Confidential

NEW

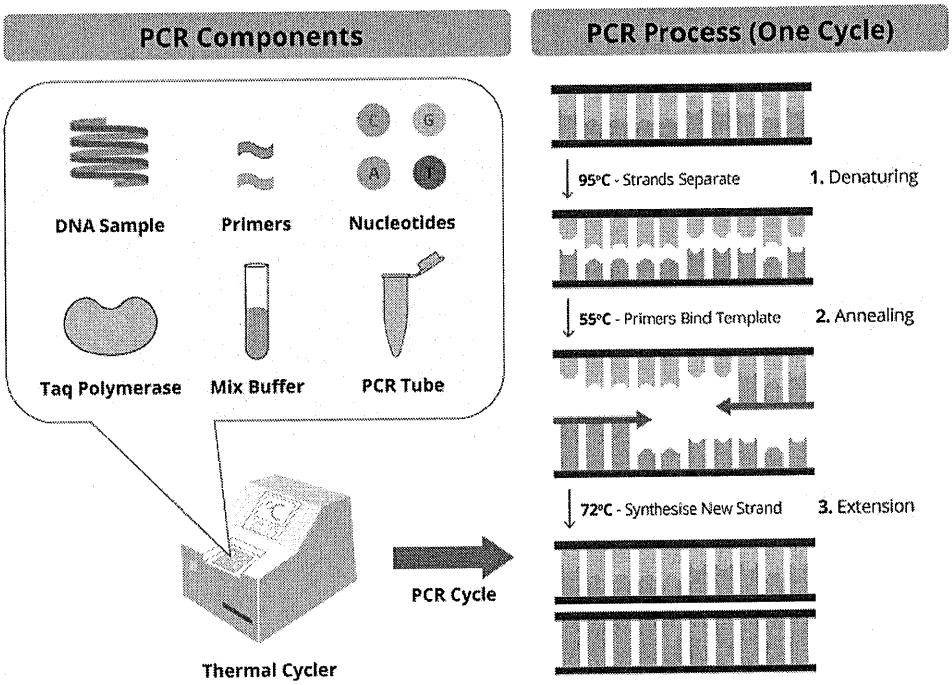
Department of Examinations – Sri Lanka

G.C.E. (A/L) Examination - 2020

09 - Biology

New Syllabus

Marking Scheme



This document 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 - 2020

09 - Biology (NEW)

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 Final Marks = 100

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 △ and write the final marks of each question as a rational number in a □ with the question number. Use the column assigned for Examiners to write down marks.

Example: **Question No. 03**

(i) ..... √ △ 4/5

(ii) ..... √ △ 3/5

(iii) ..... √ △ 3/5

03 (i) 4/5 + (ii) 3/5 + (iii) 3/5 = 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 'X' 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 wright the relevant details. For the subject 51 Art, marks for Papers 01, 02 and 03 should be entered numerically in the mark sheets.

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இலங்கைப் பரீட்சைத் திணைக்களம்

අ.පො.ස. (උ.පෙළ) විභාගය/ க.பொ.த. (உயர் தர)ப் பரீட்சை - 2020

නව නිර්දේශය/ புதிய பாடத்திட்டம்

විෂයය අංකය
பாட இலக்கம் **09**

විෂයය
பாடம் **Biology** **NEW**

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.	4	11.	3	21.	5	31.	3	41.	1/5
02.	5	12.	5	22.	5	32.	4	42.	1
03.	2	13.	3	23.	1	33.	1	43.	2
04.	5	14.	4	24.	4	34.	1	44.	1
05.	5	15.	3	25.	3	35.	5	45.	2
06.	3	16.	4	26.	5	36.	3	46.	4
07.	1	17.	5	27.	5	37.	2	47.	2
08.	2	18.	4	28.	4	38.	1	48.	2
09.	4	19.	2	29.	4	39.	3	49.	1
10.	2	20.	1	30.	5	40	2	50	3

✪ විශේෂ උපදෙස්/ விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට/ ஒரு சரியான விடைக்கு ලකුණු 01 බැගින්/புள்ளி

මුළු ලකුණු/மொத்தப் புள்ளிகள் 1 × 50 = 50

Part A – Structured Essay – New
Answer all questions on this paper itself
(Each question carries 100 Marks)

1. (A) **(i) One of the characteristic features of living organisms is irritability. What is known as irritability?**

- Ability to respond to internal and external stimuli/ Ability to respond stimuli from both internal and external environments

1pt

(ii) What is the monomer of each of the following?

Pectin: Galacturonic acid

Hemicellulose: Pentose

2pts

(iii) State two common functions of NAD^+, $NADP^+$ and FAD.

- Act as a co-enzyme
- Act as an electron carrier

2pts

(iv) Name the structure that helps in cytoplasmic streaming and movement of chromosomes, and state its structural components.

Structure: Cytoskeleton **1pt**

Structural components: Microfilaments/ Actin filaments
Microtubules **2pts**

(v) State the location of the secondary cell wall of a plant cell and name a substance present in it other than cellulose.

Location: Between plasma membrane & primary cell wall **1pt**

Substance: Lignin/ Suberin **1pt**

(B) **(i) What are the three events that contribute to genetic variations during meiosis?**

- Crossing over
- Recombination
- Independent assortment.

3pts

(ii) Name the type of photosynthetic pigment that prevents the formation of reactive oxidative molecules harmful to plant cells.

- Carotenoids

1pt

(iii) What is known as the action spectrum of photosynthesis?

- A graph showing the effectiveness of different wave lengths of light in (stimulating) photosynthesis/ A graph showing the variation of the rate of photosynthesis at different wave lengths of light.

5 / 0 marks

(iv) Name the two types of cells in which $C0_2$ fixation occurs in C4 plants and state the CO_2 acceptor and CO_2 fixing enzyme present in each of them.

Type of cell	CO_2 acceptor	CO_2 fixing enzyme
(a) Mesophyll cell	PEP/ Phosphoenol pyruvate	PEP Carboxylase
(b) Bundle sheath cell	RuBP/ Ribulose bisphosphate	RuBISCO/ Ribulose bisphosphate carboxylase oxygenase

6pts

(v) How do the two types of cells stated in B(iv) above interconnect tightly with each other?

- Having large number/high number of plasmodesmata **1pt**

(C) **(i) In which geological eon did the first eukaryotes appear on earth?**

- Proterozoic **1pt**

(ii) Three events that occurred during evolution of organisms are as follows.

P - Origin of mammals
Q - Origin of seed plants
R - Dominance of angiosperms
Write the above events in chronological order using the relevant letters.

Q P R **1pt**

(iii) State three features of free living forms of phylum Platyhelminthes that cannot be seen in parasitic forms.

- Eye spots / Sensory organs.
- Cilia.
- No larval stage / Direct development
- Eversible pharynx

Any 3pts

(iv) State where the male and female gametophytes are present in seed plants.

Male gametophyte: Inside the pollen grain

Female gametophyte: Inside the Ovule **2pt**

(v) Complete the following dichotomous key to distinguish the protists given below.
***Euglena, Paramecium, Amoeba, Ulva, Sargassum,* Diatoms**

(1) Cell wall present	- 2
Cell wall absent	- 4
(2) Multicellular	- 3
Unicellular	- Diatoms
(3) Gas filled floats present	- *Sargassum*
Gas filled floats absent	- *Ulva*
(4) Pellicle present	- 5
Pellicle absent	- *Amoeba*
(5) Cilia present	- *Paramecium*
Cilia absent	- *Euglena*

10pts

38 x 2.5= 95 marks

Marks for B (iii) = +5 marks

Total = 100 marks

2. (A) (i) State the three processes that contribute to growth of plants.

- Cell division
- Cell elongation
- Cell differentiation

3pts

(ii) State one function of each of the following plant tissues.

Vascular cambium: Produces secondary vascular tissue / xylem and phloem.

Cork cambium: Produces periderm / cork

2pts

(iii) Through which structure, each of the following activities takes place in plants?

Gaseous exchange in woody stems: Lenticels

Guttation: Hydathodes **2pts**

(iv) State in correct sequence what happens in guard cells from the stage of accumulation of K^+ ions until the opening of stomata.

- Lowering of water potential / Increase in solute potential,
- Inflow of water (due to osmosis),
- Increase in turgor,
- Expansion of cells,
- Bending of inner wall / Draw away of inner walls from each other.

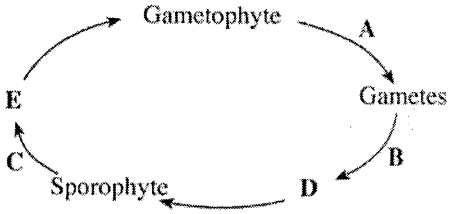
5pts

(v) How do temperatures below a critical level affect the cell membrane of plant cells?

- Lipids become crystalized.
- Membrane loses its fluidity,
- resulting in blocking transport (across membrane).
- Reduce the rate of membrane enzyme reaction/ Stops the enzyme activity.

Any 3pts

(B) (i) A sketch of the life cycle of a land plant is given below.
Name the processes denoted by A, B and C and the structures denoted by D and E.



A: Mitosis

B: Fertilization

C: Meiosis

D: (Diploid) Zygote

E: (Haploid) Spore

5pts

(ii) Slate the following types of symbiosis.

Beneficial to both organisms: Mutualism

Beneficial to one organism and no effect on the other: Commensalism

2pts

(iii) (a) Calculate the body mass index of a person who is 153 cm tall and weighs 50 kg.

$$\frac{Weight\ (kg)}{Height(m)^2} = \frac{50}{1.53^2} = 21.36 \approx 21.4$$

Equation or numerical substitution 1pt
Answer 1pt

(b) According to the World Health Organization criteria, what is the minimum weight this person should have in order to consider him as non-malnourished? (Give your answer in kg to the first decimal)

- 43.3 kg

1pt

(iv) Name a fat soluble vitamin that acts as an antioxidant.

- Vitamin E

1pt

(v) Name two hormones that are secreted by the digestive tract of man and have functions antagonistic to each other.

- Cholecystokinin / Secretin
- Gastrin

2pts

(C) (i) (a) State a common function of epithelial tissues and connective tissues.

- Protection

1pt

(b) State three structural features of dense connective tissue that can be used to distinguish it from other connective tissues when observed under the light microscope.

- Densely packed collagen fibres
- Reduced matrix
- Contain fewer cells

3pts

(ii) State the functions of the SA node and AV node of the human heart.

SA node: Initiates heart beat/ Originates the stimulus for contraction of heart.
Sets the rhythm of heart beat. **2pts**

AV node: Transmits electrical signals / impulse from atria to ventricles. **1pt**

(iii) Draw the normal ECG tracing of a healthy person and label its waves.

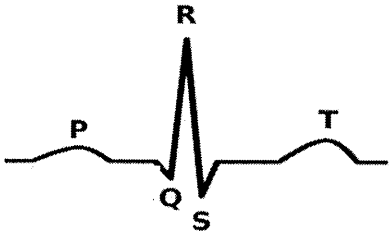


Diagram **1pt**
Correct Labelling **1pt**

(iv) State what are represented by the first and last waves of the ECG tracing.

First wave: Atrial depolarization / Spreading of impulse (from SA Node) over the atria **1 pt**

Last wave: Ventricular repolarization (and relaxation of ventricles / Relaxation of ventricular muscle)

1pt

(v) Considering a haemoglobin molecule as 'Hb' write the equation for the chemical reaction that occurs only in the red blood cells of lung capillaries.

- $Hb + 4O_2 \leftrightharpoons HbO_8$

1pt

40 X 2.5marks = 100 marks

3. (A) (i) Briefly state what interferons are?

- Proteins secreted by virus infected body cells,
- that can protect uninfected body cells (from viral infection)
- by stimulating production of anti-viral proteins /by producing proteins that inhibit viral replication.

3pts

(ii) Name two capillary networks that are associated with the human nephron other than the glomerulus.

- Peritubular Capillaries
- Vasa recta **2pts**

(iii) What is dialysis carried out for kidney patients?

Process of removing

- excretory products
- excess solutes and
- toxins

from blood by artificial method.

3pts

(iv) State a similarity between nervous coordination and hormonal coordination.

- Chemical transmission

1pt

(v) Name two phyla that include animals with brain, ventral nerve cord and segmented ganglia.

- Annelida.
- Arthropoda.

2pts

(B) (i) (a) What are known as ventricles in the human brain?

- Irregular shaped cavities in the central canal.

1pt

(b) What are the three parts of the human brain that form the brain stem?

- Mid brain.
- Pons Varolii
- Medulla oblongata.

3pts

(ii) State two functions of the human spinal cord.

- Links the central nervous system to sensory and motor neurons.
- (Facilitates) nerve impulse propagation towards the brain/ away from the brain.
- Coordinates / produces reflexes.

Any 2pts

(iii) What is the importance of refractory period of a neuron?

- Prevention of reverse conduction of a nerve impulse. **1pt**

(iv) Name the progressive motor disorder of the nervous system that leads to lack of coordination and control of muscle movements in elderly people.

- Parkinson disease

1pt

(v) Briefly state what a hormone is?

- Specific types of signaling molecules secreted by an endocrine gland / endocrine cell
- which travels in blood and
- acts on/ change the functioning of specific target cells elsewhere in the body.

3pts

(C) (i) (a) State three functions of Sertoli cells.

- Secretion of inhibin,
- Providing nourishment and
- Providing attachment for cells that are in different stages of spermatogenesis.

3pts

(b) State the function of acrosome in human sperm.

- Help the sperm to enter the ovum
- by penetrating its outer layer
- due to hydrolytic enzymes / trypsin and hyaluronidase.

3pts

(c) In which structure of the male reproductive system do the sperm mature?

Epididymis

1pt

(ii) (a) State two methods that can be used to analyze genetic disorders of the foetus during pregnancy.

1. Amniocentesis / Chorionic villi sampling
2. Analysis of genome of foetus

2pts

(b) Write in correct sequence, the pathway that oxygen poor blood of human foetus gets oxygenated and returns to the foetus.

(Foetus) ⟶ (two) arteries of umbilical cord ⟶ chorionic villi ⟶ (foetus) ⟵ umbilical veins ⟵

1pt

(iii) Name a phylum which includes animals with an endoskeleton made up of calcium carbonate plates.

- Echinodermata **1pt**

(iv) (a) Why doesn't the first pair of ribs move during inspiration of man?

- As it is firmly fixed to the sternum and first thoracic vertebra.

1pt

(b) State three structural features of the human vertebral column that help to maintain upright posture.

- Development of two secondary curvatures / Presence of two primary and two secondary curvatures.
- Vertebrae become larger towards the end of the vertebral column.
- Secral vertebra fused to form sacrum.

3pts

(v) (a) State the function of the arches of the foot of the lower limb of man.

- Distribute the weight of the body when standing / moving

1pt

(b) State two locations where ball and socket joints are found in the human body.

- Head of the humerus with glenoid cavity (of scapula)/ Shoulder joint
- Head of femur with acetabulum (of hip bone/ pelvis) Hip joint

2pts

40 X 2.5 = 100 marks

4. (A) (i) State four desirable features of garden peas for genetic experiments.

- Available in many varieties with contrasting traits
- Short generation time
- Produce a large number of offspring (from each cross)
- Crossing between plants could be (strictly) controlled

4pts

(ii) (a) What is known as pleiotropy in genetics?

- Expression of a single gene affecting the expression of multiple traits which are not related to each other.

1pt

(b) Give two examples for pleiotropy seen in man.

- Cystic fibrosis
- Sickle cell disease /Sickle cell anemia

2pts

(iii) What are known as intergenic DNA and introns?

Intergenic DNA : Regions/ DNA segments/nucleotide sequences without an identified functions present in between genes / Non – coding regions/DNA segments / neucleotide sequences in between genes.
Introns : Non – coding regions / DNA segments/ nucleotide sequences within the genes.

2pts

(iv) State whether trisomy, monosomy or gene mutation is the reason for each of the following disorders.

Disorder	Reason
Colour blindness	Gene mutation
Down syndrome	Trisomy
Turner syndrome	Monosomy

3pts

(v) (a) State why each of the following is used during DNA isolation.

Chelating agent: To inhibit DNase activity / to remove metal ions required for nuclease activity.

Proteolytic enzymes: To free DNA from its binding proteins / disrupt DNA-protein molecules /dissociation of nucleoprotein complex

Cold ethanol: To precipitate DNA

3pts

(b) State two essential features of a cloning vector.

- Ori
- Multiple cloning sites
- Markers

Any 2 pts

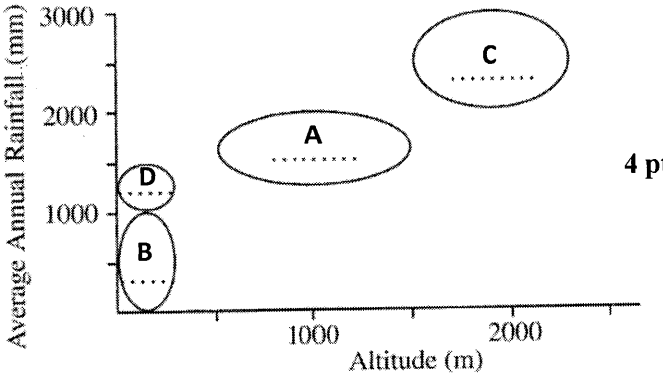
(B) (i) What is meant by primary production?

- The amount of organic matter produced by autotrophs in a given area during a given period of time.

1pt

(ii) (a) Using the correct letter, indicate the ellipse in the diagram that represents each of the following ecosystems of Sri Lanka.

A - Savanna
B - Tropical thorn scrubs
C - Wet patana
D - Tropical dry mixed evergreen forests



4 pts

(b) Which one of the ecosystems given in (ii)(a) above can be found in the dry zone as well as in the intermediate zone of Sri Lanka?

- Savanna / A

1pt

(iii) Write the common name of an endemic plant found in tropical wet lowland rain forests of Sri Lanka.

- Hora

1pt

(iv) Write the common name of a plant in Sri Lanka which is facing a very high risk of extinction in the wild.

- Wesak orchid

1pt

(v) (a) State the group of organisms that contributes most to reduce the CO_2 content in the atmosphere.

- Phytoplankton

1pt

(b) What is the major global environmental issue that affects the organisms stated in (v)(a) above?

- Ozone depletion

1pt

(C) (i) (a) Name an obligate anaerobic bacterial species.

- *Clostridium tetani/ Clostridium botulinum/ Clostridium* sp.

1pt

(b) State the importance of akinetes to cyanobacteria.

- Can survive / tolerate / resistant to unfavorable environmental conditions / high temperature/ drought

1pt

(ii) (a) COVID-19 coronavirus is roughly spherical. To which type of morphological form do such spherical viruses belong?

- Enveloped

1pt

(b) How does a viroid structurally differ from a virus?

- Due to absence of protein coat / capsid / protective layer.

1pt

(iii) Name two diseases for which immunity can be induced using subunit vaccines.

- Tetanus
- Diphtheria
- Hepatitis B

Any 2pts

(iv) Name a species of microorganisms used for the production of each of the following substances.

Citric acid from sucrose : *Aspergillus niger*

Invertase : *Saccharomyces cerevisiae*

Streptomycin : *Streptomyces griseus/ Streptomyces* sp.

3pts

(v) (a) Name two substances that are produced when putrefaction of food occurs due to action of microorganisms.

- Amino acid
- Amines
- Ammonia
- Hydrogen Sulphide

Any 2pts

(b) In routine testing of water samples for consumption, why is the presence of indicator organisms such as coliform bacteria tested instead of the presence of pathogenic microorganisms?

- Pathogens may present only in small numbers/ pathogens may not be detected.
- Takes a lot of time (to test the presence of pathogens).

2pts

40 X 2.5 = 100 marks

General Certificate (A/L) Examination – 2020 New Syllabus
09 – Biology Marking Scheme
PAPER II - PART B - Essay

5. **Describe the process of aerobic respiration that occurs in liver cells of man using glucose as the substrate.**

Three main steps

1. Glycolysis
2. Pyruvate oxidation and citric acid cycle /Krebs cycle / TCA cycle
3. Oxidative phosphorylation /Electron transport chain

4. Glycolysis takes place in the cytosol (of a cell),
5. Does not depend on oxygen/oxygen is not involved.
6. (one) Glucose (6C) molecule is oxidized (broken down) into two (3C) pyruvate molecules.
7. Two ATP (molecules) are utilized (to initiate the process) and
8. four H^+ and electrons are produced.
9. Electrons/ H^+ are accepted by two NAD^+ (molecules) and
10. two NADH (molecules) are produced.
11. (In later steps of glycolysis) four ATP (molecules) are produced
12. by substrate level phosphorylation.
13. The net gain of ATP (molecules) in glycolysis is 2 ATP (as two ATP molecules are used up).
14. Two pyruvate (molecules) enter mitochondria
15. by active transport.
16. Pyruvate is converted to acetyl group by releasing $2CO_2$ (molecules),
17. in the matrix of mitochondria.
18. Acetyl group combines with co-enzyme A to produce Acetyl Co-enzyme A.
19. (In this reaction) two NAD^+ (molecules) are converted to two NADH (molecules).
20. Cytric acid cycle/ Krebs cycle/ TCA cycle takes place in the matrix of mitochondria (using specific enzymes).
21. Acetyl Co-enzyme A is combined with (4C) oxaloacetic acid/oxaloacetate and produce (6C) citric acid/citrate.
22. Citric acid/citrate undergoes a series of reactions to regenerate oxaloacetic acid/oxaloacetate
23. by releasing two (molecules of) CO_2 (decarboxylation)
24. and one ATP molecule
25. by substrate level phosphorylation.
26. One $FADH_2$ (molecule) and
27. three (molecules of) NADH are produced (for one cycle/for one molecule of acetyl co-A)
28. These numbers should be doubled when the yield of one glucose molecule is considered.
29. Electron transport chain takes place in the inner membrane (cristae) of mitochondria and
30. synthesize ATP
31. by oxidation of reduced co-enzymes / NADH and $FADH_2$.
32. This process is oxidative phosphorylation.
33. Electrons (of reduced co-enzymes) pass through a series of proteins and non-protein molecules
34. and are finally accepted by molecular oxygen/O_2 /O_2 is the final electron acceptor.
35. One (molecule of) NADH produces 2.5 molecules of ATP.
36. One (molecule of) $FADH_2$ produces 1.5 molecules of ATP.
37. Total number of ATP molecules produced in the electron transport chain is 28.
38. Thus the total number of ATP molecules produced for one molecule of glucose is 32 (during aerobic respiration in the liver cell).

Any 37 x 4 = 148 marks

If > 37 points are correct +2 marks

Total = 150 marks

6. (a) Describe the effects of light on Plants

1. Light triggers many key events in plant growth and development.
2. It is collectively known as photomorphogenesis.
3. Light reception allows plants to measure the passage of days
4. and seasons.
5. Plants detect light signals,
6. and direction of light,
7. intensity of light and
8. wave length (Colour) of light.
9. Red and blue light are the important colours in (regulating) photomorphogenesis.

There are two major classes of light receptors:

10. Phytochrome photoreceptors / Phytochromes
11. which absorb (mostly) red light, and
12. Blue light photoreceptors
13. which initiates phototropism,
14. opening of stomata, and
15. slowing of hypocotyl elongation.
16. Positive phototropism/ growth of shoot towards light strengthen photosynthesis.
17. Phytochromes (photoreceptors) regulate plant responses to light, and
18. seed germination.
19. Some seeds remain dormant until light becomes (nearly) optimal.
20. Phytochromes provide information about the quality of light,
21. which enables the plant to get adapted to changes in (outside) light conditions.
22. eg ; Shade avoidance and
23. plant spacing.
24. When exposed to direct sun light branching is stimulated and
25. vertical growth is inhibited.
26. Photoperiod controls flowering (in many plants).

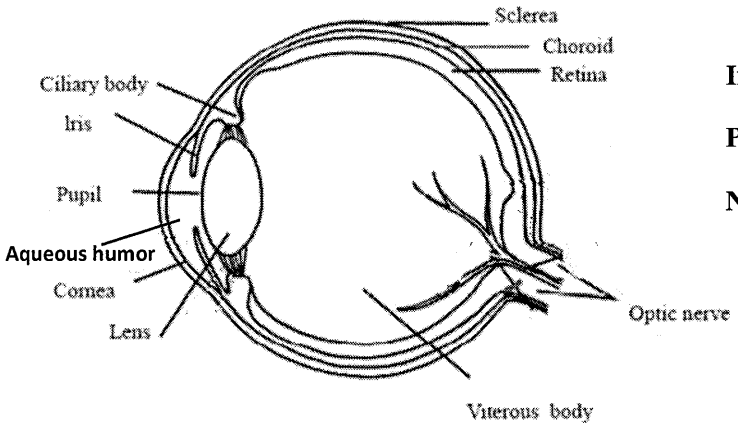
(b) Explain how plants are designed to capture maximum amount of light

1. Plants grow tall to avoid shading from neighboring plants.
2. Most tall plants have thick stems / strong mechanical support.
3. Woody plants undergo secondary growth to make (tall) stem stronger.
4. The branching pattern enables the plants to absorb maximum light.
5. Size of the leaves vary based on the place where the plant grow.
6. Large leaves are found in plants in rain forests and
7. smalle leaves are found in plants in dry / very cold environments .
8. The arrangement of leaves on the stem / phyllotaxy (helps the plants to capture maximum sun light).
9. One, two or several leaves per node.
10. Leaf orientation,
11. Some are horizontally oriented
12. to capture light efficiently in low light conditions.
13. Some leaves/ leaves of grasses are vertically arranged
14. to avoid the damage caused by exposure to the over intense light.

26 + 14 = 40
Any 37 x 4 = 148 marks
If > 37 are correct + 2 marks
Total = 150 marks

7. (a) **Briefly describe the basic structure of human eye.**

1. Outer fibrous layer
2. consists of sclera and cornea.
3. Middle vascular layer
4. consists of choroid, ciliary body and iris.
5. Inner nervous layer
6. is the retina.
7. Inside of the eye ball there is the lens, aqueous fluid/aqueous humour and vitreous body/vitreous humour/ vitreous fluid.
8. Sclera is opaque/white.
9. Cornea is clear/transparent,
10. no blood vessels.
11. Choroid is (thin) pigmented,
12. rich with blood vessels.
13. Ciliary body consists of smooth muscle fibers/ ciliary muscles.
14. Iris is coloured / contains pigmented cells and
15. has two layers of smooth muscle fibers/circular and radial bundles
16. Lens is elastic,
17. biconvex and
18. transparent.
19. Aqueous humour /aqueous fluid is clear/watery.
20. Vitreous humour/ vitreous fluid/vitreous body is colourless / transparent/ jelly like structure (behind the lens).
21. Retina contains photoreceptors/ rods and cones.



If fully labelled **06 marks**

Partially labelled **03 marks**

No marks if unlabelled

(b). Explain the role of human eye and brain in vision.

1. Light rays (coming from the object) are mostly refracted by lens
2. to focus a clear image on the retina of each eye
3. which is upside down.
4. Conjunctiva, cornea, aqueous fluid/ aqueous humour and vitreous fluid/ vitreous humour/ vitreous body also contribute to light refraction (Any 3 should be written to get the full marks).
5. For (clear) near vision, eyes make adjustments to increase the refraction
6. under the control of autonomic nervous system.
7. The muscles attached to the eye ball rotate the eye
8. to focus light rays on corresponding area of two retina/ convergence.

9. For near vision (to focus near object on retina) curvature/convexity of the lens is increased.
10. by ciliary muscle contraction/ accommodating.
11. For distant vision (to focus on distance objects on retina) curvature/convexity of the lens is reduced
12. by relaxing the ciliary muscles.
13. Photoreceptor cells, (in the retina) convert light energy to voltage changes.
14. Stimulation of rods leads to black and white vision and
15. night vision.
16. Stimulation of cones leads to color vision.
17. Bipolar cells in the retina receive electrical signals from the photoreceptor cells and
18. pass to ganglion cells.
19. Optic nerve (fibre) transmits the sensation/ action potential/impulse
20. to the occipital lobe of cerebrum.
21. Brain perceives the visual objects in the correct way/ right way up.

21 + 21 = 42
Any 36 x 4 = 144 marks
Diagram = 06 marks

Total = 150

8. Describe the menstrual cycle of women and its hormonal regulation.

1. Consists of changes in the uterus
2. that occur once a month/ 28 days
3. during the reproductive years of women.
4. These cyclic changes are controlled by the ovarian cycle.

Menstrual cycle consists of

5. Proliferative phase,
6. Secretory Phase and
7. Menstrual flow phase.

Proliferative phase:

8. Coincides/coordinates with the follicular phase of the ovarian cycle.
9. Occurs before ovulation.
10. Growing follicles in the ovary
11. secrete estradiol / oestrogen which
12. stimulate the uterus to prepare to support an embryo/for implantation
13. by stimulating the endometrium (of the uterus) to thicken.

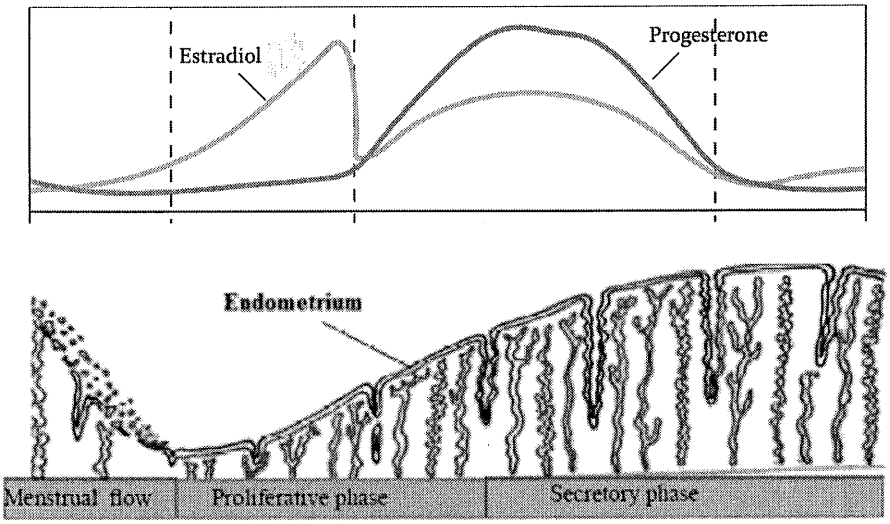
Secretory Phase:

14. Coincides/coordinates with the luteal phase of the ovarian cycle.
15. Starts after ovulation.
16. Corpus luteum, which secrete
17. estradiol/oestrogen and
18. progesterone
19. stimulates / promotes maintenance and
20. further development of the lining of uterus
21. by enlarging arteries and
22. growth of endometrial glands
23. which secrete nutrient fluid
24. that can sustain an (early) embryo if implantation occurs.

Menstrual flow phase:

25. If implantation (of an embryo) does not occur, levels of ovarian hormones /estradiol/oestrogen and progesterone are decreased
26. due to disintegration of corpus luteum.
27. As a result, arteries in the uterine lining constrict and
28. uterine lining disintegrates.
29. This causes shedding of endometrial tissues
30. and fluid from the uterus.
31. Menstrual flow occurs for a few days,
32. through cervix and
33. vagina,
34. which is called menstruation.
35. Next menstrual cycle starts during the follicular phase of the ovarian cycle
36. with the growth of a new follicle.

36 x 4 = 144 marks



* **Diagrams to show.**

- **Changes in estradiol, progesterone levels in blood.** **3 marks**
- **Gross changes in endometrium.** **3 marks**

Total = 150 marks

9. a) Briefly describe the applications of microorganisms in agriculture.

1. Used as biofertilizers
2. to improve bioavailability of nitrogen (N) and
3. phosphorous (P).
4. Improves / increases solubility of phosphate in soil solution
5. by secreting organic acids
6. that dissolve minerals containing phosphorus
7. and chelate cationic partners of phosphate ions.
8. Involved in nitrogen fixation,
9. symbiotically
10. eg. *Rhizobium* sp. living in leguminous plants/ *Anabaena* sp. living in water fern/ *Azolla.*
11. Free living nitrogen fixation (in soil/ rhizosphere)
12. eg. *Azotobacter.*
13. (Involved in) promoting plant growth
14. by secreting plant growth substances
15. such as auxins (Indole-3- acetic acid)/ cytokinins/ gibberellins.
16. Serve as biopesticides,
17. eg. Entomopathogenic fungi/ bacteria/ *Bacillus thuringiensis.*
18. Used in composting,
19. eg. thermophilic bacteria/ bacteria that degrade organic matter/ protozoa/ fungi/ actinomycetes

b) Discuss the applications of Polymerase Chain Reaction (PCR)

1. Used in analyzing clinical samples/ specimens
2. to determine the presence of infectious agents
3. such as HIV/ Hepatitis/ Malaria/ COVID-19
4. Used in analyzing mutations that cause genetic diseases/ genetic disorders
5. eg. Cystic fibrosis/ Sickle cell anemia/ Phenylketouria.
6. Used in forensic laboratories
7. because PCR can make large number of copies from a small amount of DNA (template).
8. Used in cloning
9. because a large amount of pure DNA can be produced (from tiny amount of template).
10. Used in sequencing of DNA.
11. Used in evolutionary biology
12. to identify/ explore relationships among species.
13. Used in anthropology
14. to understand the ancient human migration patterns.
15. Used in Archaeology
16. to spot the ancient human race.
17. Used in Paleontology
18. to amplify DNA from extinct species/ cryopreserved fossils
19. to explain evolutionary relationships.

19 +19= 38
Any 37 X 4 = 148 marks

If > 37 points are correct +2 marks

Total = 150 marks

10. Write short notes on the following.

(a) Salt marshes of Sri Lanka

1. Found in arid
2. coastal regions.
3. Soil dries up during dry season and
4. form crystals of salts.
5. Low rainfall.
6. High wind.
7. High temperature.
8. Loose sand.
9. Sand blows with salt.
10. Few plant species.
11. Plants are short,
12. with fleshy/ succulent bodies.
13. Few animal species are present.
14. Found in Puttalam / Hambantota / Mannar / Vakarai areas.

(b) Epigenetics

1. Occurrence of certain phenotypes (of certain characters) controlled by factors other than their DNA sequence / genetic code. /Control of certain characters by factors other than DNA sequence / genetic code.
2. This is due to switching on and
3. switching off of certain genes,
4. due to modifying nucleotides of a DNA sequence
5. by methylation/ addition of methyl groups
6. or by demethylation / removal of methyl groups.
7. This results in modified expression of a DNA sequence.
8. Epigenetics occurs due to inherited signals/ inheritance/inherited epigenetics.
9. or due to environmental factors.
10. eg: cancer
11. Inherited epigenetics can also be reversed by stimuli from the environment/due to environmental factors
12. eg: Schizophrenia.

(c) Reproduction in Ascomycota

1. Shows asexual and
2. sexual reproduction.
3. Asexual reproduction is by conidia
4. which are produced (on the tip of) in conidiophores
5. which are specialized hypae.
6. Sexual reproduction is by gametangia,
7. which are sexually differentiated.
8. They fuse and
9. produce asci,
10. which contain ascospores. / Ascospores are produced in asci.
11. There are 8 ascospores in each asci.
12. Asci are enclosed in ascocarp.

Or

Biological control of Dengue vector

1. Using (larvivorous) fish
2. eg: Guppy/ Dandi/ juvenile Tilapia
3. They feed on mosquito larvae/ control mosquito larvae.
4. Using / *Bacillus thuringiensis* / Bti,
5. which produces an endotoxin,
6. which is toxic to (mosquito) larvae.
7. There are few limitations (of biological control).
8. Fish will die
9. due to absence of food,
10. changing water quality and
11. additions of chlorinated water.
12. Bti / *Bacillus thuringiensis* cannot be applied to some places.

14 + 12 + 12 = 38 pts
37 X 4 = 148 marks
If > 37 points are correct +2 marks
Total = 150 marks