G.C.E. (A/L) Examination - 2019

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.

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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) $\frac{3}{5}$ = $\boxed{\frac{10}{15}}$

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 'V' 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.

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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 2019

නව නිර්දේශය/ புதிய பாடத்திட்டம

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

✪විශේෂ උපදෙස්/விசேட அறிவுறுத்தல் :

එක් පිළිතුරකට/ஒரு சரியான விடைக்கு ලකුණු01බැගින්/புள்ளி வீதம்
මුළු ලකුණු/மொத்தப் புள்ளிகள் 1 × 50= 50

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General Certificate of Education (A/L) Examination -2019

Biology 09 - New Syllabus

PAPER II – PART A

1. (A) (i) (a) Name the three major types of lipids found in organisms.

- Fats/ Triglycerides/Tryacylglycerol
- steroids
- phospholipids **3 pts**

(b) What is the type of lipid that forms a major component of the cell membrane?

Phospholipids **1 pt**

(ii) What is the main structural difference between saturated fatty acids and unsaturated fatty acids?

Saturated fatty acids have hydrocarbon chains without double bonds while unsaturated fatty acids have hydrocarbon chains with (one or more) double bonds **1 pt**

(iii) State three functions of rough endoplasmic reticulum.

- Transports proteins synthesized by ribosomes (attached to it)
- Synthesizes glycoproteins
- Produces transport vesicles
- (facilitates) growth of (own) membrane/ serves as membrane factory

Any 3 pts

(iv) Name three types of vacuoles seen in organisms.

- Contractile vacuoles
- food vacuoles
- central vacuoles **3 pts**

(v) State two significances of mitosis.

- Maintains genetic stability
- Growth and development
- Cell repair/replacement/ regeneration/tissue repair
- Asexual reproduction **Any 2 pts**

(B)(i) Where does the Calvin cycle take place in the chloroplast?

Stroma **1 pt**

(ii)What are the three main steps of the Calvin cycle?

- Carbon fixation/ carboxylation (of CO_2 acceptor/ RuBP)
- Reduction (of 3PGA)
- Regeneration of RuBP/ CO_2 acceptor **3 pts**

(iii) Where does the light reaction of photosynthesis take place'?

Grana/ thylakoid membrane (of chloroplast) /membrane system of thylakoids **1 pt**

(iv) State the three substances produced in the light reaction of photosynthesis.

- NADPH
- ATP
- Oxygen/ O_2 **3 pts**

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(v) How does an increase in the oxygen concentration in mesophyll cells affect photosynthetic productivity in C3 plants?

- RuBP reacts/ binds with oxygen/ Rubisco oxygenase reaction takes place
- and produces (only) one molecule of 3 PGA/3 Phosphoglycerate/ lose one 3 PGA/ lose 50% of 3 PGA
- reducing productivity. **3 pts**

(C)(i) Write in correct sequence, the four main stages by which the first cells have been produced according to the theory of biochemical evolution.

- Abiotic synthesis of small organic molecules/ Synthesis of small organic molecules from inorganic molecules.
- Polymerization (of above organic molecules) to form (organic) macromolecules
- Packing of macromolecules into membrane/ formation of protocells
- Nucleic acids gain self-replicating capability **4 pts**

(ii) What is meant by polyphyletic?

Originated from more than one ancestor **1 pt**

(iii) Briefly describe what a zygosporangium is.

- A sturdy structure
- Multinucleated
- Produced by plasmogamy/ fusion of cytoplasms of two parent cells/gametangia
- and Karyogamy/ fusion of nuclei
- during sexual reproduction
- of zygomycotes.
- Resistant to unfavorable environment/ conditions/ drying/ freezing
- Metabolically inactive (in adverse environmental conditions)
- Produces haploid spores **Any 7 pts**

(iv) Production of flagellated sperms is a feature seen in some plants. Name one phylum having plants with each of the following features together with the feature of producing flagellated sperms.

Feature	Phylum	
(a) Presence of seeds	Cycadophyta	**1 pt**
(b) Absence of a vascular system	Bryophyta	**1 pt**

(v) (a)What are the structures used to maintain osmotic balance in flukes?

Flame bulbs/ flame cells/ protonephredia **1 pt**

(b) Name the body cavity of nematodes.

Pseudocoelom **1 pt**

<u>40 pts X 2.5 = 100marks</u>

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2. (A) (i) State the three basic functions of epithelial tissues of animals.

- Protection
- Secretion
- Absorption **3 pts**

(ii) State three structural features of meristematic cells in plants.

- Isodiametric / (roughly) spherical
- Central nucleus
- Dense/ thick cytoplasm **3 pts**

(iii) Name two types of specialized cells of found in the epidermis of plants.

- Trichomes
- Guard cells
- Root hairs

Any 2 pts

(iv) You are given 12 potato strips immersed in distilled water, each of which is about 5 cm long and six petri dishes kept on graph papers, each containing sucrose solutions of 0.15 M, 0.20 M, 0.25 M, 0.30 M, 0.35 M and 0.40 M concentrations. State in correct sequence, the steps followed to determine the water potential of given fresh potato tissue.

- Completely immerse two potato strips in each sucrose solution / petri dishes
- (immediately) measure their length by the graph paper (placed under the petri dish)
- Leave (covered/ closed petri dishes) for 30 – 60 minutes (any value between these are accepted)
- Measure the length of potato strips (and calculate the mean value)
- Plot a graph of percentage mean change in length on Y axis and molarity/concentration of sucrose solution on X axis / Plot a graph of percentage mean change in length versus molarity/ concentration of sucrose solution.
- Determine the concentration of sucrose solution where there is no change in length (from the graph)
- Determine the water potential using (relevant data) tables

7 pts

(v) State three functions of calcium in plants.

- Component of/participation in the formation of middle lamella/cell wall
- Maintenance of membrane structure
- Maintenance of membrane permeability
- Signal transduction

Any 3 pts

(B) (i)Name two plant genera having photosynthetic gametophytes.

- *Pogonatum*
- *Nephrolepis*
- *Marchantia*
- *Anthoceros* **Any 2 pts**

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(ii) Name the group of plants having the least developed gametophytes.

Anthophyta/ angiosperms/ flowering plants **1 pt**

(iii) What are sori?

Cluster of sporangia **1 pt**

(iv) What is pollination?

Transfer/ deposition of pollen to a mature stigma/ovule **1 pt**

(v) State three functions of cytokinins in plants.

- Regulate cell division in shoots/ roots
- Stimulate / induce seed germination
- Modify apical dominance/ promote lateral/ axial bud growth
- Promote movement of nutrients into sink tissues
- Delay leaf senescence

any 3 pts

(C) (i) (a) Where is the caecum located in the human alimentary canal?

At the junction/place where the ileum opens to the colon /between small intestine and large intestine/ between ileum and colon

1 pt

(b) Name the type of cells in gastric glands of man that secretes pepsinogen.

Chief cells

1 pt

(ii) What is the main function of buffers present in saliva?

Prevent tooth decay (by neutralizing acid)

1 pt

(iii) State whether the following substances are transported actively or passively across epithelium of intestinal villi.

(a) Vitamins: Actively
(b) Amino acids: Actively
(c) Fructose: Passively

3 pts

(iv) (a) Name the main blood vessel formed by converging blood capillaries of the intestinal villi.

Hepatic portal vein

1 pt

(b) Why is double circulation more effective than single circulation in supplying blood to body parts?

Due to the higher pressure (exerted by heart) in systemic circulation/provides blood to organs at higher pressure **1 pt**

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(v)(a) What is hypertension?

Sustained elevated blood pressure above normal limits **1 pt**

(b) State consequences of hypertension.

- Kidney damage
- Adrenal gland disorders
- Heart attack
- Stroke/ cerebral hemorrhage
- Damages blood vessels/arteries/arterioles/capillaries
- Death

Any 5 pts

40 pts X 2.5 = 100 marks

3. (A) (i) State three main differences between active immunity and passive immunity.

Active immunity	**Passive immunity**
• Long lasting (protection)	Short term (protection)
• Involve T and B lymphocytes/ T and B cells	no involvement of T and B lymphocytes/ T and B cells
• Memory cells develop/ immunologic memory retained	memory cells not developed/no immunologic memory
• Antibodies produced in the body	Antibodies gained from outside/ Readymade antibodies

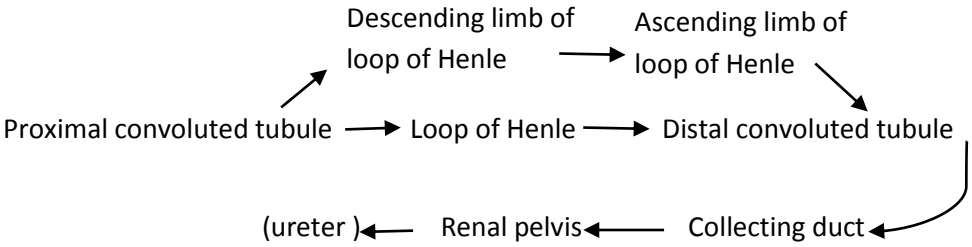
Any 3 pts

(ii) Name the two types of nephrons present in the human kidney.

- Cortical nephrons
- Juxtamedullary nephrons

2 pts

(iii) Write in correct sequence, the pathway of a creatanine molecule from a Bowman's capsule to the ureter in man.



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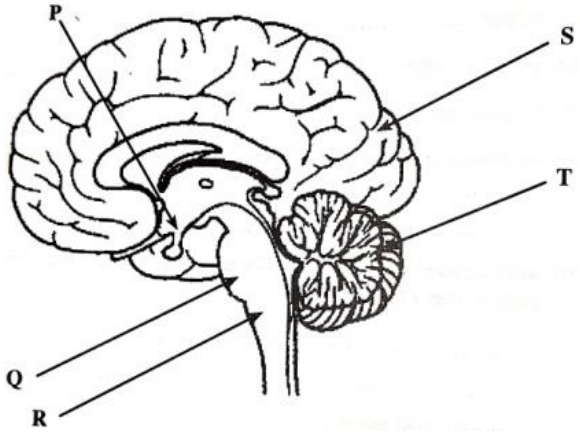
1 pt

(iv) State two disorders related to human urinary system.

- Bladder stones /Kidney stones/ Renal calculi
- Chronic Kidney disease / CKD /CKDu/ Chronic Kidney Disease of unknown etiology
- Kidney frailer **any2 pts**

(v) This question is based on the following diagram of the human brain.



(a) Name the structures labeled as P, Q, R, S and T in the above diagram.

P - Hypothalamus

Q - Pons Varolii

R – Medulla oblongata

S – Cerebrum/ Cerebral hemisphere/occipital lobe

T – Cerebellum

5 pts

(b) Name the structures responsible for the following functions of man.

Maintaining posture: Cerebellum / T

1 pt

Coordination of running: Medulla oblongata/R, Pons Varolii / Q

2 pts

Regulation of thirst: Hypothalamus / P

1 pt

(B)(i) What is a sensory receptor?

- A specialized structure which can detect a specific stimulus and
- convert its energy to a changing membrane potential
- to be transmitted as an action potential to central nerves system

3 pts

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(ii) Where are the receptors that detect sound vibrations located in the human ear?

Basilar membrane / organ of Corti **1 pt**

(iii) Name two trophic hormones secreted by anterior pituitary of man.

- Follicle stimulating hormone / FSH
- Luteinizing hormone / LH
- Thyroid stimulating hormone / TSH
- Adrenocorticotrophic hormone / ACTH

Any 2 pts

(iv) Give an example for aregulation involving a positive feedback mechanism related to endocrine system in man.

(Regulation involving/role of/action of)Oxytocin in child birth/parturition/ milk ejection

1 pt

(v) Why does blood glucose level increase above the normal level in type 2 diabetes?

Failure of target cells to take up glucose from blood **1 pt**

(C) (i) (a) State the importance of locating testes outside the abdominal cavity in man.

To be cooler /at a lower temperature than the body for proper/ efficient production of sperms.

1 pt

(b) Write in correct order, the pathway of sperms from testes to the urethra in man.

(Seminiferous tubules) → Epididymis → Vas deference → Ejaculatory duct → (urethra)

1 pt

(c) What is the sperm nutrient present in the secretion of prostate gland of man?

No marks

(ii) (a) What are the structures in the human ovary that contain hormone producing cells?

- (Growing/Graffian/Ovarian) Follicle,
- Corpus luteum **2 pts**

(b) What is fertilization?

Fusion of (haploid) nucleus/pronucleus of sperm/ male gamete and (haploid)nucleus/pronucleus of ovum/female gamete / fusion of (haploid) nuclei/pronuclei of sperm and ovum/ male and female gemetes

1 pt

(c) In which phase of the human uterine cycle does implantation occur?

Secretory phase **1 pt**

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(iii) (a) What is the basis of the early pregnancy tests?

Presence of hCG in urine / blood

1 pt

(b) Give two examples for assisted reproductive technology methods.

- In-vitro fertilization/IVF
- Intra – cytoplasmic sperm injection /ICSI

2 pts

(iv) (a) State three functions of the human skeletal system other than support, protection and movement.

- Storage / release of calcium
- Storage / release of phosphorous/ phosphate
- Production of blood cells/red blood cells/white blood cells

3 pts

(b) What is the structural arrangement that provides nodding movement of the human skull?

No marks

(c) In which human vertebrae, a prominent bifid spinous process is found?

3rd to 6th/ typical cervical vertebrae

1 pt

(v) (a) What is a sarcomere?

(repeating) contractile units present in striated muscle cell/fiber/ Region between two adjacent/consecutive Z-lines in the myofibril/functional unit of striated muscles / muscle cell/ muscle fiber

1 pt

(b) Name the currently accepted theory of striated muscle contraction.

Sliding filament theory

1 pt

40 pts X 2.5 = 100 marks

4. (A) (i) What is a pedigree chart?

Diagrammatic representation of the inheritance of a particular trait/character within a given family tree **1 pt**

(ii) What are the data required to prepare a pedigree chart?

Data of a particular trait/character for many generations **1 pt**

(iii) What is denoted by each of the following symbols used in a pedigree chart?

■ - Affected/ diseased male

○ - (Not affected/Normal) female **2 pts**

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(iv) Hardy Weinberg equilibrium of a population is expressed as $p^2+2pq+q^2=1$.Whatare denoted by p and p^2 in this equation?

p - Frequency / proportion of dominant allele

p^2- Frequency / proportion of dominant homozygotes **2 pts**

(v) In a population of about 100,000 persons, a recessive trait is expressed by about 4.000.If this population is at Hardy-Weinberg equilibrium, about how many persons are heterozygous for that character?

32 000 **1 pt**

(B)(i)State the significance of RNA polymerase in DNA synthesis.

- Initiates synthesis of RNA on a DNA template by adding ribonucleotides
- Adds/forms a short RNA primer (on the DNA template)
- Forms DNA-RNA hybrid to facilitate the action of DNA polymerase

3 pts

(ii) Name two final products of genes other than polypeptides.

- Ribosomal RNA/r RNA
- Transfer RNA/ t RNA **2 pts**

(iii) What is the source of genetic variation?

Mutations **1 pt**

(iv)What are the information expected from a restriction map?

- Position/ location of restriction sites and
- Distance between restriction sites **2 pts**

(v) (a)Give two applications of DNA fingerprinting.

- Paternity/ Parenting testing
- Criminal identification
- Victim identification
- Detecting/identifying pathogenic / infectious organisms /agents

Any 2 pts

(b)Name the DNA delivery system specifically used in plant genetic engineering.

(Delivery system) using/via *Agrobacterium*/ *Agrobacterium* mediated (gene transfer)

1 pt

(C)(i) What is meant by habitat in environmental biology?

Physical area where a species/ an organism lives **1 pt**

(ii) (a) Sate the three types of interactions that occur in an ecosystem when abiotic and biotic components are considered and give one example for each of them.

Type of interaction	**Example**
• Biotic – biotic	Competition/ symbiosis/commensalism/ parasitism/ mutualism/ predation/feeding relationships
• Biotic – abiotic	Water/ nutrients uptake by plants (from soil) Obtaining oxygen (from air) by plants /animals
• Abiotic – abiotic	Chemical reactions in soil

(No marks are given for examples if interaction is not written) **6 pts**

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(b) What is ecosystem diversity?

Variety of habitats, living communities and ecological processes in the living world

1 pt

(iii) (a) What is a flagship species?

Species selected as a symbol/ icon to represent an ecosystem in need of conservation

1 pt

(b) Name a flagship species in Sri Lanka.

Blue magpie **1 pt**

(iv) State the environmental problems that occur due to open dumping of solid waste.

- Create/provide breeding grounds for vectors of diseases/ mosquitoes/flies/mice
- Spreading of water borne diseases/ typhoid/ paratyphoid/cholera/ dysentery/ gastroenteritis
- Generate unpleasant smell/ odour
- Generate methane/causing explosions/ contribute to global warming
- Ground water/ water resources can be contaminated/ polluted

5 pts

(v) Briefly explain what a sanitary landfill is.

- An engineered/ a planned means of disposal of waste
- Waste is spread in layers
- Tightly compacted/ volume is greatly reduced
- Waste is covered with soil
- Waste will be decomposed through
- biological and
- chemical processes.

7 **pts**

40 points X 2.5 = 100marks

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General Certificate (A/L) Examination – 2019 New Syllabus
09 – Biology Marking Scheme
PAPER II - PART B - Essay

5. (a) Briefly describe the general characteristics of enzymes.
(b)(i) Explain how pH and temperature affect the rate of enzymatic reactions.
(ii) Explain the action of competitive and non-competitive inhibitors in enzymatic reactions.

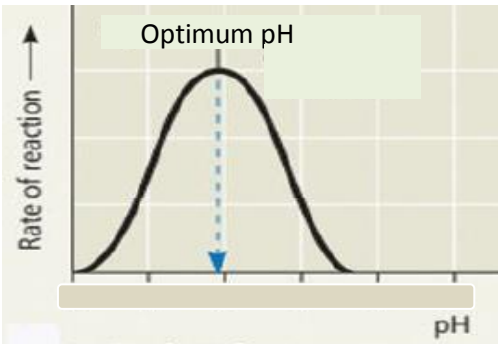
(a) Briefly describe the general characteristics of enzymes.

1. (Most) enzymes are globular proteins.
2. They are biological catalysts.
3. They increase the rate of reactions by
4. lowering the activation energy of the reactions.
5. (Most) enzymes are heat labile/ sensitive.
6. They do not alter the nature/ properties of the end products.
7. They are (highly) specific to the substrate/ substrate specific.
8. Most/Some catalyzed reactions are reversible.
9. The rate of enzymatic reaction is affected by (pH, temperature, inhibitors) and substrate/ enzyme concentrations.
10. They are not used up during the reaction/ They can be reused/ remain unchanged.
11. They possess (specific) active sites where the reactions take place/ enzyme binds with substrate.
12. Some enzymes need non-proteinous components/ cofactors (to catalyze the reactions/ for their activity).

(b) (i) Explain how pH and temperature affect the rate of enzymatic reactions.

Effect of pH

1. Enzymes function (most) effectively within a certain pH range.
2. The pH at which the highest rate of reaction occurs is the optimum pH of the enzyme.
3. A change in pH above or below the optimum pH leads to decline in enzyme activity/rate of reaction
4. due to the alteration of chemical bonds,
5. involved in formation of enzyme-substrate complex/ This prevents formation of enzyme-substrate complex.



Fully labeled correct diagram is required (marks 4/0)

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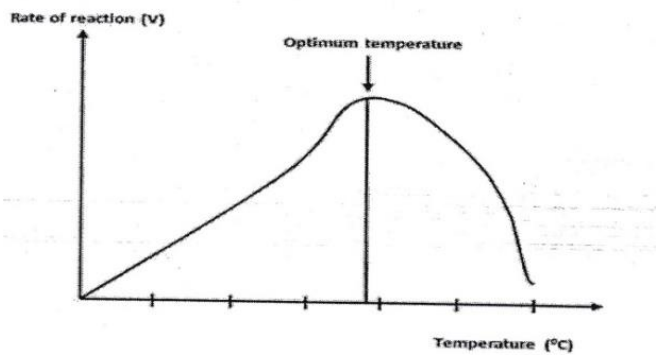
Effect of Temperature

6. Increase in temperature increases molecular motion.
7. Therefore, the speed of moving molecules of enzymes
8. and substrate will be accelerated.
9. This will enhance the colliding probability for/enhances collisions between enzyme active sites and substrate molecules.
10. More collisions result in greater chances for the reaction to occur/increase in rate of reactions.
11. This continues up to a certain point/ optimum temperature,
12. beyond which there is a rapid decline in enzymatic activity/ decrease in rate of reaction,
13. denaturing the enzyme
14. due to the disruption of hydrogen bonds,
15. ionic bonds and
16. other weak chemical bonds (of enzyme active sites), thus
17. changing the shape of the active site of enzyme
18. altering its complementary nature,
19. preventing (complementary) binding of enzyme active site and substrate molecules/ formation of enzyme-substrate complex
20. and reduces the rate of reaction.



Fully labeled correct diagram is required (marks 4/0)

(b) (ii) Explain the action of competitive and non-competitive inhibitors in enzymatic reactions.

1. Competitive inhibitors compete with substrate (selectively) for the active site of enzymes
2. due to their resemblance with (shape/ nature of) the substrate.
3. Therefore the number of active sites available declines.
4. (Actions of) competitive inhibitors are (mostly) reversible.
5. Non-competitive inhibitors do not compete with substrate (molecules).
6. They bind to (a part of) enzyme other than active site and
7. changes the shape of the enzyme/ active site and
8. active site becomes less effective/prevents for the formation of enzyme-substrate complex.

12 +20 + 8 = 40 points
Any 36 points X 4 = 144 marks
Diagrams 8 marks
Maximum 150 marks

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6. (a) Describe the histological structure of a typical dicotyledonous leaf as observed in a transverse section and state the functions of different structures seen.

(bl Describe the mechanism of phloem translocation.

(a) Describe the histological structure of a typical dicotyledonous leaf as observed in a transverse section and state the functions of different structures seen.

1. Outermost layer is epidermis (is found in both sides of the leaf/ upper and lower epidermis)
2. which is single layered and
3. covered with cuticle.
4. Stomata are found in the epidermis.
5. They are surrounded by guard cells.
6. Mesophyll is composed of parenchyma cells and
7. are found between upper and lower epidermis.
8. On the upper part of the leaf/ (just) beneath the upper epidermis,
9. (mesophyll cells called) palisade layer is present
10. consisting of (one or more layers of) elongated cells.
11. Spongy layer (consisting of loosely arranged parenchyma cells)
12. with air spaces/intercellular spaces
13. located between palisade layer and lower epidermis.
14. Mesophyll cells contain chloroplasts.
15. Vascular tissue/ vascular bundles /veins consist of xylem and phloem.
16. Outer layer of a vein is a bundle sheath layer/ cells.
17. Sclerenchyma / collenchyma present (in upper and lower sides of the main vein).

Functions

18. Cuticle - prevents water loss/ protection
19. Epidermis - protection
20. Stomata - exchange of gasses/ transpiration
21. Spongy parenchyma/ air space - exchange of gases/storages of gases
22. Mesophyll/ palisade/ spongy tissue – photosynthesis.
23. vein/ vascular bundle/xylem/ phloem – transport
24. Sclerenchyma/Collenchyma – Support
25. Guard cells – controlling gas exchange /transpiration

Any 20

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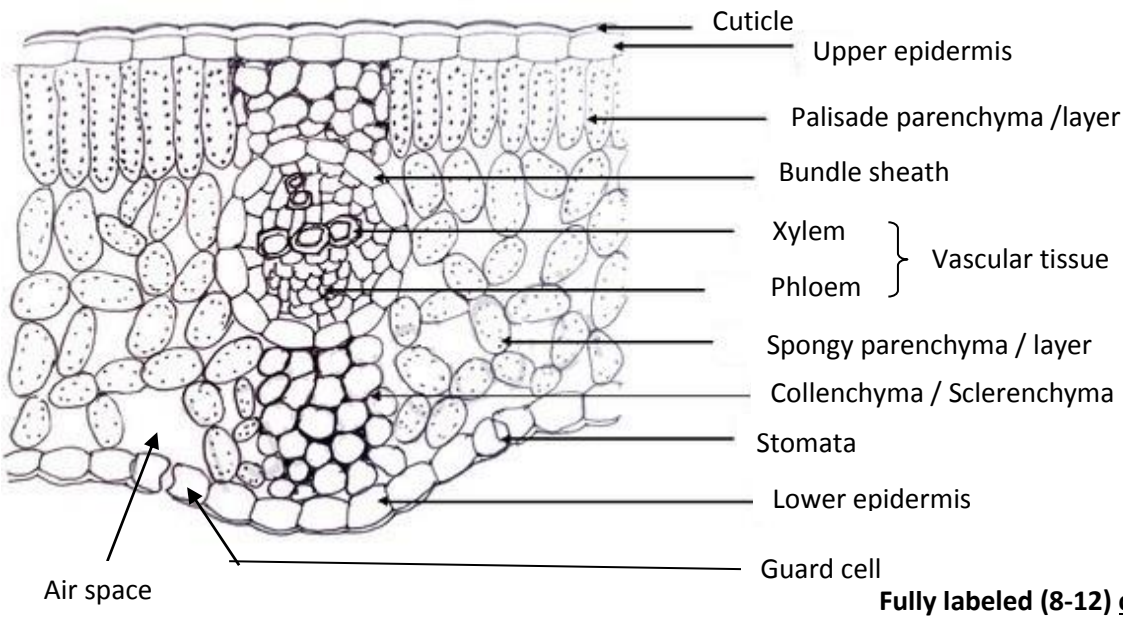

Fully labeled (8-12) correct diagram = 06
Partially labeled (<8) correct diagram= 03
Unlabeled diagram = 00

(b) Describe the mechanism of phloem translocation.

Phloem sap moves from sugar source to sugar sink. Mainly sucrose is transported through phloem.

1. Sugar is loaded into sieve tube/sieve tube element (via the companion cells/ transfer cells from mesophyll cells of source)
2. actively/using ATP/using metabolic energy
3. against concentration gradient.
4. (in some plants) From companion cells/ transfer cells, sugar diffuses/ enters into sieve tubes
5. via plasmodesmata/ symplast.
6. (This increases the solute concentration and)reduces water potential of the sieve tubes
7. resulting in entering of water into the sieve tubes
8. by osmosis
9. from adjacent xylem vessels.
10. This generates/builds up positive (hydrostatic) pressure in sieve tubes,/increases (hydrostatic) pressure in sieve tubes.
11. which forces the sap flow (transported) along the sieve tubes
12. to the area of low pressure potential.
13. At the sink unloading takes place
14. where sucrose is removed from sieve tubes/sugar molecules diffuse from phloem (into sink)
15. increasing the water potential in the sieve tubes.
16. Therefore water moves from sieve tubes to adjacent xylem vessels by osmosis
17. resulting in a decrease in (hydrostatic) pressure in sieve tubes
18. establishing a pressure potential gradient from source to sink.
19. (This mechanism is explained by) pressure flow hypothesis.

Any 16
20+16 = 36
36 X 4 = 144 marks
Diagram 6 marks
150 marks

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7. (a) Describe the mechanism of ventilation of lungs in man.
(b) Explain how breathing of man is homeostatically controlled.

(a) Describe the mechanism of ventilation of lungs in man.

Ventilation is accomplished by breathing, which is

1. alternating movement of air into and out of the lungs
2. referred to as inhalation/ inspiration and exhalation/ expiration, respectively.
3. Inhalation is negative pressure breathing/ In inhalation, air is pulled in to lungs./negative pressure breathing
4. Inhalation is an active process where
5. contraction of ribs muscles/ intercostal muscles and
6. diaphragm (muscles)
7. leads to expansion of thoracic cavity/ increase in the volume of thoracic cavity.
8. This allows visceral and parietal pleura (surrounding the lungs) slide smoothly past each other
9. increasing the lung volume.
10. As a result the pressure within the lungs decreases (in relation to the outside air)
11. creating a pressure gradient between the atmosphere and lungs.
12. Air flows from (higher pressure in the) atmosphere to (the lower pressure in) the lungs.
13. Exhalation is a passive process.
14. The rib muscles/ intercostal muscles and
15. diaphragm relax
16. reducing the volume of thoracic cavity.
17. As a result, the pressure inside the lungs increases
18. forcing air out of the lungs.
19. When activity increases (during exercise)/ during deep breathing, additional muscles (of neck, back and chest) are used/ involved
20. to <u>further</u> increase the volume of thoracic cavity.

(b) Explain how breathing of man is homeostatically controlled.

1. Breathing is controlled by an involuntary mechanism.
2. Medulla oblongata is the main breathing regulating centre (at the base of the brain).
3. A negative feedback mechanism is involved (in regulating this process).
4. During inhalation, sensors/receptors detect stretching of the lungs and
5. send nerve impulses to the medulla oblongata and
6. further inhalation is inhibited.
7. This prevents over expansion of lungs.
8. High CO_2 in blood lowers the pH (in blood).
9. pH change is detected by the sensors/ chemoreceptors in the medulla oblongata and
10. in major blood vessels/ arteries and aorta.
11. Medulla oblongata increases the depth and
12. the rate of breathing,
13. until the excess CO_2 is removed
14. in the exhaled air/ through exhalation.

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15. pH of the blood comes to its normal value/ 7.4.
16. When O_2 concentration (in blood) becomes very low, oxygen sensors
17. found in aorta and
18. carotid arteries
19. send impulses to medulla oblongata to increase the breathing rate.
20. The regulation of breathing is also modulated by additional neural circuits in the Pons (Varolii).

20 + 20 = 40
Any 38 X 4 = 152 marks
Maximum 150 marks

8. (a) Briefly describe the significance of polyploids in agriculture.
(b) Discuss possible environmental issues that may occur due to genetically modified organisms used in agriculture.

(a) Briefly describe the significance of polyploids in agriculture.

1. Polyploidy is the presence of more than two (complete) sets of homologous chromosomes per nucleus.
2. This is widely used in plant breeding.
3. Used for increasing size of plant organs/ gigas effect.
4. Caused due to increased number of gene copies.
5. Results in reduced fertility
6. due to meiotic errors.
7. Allows the production of seedless varieties.
8. eg. triploid watermelon
9. Used as a bridge for gene transferring
10. between two species having different ploidy levels.
11. Restoration of fertility
12. by genome doubling.
13. Promotes buffering effect
14. by masking deleterious alleles by extra copies of wild type alleles.
15. Allows functional diversification of redundant gene copies in which
16. one member of duplicated gene pair mutates and
17. acquires a new function without compromising essential functions.
18. It increases heterozygocity
19. which enhances vigour.
20. eg. Maize/ potato/ alfalfa
21. It improves the quality of the product and
22. increases the tolerance to (biotic and abiotic) stresses.

(b) Discuss possible environmental issues that may occur due to genetically modified organisms used in agriculture.

1. Development of insect tolerant crops may harm the non-target insects
2. by accidentally ingesting the toxin produced in GM crops
3. because toxin maybe dispersed in pollen and
4. and be deposited on non-crop plants (on which such insects feed).

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5. Cross pollination may transfer the transgene to non-GM varieties of the same crop
6. contaminating organic/ non-GM farming and
7. wild relatives of the crop.
8. Death of insects due to feeding on insect resistant GM crops
9. causes environmental imbalance.
10. (Use of herbicide tolerant crops may) form super weeds
11. which are tolerant to herbicides/ cannot be controlled by herbicides.
12. Cause gene pollution/ spread of foreign genes to naturally growing plants.
13. (Use of herbicide tolerant crops may) promote overuse of herbicides.
14. (Development of GM crops) leads to GM crop dominance/ use of limited number of varieties/ lowers crop diversity/ narrowing of crop diversity.
15. This results in low tolerance to environmental impacts
16. which may wipeout entire crop fields by a single environmental event
17. resulting in food scarcity.
18. This also results in loss of genes from crop gene pool.

22 + 18 = 40
Any 38 points X 4 = 152 marks
Maximum 150 marks

9. (a) Describe the characteristic features of inland wetland ecosystems of Sri Lanka.
(b) Explain the effects of discharging wastewater into natural water sources.

(a) Describe the characteristic features of inland wetland ecosystems of Sri Lanka.

1. Wetlands are permanent or temporary accumulations of water
2. with associated plants and animals.
3. Rivers and streams
4. that are originating in the wet highlands
5. are perennial and
6. those in dry zone are seasonal.
7. There is hardly any/ no vegetation/ plants in running water/ rivers and streams.
8. Marshes and swamp forests
9. are low-lying areas
10. which receive water through surface runoff/ flood waters from rivers
11. and ground water seepage.
12. Contain peat and
13. (water logged sticky) clay soil.
14. Provide habitats for water birds/ fish/ amphibians/ many animals.
15. Plant species are *Colocasia* species/ *Aponogeton* species/ reeds.
16. Villus
17. are the flood plains of the reservoirs.
18. (Vegetation is dominant with) grasses/ sedges.
19. Especially important for elephants and
20. birds.
21. Reservoirs
22. are man-made and
23. are manly scattered in the lowland dry zone.
24. (Free-floating) invasive alien plant species are present.

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(b) Explain the effects of discharging wastewater into natural water sources.

1. Contamination of water bodies by pathogens (through wastewater)
2. may cause typhoid fever,
3. cholera,
4. diarrhoea/ dysentery.
5. Chemical pollution of water bodies/ pollution due to chemicals in waste water.
6. Some of these chemicals are resistant to biodegradation/do not biodegrade.
7. Excessive nitrates and
8. phosphates in wastewater
9. cause eutrophication
10. resulting in excessive growth of algae and
11. cyanobacteria
12. called algal blooms.
13. Some cyanobacteria produce toxins/poisonous substances.
14. Algal blooms cause oxygen depletion zones/ increases BOD.
15. greatly reducing populations of fish/ other aquatic species.
16. It also causes bad odour/ smell.

24 + 16 = 40
Any 38 X 4= 152 marks
Maximum 150 marks

10. Write short notes on the following.
(a) Theory of natural selection
(b) Energy budget of animals
(c) Fetal membranes

(a) Theory of natural selection

1. This is one of the theories of evolution
2. put forward by Darwin and Wallace.

This theory is based on the following observations made by Darwin

3. Each species produces more offspring than the environment could support/over production.
4. The (individuals of a) population/ a species vary in characteristics /among their inheritance traits/there is variation.

The above observations were interpreted by Darwin as follows to explain the process of natural selection

5. Certain (inherited) traits/characters of a population are capable of exhibiting better survival and
6. reproduction.
7. They are successful in competition (with others).
8. Individuals with such favorable traits/characters/ those who are successful in competition can survive and produce more offspring (than others)/ survival of the fittest thus
9. enhancing the abundance of favorable characteristics/traits (for survival and reproduction)in that population (gradually /over several generations)

Some favourable characteristics for survival and reproduction are

10. Escaping from predators/defense
11. Tolerating physical/ stress conditions
12. (Successful in) obtaining food
13. Resistance against diseases
14. (High) fertilizing probability

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15. (Large) number of offspring produced.
16. Favorable traits are selected naturally/natural selection.

Any 14 pts

(b)Energy budget of animals

1. Energy budget is a balance sheet of energy intake against energy expenditure in a particular animal
2. Basic model of energy budget C =M + U +F + P, where
3. C = Energy content in the food sources taken in
4. M = Energy spent for metabolic activities
5. U = Energy associated with urinary loss
6. F = Energy associated with fecal loss
7. P = Energy associated with production/ growth and development
8. In energy budgets, energy content in the food intake is compared with energy expenditure.
9. Energy differences between the energy intake and energy expenditure for metabolism and excretion are available
10. for production/ for growth and reproduction
11. For each animal, energy budgets can be calculated based on energy measurements from field and laboratory.

11 pts

c) Fetal membranes

1. They are extra-embryonic membranes that appear after implantation
2. which provide a life supporting system for further embryonic/fetal development.
3. Chorion
4. is the main embryonic portion of the placenta.
5. Chorion protects the embryo/fetus from immune responses of mother and
6. produce hCG hormone.
7. Amnion
8. is a protective membrane surrounding the embryo/fetus,
9. creating a fluid filled cavity which
10. serves as a shock absorber and
11. prevents desiccation.
12. Yolk sac
13. contributes to the cells that will become blood cells
14. until fetal liver takes over.
15. Yolk sac is the source of primordial germ cells (that migrate to the developing gonads).
    (Allantois which is a small (outer) pouching of the yolk sac, serves as an early site for blood formation/ produces blood. It is associated with development of urinary bladder)

Any 13 pts
14 + 11 + 13 =38
38 X 4 = 152
Maximum 150 marks

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