

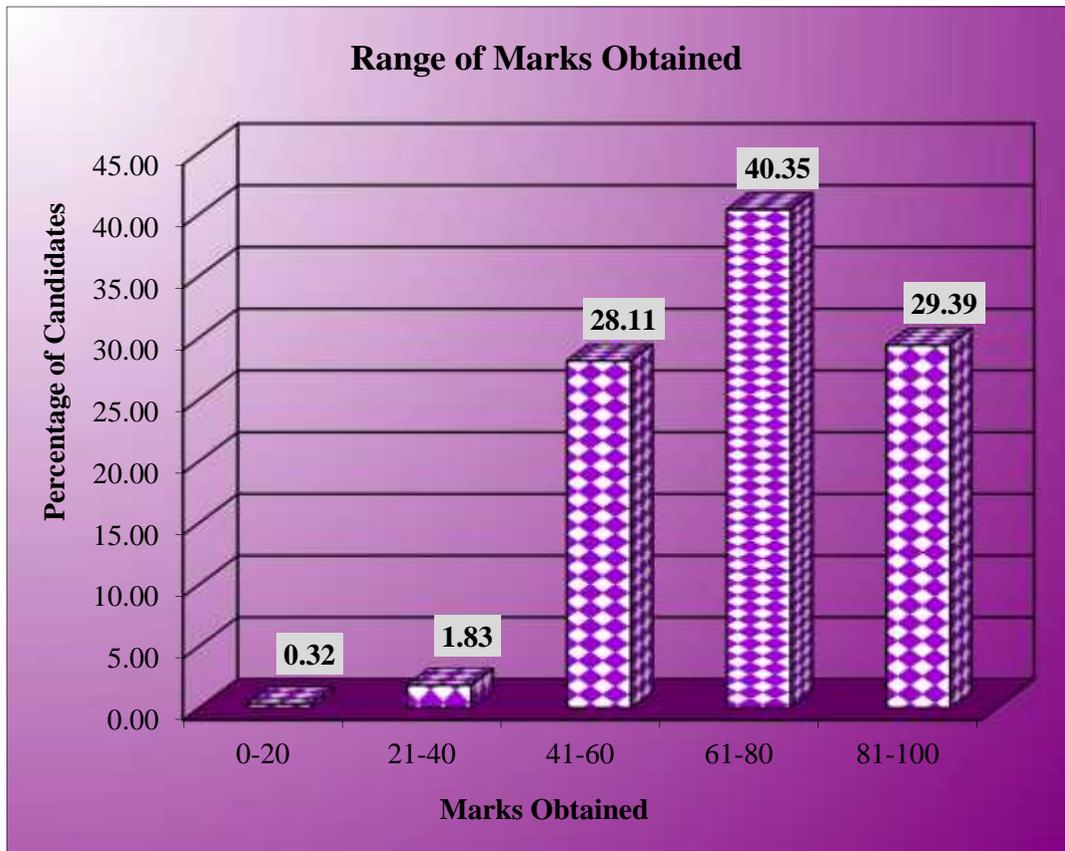
BIOLOGY

STATISTICS AT A GLANCE

Total Number of students who took the examination	13,570
Highest Marks Obtained	100
Lowest Marks Obtained	10
Mean Marks Obtained	70.74

Percentage of Candidates according to marks obtained

Details	Mark Range				
	<i>0-20</i>	<i>21-40</i>	<i>41-60</i>	<i>61-80</i>	<i>81-100</i>
Number of Candidates	43	249	3814	5476	3988
Percentage of Candidates	0.32	1.83	28.11	40.35	29.39
Cumulative Number	43	292	4106	9582	13570
Cumulative Percentage	0.32	2.15	30.26	70.61	100.00



B. ANALYSIS OF PERFORMANCE

PART I (20 Marks)

Answer all questions.

Question 1

- (a) Give a brief answer for each of the following: [4]
- (i) What is *heterosis*?
 - (ii) Why is non-cyclic photo phosphorylation considered as a non-cyclic pathway?
 - (iii) Define *test cross*.
 - (iv) What are *introns*?
- (b) Each of the following question(s)/statement(s) has four suggested answers. Choose the correct option in each case. [4]
1. Triple Fusion involves:
 - (i) Fusion of one male gamete with female gamete
 - (ii) Fusion of tube nucleus with generative nucleus
 - (iii) Fusion of two polar nuclei
 - (iv) Fusion of second male gamete with two polar nuclei
 2. An EEG represents spontaneous electrical activity of the:
 - (i) Kidney
 - (ii) Spinal cord
 - (iii) Heart
 - (iv) Brain
 3. The genotype of a person with Turner's syndrome will be:
 - (i) 44+XXY
 - (ii) 44+XYY
 - (iii) 44+XO
 - (iv) 44+XXYY
 4. Transcription is the transfer of genetic code from a DNA molecule to:
 - (i) RNA molecule
 - (ii) Second DNA molecule
 - (iii) Ribosomal sub unit
 - (iv) Sequence of amino acids in a protein molecule
- (c) Give a scientific term for each of the following: [4]
- (i) The first formed category of photosynthetic organisms.

- (ii) The surgical removal of a section of fallopian tube.
- (iii) An animal behaviour which benefits others but is of no advantage to itself.
- (iv) The hydrostatic pressure developed inside the cell on the cell wall due to endosmosis.
- (d) Expand the following abbreviations: [4]
- (i) STD
- (ii) NADP
- (iii) MRI
- (iv) DDT
- (e) Name the scientists who are associated with the following: [4]
- (i) Discovered the fossil of Australopithecus
- (ii) Microspheres
- (iii) Coined the term *Diffusion Pressure Deficit*
- (iv) Invented the CT scan

Comments of Examiners

- (a) (i) This part was attempted correctly by most of the candidates. Some candidates wrote only 'hybrid vigour' without any explanation.
- (ii) A number of candidates answered this part incorrectly. They did not mention that the electrons do not return back.
- (iii) Several candidates seemed to be confused between 'test cross' and 'back cross'. Some mentioned only offspring and parent but did not write 'cross of F₁ hybrid with recessive parent'.
- (iv) A number of candidates did not attempt this part correctly. Some wrote opposite answers. A few candidates got confused between 'introns' and 'interferons'.
- (b) (i) Most candidates answered this part correctly. Some candidates got confused with fertilisation.
- (ii) A few candidates confused with EEG with ECG.
- (iii) Most candidates attempted this part correctly.
- (iv) This part was answered well by majority of the candidates.
- (c) (i) Some candidates gave the answer as 'green plants' and a few wrote 'coacervates'.
- (ii) A few candidates gave the answer as 'vasectomy'.
- (iii) Some candidates wrote 'communalism' instead of 'commensalism'.
- (iv) A few candidates gave the answer as 'wall pressure'.

Suggestions for teachers

- In heterosis, the point that offsprings exhibit superiority over parents should be emphasized.
- Cyclic and non-cyclic photo phosphorylation should be explained with diagrams and arrows to show the flow of electrons.
- Back cross and test cross should be discussed with suitable examples and appropriate crosses using checker boards.
- For introns, stress should be laid on splicing of non-coding segments.
- Events between pollination and fertilisation should be taught. The terms fertilisation, double fertilisation and triple fusion should be explained clearly.
- Name of the instrument and application to the related organ should be taught.
- Written practice of abbreviations is a must.

- (d) (i) Most candidates answered this part correctly.
- (ii) In place of 'Dinucleotide phosphate' some candidates wrote 'Diphosphate'. Some wrote 'Adenosine' instead of 'Adenine'.
- (iii) A few candidates wrote 'magnet' instead of 'magnetic' and 'resonant' instead of 'resonance'.
- (iv) Many candidates wrote 'Tetra' instead of 'Tri' and 'ethylene/methane' in place of 'ethane'.
- (e) Candidates made mistakes in naming the scientists correctly. In some cases, the first name was written correctly but the second name was wrongly mentioned. Spelling mistakes were common.

- Normal Karyotype and chromosomal abnormality should be explained with symptoms and name of the disease.
- Terms like protobionts, coacervates, microspheres should be thoroughly discussed.
- Teachers should stress upon important terms and their correct spellings.
- Names of scientists given in the syllabus and their contributions should be studied with correct spellings.

MARKING SCHEME

Question 1.

- (a) (i) Heterosis or hybrid vigour is the exhibition of superiority of the hybrid/F1/offspring over both of its parents in one or more traits such as the ability to give higher yield or disease or pest resistance (or explained).
- (ii) In non-cyclic photo phosphorylation the electrons ejected from PS II do not return back, but instead are used by PS I (or explained diagrammatically).
- (iii) *Test cross*: A test cross is when the F1 hybrid is crossed with the double recessive parent/homozygous recessive/Tt x tt
- (iv) Introns are the non-coding segments of eukaryotic chromosomes./DNA/gene/Non coding sequences/sequences removed/spliced/intervening sequences/segments not expressed.
- (b) 1. (iv) fusion of second male gamete with two polar nuclei
2. (iv) brain
3. (iii) 44+XO
4. (i) RNA molecule
- (c) (i) Protobionts/photoautotrophs/cyanobacteria/blue green algae/ chemosynthetic/ Archaeobacteria/sulphur bacteria
- (ii) Tubectomy
- (iii) Altruism/Commensalism
- (iv) Turgor pressure
- (d) (i) STD - Sexually Transmitted Disease
- (ii) NADP - Nicotinamide Adenine Dinucleotide Phosphate
- (iii) MRI - Magnetic Resonance Imaging
- (iv) DDT – Di-chloro Diphenyl Tri-chloro ethane

- (e) (i) Raymond Dart
(ii) Sydney Fox
(iii) Meyer
(iv) Godfrey Hounsfield

PART II (50 Marks)

SECTION A

Answer any *two* questions.

Question 2

- (a) Give *any three* characters that have developed during human evolution. [3]
(b) Explain the term *chemogeny*. [1]
(c) Give *any two* distinctive features of *Dryopithecus*. [1]

Comments of Examiners

- (a) This part was well attempted by most candidates except for a few who gave vague answers such as, change in posture, change in cranial capacity, dentition, etc.
(b) While explaining the term 'chemogeny', some candidates wrote 'formation of chemicals' or 'origin of chemicals' without mentioning 'during evolution'. A few candidates did not mention 'complex organic molecules'.
(c) Distinctive features of *Dryopithecus* were not mentioned by many candidates. Vague answers like, presence of hair, walking on four legs, tree dwellers, were given by a number of candidates.

Suggestions for teachers

- Differences between the features of ancestors and modern man should be discussed in class. Comparison between ape and man should be also be discussed.
- The 'steps' of origin of life - chemogeny biogeny cognogeny should be taught in the proper context and not in isolation.
- Specific distinguishing characters of the fossils of human ancestors mentioned in the syllabus should be learnt. It should be correlated with the trend of evolution during the course of evolution of present day humans.

MARKING SCHEME

Question 2.

- (a) 1. Distinct lumber curve
2. Hind limbs to support weight/Hind limbs longer than fore limbs.
3. Forelimbs for grasping / opposable thumb

4. Pelvis broadened to balance trunk / Development of broad basin-shaped iliac bones in the pelvic girdle.
5. Skull shifted on upper end
6. Stereoscopic vision/binocular vision/3D vision.
7. Large size of brain/High cranial capacity/1400 to 1500 cc.
8. Ability to learn
9. Unspecialized teeth
10. Low fertility rate
11. Bipedal locomotion
12. Straight posture
13. Acetabular cavities shifted inward to give straight posture/erect
14. Flattening of face/orthognathus
15. Loss of supraorbital ridges/brow ridges not distinct.
16. Straightening of forehead/flattening/prominent
17. Formation of chin/jutting out
18. Sparse body hair
19. Narrowing of nose/elevated nose/nose bridge.
20. Thinning of jawbones
21. Reduction in the size of canines/small canines.
22. Increase in intelligence
23. Social and cultural organization/communication.
24. Foramen magnum shifted downward.
25. Simian gap/Diastema absent.
26. Parabolic denture
27. Loss of tail.
28. Curvature of sole/plantigrade/sub plantigrade locomotion/heel formation.
29. Flattening of sternum.

(any three)

(b) *Chemogeny*: chemical origin of life/ abiotic synthesis of macromolecules/chemical evolution

Formation of various simple and complex organic molecules from ammonia, methane, water and vapours/ Formation of chemicals/biomolecules (during origin of life) in the primitive atmosphere.

(c) Distinctive features of *Dryopithecus*:

1. Their arms and legs were of almost equal length
2. They had a semi erect posture
3. Large canines like those of modern apes
4. Frontally broadened jaws/large jaws.
5. No brow ridges
6. 4 ft. tall
7. Cranial capacity (500 to 700cc)

Question 3

- (a) Explain the evolution of giraffe's neck according to Lamarck's theory of evolution. [3]
- (b) Give two chromosomal similarities between man and apes. [1]
- (c) Name *any two* temporary embryonic structures in vertebrates which provide evidence for evolution. [1]

Comments of Examiners

- (a) Some explained the basic postulates of Lamarckism and some gave the explanation on the basis of Darwinism. A number of candidates did not mention about the loss of vegetation from the ground. They only mentioned that small sized giraffe had to stretch the neck to reach the branches of trees but the reason was not mentioned.
- (b) Some candidates gave other similarities between man and apes instead of chromosomal similarities as asked. Several candidates mentioned that the number of chromosomes is *same* (instead of similar). In banding pattern many candidates did not make a mention of 3rd and 6th chromosome number.
- (c) Instead of naming temporary embryonic structures, some candidates mentioned vestigial structures such as vermiform appendix, last molar, pinna muscles, etc.

Suggestions for teachers

- The elongation of giraffe's neck should be explained according to Lamarck as well as Darwin.
- Importance of reading the question properly should be stressed upon. The exact chromosome number of apes and man should be given. Banding pattern of 3rd and 6th chromosome must also be mentioned.
- While discussing "Theory of Recapitulation" suitable examples should be given which can be taken as embryological evidences in favour of evolution.

MARKING SCHEME

Question 3.

- (a)
- Giraffes have evolved from deer-like ancestors/goat like/small height
 - Had short neck and forelimbs
 - Grazed on grass
 - Ground vegetation disappeared /grass disappeared/ replaced by high trees
 - Stretched their neck continuously to feed upon branches/leaves of trees
 - Resulted in gradual elongation of neck and forelimbs
 - Increase was transmitted to the next generation/acquired by descendants.
- (b) Chromosomal similarities between man and apes:
- Close similarities in chromosome number. (apes = 24 pairs, humans = 23 pairs.)
 - Banding patterns of chromosome 3 and 6 are similar
 - Similarity in DNA sequences./amount/content. (any two)
- (c) Temporary embryonic structures:
- Visceral clefts or gill clefts develop in all land vertebrates, but are not present in the adult. They are only useful to fish. / Gill slits functional in fishes only but of no use for land vertebrates.
 - Tooth buds develop in embryos of toothless whales and birds, which are absent in adults.
 - Embryos of all vertebrates develop a notochord which is replaced by a vertebral column in adults.
 - Post anal tail (any two)

Question 4

- (a) *Persons suffering from sickle cell anaemia are at an advantage in Malaria infested areas.* Explain. [3]
- (b) Define the term *gene flow*. [1]
- (c) What are analogous organs? Describe with one example from the plant kingdom. [1]

Comments of Examiners

- (a) A number of candidates got confused with G6PD deficiency. The concept of homozygous and heterozygous condition was not clear to many candidates. Some candidates wrote 'sickle shaped haemoglobin' instead of 'Red Blood Cell'.
- (b) While defining *gene flow*, many candidates wrote 'flow of gene from one place to another place' instead of 'one population to another population'.
- (c) The question asked was examples of plants having analogous organs, but many candidates gave examples of animals instead.

Suggestions for teachers

- Homozygous and heterozygous condition effects must be discussed. The basic concept that due to sickle shape of RBC, surface area is reduced for oxygen transport and malarial parasite cannot multiply, should be explained.
- Difference between homologous and analogous organs must be taught with at least two examples each of plants as well as animals

MARKING SCHEME

Question 4.

- (a)
- Sickle cell anaemia is a genetic disorder/autosomal/recessive where normal haemoglobin HbA is replaced by HbS, reducing the oxygen carrying capacity.
 - RBCs become sickle shaped/malaria parasite cannot multiply and rupture at low concentration of oxygen/hypoxia leading to severe haemolytic anaemia.
 - Homozygous individuals die (Hb^S/Hb^S), but heterozygotes (Hb^A/Hb^S) remain normal.
 - Natural selection has allowed this condition to remain in Africa, where the heterozygous individuals are able to cope with malarial infection, better than the persons with normal RBCs.
- (b) Movement/ transfer/ migration of alleles/ genes from one population to another as a result of interbreeding between members of the two populations./Transfer of genes from generation to generation/transfer of genes among members of the same species/population.
- (c) Analogous organs:
- Analogous structures are those structures which perform the same function but have different origin/internal structure/basic plan/. Organs which reflect or show convergent evolution/ adaptive convergence.
- e.g. Plant leaves and ruscus cladode/asparagus both photosynthesise but are of different origin.
- Sweet potato and potato have same function but different origin.
- Tendrils help in climbing but have different origins like modified stipules in smilax petioles in Nepenthes, leaflets in pea and axillary bud in Passiflora.

SECTION B

Answer any *two* questions.

Question 5

- (a) With the help of diagrams, name and describe the different types of placentation seen in angiosperms. [4]
- (b) Give *four* points of anatomical differences between a monocot stem and a dicot stem. [4]
- (c) Define the following terms: [2]
- Racemose inflorescence
 - Osmotic pressure

Comments of Examiners

- (a) Few candidates attempted this question correctly. Some candidates did not write all the four types of placenta; several candidates discussed different types of ovules instead of placentation. In many cases, the diagrams were not drawn accurately.
- (b) Some candidates wrote morphological differences between a monocot stem and a dicot stem instead of anatomical differences as required. Some others wrote opposite answers.
- (c) (i) Many candidates wrote about acropetal succession but did not mention the very important point of 'indeterminate growth'. Correct diagram was not drawn in several cases.
- (ii) This part was generally well attempted by most candidates except for a few who defined osmosis/turgor pressure/osmotic potential instead.

Suggestions for teachers

- Types of placentation and their diagrams should be given importance in the practical class.
- Morphological as well as anatomical differences must be explained separately. Students must be taught to write differences in a tabular form. The differences written must be compatible.
- Different types of inflorescence should be explained with diagrams.
- Definitions mentioned in the scope must be explained. Key words in definitions must be highlighted and students must be asked to learn definition with the key words.

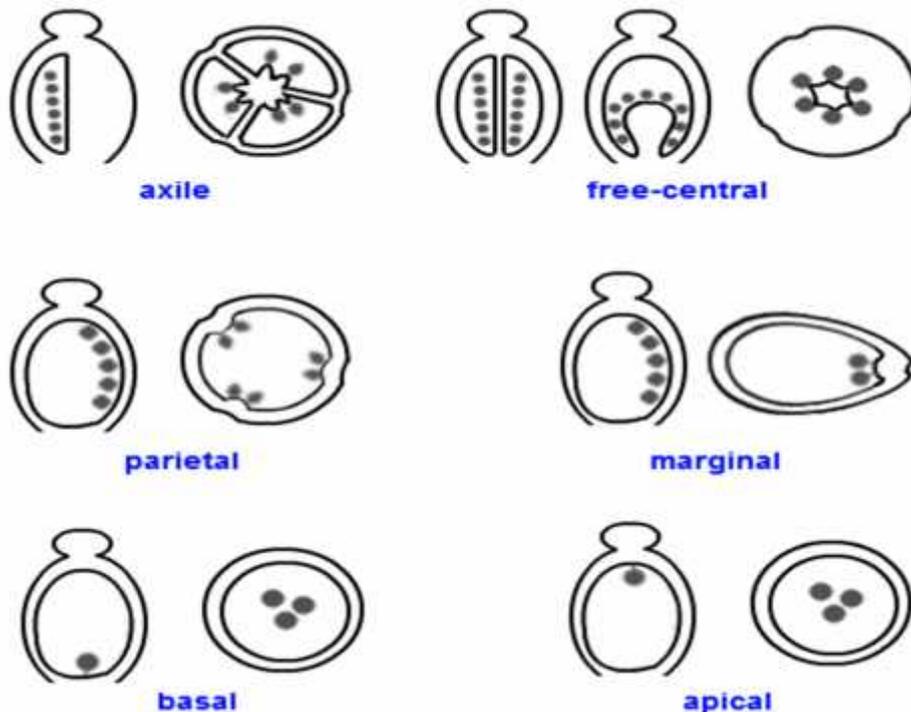
MARKING SCHEME

Question 5.

(a) Types of placentation:

1. **Marginal:** In monocarpellary, unilocular ovary, placenta is borne on the fused margins of the same carpel. The ovules are present along the ventral suture of the carpel./Placenta forms a ridge along the ventral suture of the ovary and ovules are attached on this ridge side by side in two alternating rows e.g. Pea
2. **Axile:** Multicarpellary, syncarpous multilocular gynoecium. Placenta is borne on fused margins of the same carpel. The ovules are borne on confluent margins which meet on the central axis./ovary is divided into several chambers or locules and placentae are borne along the septa of the ovary e.g. Tomato/China rose
3. **Parietal:** Multicarpellary, syncarpous unilocular ovary. Placenta is borne on the fused margin of the same carpel./ovules develop on the inner wall of the ovary or on the peripheral part e.g. Cruciferae (mustard)
4. **Free central:** Multicarpellary, syncarpous, unilocular ovary. Ovules appear to arise from the central column/Ovules are borne on the central axis and septa are absent e.g. Carnation/Dianthus.
5. **Basal:** Unilocular ovary, with a solitary ovule which appears to arise from the base of the ovary./The placenta with one ovule attached to it, lies at the base of the ovary e.g. Sunflower
6. **Superficial:** multicarpellary, syncarpous ovary. Most of the internal surface of the ovary wall is covered with ovules/Any portion of the inner wall of the ovary may serve as a placenta e.g. Water Lily
7. **Pendulous:** Placenta at the top of the ovary and ovule hanging down.
8. **Lamellar:** Placenta enlarges considerably and extends towards the centre. *(any four)*

PLACENTATION



(any four)

(b)

MONOCOT STEM	DICOT STEM
Hair/ Trichomes are absent	Trichomes present
Hypodermis is sclerenchymatous	Hypodermis is collenchymatous
Ground tissue is uniform/undifferentiated	Ground tissue differentiated into cortex, endodermis and pericycle
Numerous vascular bundles scattered in the ground tissue	Fewer vascular bundles arranged in a ring
Cambium absent and closed	Cambium present and open vascular bundles
Xylem arranged in the form of a Y/V	Xylem vessels arranged in radial rows, polygonal in shape
Lysigenous cavity present	No lysigenous cavity
Vascular bundles surrounded by sclerenchymatous bundle sheath	No bundle sheath
Medullary rays and pith absent	Medullary rays and pith present
Vascular bundles are smaller and near the periphery and bigger in the centre	They are of uniform size.
Resin ducts are absent	Resin ducts are present

(any four)

- (c) (i) **Racemose inflorescence:** The floral axis shows indeterminate growth, main axis is elongated and unbranched with older flowers at the bottom and younger flowers at the top (acropetal succession)./Main axis does not end in flower/unlimited growth
E.g. Gladiolus, Triticum, etc. (diagram accepted but tip should not have flower)
- (ii) **Osmotic pressure:** Maximum pressure developed in a solution when separated from pure water by a semipermeable membrane/pressure required to prevent osmosis.

Question 6

- (a) Draw a diagram of the internal structure of the human ovary. [4]
- (b) Define the term *water potential*. What are its components? Explain. [4]
- (c) Give definition and importance of: [2]
- (i) Imbibition
- (ii) Parturition

Comments of Examiners

- (a) Some candidates drew the ovule of plants. Several others drew the female reproductive system. The correct sequence of follicular growth was not shown by many candidates.
- (b) The concept of water potential was not clear to many candidates. Several candidates attempted only the definition of water potential. Relevant points were not given in many answers. Components of water potential were not mentioned by a number of candidates.
- (c) (i) While defining ‘imbibition’, several candidates did not mention ‘adsorption’ or ‘surface absorption’. Some also failed to mention ‘in non-living hydrophilic substances’.
- (ii) A few candidates used the word ‘babies’ instead of ‘foetus’ while defining parturition.

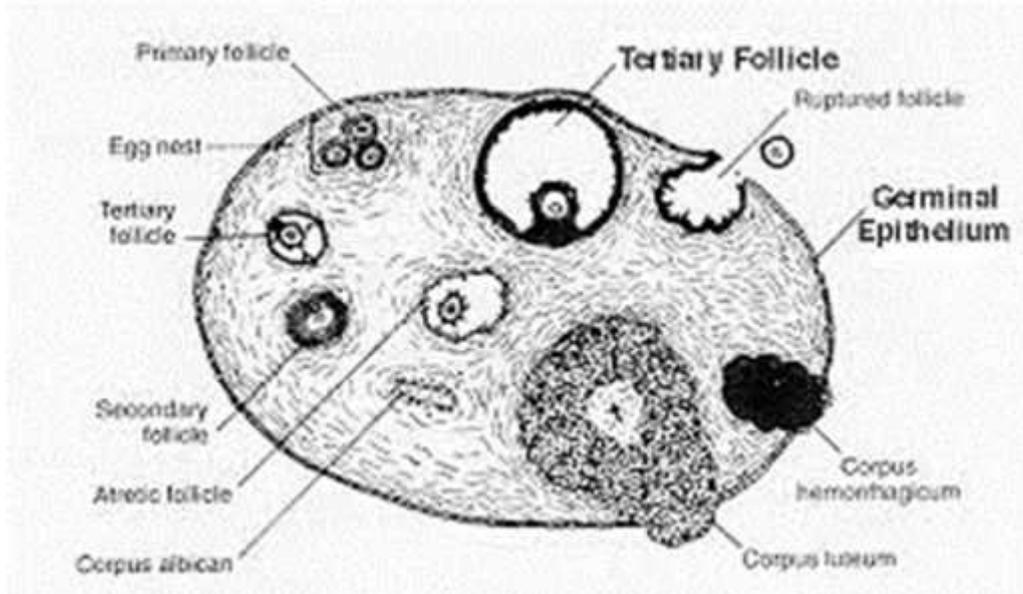
Suggestions for teachers

- Sufficient practice must be given in drawing correct labelled diagrams.
- Definition of water potential and its components should be taught emphasising why these terms are preferred over DPD, OP or TP. Their inter-relationship should be expressed in the form of mathematical equation ($w = m + s + p$). m should not be ignored. Importance of using correct key words must be highlighted.

MARKING SCHEME

Question 6.

(a)



Labelling:

- Germinal epithelium/ epithelium/ peritoneum
- Cortex
- Medulla
- Primary follicles/primordial follicle
- Secondary follicle
- Tertiary follicle
- Graphian follicle
- Ovum released
- Corpus luteum
- Corpus albicans
- Corpus hemorrhagicum
- Blood clot
- Stroma/ connective tissue
- Antrum
- Egg nest
- Atretic follicle

(Any eight)

- (b) **Water potential:** The difference in the free energy/kinetic energy of water molecules in the solution and that of pure water at the same temperature and pressure. Kinetic energy per mole of water/ the tendency of water to leave the system/sum of matrix potential, solute (osmotic) potential & pressure potential. (equation accepted)

Components:

1. **Matrix potential:** the hydrophilic colloidal particles to which water is adsorbed/ component of WP affected due to presence of hydrophilic substances/decrease in the WP due to the presence of matrix
 2. **Solute potential/Osmotic potential:** the decrease in chemical potential of pure water or solvent due to the presence of solute particles/ the component of WP affected due to presence of solutes.
 3. **Pressure potential:** Pressure which governs the movement of water into a cell, developed due to turgor and wall pressure/ the hydrostatic pressure applied by the cell contents on the cell wall in a turgid cell.
- (c) (i) **Imbibition:** Surface adsorption of water by non-living hydrophilic substances like cellulose/colloids due to surface attraction
Initial stages of absorption of water.
Initial stages of germination of seeds.
- (ii) **Parturition** – Act of expelling the full term foetus from mother’s uterus at the end of gestation.

Question 7

- (a) Give *four* adaptations in flowers pollinated by insects. [4]
- (b) Describe the mass flow hypothesis for translocation of organic solutes (food) in plants. [4]
- (c) Write a brief note on the causes of infertility. [2]

Comments of Examiners

- (a) This question was well attempted by most candidates. A few candidates wrote adaptations for wind pollination.
- (b) Very few candidates gave correct and coherent explanation in proper sequence. Some candidates mentioned the movement of water directly from xylem to phloem. They did not mention source or sink. Some of those who tried to explain with the help of diagram did not show arrows.
- (c) Some candidates mentioned causes of infertility of soil.

Suggestions for teachers

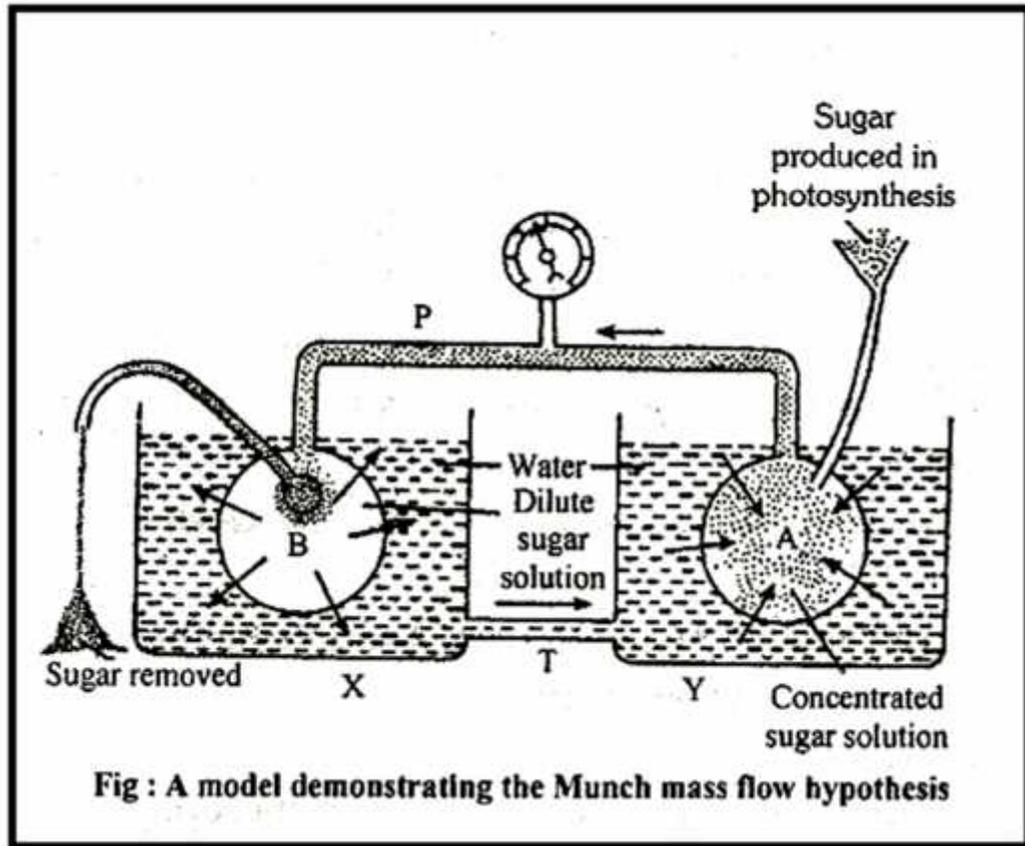
- Different types of adaptations for pollination should be taught with specific examples.
- Translocation of food should be explained by a diagram highlighting source, supply end, xylem, phloem. The point that movement of food occurs along turgor pressure gradient and not according to osmotic gradient alone must be stressed upon. Name of the scientist Munch must be mentioned.
- Students should be advised to go through the syllabus carefully and limit their answers to the scope of the syllabus.

MARKING SCHEME

Question 7.

- (a)
- Large conspicuous
 - Brightly coloured
 - Sweet smell/Fragrant
 - Nectar secreting
 - Pollen grains are rough and sticky/spiny
 - Stigma is sticky
 - Guidelines on petals
 - Arranged in inflorescence
 - Lever mechanism or mimics the female
- (Any four)*
- (b) The transport of food along the conc. gradient/TP gradient/enmass movement.)
- Munch
 - Sugar prepared in the mesophyll cells of leaf increases the osmotic pressure
 - Water from xylem elements and neighbouring cells increases the TP. This forces some of the dissolved food into sieve tube
 - The cells of the root and storage organ have low osmotic and turgor pressure due to low food concentration.

- This creates TP gradient between leaf and phloem
- As a result of this mass flow of water containing dissolved organic food takes place from the upper end to the lower end of the plant through phloem
- The source of supply is the leaf and the storage organ is the root.
- This theory could not explain the bidirectional movement of metabolites.



- Sugar added
- Entry of sugar into Bulb A
- Movement to Bulb B through P
- Exit from Bulb B
- Removal of sugar
- Movement of water from X vessel to Y vessel through T

(Diagram with arrows drawn may be accepted)

(c) Causes of infertility:

- Cryptorchidism: failure of testes to descend into the scrotum
- Hyperthermia: higher temperature of the scrotal sac
- Blockage of vas deferens /sperm duct Blockage of the fallopian tube
- Age related
- DNA damage
- Genetic factors
- Diabetes mellitus / thyroid disorders
- Hypothalamic pituitary factors (hyperprolactinemia and hypopituitarism)
- Low sperm count/oligospermia/ azospermia/ abnormal sperm structure/ poor sperm motility
- Irregular or no ovulation/ less egg production
- Defect in the genital tract
- Defective endometrium, cervix, vaginal growth
- Deficiency of sex hormones/hormonal imbalance
- Hostile response to sperm by the production of antibodies by the woman's blood.
- Overweight / underweight females.
- Improper fertilization
- Inability of meeting of sperm and egg
- Polycystic ovary

SECTION C

Answer any *two* questions.

Question 8

- (a) Give *any four* reasons for Mendel's success. [4]
- (b) Briefly describe the technique employed in DNA fingerprinting. [4]
- (c) Give *any two* features of *Genetic Code*. [2]

Comments of Examiners

- (a) Correct reasons were not mentioned by a number of candidates. Some candidates wrote about Laws of Mendel. Several candidates wrote reasons behind selecting pea plant by Mendel.
- (b) This part was not attempted properly by many candidates. Most candidates were aware of the applications of DNA fingerprinting but not of its technique. In some cases, correct sequence was not written. Some key words like, VNTR and RFLP were missing in many answers.
- (c) This part was well attempted by most candidates.

Suggestions for teachers

- Discuss the reasons for Mendel's success, his reasons for choosing pea plant and the laws separately.
- Steps for DNA fingerprinting should be taught pointwise and importance of correct sequence should be stressed upon.
- Features of genetic code should be discussed with proper explanation.

MARKING SCHEME

Question 8.

(a) Mendel selected the pea plant in which:

- Concentrated at a time only on one particular trait/one character at a time
- Maintained accurate record of observations/ used statistical/ mathematical analysis
- Several varieties available
- Easy to cultivate
- Artificial cross breeding between varieties was possible so hybrids were totally fertile.
- Genes coding for seven pairs of contrasting characters were on different chromosomes. / Fortunate in choosing seven pairs of characters
- The characters he chose did not show any interaction / linkage.
- Used pure varieties
- Bisexuality.
- Short life span
- Large sample size/high yield

(Any four)

(b) DNA fingerprinting technique: Alec Jeffery

- Isolation of DNA by high speed centrifugation.
- DNA amplification by polymerase chain reaction in case the sample is very small.
- Fragmentation of amplified DNA into segments of variable lengths by digesting with restriction endonuclease enzymes.
- Separation of DNA fragments by electrophoresis over agarose gel. The separated segments are called restriction fragment length polymorphism.
- Denaturation of DNA fragments by alkali treatment.
- Transfer of single stranded DNA fragments from gel onto a synthetic membrane such as nitrocellulose or nylon by southern blotting method.
- Fixation of separated DNA fragments to the membrane by exposing to UV light.
- Hybridisation of single stranded DNA with radio labeled VNTR probes.
- Exposure of membrane containing hybrids of radioactive DNA probes and VNTR to X rays, so that the hybridized VNTRs appear as dark bands. The film provides DNA profile and is called autoradiogram.

(c)

- It is always triplet
- Non overlapping

- Universal
- No punctuations
- Collinear
- Degenerative / Redundant
- Initiator codon AUG
- Non sense codons / termination codons

Question 9

- (a) Explain the mechanism of action of T cells to antigens. [4]
- (b) Explain how insulin can be produced using recombinant DNA technology. [4]
- (c) What is pisciculture? Give *one* advantage. [2]

Comments of Examiners

- (a) Some candidates mentioned the role of T. Lymphocytes as phagocytosis without specifying different subtypes of T-cells and their specific function.
- (b) Steps of rDT to make insulin were not written in proper sequence by many candidates. Key terms like vector, host, use of restriction enzymes, ligase, etc. were missing in many answers. Most of the candidates did not mention separate polypeptide chains-A and B and cloning of their respective genes.
- (c) Some candidates confused Pisciculture with Ichthyology i.e. instead of writing 'rearing of fish' they wrote 'study of fish'.

Suggestions for teachers

- Specific role of different components of immune system should be discussed separately under the headings of Cell mediated and Humoral immunity.
- Steps of rDT should be discussed in proper sequence, e.g. selection of host, vector, selection of recombinants, cloning etc.
- Key words should be highlighted in definitions.

MARKING SCHEME

Question 9.

- (a) Mechanism of action of T cells to antigens:
- T cells provide cell mediated immunity – recognize specific antigens.
 - The T lymphocyte divides rapidly/differentiate to form a clone of T cells of 4 types:
 - Killer cells/CT cells: destroy infected cells having the foreign antigen attached to their surface.
 - Memory T cells: are sensitized by antigens and retain their sensitization for the future/remember the nature of antigen for future (secondary) response.
 - Suppressor T cells: inhibit immune response by releasing cytokines that suppress activity of other T and B cells.
 - Helper T cells: secrete substances that enhance or activate immune response./stimulate antibody production of B – cells.

(b) Using recombinant DNA to make Insulin:

Two polypeptide chains (Chain – A with 21 amino acids, Chain – B with 30 amino acids interlinked through disulphide bridges)

Restriction enzymes used to produce nicks in insulin gene in E.coli plasmid at the same restriction sites producing sticky ends

Mutant strains of E.coli used to avoid bacteria attacking “foreign” genes

Insert insulin gene next to E.coli galactosidase gene which controls transcription

Bacterial cells replicate and make copies of insulin gene

Insulin protein is purified (beta-galactosidase removed)

Chains are mixed and disulphide bridges formed

Final product insulin is chemically identical to human insulin

The Rhesus Factor

(c) Pisciculture: The process of fish farming in isolated water bodies./rearing of fish

Advantage: - Provide income and employment to fisherman/economic, helps to enhance food production/nutrition/fish oil (cod liver oil), leather (shagreen).

- Increase in organic fertilisation by fish excreta.

- Better tilling of rice seedlings.

- Reduction in number of harmful insects whose larvae are eaten by fish.

(any one advantage)

Question 10

(a) Name the causative organism and preventive measures for each of the following: [4]

(i) Swine flu

(ii) Typhoid

(iii) Filariasis

(iv) Syphilis

(b) State *four* causes and *four* consequences of population growth. [4]

(c) Differentiate between: [2]

(i) Cannabinoids and Barbiturates

(ii) Biotic potential and Carrying capacity

Comments of Examiners

- (a) (i) Most of the candidates were able to attempt this part correctly. A few candidates wrote wrong preventive measures.
- (ii) Some candidates wrote causative agent correctly but instead of mentioning 'TAB vaccine' wrote Vaccination only. Some wrote 'more water' instead of 'clean water'.
- (iii) Scientific name with wrong spelling was written by a number candidates. Several candidates did not mention mosquito but wrote 'insects' in general. For preventive measures, some candidates wrote 'keep clean' instead of mentioning 'destruction of breeding ground'.
- (iv) Some candidates made spelling mistakes in this part. A number of candidates confused it with AIDS. Some candidates wrote preventive measures but did not mention 'multiple partners'.
- (b) A number of candidates wrote only the causes of population growth and omitted writing the consequences. Some explained the same point for cause as well as for consequence. A few wrote migration/immigration under causes.
- (c) (i) Many candidates did not have any idea about cannabinoids. Vague answers were given by many. Some defined 'cannibalism' instead of 'cannabinoids'. In many cases, the differences given were not compatible.
- (ii) In the definition of Biotic Potential, key words such as, inherent power/population/ideal conditions, etc. were found to be missing in many answers. Some candidates were confused between biotic potential and carrying capacity.

Suggestions for teachers

- Causative organisms should be written with correct generic name and specific name.
- Method of prevention and specific symptoms of diseases should be taught.
- Instruct students to read the question properly and answer to the point.

MARKING SCHEME

Question 10.

- (a) Name the causative organism and preventive measures for each of the following:

Disease	Causative Organism	Preventive Measure
(i) Swine flu	Virus/H1N1	Personal hygiene and sanitation/cover nose/mouth
(ii) Typhoid	Salmonella typhii	Sanitation, personal cleanliness, clean food and water/TAB vaccine
(iii) Filariasis	Wuchereria/Filaria bancrofti	Destruction of mosquitoes and their breeding places, protection against mosquito bites
(iv) Syphilis	Treponemapallidum	Avoid sexual intercourse with multiple partners, use of condom

(b) **Causes:**

- Advancement in agriculture
- Control of famines
- Better public health
- Control of diseases
- Better storage facilities
- More children reach reproductive age
- Low mortality rate
- Illiteracy/lack of education/lack of awareness.
- Desire for a male child
- Better socio – economic conditions/more children more money
- Religious beliefs
- Early marriage
- Lack of use of contraceptives/lack of family planning.
- Poverty/lack of recreation.

Consequences:

- Food crisis/economic crises.
- Acute clothing shortage/shelter/poverty/housing.
- Shortage of drinking water
- Pollution
- Danger of epidemics
- Unemployment
- Lack of educational facilities
- Acute shortage of natural resources/deforestation.
- Poor health of mother and child

(c) **Difference:**

(i) **Cannabinoids:**

- Obtained from Cannabis sativa/Natural
- Intoxicating and hallucinogenic/mood swings/loss of memory/loss of motor coordination/narcosis
- Interact with cannabinoid receptors present principally in the brain.
- Generally inhaled or ingested orally

Barbiturates:

- Derivatives of barbituric acid/synthetic
- Used as sedative/induce sleep/narcotic effect
- Moderate doses produce relaxing effect and relieve stress
- Larger doses impair one's physical, psychological or psychological functions/cause drowsiness/confusion
- Taken orally

(ii) **Biotic potential**

Biotic potential refers to the inherent power of a population to increase in numbers when all environmental conditions are favourable/physiological capacity to produce offsprings under ideal conditions

Carrying capacity

Carrying capacity refers to the maximum population size that a given environment can support/sustain.

GENERAL COMMENTS:

(a) Topics found difficult by candidates in the Question paper:

- Water Potential and its components.
- DNA finger printing technique.
- Action of T cells to antigens.
- Placentation in angiosperms.
- Cannabinoids and Barbiturates
- Mass flow hypothesis.
- Characteristics of Dryopithecus

(b) Concepts between which candidates got confused:

- Gene flow and genetic drift/genetic erosion
- Types of placenta and types of ovules.
- DNA finger printing and finger printing
- Pisciculture and Ichthyology
- Cannabinoids and Cannibalism
- Biotic potential and carrying capacity
- Chromosomal and anatomical features of apes and man.
- Infertility in humans and infertility in soil
- Features of pea plant and laws of Mendel

(c) Suggestions for candidates:

- Read the chapter thoroughly and prepare notes taking care of key concepts and important points.
- Practice through flow charts and diagrams with correct labelling.
- Learn the process or phenomenon in sequence.
- Read the question carefully.
- Learn definitions with the key words. Underline the key words.
- Names of scientists and abbreviations when elaborated should have correct spellings.