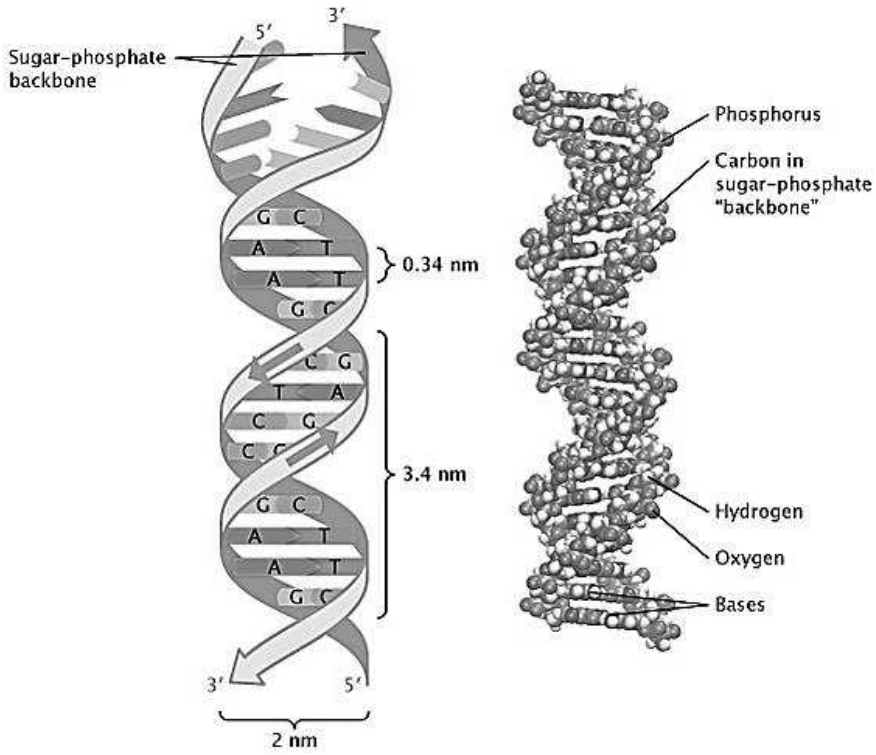
Confidential

Department of Examinations - Sri Lanka

G.C.E. (A/L) Examination - 2021 (2022)

09 - Biology

Marking Scheme



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

Amendments to be included.

G.C.E. (A/L) Examination - 2021 (2022)
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 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) $\frac{4}{5}$ + (ii) $\frac{3}{5}$ + (iii) $\frac{3}{5}$ = $\frac{10}{15}$

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 '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.

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இலங்கைப் பரீட்சைத் திணைக்களம்

අ.පො.ස. (උ.පෙළ) විභාගය / க.பொ.த. (உயர் தர)ப் பரீட்சை - 2021 (2022)

විෂය අංකය
பாட இலக்கம் **09**

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

✪ **විශේෂ උපදෙස් / விசேட அறிவுறுத்தல் :**

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

මුළු ලකුණු / மொத்தப் புள்ளிகள் 1 × 50 = 50

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

1. (A) (i) About how many years ago did life originate on earth?

(about) 3.5 billion/ (about) $3.5X10^9$ **(1 pt)**

(ii) Metabolism, growth and development are some characteristics of organisms. What is meant by each of them?

(a) Metabolism	**:**	Sum of all chemical activities / catabolic and anabolic reactions / taking place in an organism
(b) Growth	**:**	Irreversible increase in dry mass / weight (of an organism)
(c) Development	**:**	Irreversible changes that occur during the life span (of an organism)

(3 pts)

(iii) (a) State the <u>three</u> main methods by which food production can be sustainably maintained.

- Production of high yielding varieties (of plants and animals)
- Production of disease resistant varieties (of plants and animals)
- Improving the postharvest technologies/ methods

(3 pts)

(b) What mainly contributes for overuse of natural resources of earth?

Increase of (growth rate of) human population **(1 pt)**

(iv) In which geological eon, did the concentration of oxygen in earth's atmosphere start to increase?

Archaeon **(1 pt)**

(v) Name the eras in which each of the following took place.

(a)	**Colonization of land by plants**	**:**	Paleozoic
(b)	**Dominance of gymnosperms**	**:**	Mesozoic
(c)	**Appearance of first seed plants**	**:**	Paleozoic

(3 pts)

(B) (i) What is known as classification of organisms?

Arrangement of organisms into groups based on common characteristics **(1 pt)**

(ii) What are the important criteria used in modem systematics?

- Sequence of bases in important genes
- Sequences of bases in mitochondrial DNA
- Sequences bases in chloroplast DNA
- Sequences of bases of RNA of ribosomes/ ribosomal RNA
- Sequences of amino acids in common proteins
- Molecular structure of cellular components

(6 pts)

(iii) State four structural features that can be seen only in arthropods.

- Chitinous exoskeleton/ External skeleton
- Jointed legs
- Malpighian tubules
- Book lungs/ tracheal system (of chitinous tubules)

(4 pts)

(iv) State three structural features unique to class Mammalia.

- Differentiated teeth
- Hair
- (Muscular) diaphragm
- Mammary glands (any three)

(3 pts)

(v) What is the main physiological feature common to birds and mammals?

Endothermy

(1 pt)

(C) (i) State the phylum of seedless plants that has a more recent common ancestor with seed plants and name a genus that belongs to this phylum.

(a) Phylum : Pterophyta **(1 pt)**
(b) Genus : *Nephrolepis* **(1 pt)**

(ii) State two features of microphylls that can be used to distinguish them from megaphylls.

- Single veined
- Smaller in size

(2 pts)

(iii) State a structure common to sporophytes of bryophytes and angiosperms other than sub cellular components, cells, stems and leaves.

Stomata **(1 pt)**

(iv) What is the structural feature used to divide plants into two major groups?

(Extensive system of) vascular tissue **(1 pt)**

(v) State the cell wall composition of organisms belonging to each of the following domains.

(a)	Bacteria	:	Peptidoglycan	**(1 pt)**
(b)	Archaea	:	Proteins, Polysaccharides	**(2 pts)**
(c)	Eukarya	:	Cellulose, hemicellulose, pectin, chitin	**(4 pts)**

40 pts × 2 ½ marks = 100 marks

2. (A) (i) (a) What is the property of water that helps in transporting dissolved minerals through vascular tissues in plants?

Cohesive behaviour/ attraction of water molecules due to hydrogen bonds **(1 pt)**

(b) Name a protein that has a defensive role in man.

Immunoglobulin **(1 pt)**

(c) Name the monomer of a polysaccharide, which is a component of the fungal cell wall.

Glucosamine **(1 pt)**

(ii) State an event that occurs in mitosis and meiosis II, but does not occur in meiosis I of the eukaryotic cell cycle.

Separation of chromatids **(1 pt)**

(iii) (a) State where CO_2 is first fixed in C4 plants.

Mesophyll cells **(1 pt)**

(b) Give <u>two</u> reasons for PEP carboxylase in C4 pathway of photosynthesis being more efficient than RuBP carboxylase enzyme in C3 pathway.

- It reacts with HCO^-_3 rather than with CO_2 / it has higher affinity to HCO^-_3 than to CO_2.
- It has no affinity for oxygen (O_2)/ No photorespiration occurs.

(2 pts)

(iv) (a) What is known as secondary growth in plants?

<u>Increase in the diameter of stems and roots</u> due to the <u>new cells produced by lateral meristem/ vascular cambium and cork cambium</u> **(2 pts)**

(b) State <u>two</u> factors that are responsible for opening of stomata other than light.

- Internal clock in guard cells
- Decrease in CO_2 concentration in substomatal cavity **(2 pts)**

(c) What is the special feature of soil in which *Nepenthes* is grown?

Poor in/ low content of Nitrogen and minerals **(1 pt)**

(v) (a) What happens to the triploid nucleus formed after double fertilization in angiosperms?

Develops into endosperm (that stores food) **1 pt**

(b) State the specific location of statoliths in plants.

Within specialized/ certain cells in root caps **1 pt**

(B) (i) (a) State the protein-carbohydrate complex found in the matrix of cartilage tissue and name the type of cells that secretes it.

Protein-carbohydrate complex : Chondroitin sulfate
Type of cells : Chondrocytes **2 pts**

(b) State a major function of cartilage tissue other than providing support.

Providing flexibility **1 pt**

(ii) What is known as each of the following?

(a) Protein sparing : Not using protein to get energy when there is adequate carbohydrate in the diet **1 pt**

(b) Non-essential fatty acids : Fatty acids that are synthesized within the body **1 pt**

(c) Balanced diet : Diet containing all essential nutrients (required for health) in appropriate proportions **1 pt**

(iii) Name <u>two</u> nonessential amino acids.

- Alanine
- Cysteine **2 pts**

(iv) What is the normal value of each of the following in a healthy adult person?

(a) Blood pH : 7.4 **1 pt**
(b) Life span of erythrocytes : 120 days **1 pt**
(c) Blood pressure at rest : 120/80 mm Hg **1 pt**

(v) What is known by each of the following?

(a) Cardiac cycle : Sequence of events that occurs in a (complete) heartbeat **1 pt**
(b) Hypertension : Sustained elevated blood pressure above normal limits **1 pt**

(C) (i) (a) What is known as anatomical dead space?

- Volume of air in conducting tubes/ Trachea, bronchi and bronchioles **1 pt**
- which will not contribute to gas exchange (in alveoli/ lungs) **1 pt**

(b) What is the volume of the anatomical dead space of a normal healthy adult person?

150 mL / 1.5 dL / 150 cm^3 **1 pt**

(ii) State how the coordination through nervous system is faster when compared with coordination through the endocrine system.

Nervous system uses electrical signals (which travel fast) through (interconnected) neurons while endocrine system uses hormones which are transported through blood (which takes a longer time)

2 pts

(iii) (a) Name the three major functional areas of the cerebral cortex of man.

Sensory areas
Association areas
Motor areas **3 pts**

(b) State two differences between sympathetic and parasympathetic division of the autonomic nervous system.

Sympathetic division	**Parasympathetic Division**
• Nerves exit only from the spinal cord/ as spinal nerves	Nerves exit from brain and spinal cord / as cranial and spinal nerves
• Prepare body for exciting / stress / Energy generating situation / Flight or fight	(Promote) calming/ return to self/return to normal condition
• (Main) neurotransmitter is norepinephrine/ noradrenaline	Neurotransmitter is acetylcholine

(both sides should be correct)
any two

2 pts

(iv) Name the disease that causes severe mental deterioration characterized by confusion and memory loss in man.

Alzheimer's disease **1 pt**

(v) (a) State an advantage of binocular vision.

Three-dimensional vision / judging speed / judging depth / judging distance (of an incoming object)

1 pt

(b) What is the function of the Eustachian tube?

Maintenance of air pressure on both sides of the tympanic membrane at the atmospheric level/ at the same level **1 pt**

40 pts × 2 ½ marks = 100 marks

3. (A) (i) Name a phylum that contains animals with hydrostatic skeleton.

Annelida/ Nematoda **1 pt**

(ii) (a) State <u>one</u> function of each of the following in the human skull

Fontanelles: Allows compression of skull at birth/ facilitates parturition **1 pt**

Sutures: No marks

(b) Which human vertebrae contain a foramen in each transverse process?

Cervical vertebrae **1 pt**

(c) Give <u>two</u> examples for hinge joints found in the human lower limb.

- Knee joint
- Ankle joint
- joints between phalanges (of toes) **(any two)**

2 pts

(III) Name a group of animals which possesses salt glands for excretion.

Marine birds/ marine reptiles **1 pt**

(iv) (a) Name <u>two</u> substances that are secreted by the distal convoluted tubule of human nephron.

- H^+ / hydrogen ions
- K^+ / potassium ions **2 pts**

(b) State the <u>two</u> sites of action of ADH in the human kidney.

- Distal convoluted tubule
- Collecting duct **2 pts**

(v) Stale the roles of helper T cells in immunity.

- (Provide signals to) activate cytotoxic T cells (to kill infected cells)
- (Provide signals to) activate B lymphocytes/ B cells (to produce antibodies)

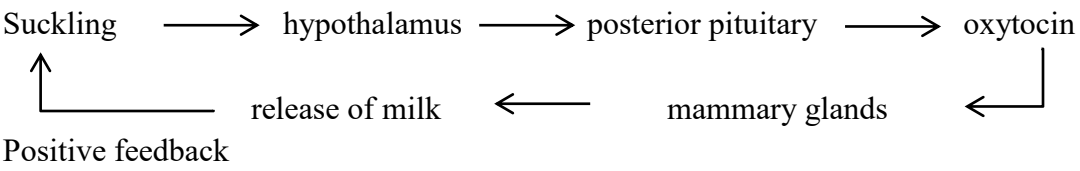
2 pts

(B) (i) What is the reason for developing Type I diabetes in man?

Destruction / attacking of β cells in pancreas by (cytotoxic) T cells

1 pt

(ii) Construct a flow chart to show the feedback mechanism related to the action of oxytocin on mammary glands of humans.



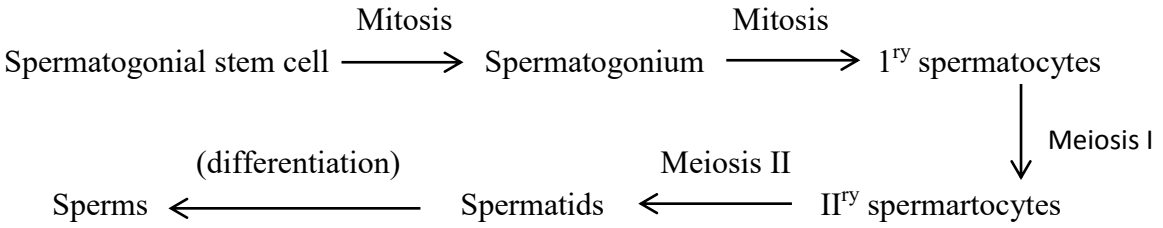
Correct sequence 1 pt
Positive feedback 1pt

(iii) State <u>two</u> advantages of asexual reproduction seen among invertebrates.

- Only one parent is needed
- Allows rapid multiplication of individuals
- No time/ energy needed to find a mate for reproduction
- Genetically identical offspring are produced
- Offspring genetically identical to the parent is produced **(any two)**

2 pts

(iv) (a) Write in correct sequence, the entire process of production of sperm in man starting from spermatogonial stem cells.

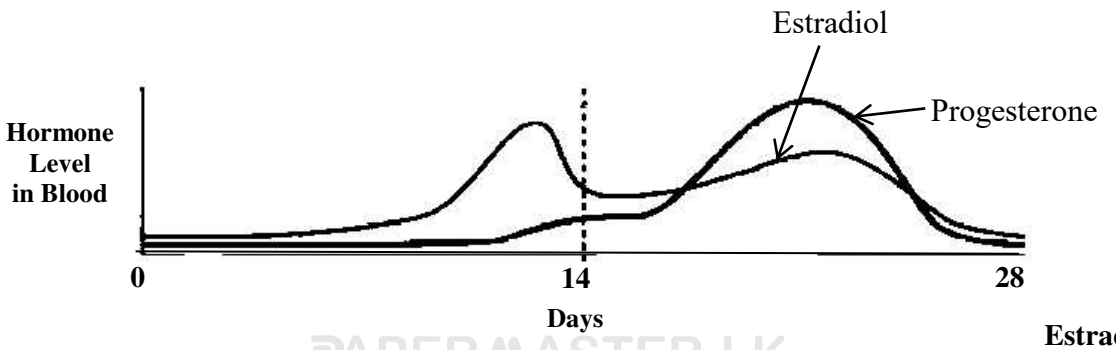


for cells ; 1 pt
(All cells should be written)
for what happens in each step ; 1 pt
(All what happens should be written)

(b) From which portion of the blastocyst, does the fetal portion of placenta develop in humans?

No marks

(v) (a) Indicate below, how the levels of ovarian hormones in the blood are changed during the typical 28 days reproductive cycle of a mature woman.



Estradiol 1 pt
Progesterone 1 pt

(b) State the actions of Depo-Provera injection in human females.

- Thickens cervical mucus preventing sperm entry **2 pts**
- Makes endometrium thin preventing implantation if fertilization occurs **2 pts**

(C) (i) (a) What are known as microaerophilic organisms?

Organisms that grow only in low oxygen concentration / oxygen levels lower than that in air **1 pt**

(b) Name a microaerophilic bacterial species.

Lactobacillus sp. **1 pt**

(ii) Why do heterocysts have thick walls?

To protect nitrogenase (enzyme) which is sensitive to oxygen/ to protect nitrogenase from oxygen **1 pt**

(iii) (a) State two methods where dry heat is used for sterilization of materials in a microbiological laboratory.

- Direct flaming
- Hot air sterilization **2 pts**

(b) State two methods of disinfection used in drinking water treatment.

- Chlorination
- Use of ozone **2 pts**

(iv) Name a fungal species and a bacterial species that cause food intoxication.

Fungal species : *Aspergillus flavus* **1 pt**

Bacterial species : *Staphylococcus aureus*/ *Clostridium botulinum* **1 pt**

(v) (a) State two differences between sub-unit vaccines and live attenuated vaccines.

- Subunit vaccines contain antigenic fragments (that can induce immunity) and (usually) need booster dose/repeated vaccination

- Live attenuated vaccines contain pathogenicity / virulence controlled/ (deliberately) weakened pathogens/ live microorganisms and booster dose/ repeated vaccination (usually) not needed/ lifelong immunity

(for each point feature in both vaccines should be written)

2 pts

(b) State in correct sequence, the <u>two</u> steps in the production of vinegar using fruit juice and name <u>one</u> species of microorganisms used in each of these steps.

Step	microorganism Species
Alcoholic fermentation / sugar → Ethanol	*Saccharomyces cerevisiae*
Acetic acid fermentation/Ethanol → Acetic acid / $C_2H_5OH \rightarrow CH_3COOH$	*Acetobacter* sp. / *Gluconobacter* sp.

2 pts **2 pts**

40 pts × 2 ½ marks = 100 marks

4 (A) (i) What are the <u>two</u> types of signals that are responsible for epigenetics?

- Inherited signals
- Signals by environmental factors/ Environmental signals

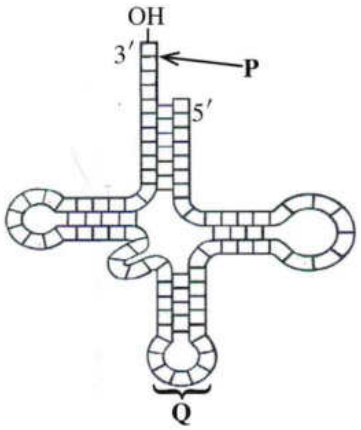
2 pts

(ii) State a major function of signal peptides present in certain polypeptides.

Guiding the polypeptides to particular locations in cell/ guiding the polypeptides to be secreted/ Protein trafficking

1 pt

(iii) Identify the molecule given in the diagram and name the parts labelled as <u>P</u> and <u>Q</u>.



Molecule : tRNA/ Transfer RNA

P : Amino acid arm/ Site where the amino acid attaches **1 pt**

Q : Anticodon **1 pt**

(iv) What is the property of the genetic code that allows a gene isolated from one organism expressing the same polypeptide when inserted into another organism?

Universality **1 pt**

(v) State <u>two</u> methods used to introduce a foreign DNA molecule into a plant cell.

- Using a plant virus vector / transduction
- Using gene gun
- *Agrobacterium* mediated gene transfer / Using *Agrobacterium*
- Transformation / mixing large number of copied of DNA with host cell

(any two) **2 pts**

(B) (i) Name the <u>three</u> biomes that are located closest to the equator.

- Tropical forest
- Savanna
- Desert **3 pts**

(ii) (a) State the <u>two</u> dominant vegetation types in villus.

- Grasses
- Sedges **2 pts**

(b) State <u>two</u> locations in Sri Lanka where villus are common.

- Wilpattu (national park)
- Mahaweli flood plains **2 pts**

(iii) What is meant by each of the following?

(a) Population: Group of individuals of the same species living in the same area (and producing fertile offspring through interbreeding) **1 pt**

(b) Trophic level: Feeding group in an ecosystem **1 pt**

(c) Food chain: (Linear) sequence of organisms through which nutrients and energy pass from one trophic level to another/ next trophic level in an ecosystem beginning with a primary producer **1 pt**

(iv) (a) Name <u>two</u> invasive alien plants found in the reservoirs of Sri Lanka.

- *Salvinia*
- Water hyacinth **2 pts**

(b) Name <u>two</u> common sea grass genera in Sri Lanka.

- *Halodule*
- *Halophyla* **2 pts**

(v) Why are coral reefs considered as rain forests of the sea?

- High productivity
- High diversity of organisms/ High species diversity **2 pts**

(C) (i) State <u>five</u> important environmental services provided by biodiversity.

- CO_2 fixation/ photosynthesis
- Maintaining nutrient cycles/ N_2 cycle/ P cycle
- Maintaining water cycle/ recycling moisture in atmosphere/ recharging groundwater
- Soil formation
- Preventing soil erosion/ Protection of soil from erosion
- Regulating climate
- Water purification
- Pollination **(any five)** **5 pts**

(ii) State <u>five</u> human activities that contribute to desertification.

- Deforestation
- Overexploitation of water
- Overexploitation of soil
- Uncontrolled mining
- Excessive use of agrochemicals
- Poor land management **(any five)** **5 pts**

(iii) (a) Many legislations and policies are formulated by the Sri Lankan government for environmental conservation. What is meant by legislation and a policy?

Legislation: (Set of regulations and) penalty is given when violated **1 pt**

Policy: Set of practices that is followed (and no penalty when not practiced) **1 pt**

(b) State a key legislation available in Sri Lanka for environmental conservation.

Flora and Fauna Protection Ordinance/ FFPO/ National Environmental Act **1 pt**

(iv) State the main concept on which tissue culture is based.

Totipotent potential **/** Totipotent / Single cell has the genetic programme to grow into an entire new plant

1 pt

(v) How does addition of sugar preserve food?

By producing osmotic stress on microorganisms **1 pt**

40 pts × 2 ½ marks = 100 marks

Part B - Essay

5. (a) Describe the components of nucleotides and explain how nucleotides form the backbone of DNA.

1. A nucleotide consists of Pentose sugar,
2. Nitrogenous base and
3. Phosphate group.

Two types of pentose sugars,

4. Deoxyribose and
5. Ribose.
6. In deoxyribose, one oxygen atom is less than that in ribose.

Two types of nitrogenous bases,

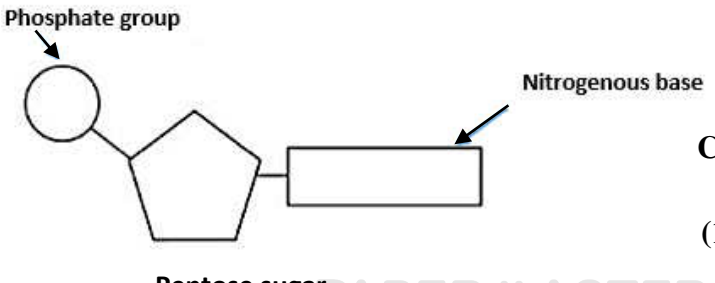
7. Purines and
8. Pyrimidines.
9. Purines have two rings and
10. Pyrimidines have one ring.
11. Pyrimidines are smaller in size (than purines)/ Purines are larger in size (than pyrimidines)

Two types of purines

12. Adenine /A and
13. Guanine /G.

Two types of pyrimidines

14. Thymine /T
15. Uracil /U and
16 Cytosine /C.
17. Nucleotides join by phosphodiester bonds and
18. form polynucleotide chain
19. by condensation between OH group of phosphate of one nucleotide with the OH group of 3rd carbon of pentose sugar of another / adjacent nucleotide.
20. These bonds result in a backbone with a repeating pattern of sugar-phosphate units.
21. Sugar (molecule) of DNA is deoxyribose.
22. DNA contain Adenine /A, Thymine /T, Guanine/G, and Cytosine /C.
23. Sugar (molecule) of RNA is ribose
24. RNA contain Adenine / A , Guanine / G, Cytosine / C and Uracil / U



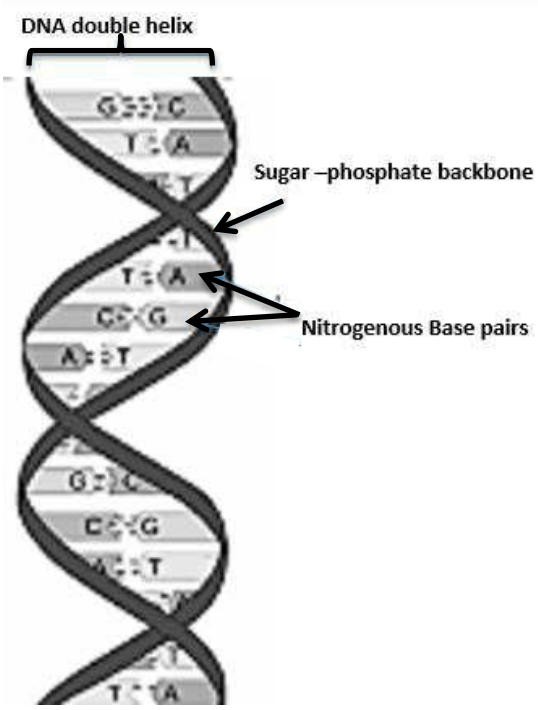
Correct diagram of a nucleotide:
Fully labelled : 3 marks
(1 mark for each label)
Unlabeled : 0 marks

(b) Describe the structure of DNA molecule according to Watson and Crick model.

1. DNA molecule consists of two polynucleotide chains
2. which are spirally arranged/spiral
3. around an imaginary axis and
4. forming a double helix.
5. Sugar-Phosphate backbones run in opposite directions
6. and is called antiparallel.
7. Sugar-Phosphate backbones are on outer side of the helix.
8. Nitrogenous bases are paired and
9. are interior (of the helix)
10. Two strands/chains are held (together) by hydrogen bonds
11. between two complementary nitrogenous bases.
12. Adenine / A pairs / binds with Thymine / T
13. Guanine/G pairs /binds with Cytosine / C

(If written as purines pair/bind with pyrimidines, consider as one point instead of 12 and 13)

14. Two hydrogen bonds between Adenine /A and Thymine/T.
15. Three hydrogen bonds between Guanine /G and Cytosine /C.
16. Two chains/strands are complementary to each other.



Correct diagram of DNA structure
Fully labelled correct diagram : 3 marks
(1 mark for each label)
Unlabeled diagram : 0 marks

24 points + 16 points	**=**	**30 points**
Any 36 points × 4 marks	**=**	**144 marks**
Diagrams: 03 + 03	**=**	**06 marks**
Total	**=**	**150 marks**

6. Briefly describe the structure and functions of ground tissue in plants.

Ground tissue consists of three main types of cells;

1. Parenchyma cells,
2. Collenchyma cells and
3. Sclerenchyma cells.
4. Parenchyma cells have primary cell walls,
5. which are thin

6, 7 They contain a large, central vacuole
8. Some contain plastids /leucoplasts/chloroplasts.
9. Collenchyma cells are (generally) elongated and
10. have primary cell walls,
11 which are thicker than those of parenchyma cells and
12 unevenly thickened.
13. Sclerenchyma cells have secondary cell walls,
14, 15. which are thickened by large amount of lignin.

Two types of sclerenchyma cells,
16. sclereids and
17. fibers.
18. Sclereids are irregular in shape,
19, 20. shorter and wider than fibers.
21. Fibers are long,
22, 23. slender and tapered.

Functions

24. Fills the gap between dermal tissue and vascular tissue.
25, 26. Forms cortex and pith.
27. Photosynthesis.
28. Short distance transport (of substances).
29. Parenchyma cells carry out metabolic functions
30. such as synthesis of organic substances /products,
31. storage (of substances) and
32. wound repair.
33. Collenchyma cells provide (mechanical) support
34, 35. Sclerenchyma cells / sclereids / fibers provide support and strength.

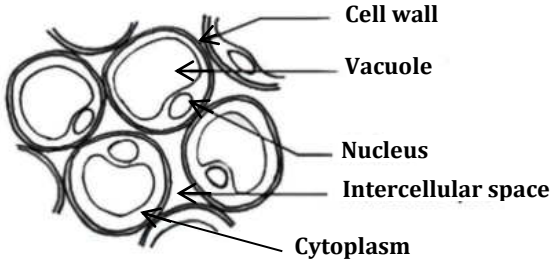


Diagram of Parenchyma cells	**:**	**6 marks**
Fully labelled correct diagram	**:**	**6 marks**
Partially labelled correct diagram	**:**	**3 marks**
Unlabeled diagram	**:**	**no marks**

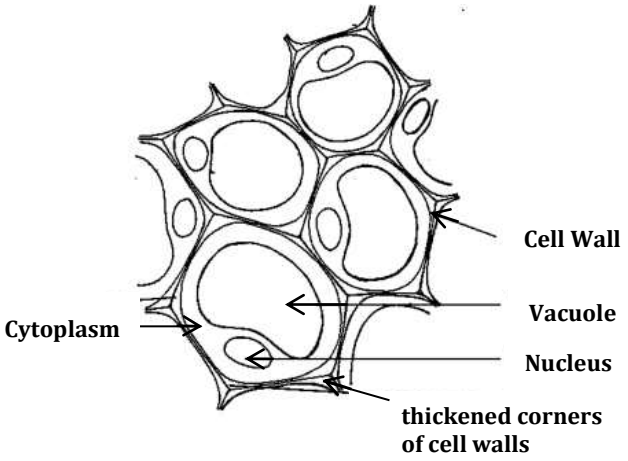


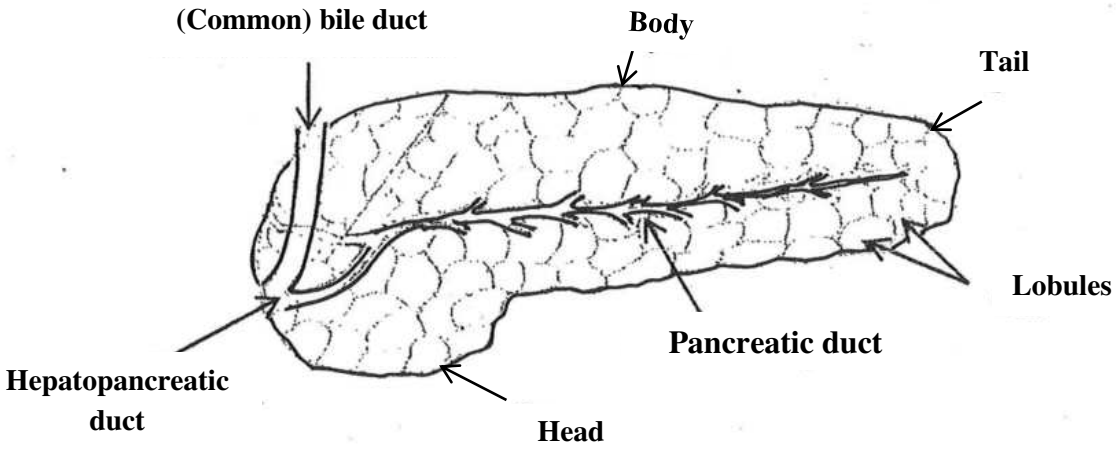
Diagram of Collenchyma cells	**:**	**6 marks**
Fully labelled correct diagram	**:**	**6 marks**
Partially labelled correct diagram	**:**	**3 marks**
Unlabeled diagram	**:**	**no marks**

Correct diagram of T.S. of sclereids : 2 marks

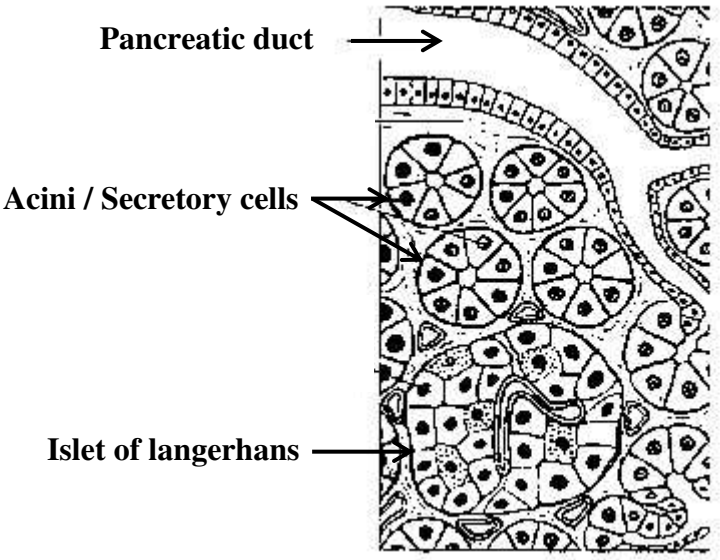
Any 34 points × 4 marks	**=**	**136**
Diagram of parenchyma cells	**=**	**6 marks**
Diagram of collenchyma cells	**=**	**6 marks**
Diagram of T.S. of sclereids	**=**	**2 marks**
Total	**=**	**150 marks**

7. (a) Describe the structure of human pancreas.

1. Consists of head, body and tail.
2. Head is broad.
3. Tail is narrow.
4. Consists of exocrine part and endocrine part.
5. Large number of lobules are present
6. in the exocrine part.
7. (Lobules are made up of) acini
8. which are (very) small.
9. Secretory cells are present in acini walls.
10. Each lobule is drained by a duct / Each lobule opens into a duct / A duct starts from a lobule.
11. These ducts form pancreatic duct
12. Common joins with (common) bile duct
13. forming hepatopancreatic duct
14. which opens to duodenum.
15. Islets of Langerhans are present
16. in the endocrine part
17. They consist of (group of) specialized cells.
18. They do not have ducts



Correct diagram of gross structure of the pancreas
Fully labelled correct diagram : 7 marks
(1 mark for each label)
Unlabeled diagram : no marks



Correct diagram of Histological structure
Fully labelled correct diagram : 3 marks
(1 mark for each label)
Unlabeled diagram : no marks

(b) Explain the role of human pancreas in digestion of food.

1. Exocrine part / acini / lobules secrete pancreatic juice.
2. It contains bicarbonate ion / HCO_3^-,
3. (Pancreatic) amylase,
4. (Pancreatic) lipase,
5. (Pancreatic) nuclease,
6. Chymotrypsinogen,
7. Trypsinogen and
8. Pancreatic carboxypeptidase.
9. (Pancreatic) amylase catalyses the conversion of / breakdown of polysaccharides to disaccharides.
10. (Pancreatic) lipase catalyses the conversion of / breakdown of fat / triglycerides into glycerols, fatty acids and monoglycerides.
11. (Pancreatic) nucleases catalyse the conversion of / breakdown of nucleic acids / DNA and RNA into nucleotides.
12. Chymotrypsinogen is converted to chymotrypsin and
13. trypsinogen is converted to trypsin.
14, 15. Chymotrypsin and trypsin catalyse the conversion of / breakdown of small polypeptides into smaller polypeptides.
16, 17. Pancreatic carboxypeptidase catalyses the conversion of / breakdown of smaller polypeptides into more small polypeptides / peptides and amino acids.
18. Bicarbonate ions neutralize chyme (received from the stomach).

18 + 18	**=**	**36 points**
Any 35 points × 4 marks	**=**	**140 marks**
Gross structure diagram	**=**	**7 marks**
Histological structure diagram	**=**	**3 marks**
Total	**=**	**150 marks**

8. Discuss the innate immunity of the human body against pathogen invasions.

Innate defense mechanisms are of two types.

1. External defenses /barrier defense and
2. Internal (nonspecific) defenses.
3. External defenses / barrier defenses discourage entry of pathogens and
4. foreign substances.
5. Skin / Epidermis with closely packed / keratinized cell layers
6. serves as a physical barrier.
7. Periodic shedding of epidermal cells removes microbes (from skin surface).
8. Mucus membranes trap microbes (and other particles)
9. Secretions / tears / saliva are physical barriers as well as
10. chemical barriers.
11. Washing action dilute microorganisms and
12. inhibit colonization / prevent settling of microbes / bacteria /fungi.
13. Lysozymes destroy cell walls of (some) bacteria.
14. Gastric juice provides acidic environment / condition and
15. destroys (many) bacteria / bacterial toxins.
16. Secretions of sweat glands / sebaceous glands provide acidity and
17. prevent growth of bacteria.

18. Internal defenses detect non - self cells / foreign substances
19. by molecular recognition.
20. Phagocytic cells / neutrophils / macrophages ingest microbes /foreign particles.
21. Natural killer cells detect / bind with cells with abnormal surface molecules and
22. release chemicals to kill / destroy them.
23. Antimicrobial proteins attack microbes (directly) and
24. impede their reproduction / growth.
25. Interferons which are produced by virus infected cells,
26. stimulate uninfected (neighboring) cells to produce antiviral proteins
27. that inhibit replication of viruses.
28. (Some) interferons activate macrophages.
29. Complement proteins are activated by substances present on surface of microbes and
30. carry out / lead to lysis of invaded cells / microbes, and
31. promote phagocytosis and
32. inflammatory response.
33. Inflammatory response occurs due to signaling molecules (upon infections)/histamine
34. which increase permeability
35. and dilation of blood vessels.
36. enhancing infiltration of white blood cells / phagocytes / macrophages / neutrophils and
37. antimicrobial proteins to infected / injured area.
38. Activated complement proteins increase histamine release.
39. Activated phagocytes / macrophages / neutrophils release cytokinines / signaling molecules
40. which promote blood flow to infected / injured area.

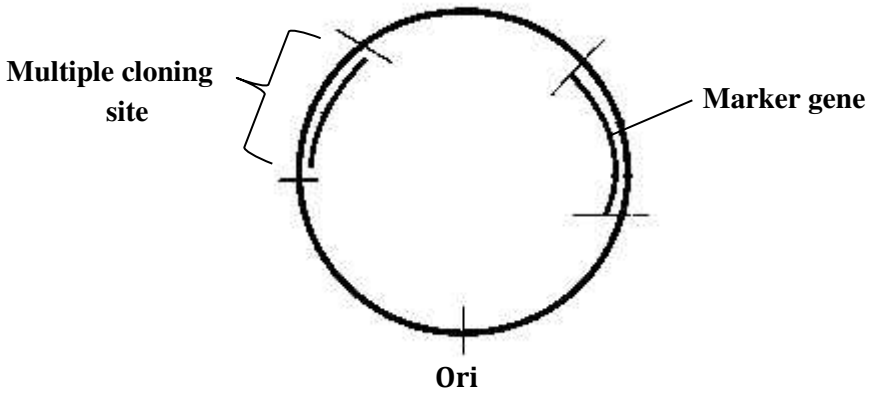
Any 37 points × 4 marks = 148 marks
If more than 37 points written, add 2 marks = 2 marks
Total = 150 marks

9 .(a) Write an account of the essential features of a cloning vector.

1. Ori / Origin of replication is present.
2. Replication initiates from Ori,
3. independent of chromosomal DNA.
4. Multiple cloning sites are present,
5. where the DNA to be cloned / DNA of interest / recombinant DNA molecule is inserted.
6. Cloning site contains sequences (of nitrogenous bases which carry sites) for many restriction enzymes
7. and therefore can use several restriction enzymes (to cut DNA).
8. Marker gene / marker is present
9. which helps to identify / identifies the transformed host cells.
10. Example: Antibiotic resistant gene
11. Some markers are selective markers.
12. They allow the growth of transformed cells only.
13. Example: Host cells sensitive to a particular antibiotic will not grow when that antibiotic is present (in the medium),
14. but transformed cell can grow (when antibiotic is present in the medium),
15. because the vector carries the resistant gene.

16. All vectors do not recombine with DNA/ gene of interest.
17. (Therefore) there is another marker
18. to distinguish (the colonies with) the vectors containing the inserted gene / inserted DNA / DNA insert (from those which do not contain that gene / DNA)

18 points



Fully labelled correct diagram : 4 marks
Partially labelled correct diagram : 2 marks
Unlabelled diagram : no marks

(b) Briefly describe the chemical changes that take place in food during spoilage due to microbial activity.

1, 2, 3. Occurs due to heterotrophic bacteria and fungi (if only microorganisms written consider as one point) that grows in food.
4. They secrete / release/ produce extracellular enzymes.
5. Putrefaction
6. occurs due to breaking down of proteins (in food)
7. by proteolytic enzymes
8. released / secreted / produced by proteolytic microorganisms / fungi and bacteria
9, 10. into amino acids, amines, ammonia / NH_3 and hydrogen sulphide / H_2S (Any two considered as one point).
11. Fermentation
12. occurs due to breaking down of complex carbohydrates (in food)
13. by amylase
14. into simple carbohydrates / sugars
15 and converting those into carbohydrate food acid, alcohol and gases
16. by (enzymes released by) saccharolytic microorganisms / fungi and bacteria.
17. Rancidity
18. occurs due to breaking down / conversion of lipids (in food)
19. into fatty acids and glycerol
20. by (enzymes released by) lipolytic microorganisms / fungi and bacteria.

Any 18 points

18 points + 18 points = 36 Points
36 points × 4 marks = 144 marks
If more than 37 points written, add 2 marks = 2 marks
Diagram = 4 marks
Total = 150 marks

10. Write short notes on the following.

(a) Rules of nomenclature

1. Two species cannot have the same name.
2. Each species has a species name / scientific name
3. which consists of a generic name and a specific epithet.
4. Name is made up of Latinized words**.**
5. It is written as Roman script /English letters.
6. It is italicized when printed and
7. underlined when handwritten.
8. First letter of the generic name is capitalized.
9. Specific epithet is in simple letters.
10. Name of the author /person who gave the name is given at the end of the name.
11. and it is not Latinized and
12. is indicated as full word, as an abbreviation or by a capital letter (Any two).
13. Third word can be given /used to indicate subspecies /variety.

(b) Hardy-Weinberg equilibrium and evolution

1. Hardy-Weinberg equilibrium is used to assess whether a population is evolving.
2. with respect to a particular characteristic / genetic locus.
3. If not evolving (at that genetic locus) genetic make up of a trait /allele frequency / genotype frequency will remain unchanged.
4. Hardy-Weinberg equilibrium is applicable to a population which is not evolving,
5 and therefore has no mutations,
6. has random mating,
7. no natural selection,
8. large population
9. with no immigration/emigration/migration.

[Opposites of points 5 to 9 are also accepted.
For evolution to occur
5. there should be mutations,
6. non-random mating / selective mating,
7. natural selection,
8. small population,
9.with immigration /emigration/migration.]

10. Most populations deviate from Hardy-Weinberg equilibrium
11. except for certain genetic loci.
12. Slowly evolving populations do not deviate much from Hardy-Weinberg equilibrium.

(c) General characteristics of a culturable fish species

1. Should withstand climate in the region;
2. Should grow well / fast in prevailing conditions / physical and chemical parameters of water in the area;
3. Should be easy to breed;
4. Should be hardy;
5. Should not reproduce in grow-out ponds /tanks;
6. Should reach sexual maturation (relatively) late;
7. Should accept / feed on formulated food;
8. Should be an efficient converter of (economical) food;
9. Should not have adverse environmental impacts;
10. Should tolerate high population density;
11. Should be resistant to (common) diseases;

12, 13. Should satisfy consumers, have good taste, good nutritive value, good texture of flesh, good appearance / colour. (Any two considered as 1 point)

13 points + 12 points13 + points	**=**	**38 Points**
38 points × 4 marks	**=**	**148 marks**
If more than 37 points written, add 2 marks	**=**	**2 marks**
Total	**=**	**150 marks**