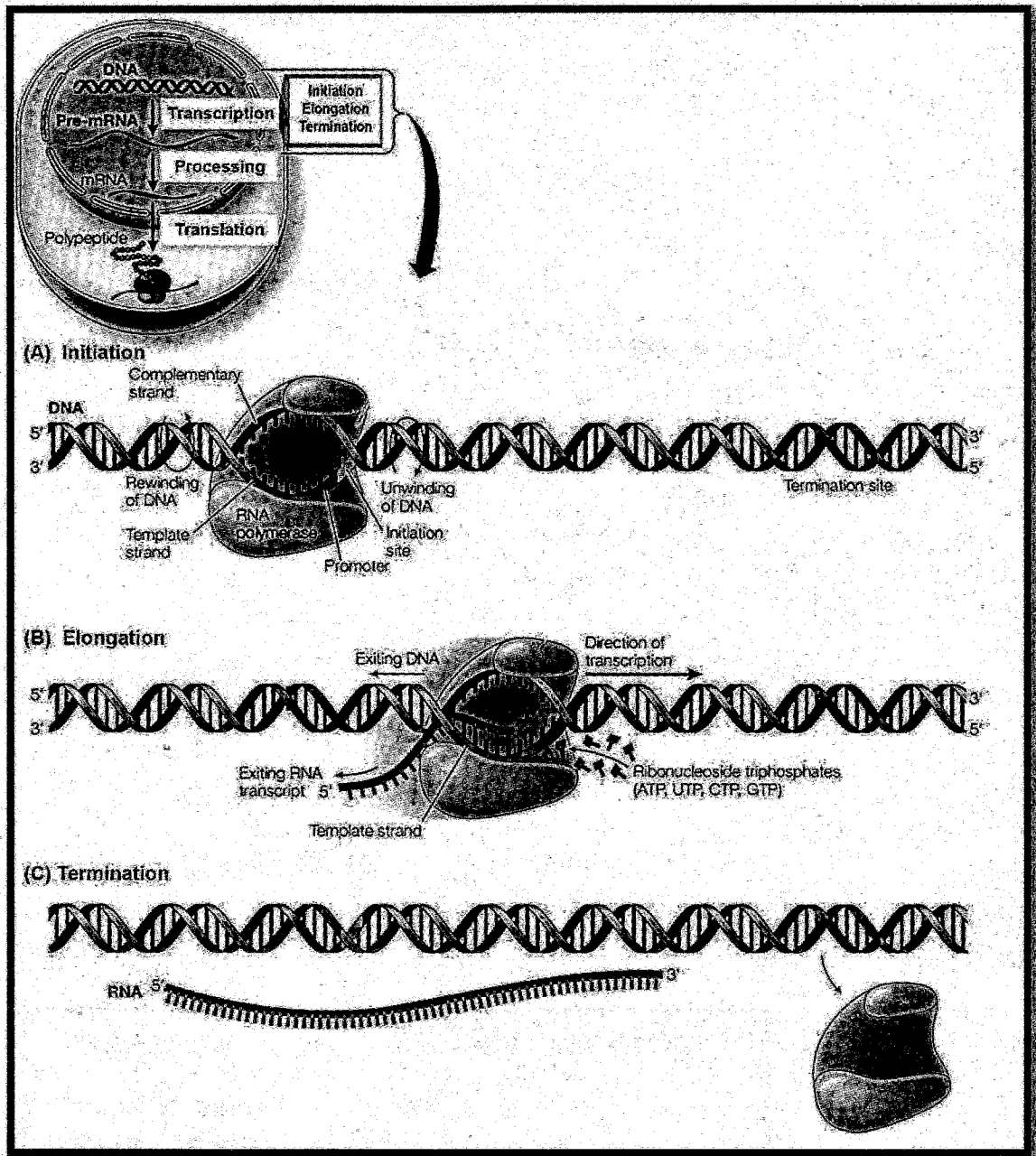


Department of Examinations – Sri Lanka
G.C.E. (A/L) Examination – 2024

09 – Biology
Marking Scheme



This has been prepared for the use of marking examiners. Some changes would be made according to the views presented at the Chief Examiners' meeting.

Amendments to be included

G.C.E. (A/L) Examination - 2024

09 - Biology

Distribution of Marks

- Paper I - 1 x 50 = 50

Paper II

Part A - Structured Essay (Answer all four questions)

Question No. 01 - 100

Question No. 02 - 100

Question No. 03 - 100

Question No. 04 - 100

100 x 4 = 400

Part B - Essay (Answer four questions only)

Question No. 05 - 150

Question No. 06 - 150

Question No. 07 - 150

Question No. 08 - 150

Question No. 09 - 150

Question No. 10 - 150

150 x 4 = 600

Total Marks = 400 + 600 = 1000

Paper II Marks = 1000

Paper I Marks = 50

Final Marks = 50 + $\left(\frac{1000}{20}\right)$

Common Techniques of Marking Answer Scripts.

It is compulsory to adhere to the following standard method in marking answer scripts and entering marks into the mark sheets.

1. Use a red color ball point pen for marking. (Only Chief/Additional Chief Examiner may use a mauve color pen.)
2. Note down Examiner's Code Number and initials on the front page of each answer script.
3. Write off any numerals written wrong with a clear single line and authenticate the alterations with Examiner's initials.
4. Write down marks of each subsection in a \triangle and write the final marks of each question as a rational number in a \square with the question number. Use the column assigned for Examiners to write down marks.

Example:

Question No. 03

(i)

.....

✓

\triangle
 $\frac{4}{5}$

(ii)

.....

✓

\triangle
 $\frac{3}{5}$

(iii)

.....

✓

\triangle
 $\frac{3}{5}$

03

(i)

$\frac{4}{5}$

+

(ii)

$\frac{3}{5}$

+

(iii)

$\frac{3}{5}$

=

\square
 $\frac{10}{15}$

MCQ answer scripts: (Template)

1. Marking templets for G.C.E.(A/L) and GIT examination will be provided by the Department of Examinations itself. Marking examiners bear the responsibility of using correctly prepared and certified templates.
2. Then, check the answer scripts carefully. If there are more than one or no answers Marked to a certain question write off the options with a line. Sometimes candidates may have erased an option marked previously and selected another option. In such occasions, if the erasure is not clear write off those options too.
3. Place the template on the answer script correctly. Mark the right answers with a '✓' and the wrong answers with a '0' against the options column. Write down the number of correct answers inside the cage given under each column. Then, add those numbers and write the number of correct answers in the relevant cage.

Structured essay type and assay type answer scripts:

1. Cross off any pages left blank by candidates. Underline wrong or unsuitable answers. Show areas where marks can be offered with check marks.
2. Use the right margin of the overland paper to write down the marks.
3. Write down the marks given for each question against the question number in the relevant cage on the front page in two digits. Selection of questions should be in accordance with the instructions given in the question paper. Mark all answers and transfer the marks to the front page, and write off answers with lower marks if extra questions have been answered against instructions.
4. Add the total carefully and write in the relevant cage on the front page. Turn pages of answer script and add all the marks given for all answers again. Check whether that total tallies with the total marks written on the front page.

Preparation of Mark Sheets.

Except for the subjects with a single question paper, final marks of two papers will not be calculated within the evaluation board this time. Therefore, add separate mark sheets for each of the question paper. Write paper 01 marks in the paper 01 column of the mark sheet and write them in words too. Write paper II Marks in the paper II Column and write the relevant details.

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்

අ.සො.ස. (උ.පෙළ) විභාගය / க.பொ.த. (உயர் தர)ப் பரீட்சை - 2024

විෂය අංකය
பாட இலக்கம்

09

විෂය
பாடம்

Biology

ලකුණු දීමේ පටිපාටිය / புள்ளி வழங்கும் திட்டம்

I පත්‍රය / பத்திரம் I

ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.	ප්‍රශ්න අංකය வினா இல.	පිළිතුරු අංකය விடை இல.
01.	3	11.	1	21.	1	31.	2	41.	3
02.	4	12.	3	22.	3	32.	1	42.	1
03.	5	13.	4	23.	5	33.	2	43.	4
04.	3	14.	5	24.	4	34.	5	44.	1
05.	2	15.	2	25.	4	35.	4	45.	5(S) 4(T,E)
06.	3	16.	2	26.	4	36.	1	46.	3(S,E) 5(T)
07.	5	17.	3	27.	2	37.	3	47.	2
08.	4	18.	3	28.	5	38.	2	48.	3
09.	5	19.	5	29.	4	39.	5	49.	2
10.	4	20.	2	30.	2	40.	4	50.	1

❖ විශේෂ උපදෙස් / விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට / ஒரு சரியான விடைக்கு ලකුණු 01 බැගින් / புள்ளி வீதம்

මුළු ලකුණු / மொத்தப் புள்ளிகள் — × 50 = 50

Part A - Structured Essay

I. (A) (i) State the function of each of the following proteins.

- | | | |
|-------------------|-------------------------|-------|
| (a) Serum albumin | : Transport fatty acids | 01 pt |
| (b) Ovalbumin | : Storage in eggs | 01 pt |

(ii) (a) Why are amino acids considered as amphoteric molecules?

Because they have an alkaline (amino) group and an acidic (carboxyl) group within the same molecule / because they have an alkaline nature and acidic nature in the same molecule.

01 pt

(b) State two differences between animal fats and plant fats.

- Animal fats do not contain double bonds / made up of saturated fatty acids while plant fats contain (one or more) double bonds / made up of unsaturated fatty acids.
- Animal fats are solid at room temperature while plant fats are liquid at room temperature

02 pts

(iii) (a) Name a protein with alpha helix structure, which is a component of intermediate filaments of the animal cytoskeleton.

Keratin

01 pt

(b) Name a compound present in the cell walls of both bacteria and cyanobacteria but not in the cell walls of archaeobacteria.

Peptidoglycan

01 pt

(iv) (a) What acts as the object for the eyepiece lens when a specimen is observed through a compound light microscope?

The (magnified) image of the specimen produced by the objective (lens)

01 pt

(b) What is used to stain specimens for observation through the transmission electron microscope?

Heavy metals

01 pt

(v) State two functions carried out by both rough and smooth endoplasmic reticulums and two functions carried out only by smooth endoplasmic reticulum (SER).

- | | | |
|-------------------|---|--------|
| (a) By both : | <ul style="list-style-type: none"> • Synthesis of phospholipids • Production of transport vesicles | 02 pts |
| (b) By SER only : | <ul style="list-style-type: none"> • Detoxification • Synthesis of oils / steroids • Storage of Ca^{2+} ions • Metabolism of carbohydrates (any two) | 02 pts |

(B) (i) Name the most abundant glycoprotein in the extracellular matrix of animal cells.

Collagen

01 pt

- (ii) (a) Name the subcellular component that carries out each of the following activities in cells.
- Transporting residue material out of the cell : Lysosomes
- Cytoplasmic streaming : Cytoskeleton **02 pts**
- (b) Which organelle in plant cells is involved in the formation of the cell plate during cytokinesis?
- Golgi apparatus **01 pt**
- (iii) During which phase of mitosis are the chromosomes located at the middle of the cell?
- Metaphase **01 pt**
- (iv) Name two cell types in the human body that are at G_0 phase.
- Nerve cells, Muscle cells **02 pts**
- (v) (a) State the precise site at which each of the following is carried out during cellular respiration.
- Breakdown of glucose to pyruvate : Cytosol
- Production of oxaloacetate : Matrix of mitochondria **02 pts**
- (b) Name the final hydrogen acceptor in each of the following.
- Ethyl alcohol fermentation : Acetaldehyde
- Lactic acid fermentation : Pyruvate **02 pts**
- (C) (i) (a) State what is meant by cofactors of enzymes.
- Non proteinaceous compounds that are essential for the catalytic activities of certain enzymes **01 pt**
- (b) Name two inorganic cofactors.
- Zn^{2+} , Fe^{2+} , Cu^{2+} , K^+ (any two) **02 pts**
- (ii) (a) How does ADP carry out allosteric regulation of an enzyme?
- Acts as an allosteric activator
 - Binds to the regulatory site of the enzyme (and stimulates the production of ATP)
 - Stabilises the shape with functional activities.
- 03 pts**
- (b) Name a solution that can be used as an indicator to demonstrate amylase activity on starch.
- I_2 solution
 - I_2 / KI ($I_2 - KI$) (any one)
- 01 pt**
- (iii) (a) Where are the photosystems located in chloroplasts?
- Thylakoid membranes **01 pt**
- (b) State the wave lengths of light absorbed by chlorophyll-a molecules in photosystem I and photosystem II.
- Photosystem I : 700 nm
- Photosystem II : 680 nm **02 pts**

(iv) State **three** ways by which the cyclic electron flow differs from the linear electron flow in the light reaction of photosynthesis.

- Occurs in PS I only.
- NADPH is not produced / only ATP is produced.
- Oxygen is not released.

03 pts

(v) Photosynthetic plants were highly abundant in the Phanerozoic eon. Name the **three** eras of the Phanerozoic eon.

Palaeozoic, Mesozoic, Cenozoic

03 pts

40 pts x 2½ marks

Total = 100 marks

2. (A) (i) State **five** features of organisms of domain Eukarya that are common to all or some organisms of domain Archaea.

- Presence of histones associated with DNA
- Presence of introns in genes
- Initiator amino acid in protein synthesis is methionine
- Presence of several kinds of RNA polymerases
- Growth is not inhibited by antibiotics / streptomycin / chloramphenicol
- Unbranched hydrocarbons in membrane lipids (any five)

05 pts

(ii) State **three** substances other than cellulose that are present in the cell walls of some protists and name an organism/group of organisms that contains each of these substances.

Substance	Organism/Group of organisms
Alginic acid	<i>Sargassum</i>
Pectin	Diatoms
Silica	Diatoms

02 pts

02 pts

02 pts

(iii) What are the structures that form the ovule of seed plants?

Megaspore, Megasporangium, Integument

03 pts

(iv) State **five** characteristic features of phylum Nematoda that can be observed when a specimen of *Ascaris* (round worm) is examined externally.

- Cylindrical body with tapering ends
- Sensory papillae in the anterior end
- No segmentation / unsegmented body
- Presence of excretory pores in the body wall
- No special locomotory structures
- Bilateral symmetry
- No (distinct) cephalization (any five)

05 pts

(B) (i) State **two** functions of hair like trichomes.

- Reduce water loss
- Reflect excess light

02 pts

(ii) What form the symplastic route of radial transport in plants?

- Cytosol
- Plasmodesmata

02 pts

(iii) What is the form of intake of sulphur into plants?

SO₄²⁻ / Sulphate ions

01 pt

(iv) Why do land plants carry out internal fertilization?

To prevent desiccation of gametes

01 pt

(v) What are known as statoliths that help to detect gravity by vascular plants?

Specialized plastids containing (dense) starch grains

01 pt

(C) (i) State the structural features of a skeletal muscle tissue that can be observed under the light microscope.

- Multinucleated / Many nuclei per cell
- Striated / Striations
- Long cells
- Cylindrical cells (any three)

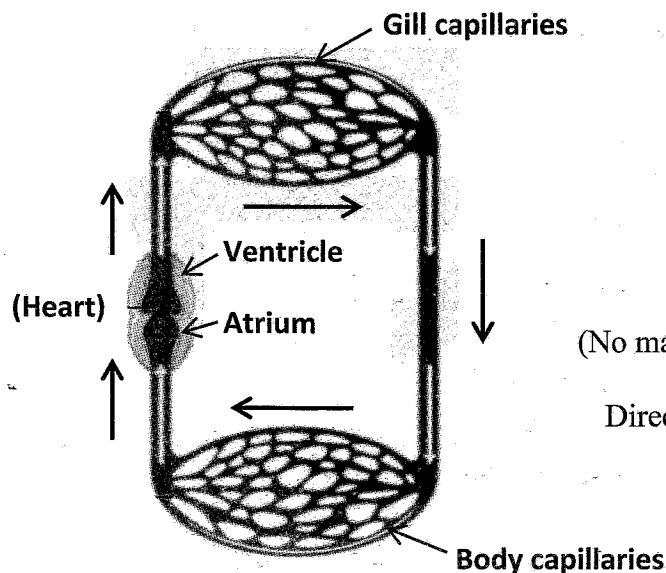
03 pts

(ii) State the functions performed by tongue in the nutrition of humans.

- Mixing food with saliva
- Making food bolus
- Facilitating swallowing
- Pushing the food bolus into the posterior part of the oral cavity and into the pharynx

05 pts

(iii) Using a labelled diagram, indicate the direction of blood flow in the single circulation of fish.



Labelled diagram 01 pt
(No marks for flow chart)

Direction of blood flow 01 pt

(iv) How do the fluids and proteins lost during capillary exchange of substances return to blood in humans?

Via two large lymphatic ducts which drain into (two) veins at the base of neck

02 pts

(v) (a) Indicate the correct pathway through which erythrocytes in the inferior vena cava reach the aorta.

(Inferior vena cava) → Right atrium → Right ventricle → Pulmonary artery
 ↓
 (Lung capillaries)
 ↓
 (Aorta) ← Left ventricle ← Left atrium ← Pulmonary veins

01 pt

(b) Why have respiratory pigments evolved in complex animals?

To transport oxygen from respiratory surface to tissues / organs as oxygen is less soluble in watery medium / blood

01 pt

40 pts x 2½ marks

Total = 100 marks

3. (A) (i) (a) Why are respiratory structures needed for animals?

Gas exchange through body surface is not adequate to fulfil the energy requirements as the body size is increased and becomes complex.

02 pts

(b) State the difference between the vital capacity and total lung capacity of humans.

Vital capacity is the maximum volume of air which can be inhaled and exhaled whereas total lung capacity is the maximum volume of air that lungs can hold.

02 pts

(ii) Name two types of 'antigen presenting cells' in humans.

No Marks

(iii) (a) State the advantage of excreting nitrogenous waste as ammonia for many aquatic invertebrates.

Energy cost for production (for excretion) is less (compared to other wastes)

01 pt

(b) What is the process by which most water is reabsorbed in the nephrons of humans?

Osmosis

01 pt

(c) State the location at which the nephridia of annelids open internally.

Coelom

01 pt

(iv) (a) What is chronic kidney disease?

Gradual loss of kidney function over time

01 pt

(b) Name the endocrine disorder that would lead to kidney failure in humans.

Diabetes

01 pt

(v) (a) State how the nervous system of arthropods is organised.

Brain and ventral nerve cord with segmented ganglia

01 pt

(b) From which part of the human embryonic brain does each of the following structures originate?

Pons Varolii : Hind brain

Pineal body : Forebrain

02 pts

(B) (i) (a) Where are the nerve cell bodies located in the cerebrum of man?

Cerebral cortex

01 pt

(b) Write in correct sequence, the pathway of transmission of impulses in a typical reflex arc in man.

Sensory receptor → afferent / sensory neuron → Inter neuron

Effector/tissue/organ ← Efferent/motor neuron ←

01 pt

- (c) Name the disorder of the human nervous system that is associated with distorted perception of reality.
Schizophrenia 01 pt
- (ii) (a) State the arrangement of cells in the human retina starting from the innermost cell layer.
Ganglion cells, bipolar cells / bipolar neurons, photoreceptors / rods and cones, pigmented (epithelial) cells. 01 pt
epithelium
- (b) How is a single image perceived in binocular vision in humans?
Due to fusion of left, middle and right of visual field images from two eyes in the occipital lobe of cerebrum
(if occipital lobe is not mentioned consider as 01 pt) 02 pts
- (iii) What is perceived as sound in hearing?
Nerve impulses generated as a result of transduction of pressure waves produced in the surrounding air by vibrating objects 01 pt
- (iv) (a) What is an endocrine gland?
Ductless gland consisting of (group of) specialized cells which secrete hormones / chemical messengers 01 pt
- (b) State the reasons for hypothyroidism in humans.
- Insufficient secretion of thyroid hormones / T_3 and T_4
 - Lack of TSH production (by anterior pituitary)
 - Iodine deficiency (any two) 02 pts
- (v) (a) How does luteinizing hormone promote spermatogenesis in man?
By stimulating Leydig cells to produce testosterone and other androgens 02 pts
- (b) What are the main structural changes that occur in the uterus of a mature, normal woman during the uterine cycle in preparation for the arrival of fertilised ovum?
- Thickening of the endometrium
 - Enlarging arteries in the endometrium
 - Growth of endometrial glands 03 pts
- (C) (i) (a) Name the two hormones responsible for the preparation of uterus for receiving the fertilised ovum.
Progesterone, Estradiol / Estrogen 02 pts
- (b) What is the foetal membrane associated with the development of urinary bladder in humans?
Allantois 01 pt
- (ii) Name a sexually transmitted infection in man caused by a virus other than HIV.
Genital Herpes 01 pt
- (iii) (a) Name a group of animals that move by taking water into the body and squirting it out in bursts.
Squids 01 pt

(b) What is the role of Ca^{2+} in shortening of sarcomeres in the skeletal muscles?
 (Contribute to) exposing myosin binding sites on actin (molecules) **01 pt**

(iv) (a) State the functions of sinuses in the human skull.
 • Provide resonance to voice
 • Reduce weight of skull **02 pts**

(b) What is the structural arrangement in the upper limb of human which permits power grip?
 (Hinge) joints between metacarpels and phalanges **01 pt**

(c) Name the joint that bears the body weight of the human when standing.
 Hip joint / ball and socket joint formed by head of femur with acetabulum (of the hip bone of pelvis) **01 pt**

(v) (a) What is a gene?
 Basic unit by which genetic information is passed from parents to offspring /
 Nucleotide sequence of DNA at a specific locus on a chromosome / Basic
 physical and functional unit of inheritance **01 pt**

(b) What is known as mutation breeding in crop plants?
 Inducing desirable mutations using chemical or physical agents **02 pts**

40 pts x 2½ marks
Total = 100 marks

4. (A) (i) Nucleotide sequence of a part of a DNA coding strand for a polypeptide and relevant amino acids are given in diagram X.

(a) Name the types of specific point mutations if nucleotide sequence of X is altered due to substitution as shown in diagrams Y and Z.

X : CGTTTTTACCTATA
 Arg Phe Leu Pro Ile

Y : CGTTTTTCACCTATA
 Arg Phe Ser Pro Ile

Z : CGTTTTTGCCTATA
 Arg Phe Leu Pro Ile

Y : Missense mutation **02 pts**
 Z : Silent Mutation

(b) Write the mRNA nucleotide sequence corresponding to the part of the DNA coding strand given in X.
 CGUUUUUACCUAUA **01 pt**

- (ii) (a) What is meant by vector in gene technology?
Vehicle that carries the required DNA into a host for multiplication or cloning. 01 pt
- (b) Give two examples for cloning vectors.
Plasmid, Bacteriophage 02 pt
- (iii) Why is recycling of materials in an ecosystem important?
Because the materials available for living organisms are limited/After the death of an organism, materials should be made available to other organisms 01 pt
- (iv) Name three biomes where the temperature reaches 35°C or above.
Desert, Chaparral, Temperate broad leaf forest. 03 pts
- (v) (a) What is meant by ethical value of biodiversity?
 - All living beings have the right to live
 - Humans/we have no right to decide which species should exist
02 pts
- (b) What is the purpose of Kyoto protocol?
Reduction of emission of greenhouse gases 01 pt
- (B) (i) State the specific physical method that can be used to sterilize each of the following.
- (a) Hospital waste : Incineration 01 pt
- (b) Air in operating theatres : UV radiation / Ultraviolet radiation 01 pt
- (c) Enzyme solutions with microbial cells larger than 0.45 µm :
Membrane filtration 01 pt
- (d) Inoculation loops : Direct flaming 01 pt
- (ii) Name a chemoautotrophic bacterial genus that oxidises NO_2^- to NO_3^- in soil.
Nitrobacter 01 pt
- (iii) State two modes of respiration present in both mycoplasma and unicellular protists.
Aerobic , Facultative anaerobic 02 pts
- (iv) Name a simple stain used to observe the cellular shape of bacteria.
Methylene blue/ Crystal violet / Safranin 01 pt
- (v) If a student is provided with two sets of petri dishes with sterile solidified nutrient agar and a phenol solution, write in correct sequence the procedure that should be followed to test the effect of phenol on microorganisms in air.
- Expose both sets of nutrient agar plates / petri dishes to air for (about) 10 minutes.
 - Close one set of petri dishes after rinsing with phenol.
 - Close / keep closed the other set.
 - Incubate for 24-48 hours and observe for number of colonies (in both sets)
- (All 4 points should be in correct order. otherwise no marks) 04 pts/ 0 pt
- (C) (i) (a) What is the role of methanotroph microorganisms present in oceans?
Consumption of methane before it reaches the atmosphere / Consumption (80% of) methane generated in the ocean 01 pt

- (b) How are mycorrhizae beneficial to plants?
- Increasing the area of nutrient / mineral / water uptake.
 - Reaching small pores in soil where roots cannot reach.
 - Increasing the uptake of immobile nutrients / P / Zn / Cu
- 03 pts
- (ii) (a) Name two species of genetically modified microorganisms used to produce human insulin.
- Escherichia coli*
Saccharomyces cerevisiae
- 02 pts
- (b) State the cause for algal blooms seen in some freshwater bodies.
Accumulation of excessive amounts of phosphates and nitrates into water bodies.
(If only eutrophication is written consider as 01 pt.)
- 02 pts
- (iii) (a) Why is activated carbon used in some drinking water treatment plants?
To remove toxic chemicals
- 01 pt
- (b) What does the presence of coliform bacteria in drinking water indicate?
- Fecal contamination
 - Potential Contamination by / presence of pathogenic microorganisms
(any one)
- 01 pt
- (iv) (a) Name a type of microorganism that cause spoilage of each of the following foods.
- Food stored at 4°C : Psychrophilic bacteria
- Food containing sugar : Osmophilic / Xerophilic molds / yeast
- 02 pts
- (b) How does *Aspergillus flavus* cause food intoxication in humans?
By producing Aflatoxins
- 01 pt
- (v) State two uses of nano device sensors in nanomedicine.
- To monitor blood pressure
 - To monitor blood oxygen levels
 - To monitor hormone concentrations (Any two)
- 02 pts

40 pts x 2½ marks
Total = 100 marks

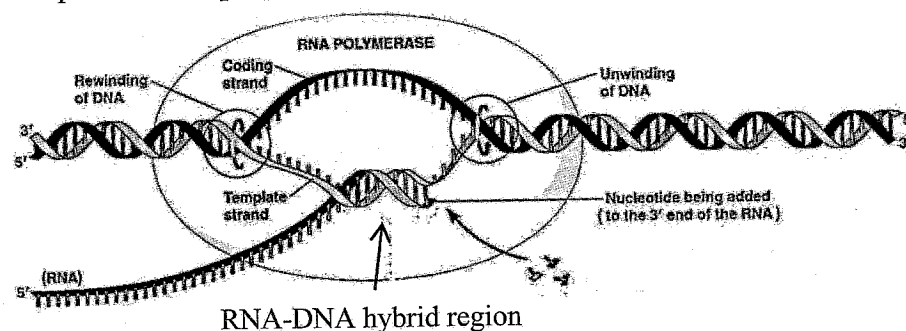
Paper II : Part B - Essay

5. (a) Describe the transcription process in polypeptide synthesis of eukaryotes.

(b) Explain the structure of the plasma membrane of a living cell.

(a)

1. This is the initial process of polypeptide synthesis.
2. During this process nucleotide sequence of DNA is copied into mRNA.
There are three steps in this process.
- 3,4,5. They are initiation, elongation and termination.
6. Initiation occurs at a specific site/promoter site/promoter.
7. This site includes a transcription initiation site and other nucleotides.
8. One DNA strand acts as the template (for transcription).
- 9,10. RNA polymerase/polymerizing enzyme binds to the promoter site, in correct orientation and
11. unwinds the two DNA strands.
12. (During elongation) RNA polymerase starts adding/ adds complementary ribonucleotides on/against the DNA template
13. in 5' to 3' direction.
14. RNA polymerase moves forward and
- 15,16,17. DNA double strand unwinds, exposing DNA template, allowing pairing with ribonucleotides.
18. This is continued until RNA polymerase reaches the (transcription) termination site.
19. Two DNA strands rewind at the other end.
(When new mRNA/pre mRNA is synthesized, RNA polymerase releases the DNA template / RNA polymerase falls off).

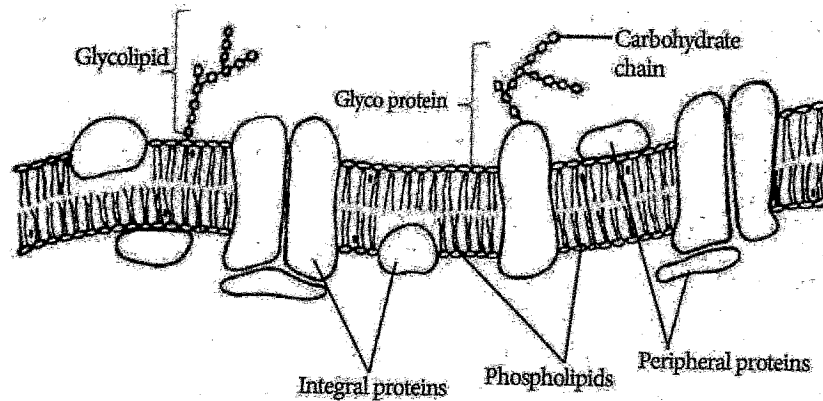


Fully labeled correct diagram: 5 marks
Partially labeled correct diagram: 3 marks
Unlabeled diagram: 0 marks

(b)

1. Structure of plasma membrane is explained by fluid mosaic model.
2. Plasma membrane is mainly made up of phospholipids and proteins.
3. Phospholipids are arranged in a bilayer and
- 4, 5. have (hydrophilic) heads which face outward and
- 6,7. (hydrophobic) tails which face inward.
- 8,9. Protein molecules/integral proteins are embedded in the membrane / lipid bilayer randomly.
- 10,11. Some (integral proteins) penetrate all the way through the membrane and they are called transmembrane proteins.
12. (Most of) the transmembrane proteins have (hydrophilic) channels.

13. Some (integrated) proteins penetrate only part of the way into membrane/partially embedded.
- 14,15,16. Some proteins are not embedded (in the lipid bilayer) and are loosely bound; they are called peripheral proteins
- 17,18. (Short branched) carbohydrates bind to proteins and lipids and
- 19,20. form glycoproteins and glycolipids.



Fully labeled correct diagram: 5 marks
 Partially labeled correct diagram: 3 marks
 Unlabeled diagram: 0 marks

19+20 = 39 points
 Any 35 points x 4 = 140 marks
 Two diagrams: 5x2 = 10 marks
Maximum 150 marks

6. Describe the defence mechanisms shown by plants against pests and pathogens.

1. Some defence mechanisms already exist in plants.
2. Some are induced (by pathogens and pests).
- 3, 4. These are structural and chemical mechanisms.
 Defence mechanisms include the following:
- 5, 6. Presence of epidermis with tightly packed cells;
7. Presence of cuticle/wax layers;
- 8, 9. Amount and quality of wax;
- 10, 11. Structure and thickness of epidermal cell walls;
- 12,13,14. Size, location and shape of stomata;
- 15,16,17. Presence of pricks, thorns, and trichomes;
- 18, 19. Formation of cork and abscission layer;
- 20, 21. Containing waxy (hydrophobic) material known as suberin;
22. Presence/deposition of resins (in heart wood);
23. Morphological / structural changes in the cell wall;
24. Presence/production of secondary metabolites
- 25, 26. such as toxic compounds, e.g. cyanogenic glycosides,
- 27, 28. Alkaloids e.g. nicotine,
- 29, 30. Phenolic compounds, e.g. flavonoids,
- 31, 32. Lignin, tannin,
- 33,34,35. Terpenoids e.g. azadiractin, lectin.
- 36,37,38. Production of enzymes that degrade fungal cell walls or damage insect organs.

Any 37 points x 4 = 148 marks
 If more than 37 points written add 2 marks
Maximum 150 marks

7. (a) Briefly describe the role of liver in human nutrition.

(b) Explain how digestion is regulated in man.

(a)

- 1, 2. Secretes / synthesizes bile which contains bile salts.
- 3, 4. Helps in digestion and absorption of fats
5. through emulsification.
6. Regulates distribution of nutrients (in the body).
- 7, 8. Stores excess glucose in blood as glycogen.
9. Breaks down glycogen (back) to glucose when required.
10. Stores fat soluble vitamins / vitamins A, D, E and K,
- 11,12. (some) water soluble vitamins / vitamin B₁₂ and iron (Fe) / copper (Cu).
- 13,14. Stores fat and breaks down (stored) fat when needed.
15. Synthesizes nonessential amino acids.

(b)

- 1,2. Done by nervous regulation and endocrine regulation
3. Nervous regulation is done through nervous reflexes.
4. Examples: When food reaches mouth, saliva is secreted;
5. When food reaches stomach, its wall is stretched,
- 6,7. stimulating the release of gastric juice and churning
8. and release of gastrin.
9. Gastrin stimulates production of gastric juices.
- 10,11. Fatty acids and/or amino acids in chyme
- 12,13,14. stimulates/triggers release of cholecystokinin and secretin from duodenum.
- 15,16. Cholecystokinin stimulates/triggers release of bile from gall bladder
- 17,18. and digestive enzymes from pancreas.
- 19,20. Secretin stimulates release of HCO₃⁻ from pancreas.
21. When chyme is rich in fat, digestion in stomach slows down due to
- 22,23. high levels of cholecystokinin and secretin
- 24,25. which inhibit secretions of gastric juice and peristalsis.

15 + 25 = 40 points

Any 37 points X 4 = 148 marks

If more than 37 points written add 2 marks

Maximum 150 marks

8. (a) Briefly describe separately the major changes that take place in the human foetus during second and third trimesters of pregnancy.

(b) Explain modern reproductive technology that can be used in resolving infertility problems in humans.

(a)

Second trimester

1. Organ systems completely developed.
2. Foetus assumes distinctively human features.
3. Foetus grows to (about) 30 cm in length.
4. Foetus is very active.

Third trimester

5. Foetus grows rapidly.
6. Most organ systems become fully functional.
- 7, 8. Foetus grows to (about) 50 cm in length, and weighs (about) 3-4 kg.
- 9, 10. Foetus fills the space within the uterus, (and therefore) foetal activity / movement decreases.

(b)

- 1,2,3. Modern reproductive technology includes hormone therapy, surgery, and assisted reproductive technology.
- 4,5. Hormone therapy is used to increase sperm production in infertile males, and egg production in infertile females.
- 6,7. Ducts in the reproductive system which are improperly formed, or blocked are corrected by surgery.
- 8,9. In vitro fertilization / IVF is a series of procedures used to assist with / allow conception of a child.
The IVF process involves
- 10,11. removal of oocyte(s) from an ovary, and obtaining sperm (from a male) and
- 12,13. allow fertilization, under laboratory conditions.
- 14,15. Fertilized eggs are incubated, until they reach (at least) 8 cells and
- 16,17. embryos are implanted in a woman's uterus/transferred to woman's uterus for implantation, for continuation of its development.
18. As acrosome reaction has to take place
- 19,20. thousands of sperm / 50000-100000 sperm are needed per one oocyte, to fertilize one egg/to achieve fertilization.
- 21,22. Intra-cytoplasmic Sperm Injection/ICSI, is a method used to address male infertility.
- 23, 24. This is done if mature sperm are defective, or low in numbers (in such males),
- 25, 26,27. Whole sperm, or a spermatid nucleus is injected (directly) into the cytoplasm of an oocyte, which is removed from a woman's ovary.
- 28,29. Fertilized egg is returned to the (woman's) uterus, for implantation.
30. (ICSI) needs only one selected sperm per oocyte.

10 + 30 = 40 points

Any 37 points X 4 = 148 marks

If more than 37 points written add 2 marks

Maximum 150 marks

9. (a) Explain the Darwin-Wallace theory of evolution.

(b) Briefly discuss the factors that contribute for global warming.

(a)

- 1,2. It is based on observations and their interpretations.
Observations:
3. Populations vary in (inherited) traits/characters. / Members of a population show genetic variations.
4. More offspring than the environment can accommodate are produced (overproduction).
- Interpretations:
- 5,6. Certain traits are capable of better survival/have high potential for survival and reproduction.
7. They produce more offspring and
- 8,9. the abundance of favourable characters in the population is increased (over generations), due to favourable variations / variations in abilities for survival and reproduction.
- 10,11,12. Favorable characters are protection/escaping from predators, tolerating physical, and stress conditions,
- 13,14. obtaining food, resistance to disease,
- 15,16. fertilization probability, and number of offspring produced.

17. There is competition (among individuals) and
18. fittest individuals survive/survival of the fittest.
19. Natural selection of favourable traits occurs.
20. (Hence) this theory is also termed as the theory of natural selection.

(b)

1. Main reason/factor is the emission of greenhouse gases (GHGs) (into atmosphere) / increase in atmospheric concentration of GHGs.
2. This happens due to emission of CO₂ / increase in CO₂ content in atmosphere
- 3,4,5. due to burning of fossil fuels, solid waste and forests.
6. Emission of CH₄ / increase in CH₄ content
7. due to anaerobic decomposition of manure / waste management,
- 8,9. cattle farming / enteric fermentation and paddy cultivation;
10. Emission of N₂O / increase in N₂O content
11. due to fertilizer production / fertilizer use,
12. nitric acid production, and
13. fossil fuel combustion in internal combustion engines.
14. Emission /increase in content of industrial gases / PFCs / perfluorocarbons / HFCs / Hydrofluorocarbons / SF₆ / Sulphur hexafluoride;
15. Increase in /suspension of black carbon particles in lower atmosphere
16. due to incomplete combustion of fossil fuels/other organic matter.
17. Reduction of carbon sequestration / removal of CO₂ from atmosphere
18. due to deforestation / reduction in vegetation cover,
- 19,20. destroying of phytoplankton, due to depletion of ozone layer.

20 + 20 = 40 points**Any 37 points X 4 =148 marks****If more than 37 points written add 2 marks****Maximum 150 marks****10. Write short notes on the following.**

(a) Human sex linked characteristics

(b) Prions

(c) Applications of stem cells

(a) Human sex linked characteristics

1. These are the characters carried on / expressed by sex chromosomes /X and Y chromosomes.
2. Characters expressed by/carried on X chromosomes are X linked characters and
3. those genes are (called) X-linked genes.
4. Characters expressed by/carried on Y chromosome are Y linked characters and
5. those genes are (called) Y-linked genes.
6. In females X-linked recessive characters / disorders are expressed (only) in homozygous condition and
7. In males, even one X-linked recessive allele is expressed.
- 8,9. Examples are red green colour blindness and haemophilia.
10. In red green colour blindness, perceiving differences in red and green colour is difficult.
- 11,12. In haemophilia, blood clot formation (during an injury) is delayed, due to absence of (one or more) proteins required for blood clotting.
- 13,14. Y linked characters/ disorders are transferred and expressed only in males.
15. e.g. inability to produce normal sperm

(b) Prions

1. Size is smaller than viruses.
- 2, 3. Prions are proteinaceous, infectious particles.
4. They do not have nucleic acids.
5. They can replicate with the help of a host's gene that codes the prion protein.
- 6,7,8. Prions cause neurological diseases in some birds and mammals.
9. Example: Transmissible Spongiform Encephalopathies (TSEs) / developing large vacuoles in brain giving sponge like appearance,
10. Mad cow disease,
11. Creutzfeldt-Jakob Disease (CJD) (in man).
12. Prions are involved in human to human disease transmission which occurs due to
13. transfusion of infected blood and
14. prion infected organ/tissue transplantation.

(c) Applications of stem cells

1. (Growing healthy) stem cells are used to identify/understand birth defects and to treat birth defects.
2. Used in genetic manipulation (for delivering genes) / in gene therapy.
3. creating whole tissues in the laboratory/tissue engineering and
4. repairing damaged tissues/ heart muscles and
5. repairing damaged spinal neurons.
6. Blood stem cells / haemopoietic stem cells (taken from the bone marrow of a healthy immunologically capable donor) are used to replenish bone marrow in leukemia patients.
7. These are used to treat Stroke, Heart disease,
- 8,9. Parkinson disease, Alzheimer's disease, and
- 10,11. Diabetes etc.
- 12.

15 +14+12 = 41 points

Any 37 points X 4 =148 marks

If more than 37 points written add 2 marks

Maximum 150 marks
