaf, etc.,) on to a culture medium is called inoculation. The inoculation is carried out under aseptic condition for which an apparatus called laminar air flow chamber is used. Flamed and cooled forceps are used for transfer of plant materials to different culture media kept in glasswares.
- (v) **Incubation:** The culture medium with the inoculum is incubated at $26 \pm 2^\circ\text{C}$ with the light intensity at 2000 to 4000 lux (unit of intensity of light) and allowing photoperiod of 16 hours of light and 8 hours of darkness.
- (vi) **Induction of callus:** Due to activity of auxins and cytokinins, the explant is induced to form callus. The callus is an unorganized mass of undifferentiated tissue. The mechanism of callus formation is that auxin induces cell elongation and cytokinin induces cell division as a result of which masses of cells are formed.
- (vii) **Morphogenesis:** Formation of new organs from the callus under the influence of auxin and cytokinin is called Morphogenesis. Roots and shoots are differentiated from the callus. Such embryos are called somatic embryos that result in the formation of young plantlet.

There are two types of morphogenesis:

- (a) **Organogenesis:** Formation of new organs such as shoot and root is known as organogenesis. The development of shoot from the callus is called caulogenesis and formation of root is called rhizogenesis respectively.
- (b) **Embryogenesis:** Formation of embryos (i.e., bipolar structure having shoot and root) from the callus is called embryogenesis. These embryos arise from somatic

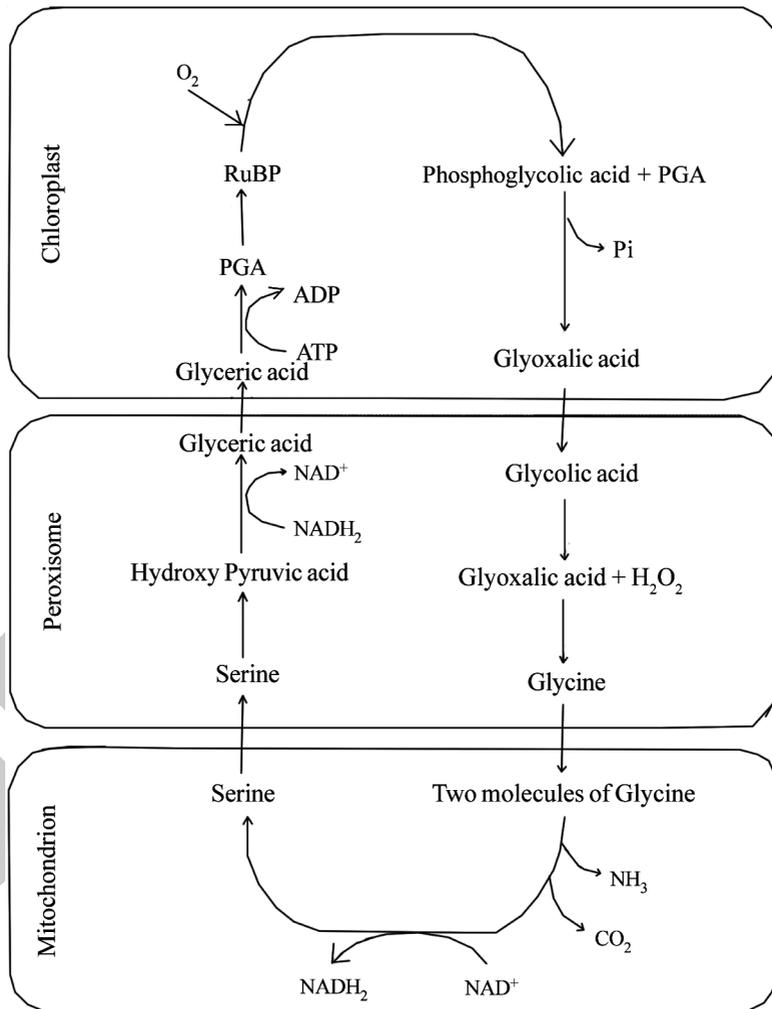
callus tissue and are called somatic embryos or embryoids or somaclonal embryos.

- (viii) **Hardening:** Exposing the plantlets to the natural environment in a stepwise manner is known as hardening. Finally the plantlets are gradually transferred to the soil.
35. In animals and bacteria, only one kind of respiration known as dark respiration occurs. This is not affected by the presence or absence of light. But in certain green plants, there are two distinct types of respiration: (i) photorespiration and (ii) dark respiration. Respiration that occurs in photosynthetic tissues in the presence of light and resulting in increased rate of carbondioxide evolution is called photorespiration or light respiration. Photorespiration involves three organelles: (a) chloroplasts; (b) peroxisomes and (c) mitochondria. Oxidation of RuBP in the presence of high oxygen is the first reaction of photorespiration. This reaction is catalyzed by *Rubisco enzyme* called *carboxylase*. It leads to the formation of 2C compound-phosphoglycolic acid and 3C compound PGA. When PGA is used up in the Calvin cycle, the phosphoglycolic acid is dephosphorylated to form glycolic acid in the chloroplasts.
- From the chloroplast, the glycolic acid diffuses into the peroxisome where it is oxidised to glyoxalic acid and hydrogen peroxide. In peroxisome, from glyoxalic acid glycine is formed.
- Glycine molecules enter into mitochondria where two molecules of glycine combine to give a molecule of serine, NH_3 and CO_2 . During this process, NAD^+ is reduced to NADH_2 .
- The amino acid serine is taken to peroxisome where, it is converted into hydroxy pyruvic acid. Hydroxy pyruvic acid is reduced by NADH_2 to form glyceric acid.
- The glyceric acid leaves peroxisome and enters chloroplast, where it is phosphorylated

to PGA, which enters into Calvin cycle. During the photorespiratory pathway, one CO₂ molecule released in mitochondria is to be refixed.

Photorespiration is also known as photosynthetic carbon oxidation cycle or C₂ cycle. Under the conditions of high light and limited CO₂ supply, photorespiration protects the plants from photooxidative

damage. This means that, if enough CO₂ is not available to utilize light energy, excess energy causes damage to plant. However, photorespiration utilizes part of the light energy and saves the plant from photooxidative damage. Increased O₂ level increases photorespiration whereas increased CO₂ level decreases photorespiration and increases photosynthesis.



Photorespiratory Pathway



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

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

SECTION - B

17. i) Genetic reasons
ii) Increased appetite
iii) Endocrine causes
iv) Metabolic disorders
18. The corpus luteum plays an important role at the time of pregnancy. It is derived from the empty Graffian follicle after ovulation. The corpus luteum secretes a hormone called progesterone. It is a steroid hormone, secreted in significant amounts by the corpus luteum and placenta.
19. Vomiting, profuse diarrhoeal stool (rice water stool) which results in severe dehydration, loss of minerals, increased blood acidity, and haemoconcentration.
20. The free antibodies have three main functions viz.,
- Agglutination of particulate matter, including bacteria and viruses.
 - Opsonisation or coating over bacteria to facilitate recognition and phagocytosis by the phagocytes and
 - Neutralization of toxins released by bacteria.
21. The part of the antibody molecule which makes contact with the antigen is termed the paratope. Consequently, the part of the antigen molecule that makes contact with the paratope is called the epitope.
22. (i) Karyotyping helps to identify the sex of individuals through amniocentesis.
(ii) Genetic diseases in human beings can be detected by this technique. If a disease is detected, the medical counselling for termination of pregnancy and abortion of such foetus can be done.
(iii) By characterizing the normal karyotype, the chromosomal abnormalities such

as deletion, duplication, translation, non-disjunctions and the consequent aneuploids could be detected.

23. Genetically engineered bacteria are called superbugs. They can degrade several aromatic hydrocarbons, at the same time. They are employed in clearing oil spills in the ocean. Thus they are used in pollution abatement. It was first produced by Anand Chakraborty in USA (strain of pseudomonas bacteria).
24. In cDNA copies of messenger RNA are made by using reverse transcriptase enzymes. The cDNA libraries are smaller than genomic libraries and contains only DNA molecules for genes.
25. i) Nokrek (Meghalaya)
ii) Nanda Devi (Uttar Pradesh)
iii) Sundarbans (West Bengal)
26. Feeding jaggery along with lime water, few days prior to calving and giving soft nutritious and easily digestible food for a few days after calving prevents milk fever. Cleaning the udder with warm cloth and preventing infection from the floor. Pumping clean air into the udder and massaging are other measures to be adopted.
27. 1. Accuracy is more when compared with manual method.
2. Large number of samples may be processed in minimal time.
3. Two or more assays may be performed simultaneously.
4. Calculations are not required.
28. The 'Germplasm theory' states that 'any change in the somatoplasm will not have an influence over the germplasm'. This was formulated by August Weismann.

SECTION - C

29. Root canal treatment is a modern dental procedure to save a tooth in which the pulp (the living tissue within a tooth) has died or become untreatably diseased, usually as a result of extensive dental caries.

Steps involved in Root Canal Treatment :

- (i) A hole is drilled into the crown to remove all material from the pulp chamber. The

root canals are then cleaned with fine tipped instruments. The procedure is usually monitored by X-rays.

- (ii) The cavity is washed out and antibiotic paste and a temporary filling are packed into it. Some days later, the filling is removed and the canals are checked for sterility.
- (iii) When no infection can be detected, the cavity is filled with a sealing paste and/or tapering solid 'point' made of gutta-percha resin mixed with zinc and bismuth oxides. The month cavity is then sealed with cement.

30. **The following symptoms, have been defined by WHO.**

- (i) Weight loss of atleast 10% body weight.
- (ii) Chronic diarrhoea for more than a month.
- (iii) Prolonged fever for more than a month.
- (iv) Night sweats and persistent coughs.
- (v) Opportunistic infections such as tuberculosis, oropharyngeal candidiasis (fungal infection in mouth and throat).
- (vi) Recurrent herpes zoster (viral) infection.
- (vii) Meningitis and nerve damage.
- (viii) Loss of memory and intelligence.
- (ix) An unusual cancer, kaposi sarcoma which produces scattered purplish lesions over the chest and abdomen.

31. Acquired immunity, also known as adaptive or specific immunity, is capable of recognizing and selectively eliminating specific microorganisms. Adaptive immunity has the following unique features.

- (i) **Specificity.** It is the ability to distinguish differences among various foreign molecules.
- (ii) **Diversity.** It can recognize a vast variety of foreign molecules.
- (iii) **Discrimination between Self and Non-Self.** It is able to recognize and respond to molecules that are foreign (non-self) to the body. At the same time, it can avoid response to those molecules that are present within the body (self antigens) of the given animal.

- (iv) **Memory.** When the immune system encounters a specific foreign agent e.g. microbe for the first time, it generates an immune response and eliminates the invader. The immune system retains the memory of this encounter for a prolonged interval. As a result, a second encounter with the same microbe evokes a heightened immune response.

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.

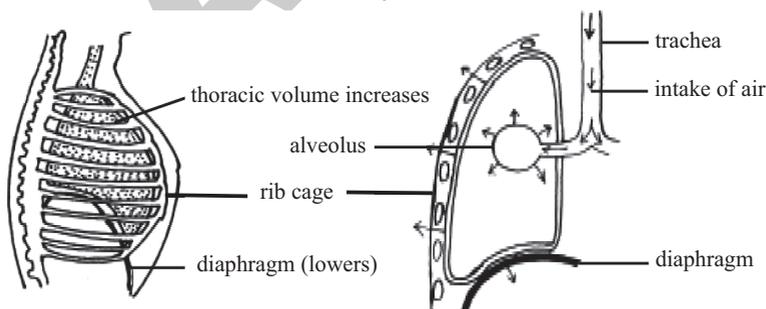
SECTION - D

34. **Mechanism of Breathing :** The process of inspiration and expiration happens due to pressure changes in the thorax or thoracic cavity. The thorax is an airtight compartment bounded by the sternum in front, the vertebral column at the back, the ribs encircling the sides and the diaphragm found below. The

rib bones are provided with the two sets of muscles namely external and internal intercostal muscles. By the contraction and expansion of these muscles the volume of the thoracic cavity is reduced or increased. The floor of the thoracic cavity is completely closed by the diaphragm. The act of breathing is performed by expansion and contraction of the thoracic cavity.

Inspiration : It is the process by which fresh air is drawn into the lungs. It is an active process. The muscles participating in the inspiration process are external-intercostal muscles present in between the ribs and the diaphragm.

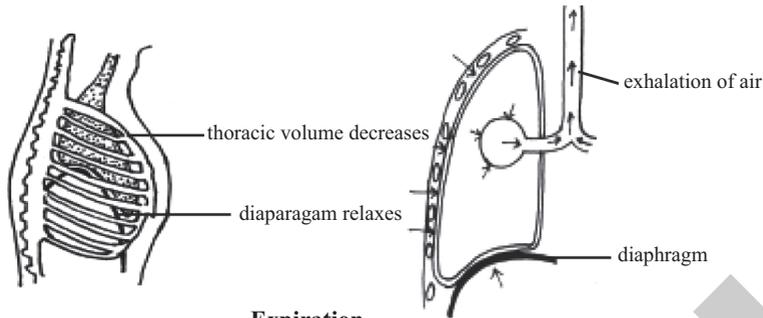
During quiet respiration, contraction of external intercostal muscle causes the ribs to move anteriorly and outwardly. This movement enlarges the cavity of the thorax by increasing it side to side and in dorso-ventral dimensions. The contraction of radial muscles of the diaphragm leads to flattening of inelastic, dome shaped central part of the diaphragm. As a result of these muscular movements, the volume of the thoracic cavity is increased. This causes the air pressure within the lungs to fall below the atmospheric pressure. So air (tidal air) from outside passes through the air passage into the lungs to equalize the pressure.



Inspiration

Expiration : Inspiration is followed by expiration. It is a passive process. It is the process by which air is exhaled or blown out from the lungs. The expiration results when the volume of the thoracic cavity is decreased and air pressure in the lung is increased. The expiratory process involves the following movements.

- (i) The diaphragm relaxes and rises to resume the original dome shape.
- (ii) The ribs take their original position as a result of contraction of the internal intercostal muscles.



Expiration

35. **Fore Brain (Prosencephalon) :-** This region of the brain comprises

Diencephalon and the **cerebrum**.

The diencephalon is formed of **thalamus** and **hypothalamus**.

Thalamus :- It is the largest part of the diencephalon. This region contains a cluster of nuclei. Most of the sensory inputs are conducted to the cerebral cortex through the thalamus. Axons carrying auditory, visual and other sensory informations synapse with specific nuclei of this region. This region may also influence mood and general body movements due to strong emotions such as fear or anger.

Hypothalamus :-

This region contains small nuclei and nerve tracts. The nuclei called **mamillary bodies** are involved in olfactory reflexes and emotional responses to odours. The funnel shaped infundibulum from the hypothalamus

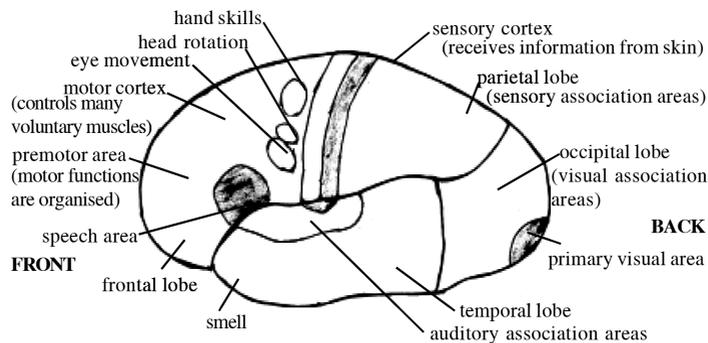
connects it to the posterior **pituitary** or **neurohypophysis**. This region controls the secretions of the pituitary gland.

The hypothalamus receives inputs from several sensory systems such as tongue, nose and external genitalia. It is associated with emotional and mood relationships. It provides a relaxed feeling. Feeling good after a meal, rage and fear are also due to this region. It also coordinates responses to the sleep-wake cycle with other areas.

Cerebrum :-

It is the largest part of the brain. It weighs about 1400g in males and 1200g in females. Larger brains are normally associated with larger bodies and not with greater intelligence.

The grey matter on the outer surface of the cerebrum is the **cortex**. It forms clusters deep inside the brain called **nuclei**. The inner part of the brain, in between the cortex and the nuclei has white matter named as **cerebral medulla**.



Cerebral cortex - functional areas

Cerebral cortex :-

The cortex contains several primary sensory areas. These areas include **taste area**, **primary auditory cortex** for processing auditory stimuli, **visual cortex** for perceiving visual images and areas for other **cutaneous sensations**.

The cortical areas adjacent to the primary sensory centers are called the **association areas**. These areas are involved in the process of recognition. For example the sensory stimulus from the retina of the eye reaches the **visual association area** of the cortex. Here the visual information is compared with past experiences. Further this area has connections with other parts of the cortex, which influence decisions. Thus visual information is judged several times. This may be one of the reasons why two people who witness the same event can present somewhat different versions of what happened.

The **primary motor area** of the cortex controls many voluntary movements, especially the finer motor movements of the hands. Muscle groups such as facial muscles, that have many motor units have greater innervation. They are represented by a large area of the motor cortex.

Anterior to the primary motor area are the **premotor area**. It is the staging area in which motor functions are organized before they are initiated in the motor cortex. For example, if a person decides to lift a hand, the neurons of the premotor area are stimulated first. This area determines the order and the degree to which the muscles must contract.

The **prefrontal area** provides motivation and foresight to plan and initiate movements. This area is well developed only in primates and especially in humans. Our emotional behaviour and mood are controlled by this area.

36. The electromagnetic radiation emitted from the sun includes ultraviolet radiation, which is potentially harmful to most living things since it can damage DNA. The ozone layer screens out the sun's harmful ultraviolet radiation. Even 1% reduction in the amount

of ozone in the upper stratosphere causes a measurable increase in the ultraviolet radiation that reaches the earth surface.

If there was no ozone at all, the amount of ultraviolet radiation reaching as would be catastrophically high. All living things would suffer radiation burns, unless they were underground or in the sea.

In the stratosphere, small amounts of ozone are constantly being made by the action of sunlight on oxygen. At the same time, natural processes are breaking down ozone. The total amount of ozone usually stays constant because its formation and destruction-occur at about the same rate. But unfortunately human activity has recently changed that natural balance. Some manufactured substances such as chlorofluorocarbons and hydrochlorofluorocarbons can destroy stratosphere ozone much faster than it is formed.

37. **Conditioning**

- A layer of lime is spread over the bottom for 2 weeks.
- Lime removes the acidity of soil, facilitates desirable geochemical cycles and kills unwanted soil organisms.
- Water may be let in slowly after 2 weeks and filled to the desired depth.
- The quality parameters like temperature, O₂ content, pH, turbidity, hardness, alkalinity and plankton growth should be checked before stocking those periodically.

Manuring

- The fertilization should be done after 15 days of liming.
- Organic manure or Inorganic manure required for the growth of fish are to be applied. E.g. urine or sewage rich in nitrogenous matters, cow dung, pig dung, poultry manure and plant manures like green manure, compost, oil cake etc.

- If organic 'C' is less, cow dung is applied at the rate of 2-3 tonnes / ha; poultry manure is at the rate of 5000 kg/ha induces the growth of zooplanktons.
- The standard combination of NPK as 18:10:4 is usually recommended for fresh water ponds.
- The urea at the rate of 200 kg/ha/yr or ammonium sulphate at the rate of 450 kg/ ha/yr may be applied to increase the production of pond.

Maintenance of Fish Farm :

- Feed and water quality provided to fish increase their productivity.
- Seed quality, stocking and other management measures also determinate the extent of fish production.
- Temperature at 25 - 33°C, sufficient dissolved O₂, pH 6.5 - 9.0, hardness alkalinity, turbidity (transparent) and plankton culture determine the quality of water provided to fish culture.
- Addition of artificial feed to the natural food increases the growth period of fish.
- In general, artificial feed should contain 30 - 40% of protein, 5 - 10% of fat, 50 - 60% of carbohydrate, less than 5% of cellulose, 10 % water, Vitamins and minerals in right proportions.
- To formulate feed pellets animal and vegetable ingredients can be provided to fish.

- Good feed ingredients like fish meal, prawn meal, soyabean, aquatic weeds oilcakes etc.
- Rice bran and oil cakes are usually provided by Indian farmers in powdered form to major corps.
- Carnivorous fishes like murrels and cat fishes may be provided with trash fishes.
- For adult fish, daily supplementary feeding can be at 2% of its body weight.
- Analysing water parameters, replenishment of water; aeration, regular feeding, observation for mortality and disease symptoms should be checked routinely.
- Ectoparasites or endoparasites, bacteria and viruses causing diseases to fish are to be killed by suitable drugs and diseased fish are to be treated with drugs or dead fishes are to be eliminated from ponds.

Routine Management and Diseases

- Analysing Water parameters, replenishment of water, aeration, regular feeding, observation for mortality and disease symptoms should be routine checks in the management of aquaculture ponds.
- Diseases can be of viral or bacterial origin or may be due to ectoparasites or endoparasites.

