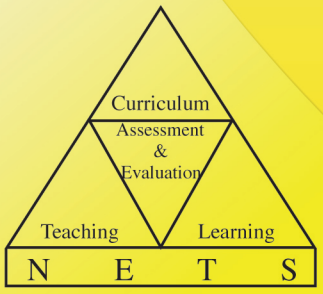
# G.C.E.(A.L.) Examination - 2016

# Evaluation Report

# 09 - Biology




**Research & Development Branch**
**National Evaluation & Testing Service**
**Department of Examinations**

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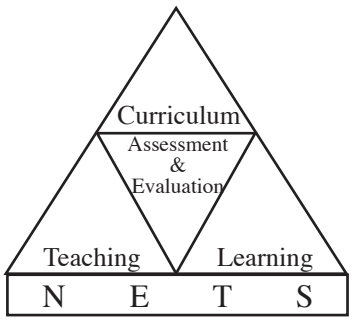



**Research and Development Branch**
**National Evaluation and Testing Service**
**Department of Examinations, Sri Lanka**

**Biology**

Evaluation Report - G.C.E.(A.L) Examination - 2016

## Financial Aid

Transforming the School Education System as the Foundation of a Knowledge Hub Project (TSEP-WB)

## INTRODUCTION

The General Certificate of Education (Advanced Level) Examination is the final certification examination of the Senior Secondary Education in Sri Lanka. Though certification of the students' achievement level at the end of Senior Secondary Education is the major aim of this examination, it bears a momentous position as an achievement test as well as a selection test because the eligible candidates for national universities and other higher education and vocational training institutes and also for the National Colleges of Education are selected on the results of this examination. This has also been accepted as an examination that certifies entry qualifications for the tertiary level employments. In the year 2016, 211865 school candidates and 46328 private candidates sat this examination.

Much pains are being taken by students to have a high achievement level at this examination and teachers and parents to fulfil their expectations. This evaluation report has been prepared by the Department of Examinations to assist the realization of their goals. It is certain that the information provided by this evaluation report is equally important for candidates, teachers, principals, in-service advisers, subject directors, parents and researchers in education. So it is more suitable to tender this report for wider reference.

This evaluation report comprises of three parts as I, II and III. Part I of this report consists of information related to aims and achievement of the subject Biology in G.C.E. (A.L) Examination. Presented under it are the statistical information on subject achievement, that is number of candidates sat for the subject, how they have obtained grades, how school candidates have obtained grades by district and distribution of marks according to class intervals and a comprehensive analysis of the subject achievement that reveals how candidates have selected questions in Papers I and II in Biology and how they have scored marks for each of the questions in them and the sub parts of each question. Part II of this report presents the questions in Paper I and Paper II of Biology in the G.C.E. (A.L) Examination 2016 and information about the candidates' responses to them. It encompasses expected answers for the questions of papers I and II, the mark scheme, observations on answers, conclusions and constructive suggestions.

This evaluation report prepared by the Research and Development Branch of the Department of Examinations is based on the information, observations, ideas and suggestions provided by chief examiners, additional chief examiners and assistant examiners involved in evaluating answer scripts and the information drawn through the analysis of candidates' responses using the Classical Test Theory and the Item Response Theory.

Part III of this report embodies the facts that should be taken into consideration by the candidates when answering each question and opinions and suggestions with regard to the learning teaching process. I think that this report is of immense value in the organization of the learning teaching process to achieve respective competencies and competency levels. You are kindly requested to direct your productive ideas and suggestions to us to improve the quality of our future evaluation reports.

I wish to extend my sincere thanks to the chief examiners, additional chief examiners and assistant examiners who provided information to prepare this report, the committee members who fervently and actively contributed to the task, the officers and the staff of the Department of Examinations who shouldered the responsibility, and the TSEP-WB that provided financial assistance for it.

**B. Sanath Pujitja**
Commissioner General of Examinations

01st December 2017
Research & Development Branch
National Evaluation & Testing Service
Department of Examinations.
Pelawatta, Battaramulla.

| | | |
|---|---|---|
| **Guidance** | : | B. Sanath Pujitha<br>Commissioner General of Examinations |
| **Direction and Organization** | : | Gayathri Abeygunasekera<br>Commissioner of Examinations<br>(Research/ Development & Evaluation) |
| **Co-ordination** | : | Hasantha Kuruppu<br>Assistant Commissioner of Examinations<br>(Research and Development) |
| **Editing** | : | Senior Professor M. Hettiarachchi<br>Department of Zoology<br>University of Kelaniya<br><br>Professor N.J.De. S. Amarasinghe<br>Department of Zoology<br>University of Ruhuna<br><br>Professor T.D. de Silva<br>Department of Plant Sciences<br>University of Colombo<br><br>S.A. Sepali<br>Sri Lanka Teacher service<br>Vishaka Vidyalaya, Colombo 05 |
| **Panel of Writers** | : | S.A. Sepali<br>Sri Lanka Teacher service<br>Vishaka Vidyalaya, Colombo 05<br><br>Gunasinghe Rajapura<br>Sri Lanka Teacher service<br>Rahula Vidyalaya, Matara<br><br>P. Rekha Dikkumbura<br>Sri Lanka Teacher service<br>Mathara M. M. V, Mathara<br><br>W.H.M. Bhadra Wijekoon<br>Sri Lanka Teacher service<br>WP/KE/Sri Dharmaloka National School<br><br>S.L. Nelum Wijesiri<br>Divisional Educational Office<br>Sri Jayawardhanapura, Battaramulla<br><br>R.A. Swarnapali<br>Sri Lanka Teacher service<br>Horana Royal National School |
| **Computer Type Setting** | : | P. Madhushani Mandalawaththa<br>Data Entry Operator |
| **Cover page Designing** | : | Y. S. Anuradi<br>Development Officer |

## Contents

# Part I

## 1. Subject Objectives and information on subject achievement

### 1.1. Subject objectives

**After completion of this course, the students will:**

- Develop an interest and desire to acquire an extensive and deep knowledge in the field of Biology.
- Engage in cooperative learning (or group studies) to understand concepts, phenomena, fundamentals and processes in Biology.
- Determine the place we have in the nature by understanding the effect on natural and social environment with interactive processes among them.
- Develop the ability to plan research processes to solve the problems in the field of Biology.
- Develop the feeling that he/she is a part of the same environment while identifying natural habitats of the country with positive attitudes towards flora and fauna in order to take responsibility and to contribute for environmental conservation and protection of the environmental quality.
- Develop the sensitivity on the practical problems that encounters in day to day life.
- Develop the ability to acquire good habits that are essential for maintaining hygiene, health and quality of life.

## 1.2. Statistical information on subject achievement

### 1.2.1 Number of candidates sat for the subject

| Medium | School | Private | Total |
|---|---|---|---|
| Sinhala | 29388 | 9593 | 38981 |
| Tamil | 5342 | 1244 | 6586 |
| English | 1681 | 478 | 2159 |
| **Total** | **36411** | **11315** | **47726** |

**Table 1**

### 1.2.2 Grades obtained by the candidates

| Grade | School candidates | | Private Candidates | | Total | Percentage |
|---|---|---|---|---|---|---|
| | Number | Percentage | Number | Percentage | | |
| A | 1625 | 4.46 | 649 | 5.74 | 2274 | 4.76 |
| B | 4361 | 11.98 | 1674 | 14.79 | 6035 | 12.65 |
| C | 9614 | 26.40 | 2980 | 26.34 | 12594 | 26.39 |
| S | 11745 | 32.26 | 3394 | 30.00 | 15139 | 31.72 |
| F | 9066 | 24.90 | 2618 | 23.14 | 11684 | 24.48 |
| **Total** | **36411** | **100.00** | **11315** | **100.00** | **47726** | **100.00** |

**Table 2**

### 1.2.3 Grades obtained by school candidates who sat the examination for the first time - Districtwise

| District | No. Sat | Distinction (A) | | Very Good Pass (B) | | Credit Pass (C) | | Ordinary pass (S) | | Pass (A+B+C+S) | | Failed (F) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number | % | Number | % | Number | % | Number | % | Number | % | Number | % |
| 1. Colombo | 2766 | 179 | 6.47 | 438 | 15.84 | 800 | 28.92 | 819 | 29.61 | 2236 | 80.84 | 530 | 19.16 |
| 2. Gampaha | 1653 | 31 | 1.88 | 174 | 10.53 | 429 | 25.95 | 568 | 34.36 | 1202 | 72.72 | 451 | 27.28 |
| 3. Kalutara | 1116 | 27 | 2.42 | 94 | 8.42 | 295 | 26.43 | 393 | 35.22 | 809 | 72.49 | 307 | 27.51 |
| 4. Kandy | 1774 | 49 | 2.76 | 176 | 9.92 | 452 | 25.48 | 591 | 33.31 | 1268 | 71.48 | 506 | 28.52 |
| 5. Matale | 425 | 3 | 0.71 | 31 | 7.29 | 90 | 21.18 | 153 | 36.00 | 277 | 65.18 | 148 | 34.82 |
| 6. Nuwara Eliya | 566 | 7 | 1.24 | 41 | 7.24 | 106 | 18.73 | 208 | 36.75 | 362 | 63.96 | 204 | 36.04 |
| 7. Galle | 1296 | 46 | 3.55 | 98 | 7.56 | 275 | 21.22 | 443 | 34.18 | 862 | 66.51 | 434 | 33.49 |
| 8. Matara | 946 | 34 | 3.59 | 78 | 8.25 | 240 | 25.37 | 349 | 36.89 | 701 | 74.10 | 245 | 25.90 |
| 9. Hambantota | 713 | 43 | 6.03 | 36 | 5.05 | 106 | 14.87 | 213 | 29.87 | 398 | 55.82 | 315 | 44.18 |
| 10. Jaffna | 567 | 34 | 6.00 | 88 | 15.52 | 161 | 28.40 | 164 | 28.92 | 447 | 78.84 | 120 | 21.16 |
| 11. Kilinochchi | 96 | 2 | 2.08 | 6 | 6.25 | 20 | 20.83 | 30 | 31.25 | 58 | 60.42 | 38 | 39.58 |
| 12. Mannar | 108 | 1 | 0.93 | 8 | 7.41 | 32 | 29.63 | 37 | 34.26 | 78 | 72.22 | 30 | 27.78 |
| 13. Vavuniya | 173 | 11 | 6.36 | 18 | 10.40 | 36 | 20.81 | 58 | 33.53 | 123 | 71.10 | 50 | 28.90 |
| 14. Mullativu | 85 | 2 | 2.35 | 7 | 8.24 | 26 | 30.59 | 31 | 36.47 | 66 | 77.65 | 19 | 22.35 |
| 15. Batticaloa | 445 | 19 | 4.27 | 51 | 11.46 | 122 | 27.42 | 171 | 38.43 | 363 | 81.57 | 82 | 18.43 |
| 16. Ampara | 697 | 25 | 3.59 | 59 | 8.46 | 160 | 22.96 | 229 | 32.86 | 473 | 67.86 | 224 | 32.14 |
| 17. Trincomalee | 334 | 15 | 4.49 | 40 | 11.98 | 82 | 24.55 | 102 | 30.54 | 239 | 71.56 | 95 | 28.44 |
| 18. Kurunegala | 1706 | 22 | 1.29 | 120 | 7.03 | 362 | 21.22 | 595 | 34.88 | 1099 | 64.42 | 607 | 35.58 |
| 19. Puttalam | 634 | 11 | 1.74 | 51 | 8.04 | 153 | 24.13 | 223 | 35.17 | 438 | 69.09 | 196 | 30.91 |
| 20. Anuradhapura | 830 | 9 | 1.08 | 56 | 6.75 | 140 | 16.87 | 265 | 31.93 | 470 | 56.63 | 360 | 43.37 |
| 21. Polonnaruwa | 180 | 1 | 0.56 | 7 | 3.89 | 12 | 6.67 | 41 | 22.78 | 61 | 33.89 | 119 | 66.11 |
| 22. Badulla | 924 | 19 | 2.06 | 78 | 8.44 | 206 | 22.29 | 320 | 34.63 | 623 | 67.42 | 301 | 32.58 |
| 23. Monaragala | 430 | 4 | 0.93 | 13 | 3.02 | 91 | 21.16 | 162 | 37.67 | 270 | 62.79 | 160 | 37.21 |
| 24. Ratnapura | 741 | 44 | 5.94 | 50 | 6.75 | 89 | 12.01 | 188 | 25.37 | 371 | 50.07 | 370 | 49.93 |
| 25. Kegalle | 998 | 6 | 0.60 | 46 | 4.61 | 201 | 20.14 | 384 | 38.48 | 637 | 63.83 | 361 | 36.17 |
| All Island | **20203** | **644** | **3.19** | **1864** | **9.23** | **4686** | **23.19** | **6737** | **33.35** | **13931** | **68.96** | **6272** | **31.04** |

**Table 3**

### 1.2.4 Marks obtained according to class intervals

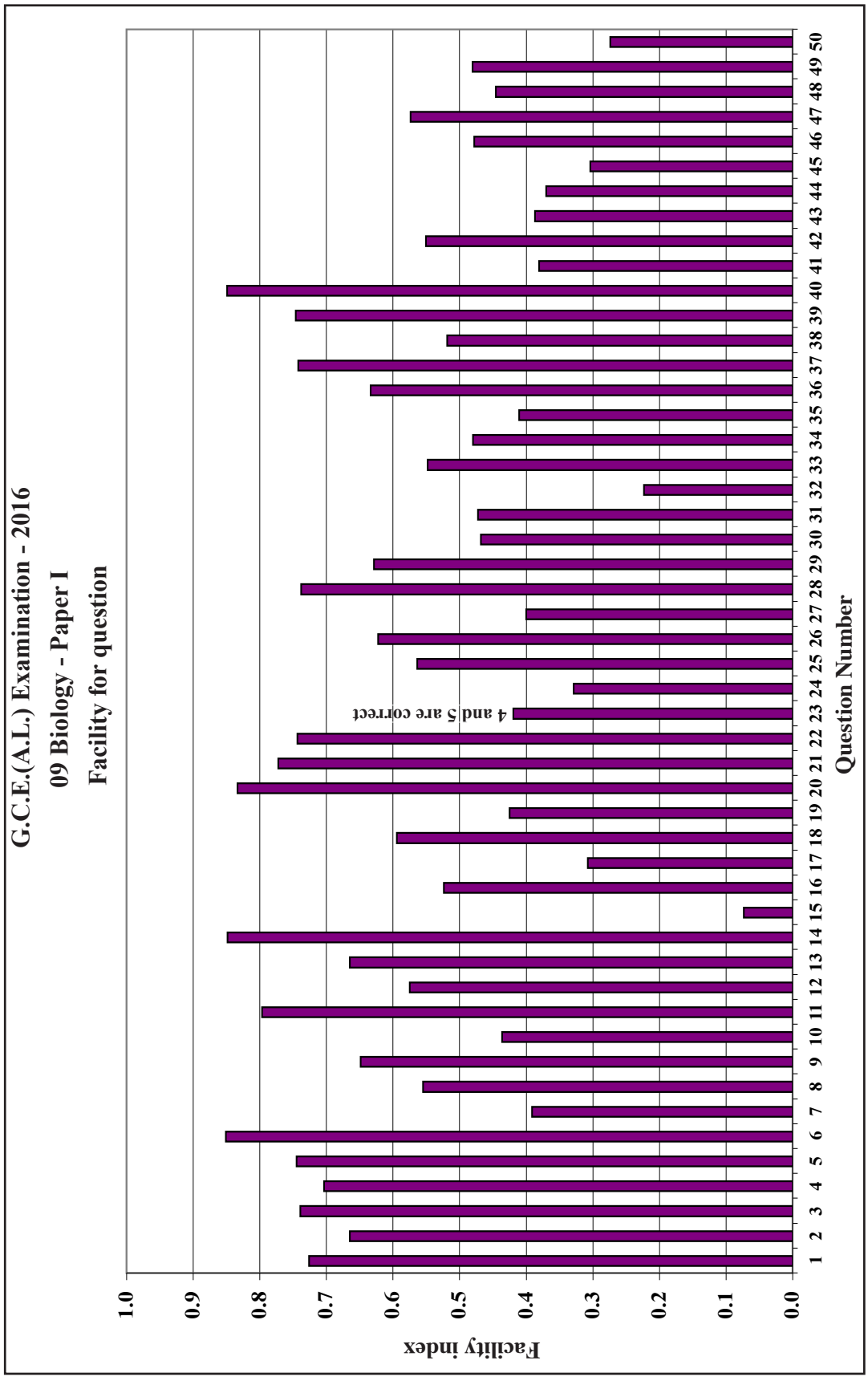
| Class Interval | Frequency | Frequency Percentage | Cumulative Frequency | Cumulative Frequency Percentage |
|---|---|---|---|---|
| 91-100 | 0 | 0.00 | 47726 | 100.00 |
| 81-90 | 432 | 0.91 | 47726 | 100.00 |
| 71-80 | 3938 | 8.25 | 47294 | 99.09 |
| 61-70 | 6893 | 14.44 | 43356 | 90.84 |
| 51-60 | 8723 | 18.28 | 36463 | 76.40 |
| 41-50 | 9375 | 19.64 | 27740 | 58.12 |
| 31-40 | **9248** | **19.38** | **18365** | **38.48** |
| 21-30 | 6688 | 14.01 | 9117 | 19.10 |
| 11-20 | 2326 | 4.87 | 2429 | 5.09 |
| 01-10 | 101 | 0.21 | 103 | 0.22 |
| 00-00 | 2 | 0.00 | 2 | 0.00 |

**Table 4**

E.g. (when 31 – 40 interval is taken)
The number of candidates scoring within 31 - 40 interval for this subject is 9248. As a percentage, it is 19.38%. The cumulative number of candidates that has scored 40 marks or below 40 is 18365 and as a percentage it is 38.48%.

## 1.3 Analysis of Subject Achievement

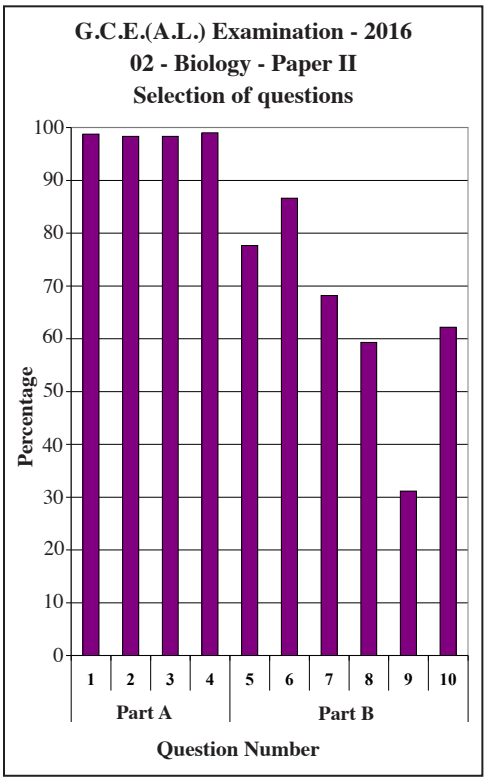
### 1.3.1 Achievement in Paper I




**Graph 1 (Prepared using the information obtained from the form RD/16/05/AL.)**

According to above graph, the question that had been correctly responded by the highest number of candidates is number 06. Its percentage is 85.06%. The least number of candidates had correctly responded to question number .15. Its percentage is 7.29%.

### 1.3.2 Selection of questions in paper II

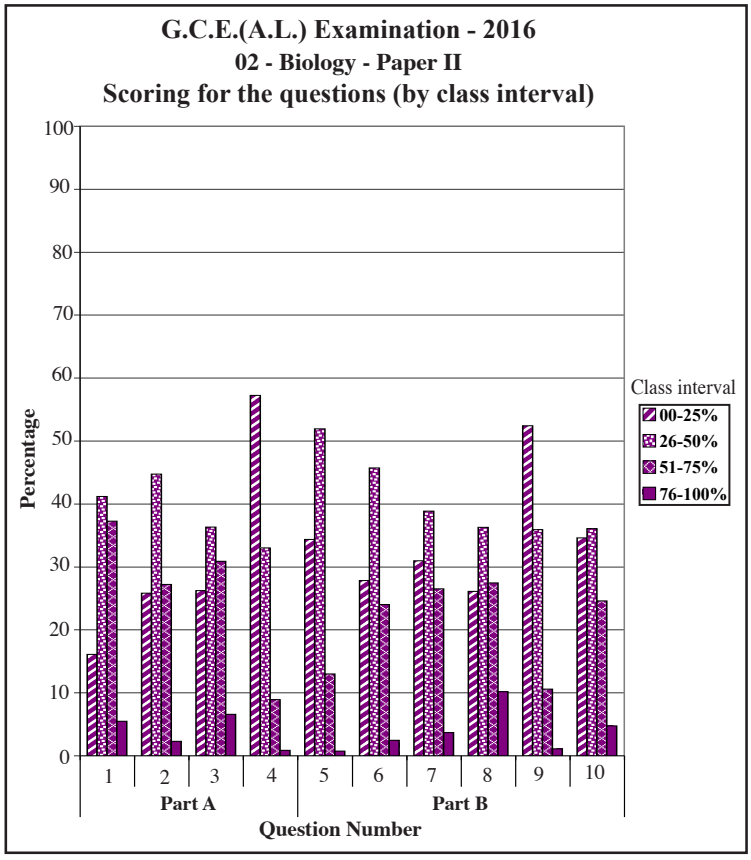



How information can be elicited from this graph is illustrated by the example stated below.

eg :- Though 1 - 4 questions in part A were compulsory, a few number of candidates had not answered to those compulsory questions. Only about 99% have answered question number 01. From the essay questions of Part B, 87% of candidates had selected the question number 06. This is the question that had been selected by the highest number of candidates. The percentage of question number 09 is 31% and this is the question that had been selected by a least number of candidates.

**Graph 2** (Prepared using the information collected from the form RD/16/02/AL**)**

### 1.3.3 Scoring for the questions in paper II



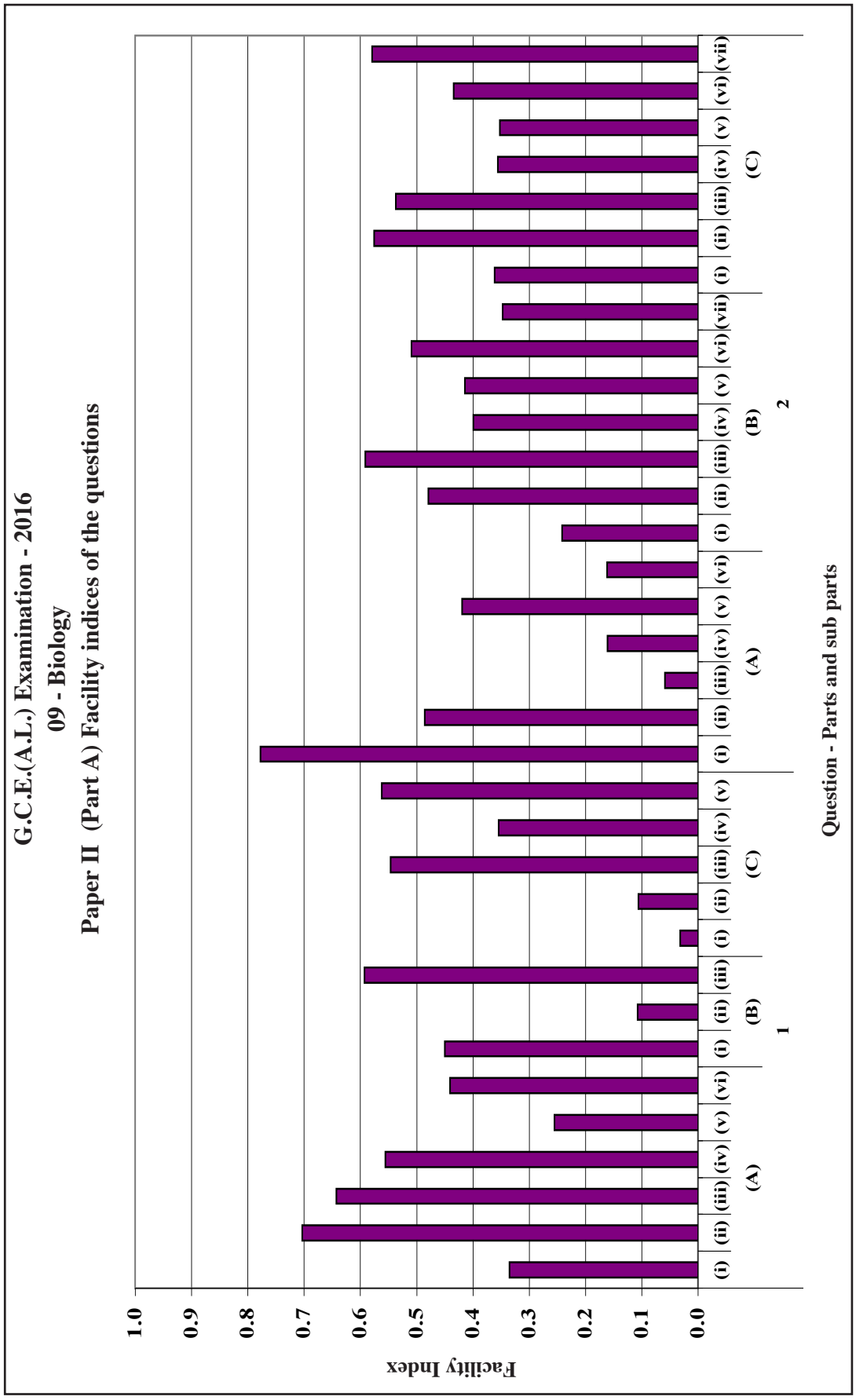

How information can be elicited from this graph is illustrated by the example stated below.

eg :- Marks allocated for the question number 1 is 100. Out of this, the candidates who had obtain marks between 76 - 100% is 5% and 16% of candidates scored within 00 - 25% marks range.

The highest percentage of candidates that is 85 - 90% had obtained low marks for question numbers as 4, 5 and 9.

**Graph 3** (Prepared using the information collected from the form RD/16/02/AL**)**

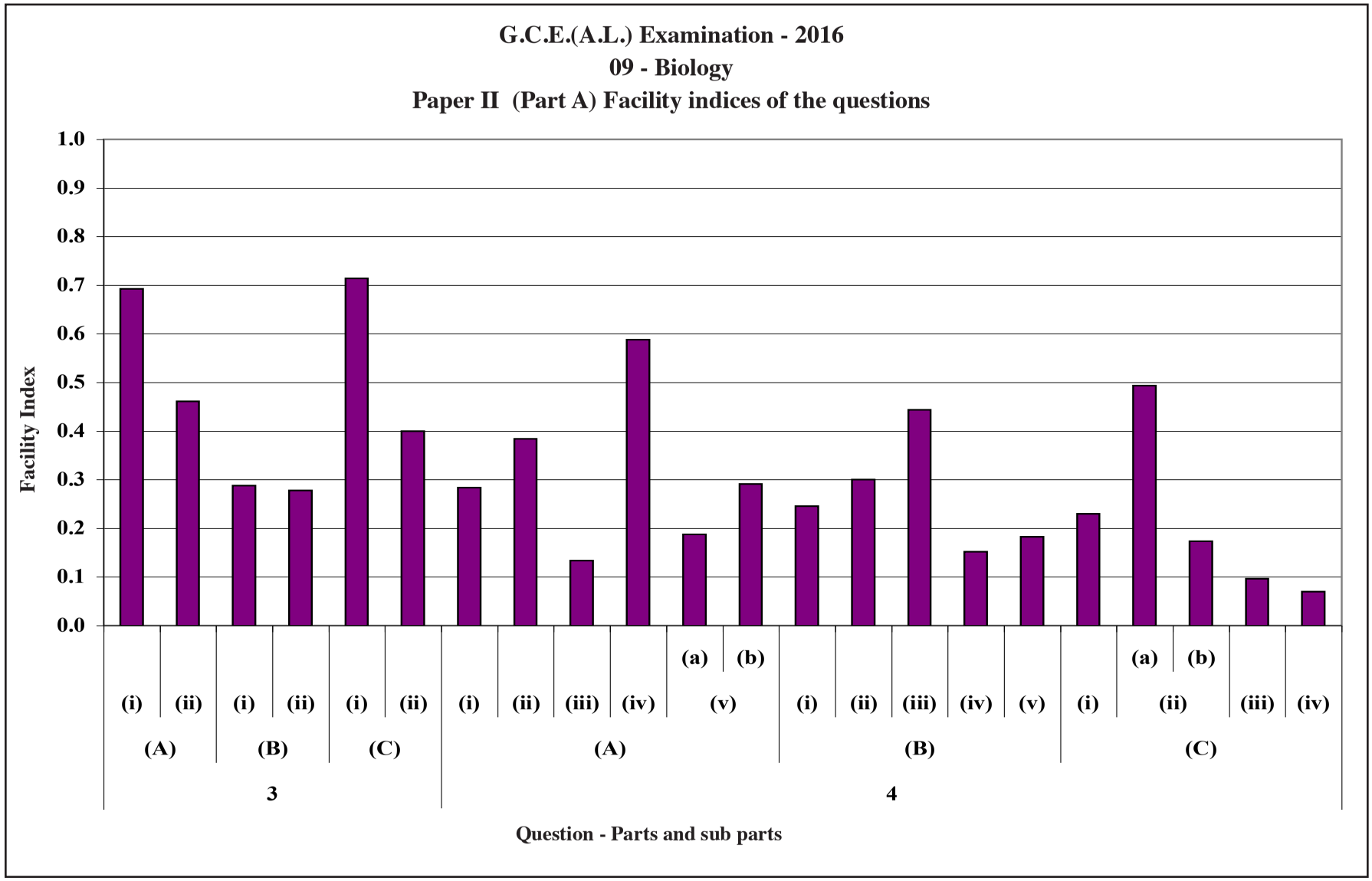
### 1.3.4 Achievement in Paper II



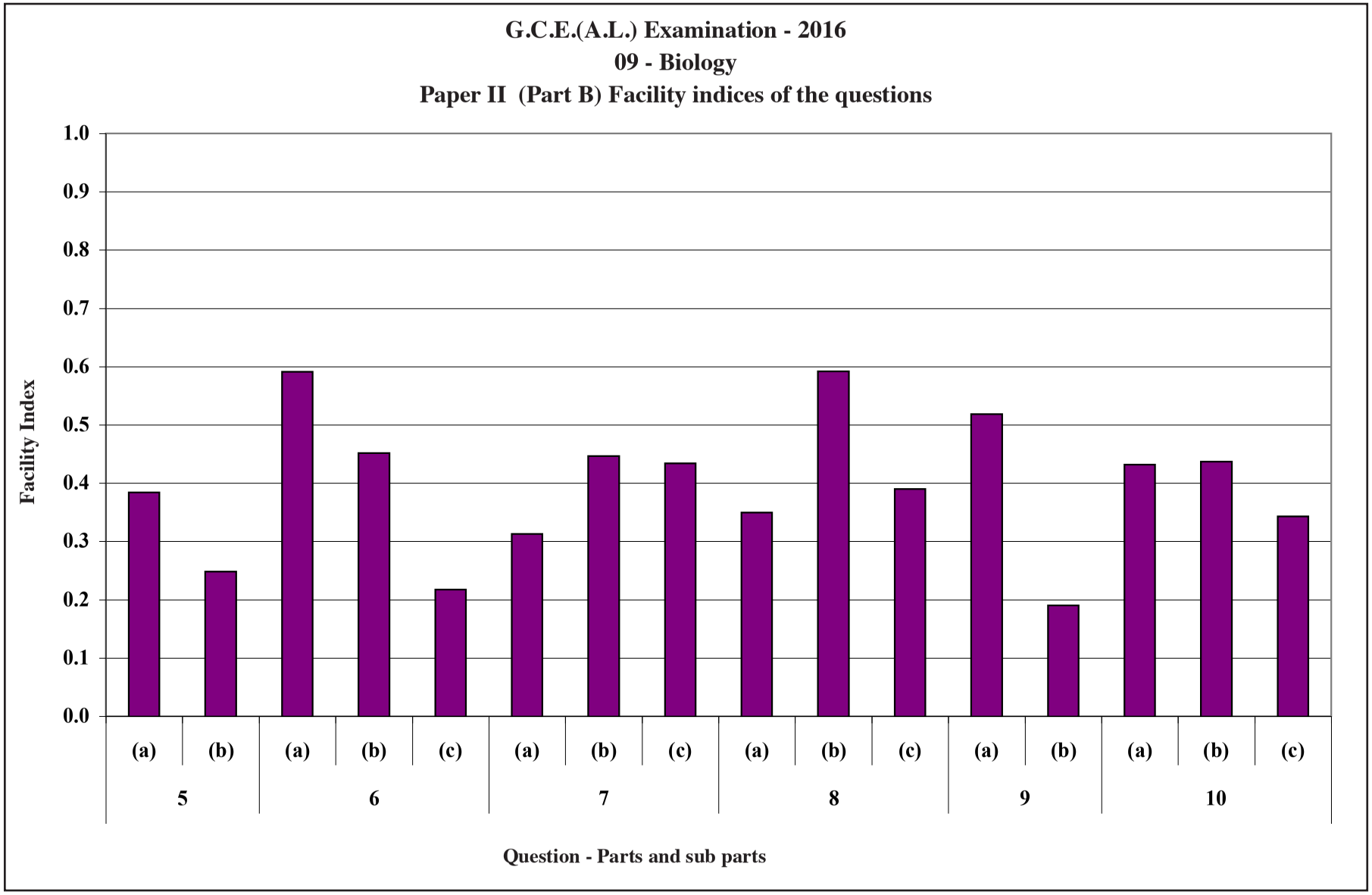

**Graph 4.1 (Prepared using the information obtained from the form RD/16/04/AL.)**

How information can be elicited from the above graph is illustrated by the example stated below.

E.g. The facility of Part A of question 01 (vi) is 44% while facility of Part (C) (ii) of the same question is 11%.


G.C.E.(A.L.) Examination - 2016
09 - Biology
Paper II (Part A) Facility indices of the questions
Facility Index
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
(i) (ii) (i) (ii) (i) (ii) (i) (ii) (iii) (iv) (a) (b) (i) (ii) (iii) (iv) (v) (i) (a) (b) (ii) (iii) (iv)
(v)
(A) (B) (C) (A) (B) (C)
3 4
Question - Parts and sub parts

**Graph 4.2**


G.C.E.(A.L.) Examination - 2016
09 - Biology
Paper II (Part B) Facility indices of the questions
Facility Index
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
(a) (b) (a) (b) (c) (a) (b) (c) (a) (b) (c) (a) (b) (a) (b) (c)
5 6 7 8 9 10
Question - Parts and sub parts

**Graph 4.3**

# Part II

## 2. Information on questions and answering

### 2.1 Question paper I and information on answers to paper I

#### 2.1.1 Structure of the question paper I

Time : 02 hours.

- ⋆ 50 multiple choice questions with 5 options form which correct or most approbate option should be selected.
- ⋆ All questions should be answered.
- ⋆ Each question carries 02 marks. Total marks : 100.

## 2.1.2 Paper I

1. Which of the following organelles in plant cells converts fats into carbohydrates?
   (1) Lysosomes (2) Peroxisomes (3) Glyoxisomes
   (4) Endoplasmic reticulum (5) Golgi complex

2. Which of the following is correct regarding prokaryotic organisms?
   (1) All prokaryotic organisms are heterotrophic.
   (2) All prokaryotic organisms do not have peptidoglycans in their cell walls.
   (3) All prokaryotic organisms can fix atmospheric nitrogen.
   (4) All prokaryotic organisms do not have ribosomes.
   (5) All prokaryotic organisms are not microorganisms.

3. The base Adenine (A) of DNA of an organism forms 23.3% of its composition. Which of the followin is the most likely base composition of its DNA?
   (1) A = T 23.3% and G = C 23.3% (2) A = T 26.7% and G = C 26.7%
   (3) A = T 23.3% and G = C 26.7% (4) A = T 26.7% and G = C 23.3%
   (5) A = T 23.3% and G = C 76.7%

4. Which of the following 'structure-function' combinations is **incorrect**?

| | **Structure** | **Function** |
|---|---|---|
| (1) | Nucleolus | Ribosome production |
| (2) | Glyoxisomes | Photorespiration in plants |
| (3) | Cytoskeleton | Determines the shape of the cell |
| (4) | Vacuoles | Store soluble substances needed for cellular activities |
| (5) | Golgi complex | Produces lysosomes |

5. Which of the following is common to lactic acid fermentation, alcoholic fermentation and aerobic respiration?
   (1) Glycolysis (2) Krebs cycle
   (3) Electron transport chain (4) Production of acetyl co-enzyme A from pyruvate
   (5) Oxidation of glucose to $CO_2$ and water

6. Which of the following comparisons between $C_3$ and $C_4$ photosynthesis in plants is **incorrect**?

| | **$C_3$** | **$C_4$** |
|---|---|---|
| (1) | $CO_2$ fixation occurs only once. | $CO_2$ fixation occurs twice. |
| (2) | Major $CO_2$ acceptor is RuBP. | Major $CO_2$ acceptor is PEP. |
| (3) | $CO_2$ fixing enzyme is RuBP carboxylase. | $CO_2$ fixing enzyme is PEP carboxylase. |
| (4) | Photosynthetic yield is high. | Photosynthetic yield is usually low. |
| (5) | First product of photosynthesis is PGA. | First product of photosynthesis is oxaloacetate. |

7. One characteristic of each of the organisms labelled as A, B, C and D is as follows.
   (A) Heterosporous
   (B) Gametophyte is photosynthetic
   (C) Seedless
   (D) Thalloid gametophyte

   The organisms A, B, C and D in correct order are
   (1) *Cycas, Marchantia, Selaginella* and *Pogonatum*.
   (2) *Pinus, Pogonatum, Cycas* and *Nephrolepis*.
   (3) Mango, *Nephrolepis, Lycopodium* and *Marchantia*.
   (4) Banana, *Pinus, Nephrolepis* and *Marchantia*.
   (5) *Pogonatum, Cycas, Marchantia* and *Nephrolepis*.

8. In the classification of organisms, the taxon phylum was introduced by
   (1) Carl Woese. (2) Robert Whittaker.
   (3) Ernest Haeckel. (4) Carolus Linnaeus.
   (5) Aristotle.

**9.** Two phyla that include organisms having glycogen as the main stored food are
(1) Chytridiomycota and Lycophyta. (2) Zygomycota and Pterophyta.
(3) Chordata and Chrysophyta. (4) Cycadophyta and Phaeophyta.
(5) Basidiomycota and Ascomycota.

**10.** A student observed an animal with one pair of antennae, and one pair of appendages in each segment of the body. This animal belongs to class
(1) Crustacea. (2) Chilopoda. (3) Diplopoda. (4) Insecta. (5) Arachnida.

**11.** Anaemia is a deficiency syndrome of which of the following vitamins?
(1) A, D, Thiamin (2) $B_{12}$, $B_6$, Folic acid
(3) K, $B_1$, Biotin (4) $B_5$, $B_3$, $B_1$
(5) $B_1$, $B_2$, Pantothenic acid

**12.** Which of the following statements regarding the respiratory system of man is correct?
(1) Contraction of external intercostal muscles results in inspiration.
(2) Tracheal cavity is lined with columnar epithelium.
(3) Right lung consists of two lobes.
(4) Exchange of respiratory gases in the lung requires energy.
(5) Larynx is located at the level of $2^{nd}$ and $3^{rd}$ cervical vertebrae.

**13.** Select the **incorrect** statement regarding human blood.
(1) It is a specialized connective tissue.
(2) A mature erythrocyte lacks both nucleus and mitochondria.
(3) Neutrophils and monocytes are leucocytes showing phagocytosis.
(4) Most of the carbon dioxide is transported in combination with haemoglobin.
(5) It helps to regulate body temperature.

**14.** Which of the following is **not** a part of the conducting system of human heart?
(1) Chordae tendineae (2) Atrioventricular (AV) node
(3) Bundle of His (4) Sino-auricular (SA) node
(5) Purkinje fibres

**15.** Which of the following processes in plants increases in the absence of light?
(1) Absorption of minerals (2) Absorption of water
(3) Ascent of sap (4) Elongation of internodes
(5) Guttation

**16.** Which of the following is **incorrect** regarding phloem transport?
(1) Translocation of phloem sap from leaves to roots takes place through apoplast of sieve tube elements.
(2) Mature leaves are the major sugar sources in phloem transport.
(3) Developing root apices and shoot apices are usually sugar sinks in plants.
(4) Phloem loading and unloading are active processes.
(5) Translocation of phloem sap from one sieve tube element to the next is a passive process.

**17.** Select the **incorrect** statement regarding human growth hormone.
(1) It is synthesized and released by the anterior pituitary.
(2) Its release can be either increased or reduced by the hypothalamus.
(3) It increases blood glucose level.
(4) It increases synthesis of fats.
(5) It regulates the metabolism of liver.

**18.** Select the **incorrect** statement regarding human brain.
(1) Functional area concerned with speech is located in the frontal lobe.
(2) Corpus callosum connects the two hemispheres of the cerebrum.
(3) Cerebellum plays an important role in maintaining balance and equilibrium.
(4) Thalamus is involved in the integration of sensory information.
(5) Reflex centre for coughing is located in the pons varolii.

**19.** Select the **incorrect** statement regarding an action potential of a human motor neurone.
(1) Immediately after one action potential, a second action potential cannot be produced.
(2) It is generated only at nodes of Ranvier.
(3) Its depolarization phase is immediately followed by the hyperpolarization phase.
(4) Its duration is about two milliseconds.
(5) A threshold stimulus is essential to produce it.

**20.** Select the **incorrect** statement regarding excretion.
(1) If excretion does not occur blood pH may change.
(2) Defaecation is a form of excretion.
(3) Bile pigments are an excretory product in man.
(4) Carbon loss is highest when uric acid is produced as nitrogenous excretory product.
(5) Production of ammonia as an excretory product does not require energy.

**21.** Which of the following statements is **incorrect** regarding smooth muscles?
(1) They show the ability to return to original length after being stretched.
(2) Adrenaline causes contractions in some smooth muscles and relaxation in others.
(3) Some show rhythmic contractions.
(4) They fatigue rapidly.
(5) They are innervated by the autonomic nervous system.

**22.** Which of the following is **incorrect** regarding skeletal muscle?
(1) Normally, acetylcholine is necessary to initiate its contraction.
(2) During its contraction the length of A bands and I bands remains constant.
(3) Series of power strokes occurs during its contraction.
(4) Without ATP and $Ca^{2+}$ it cannot contract.
(5) During its contraction the length between two Z lines shortens.

**23.** Select the **incorrect** statement regarding human scapula.
(1) It is a flat triangular-shaped bone.
(2) Its posterior surface is rough.
(3) Its acromion process articulates with the clavicle.
(4) Its glenoid cavity lies in the medial border.
(5) Coronoid process is a projection arising from its upper border.

**24.** Select the **incorrect** statement regarding lower limb of man.
(1) Femur is a long bone located parallel to the mid line of the body.
(2) Tibia is the second longest bone in the lower limb.
(3) It consists of 30 bones.
(4) Fibula is not a part of the knee joint.
(5) Foot has both longitudinal and transverse arches.

**25.** Select the **incorrect** statement regarding reproduction of human males.
(1) Testosterone acts on all parts of the reproductive system.
(2) Seminal vesicular secretion contains glucose and vitamin C.
(3) Capacitation of sperms occurs in the female genital tract.
(4) Duration of spermatogenesis is about 72 days.
(5) Sertoli cell functions as an endocrine structure.

**26.** Which one of the following reproductive structures is **unpaired**?
(1) Seminal vesicle (2) Cowper's gland
(3) Ejaculatory duct (4) Prostate gland
(5) Vas deferens

**27.** Which of the following plant growth substances prevents leaf fall?
(1) Abscisic acid (2) Auxins (3) Cytokinins (4) Gibberellins (5) Ethylene

**28.** Two true breeding plants, one with dark blue flowers and one with white flowers were crossed. The $F_1$ offspring of this cross produced light blue flowers. When the $F_1$ progeny was self crossed, 1:2:1 ratio of plants with dark blue, light blue and white flowers was observed. What genetic character is shown by these results?

(1) Epistasis
(2) Incomplete dominance
(3) Co-dominance
(4) Polyallelism
(5) Gene linkage

**29.** Which of the following combinations of triplet codes in the corresponding mRNA and tRNA is the correct representation of the triplet code of CAT in DNA?

| | **mRNA** | **tRNA** |
|---|---|---|
| (1) | GAA | CAT |
| (2) | CAT | CAT |
| (3) | GUA | CAU |
| (4) | GTA | CAU |
| (5) | GUA | CAT |

**30.** A cross between pure line short-black haired and pure line long-white haired Guinea pigs produced short-black haired offspring in the $F_1$ generation. If there were 33 offspring in the $F_2$ generation of this cross, how many of them would have short-black hair according to Mendel's laws?

(1) 19 (2) 12 (3) 9 (4) 6 (5) 2

**31.** Which of the following statements regarding the inheritance of haemophilia in humans is correct?

(1) If a carrier woman marries a haemophilic man, 50% of their children would be normal.
(2) If a carrier woman marries a normal man, 50% of their children would be haemophilic.
(3) If a normal woman marries a haemophilic man, 50% of their sons would be normal.
(4) If a carrier woman marries a normal man, 50% of their children would be normal.
(5) If a carrier woman marries a haemophilic man, all of their sons would be haemophilic.

**32.** Which of the following statements regarding the time of origin of different groups of organisms is **incorrect**?

(1) Dinosaurs appeared during the same period in which the mammals appeared.
(2) Insects appeared during the Palaeozoic era.
(3) Modern fish originated during the Mesozoic era.
(4) Placental mammals originated during the Cretaceous period.
(5) Conifers appeared during the Mesozoic era.

**33.** Which of the following terrestrial biomes shows the least variation in temperature?

(1) Temperate grasslands
(2) Temperate broad leaf forests
(3) Coniferous forests
(4) Tropical forests
(5) Deserts

**34.** Which of the following statements regarding the phosphorus cycle is correct?

(1) The largest accumulation of phosphorus is in the soil.
(2) $HPO_4^{2-}$ is the most abundant form of inorganic phosphorus in the phosphorus cycle.
(3) There is an atmospheric phase in the phosphorus cycle.
(4) Plants absorb phosphorus in the form of $H_2PO_4^-$.
(5) Human activities have no impact on phosphorus cycle.

**35.** This question is based on the following species.

A - *Lantana camara*
B - *Puntius nigrofasciatus*
C - *Garcinia quaesita*
D - *Caretta caretta*
E - *Dermochelys coriacea*
F - *Elephas maximus*

Which of the following statements regarding the above species is correct?

(1) Two of the above species are invasive.
(2) Two of the above species are endemic to Sri Lanka.
(3) Two of the above species are critically endangered.
(4) One of the above species is extinct in the wild.
(5) None of the above species is included in the vulnerable category.

**36.** Which of the following organisms causing food borne infections contain endotoxins?
(1) *Vibrio cholerae* (2) *Staphylococcus aureus*
(3) *Clostridium botulinum* (4) *Salmonella typhi*
(5) *Shigella flexneri*

**37.** Which of the following is **incorrect** regarding prions?
(1) They are infectious particles containing proteins.
(2) They self replicate in the host tissue using their own nucleic acids.
(3) They are smaller than viruses.
(4) They cause fatal degenerative brain diseases in mammals.
(5) Diseases caused by them can be transmitted to humans from animals.

**38.** Which of the following is a genetically modified vaccine used in active immunization?
(1) Antitetanus vaccine (2) Hepatitis B vaccine
(3) Antirabies vaccine (4) Oral Polio vaccine
(5) BCG vaccine

**39.** Which of the following biochemical processes in the nitrogen cycle is effected by *Nitrosomonas*?
(1) Proteolysis (2) Nitrification
(3) Denitrification (4) Nitrogen fixation
(5) Ammonification

**40.** Which of the following microorganisms are used in biological extraction of metals from low grade metal ores?
(1) *Pseudomonas aeruginosa* (2) *Thiobacillus ferrooxidans*
(3) *Bacillus thuringiensis* (4) *Lactobacillus bulgaricus*
(5) *Aspergillus oryzae*

- **For each of the questions 41 to 50 one or more of the responses is/are correct. Decide which response/ responses is/are correct and then select the correct number.**

If only **A, B** and **D** are correct..... 1
If only **A, C** and **D** are correct ..... 2
If only **A** and **B** are correct..... 3
If only **C** and **D** are correct ..... 4
If any other response or combination of responses is correct.... 5

| **Directions summarised** | | | | |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** |
| **A, B, D** correct. | **A, C, D** correct. | **A, B** correct. | **C, D** correct. | Any other response or combination of responses correct. |

**41.** Which of the following is/are the end product/products of oxidative phosphorylation?
(A) ATP (B) Oxygen
(C) $NAD^+$ (D) $H_2O$
(E) $CO_2$

**42.** Which of the following is/are **not** a polymer/polymers of glucose?
(A) Pectin (B) Inulin
(C) Glycogen (D) Chitin
(E) Cellulose

**43.** Which of the following feature/features can be seen in both chordates and molluscs?
(A) Internal skeleton (B) Gills
(C) Internal fertilization (D) Well developed eyes
(E) Radula

**44.** Which of the following 'Nutrition type – Example' combinations is/are correct?
(A) Symbiotic – *Cuscuta*
(B) Photoautotrophic – Purple nonsulphur bacteria
(C) Saprophytic – *Mucor*
(D) Chemoautotrophic – *Nitrobacter*
(E) Holozoic – *Drosera*

45. Select the correct statement/statements regarding sodium-potassium pump of a neurone.
(A) Pumping of $Na^+$ and $K^+$ are interdependent.
(B) It is located in the neurilemma.
(C) Deficiency of ATP can interrupt its functioning.
(D) It is essential for the maintenance of the resting membrane potential.
(E) It pumps $Na^+$ from the extracellular fluid into the neurone.

46. Urine output of a healthy adult person depends on which of the following?
(A) ADH level in blood
(B) Functioning of hypothalamus
(C) Functioning of the proximal convoluted tubules of nephrons
(D) Physical activity
(E) Blood volume

47. Select the correct statement/statements regarding human placenta.
(A) It is deciduous alantochorian type of placenta.
(B) It produces hCG and progesterone at initial stages of pregnancy.
(C) It prevents mixing of foetal and maternal blood.
(D) It can produce prostaglandins.
(E) It allows passage of water both from mother to foetus and from foetus to mother.

48. Select the **incorrect** statement/statements regarding human womb.
(A) It is a hollow, muscular, pear-shaped organ.
(B) Progesterone inhibits its contractibility.
(C) Fertilization normally occurs within it.
(D) Its inner layer is composed of a cuboidal epithelium and mucus secreting tubular glands.
(E) At the end of pregnancy oestrogen stimulates its contractions.

49. Which of the following feature/features is/are **not** common to all phyla of vascular plants?
(A) Development of seeds
(B) Alternation of generations
(C) Photosynthetic gametophyte
(D) Heterospory
(E) Dominant sporophyte

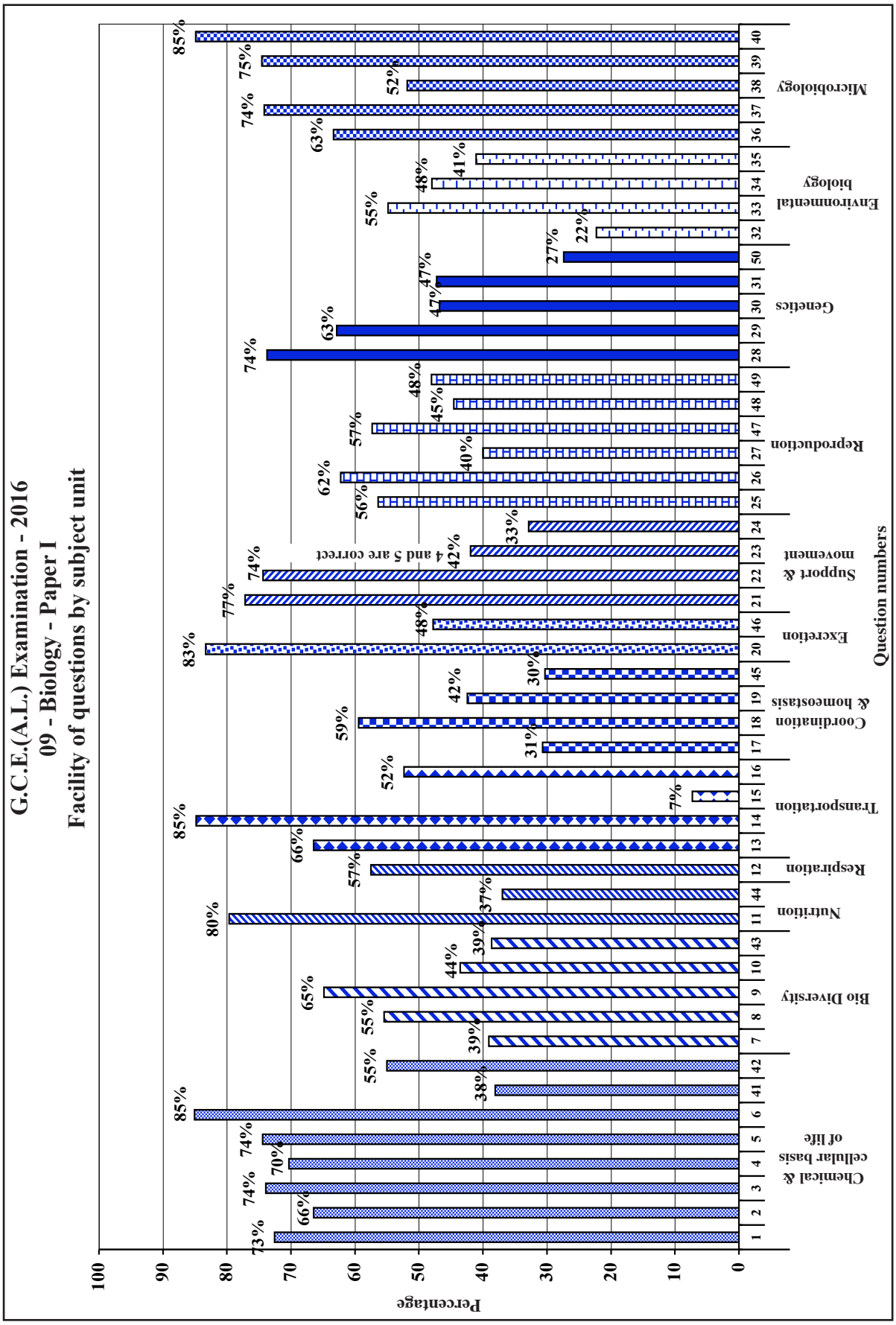
50. Which of the following statements is/are correct?
(A) Allele is one of the alternative forms of the same gene.
(B) Locus is the position of an allele in a DNA molecule.
(C) Human ABO blood groups are an example for codominance.
(D) Gene is the basic unit of inheritance of a certain character.
(E) The cross carried out to determine the genotype of an organism is the back-cross.

### 2.1.3 Expected answers and the scheme of marking for paper I

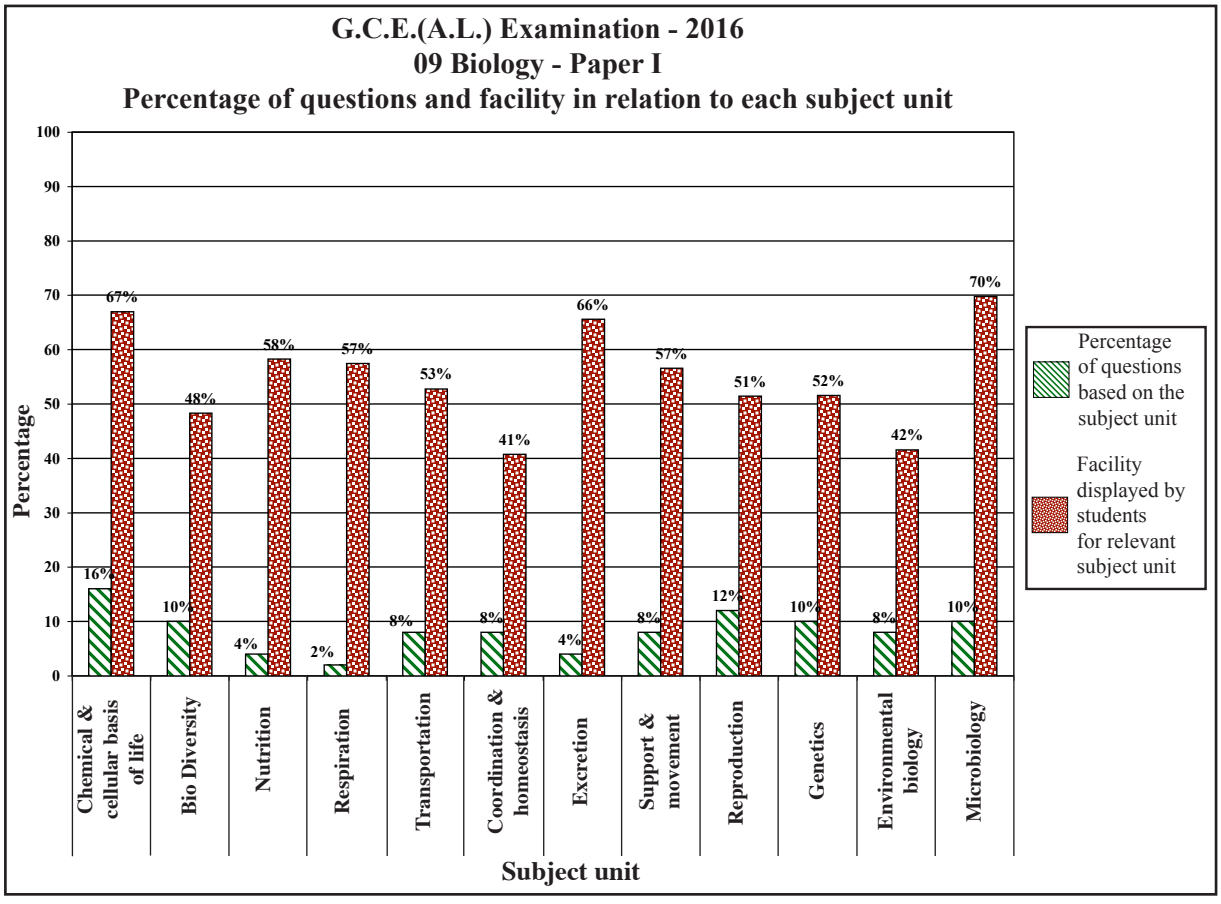
| Question No | Answer | Question No | Answer |
|---|---|---|---|
| 01. | 3 | 26. | 4 |
| 02. | 2 | 27. | 2 |
| 03. | 3 | 28. | 2 |
| 04. | 2 | 29. | 3 |
| 05. | 1 | 30. | 1 |
| 06. | 4 | 31. | 4 |
| 07. | 3 | 32. | 5 |
| 08. | 3 | 33. | 4 |
| 09. | 5 | 34. | 4 |
| 10. | 2 | 35. | 2 |
| 11. | 2 | 36. | 4 |
| 12. | 1 | 37. | 2 |
| 13. | 4 | 38. | 2 |
| 14. | 1 | 39. | 2 |
| 15. | 4 | 40. | 2 |
| 16. | 1 | 41. | 2 |
| 17. | 4 | 42. | 1 |
| 18. | 5 | 43. | 5 |
| 19. | 3 | 44. | 2 |
| 20. | 2 | 45. | 2 |
| 21. | 4 | 46. | 5 |
| 22. | 2 | 47. | 5 |
| 23. | 4, 5 | 48. | 5 |
| 24. | 1 | 49. | 2 |
| 25. | 2 | 50. | 1 |

**Each correct answer carries 02 marks, amounting the total to 100.**

### 2.1.4 Observations on the responses to paper I



| Subject unit | No. of multiple choice questions | Highest facility | | Lowest facility | |
|---|---|---|---|---|---|
| | | Question | Facility | Question | Facility |
| Chemical & cellular basis of life | 8 | 6 | 85.06 | 41 | 38.07 |
| Bio Diversity | 5 | 9 | 64.83 | 43 | 38.66 |
| Nutrition | 2 | 11 | 79.63 | 44 | 36.95 |
| Respiration | 1 | 12 | 57.47 | - | - |
| Transportation | 4 | 14 | 84.83 | 15 | 7.29 |
| Coordination & homeostasis | 4 | 18 | 59.41 | 45 | 30.33 |
| Excretion | 2 | 20 | 83.35 | 46 | 47.81 |
| Support & movement | 4 | 21 | 77.17 | 24 | 32.86 |
| Reproduction | 6 | 26 | 62.23 | 27 | 40.00 |
| Genetics | 5 | 28 | 73.75 | 50 | 27.36 |
| Environmental biology | 4 | 33 | 54.80 | 32 | 22.30 |
| Microbiology | 5 | 40 | 84.91 | 38 | 51.82 |



### 2.1.5 Responses to the options of each question in Paper 1 – as a percentage

| Question No. | Correct answer | Percentage of students selecting each option | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Missing |
| 1 | 3 | 2.60% | 8.10% | **72.57%** | 9.29% | 7.29% | - |
| 2 | 2 | 4.31% | **66.47%** | 9.96% | 6.62% | 12.42% | - |
| 3 | 3 | 6.54% | 1.64% | **73.90%** | 1.26% | 16.58% | - |
| 4 | 2 | 12.79% | **70.33%** | 5.58% | 7.29% | 3.87% | - |
| 5 | 1 | **74.42%** | 6.25% | 3.42% | 7.58% | 8.10% | - |
| 6 | 4 | 2.23% | 1.49% | 4.61% | **85.06%** | 6.39% | - |
| 7 | 3 | 19.03% | 20.74% | **39.11%** | 7.21% | 13.68% | - |
| 8 | 3 | 14.57% | 15.91% | **55.46%** | 11.67% | 2.01% | - |
| 9 | 5 | 5.06% | 5.72% | 18.96% | 5.13% | **64.83%** | - |
| 10 | 2 | 11.45% | **43.57%** | 23.35% | 14.57% | 6.77% | - |
| 11 | 2 | 5.50% | **79.63%** | 6.62% | 3.57% | 4.16% | 1% |
| 12 | 1 | **57.47%** | 11.52% | 5.72% | 9.96% | 15.02% | - |
| 13 | 4 | 2.83% | 13.61% | 11.67% | **66.47%** | 5.13% | - |
| 14 | 1 | **84.83%** | 1.34% | 9.00% | 1.56% | 2.83% | - |
| 15 | 4 | 2.45% | 1.78% | 3.42% | **7.29%** | 84.46% | 1% |
| 16 | 1 | **52.34%** | 11.45% | 10.26% | 17.32% | 8.33% | - |
| 17 | 4 | 10.26% | 6.84% | 31.82% | **30.71%** | 19.93% | - |
| 18 | 5 | 20.59% | 4.54% | 6.17% | 9.07% | **59.41%** | - |
| 19 | 3 | 10.71% | 29.96% | **42.45%** | 12.34% | 4.24% | - |
| 20 | 2 | 2.45% | **83.35%** | 6.25% | 3.87% | 3.94% | - |
| 21 | 4 | 2.08% | 9.37% | 8.10% | **77.17%** | 3.20% | - |
| 22 | 2 | 8.77% | **74.35%** | 4.16% | 6.62% | 5.95% | - |
| 23 | 4 and 5 | 3.12% | 11.90% | 10.78% | **41.93%** | **31.97%** | - |
| 24 | 1 | **32.86%** | 12.64% | 21.34 | 20.74% | 12.27% | - |
| 25 | 2 | 20.67% | **56.36%** | 4.24% | 11.00% | 7.66% | - |
| 26 | 4 | 3.94% | 6.91% | 18.29% | **62.23%** | 8.33% | - |
| 27 | 2 | 9.59% | **40.00%** | 28.10% | 14.94% | 6.91% | - |
| 28 | 2 | 4.09% | **73.75%** | 12.79% | 4.98% | 4.09% | - |
| 29 | 3 | 2.68% | 5.35% | **62.83%** | 14.20% | 14.87% | - |
| 30 | 1 | **46.77%** | 15.69% | 25.95% | 7.73% | 3.35% | 1% |
| 31 | 4 | 15.24% | 10.63% | 14.05% | **47.21%** | 12.71% | - |
| 32 | 5 | 32.12% | 14.72% | 17.70% | 12.79% | **22.30%** | - |
| 33 | 4 | 7.81% | 10.56% | 20.37% | **54.80%** | 6.32% | - |
| 34 | 4 | 30.26% | 10.86% | 7.73% | **47.96%** | 2.75% | - |
| 35 | 2 | 19.55% | **41.04%** | 16.13% | 12.42% | 10.63% | - |
| 36 | 4 | 11.23% | 7.43% | 14.72% | **63.35%** | 2.97% | - |
| 37 | 2 | 5.28% | **74.20%** | 11.60% | 3.64% | 5.06% | - |
| 38 | 2 | 7.73% | **51.82%** | 9.29% | 12.42% | 18.29% | - |
| 39 | 2 | 0.89% | **74.57%** | 10.56% | 10.11% | 3.64% | - |
| 40 | 2 | 3.64% | **84.91%** | 5.50% | 2.83% | 2.68% | - |
| 41 | 2 | 16.06% | **38.07%** | 13.83% | 3.42% | 28.25% | - |
| 42 | 1 | **55.02%** | 6.32% | 8.62% | 5.43% | 24.54% | - |
| 43 | 5 | 21.64% | 21.41% | 4.91% | 13.31% | **38.66%** | - |
| 44 | 2 | 6.69% | **36.95%** | 2.45% | 37.10% | 16.51% | - |
| 45 | 2 | 10.93% | **30.33%** | 5.58% | 16.43% | 36.28% | - |
| 46 | 5 | 16.06% | 20.82% | 9.59% | 5.43% | **47.81%** | - |
| 47 | 5 | 8.70% | 24.31% | 5.65% | 3.87% | **57.32%** | - |
| 48 | 5 | 6.25% | 7.81% | 6.62% | 34.65% | **44.54%** | - |
| 49 | 2 | 7.43% | **48.03%** | 7.06% | 9.59% | 27.73% | - |
| 50 | 1 | **27.36%** | 23.42% | 4.68% | 12.57% | 31.67% | - |

Under each question, the student percentage selecting the correct option is shaded.

### 2.1.6 Overall observation, conclusions and suggestions regarding the answers to paper 1

- For the Biology Paper I, which is the multiple choice question paper there were 04 questions in which the facility was 80% - 90% and the number of those questions were 06, 14, 20 and 40. All these four questions were knowledge based and easy.
- There were 10 questions in which facility was 70% - 80%. Question numbers were 01, 03, 04, 05, 11, 21, 22, 28, 37 and 39. These questions are knowledge based and belong to cognitive domain.
- There were 06 questions possessed a facility 60% - 70%. Question numbers were 02, 09, 13, 26, 29 and 36.
- Number of questions having a facility of 50% - 60% was 09. Question numbers were 08, 12, 16, 18, 25, 33, 38, 42, and 47.
- Number of questions having a facility of 40% - 50% was 11. Question numbers were 10, 19, 23, 27, 30, 31, 34, 35, 46, 48 and 49.
- 07 questions possessed a facility of 30% - 40%. Question numbers were 07, 17, 24, 41, 43, 44 and 45.
- Two questions have a facility of 20% - 30% those were 32 and 50 questions.
- There were no questions with the facility of 10% - 20%.
- One question had the facility less than 10%. It was 15$^{th}$ question.
- According to above data, there are 14 questions having a facility higher than 70%.
- There were 26 questions having an intermediate facility between 40% - 69%.
- According to above data there were 10 questions with a facility lesser than 40%.
- Following is an analysis of few such complicated questions.

  * 7$^{th}$ question was given regarding the diversity and reproduction of organisms. The answer of if was (3)rd response. The facility of this question was 39.11%. Candidates were failed to select the correct response because they couldn't identify the specific features of given plants correctly. When consider each response individually, because of,

    - the gametophyte of *Pogonatum* was not in thalloid form in (1)$^{st}$ response.
    - *Cycas* was a seed plant in (2)$^{nd}$ response.
    - the gametophyte of *Pinus* was non-photosynthetic in (4)$^{th}$ response.
    - *Pogonatum* was homosporous and gametophtye of *Cycas* was non-photosynthetic in (5)$^{th}$ response. These responses get rejected.
    - the (3)$^{rd}$ response is confirmed as the correct one.

* 12th question was based on human respiratory system. The correct answer was (1)st response. The facility of this question was 57.47%. Other responses 2 - 5 were rejected because the trachea is paved by pseudostratified cilliated epithelia, columnar, consisting of right lung with 3 lobes, gas exchange occurs passively by diflusion in lungs and, location of the larynx at 4 - 6 cervical vertebra level.

* The least facility of this paper was in the 15th question. The facility of this question was law as 7.29%. The correct answer for this was 4th response. The process occurs when light is absent is asked in this. Though the correct response was elongation of internode, 80.46% candidates selected the 5th answer because the guttation generally happens in night. Lack of a proper understanding about the subject mater, caused to low achievement level of candidates.

* Knowledge about human growth hormone was asked in 17th question. The answer was 4th response. The facility was 30.71%, 31.82% of candidates had selected 3rd response as the answer. They should understand not only glucogen, but also growth hormone, cortisol, adrenaline and thyroxin hormone cause to increase of blood glucose level and only insulin causes in decreasing blood glucose level.

* The incorrect statement about human brain was asked in 18th question. The facility of this question was 59.41%. The answer of this was 5th response. The speech motor area is located on frontal lobe. Corpus callosum joins two cerebral hemispheres deeply in brain. Balancing and equilibrium is maintained by the nerve impulses transmitted from utricle and saccule of inner ear to cerebellum. Thalamus acts as the integrating and exchanging centre from sensory organs. Medulla oblongata acts as the centre for reflexes such as cough, vomiting, secretion of digestive juices, sneezing.

* 19th question was based on knowledge about the action potential of a human motor neurone. The facility of this is 42.25%. The answer is 3rd response. There should be a refractory period of 2 ms between two consequetive action potentials. Nerve impulse transmission speeds up in myelinated axons, due to generation of action potentials only at nodes of ranvier. Depolarization starts due to entering of $Na^+$ ions the axon and repolarization happens due to exit of $K^+$ from the axon. Due to overshoot of $K^+$ out, the potential drops than resting level and is known as hyperpolarization.

* 23rd question was given to select the incorrect statement about human scapula. Due to location of glenoid fossa at the lateral margin of scapula and because of the process arise from the superior border of scapula is corocoid process not the coronoid process both 4th and 5th options were wrong. Hence, 4th and 5th were selected as answers.

* 24th question was given to select incorrect statement regarding human lower limb. The facility shown by candidates was a low value as 32.86%. The correct response is (1)st statement. Femur get closer to midline where centre of gravity is located hence it is not parallel and stays being slanted. 4th response is correct because fibula articulates only with tibia at upper extremity hence it is not a component of the knee joint.

* Plant growth substance relevant to prevent falling of leaves was asked in 27th question. The facility was 40%. Though the correct response was 2nd, 28.1% of candidates have selected the (3)rd response. This indicates the poor knowledge of candidates though the subject mater of plants growth substances, sites of synthesis and roles of growth substances which are given properly in teacher's manual.

* Question numbers 30 and 31 were related with Genetics unit. The facility of these questions were 46.77% and 47.21% respectively. The 30th question was a Mendalian dihybrid cross. It can be solved as following.

* The correct response of 30th question is (1)

Pure line × Pure line

Black - Short haired White - long haired

BBSS bbss ——— p

↓

BbSs ——— $F_1$

black - short haired 100%

$F_1$ × $F_1$ ——— $P_2$

BbSs BbSs

B-S- : B-ss : bbS- : bbss ——— $F_2$

black / short black / long white / short white / long

Phenotype ratio } 9 : 3 : 3 : 1

Phenotype ratio of black short haired in $F_2$ ——— 9 / 16

Number of expected phenotypes of 33 fillials in $F_2$ = 9 / 16 × 33

= 18.5 (Ω 19)

* The correct response of 31st question is (4)

When consider (1) and (5) responses

carrier female × haemophillic male

$X^HX^h$ ↓ $X^hY$ — P

| $X^HX^h$ | $X^hX^h$ | $X^HY$ | $X^hY$ | — $F_1$ |
|---|---|---|---|---|
| carrier female | haemophillic female (lethal) | normal male | haemophillic male | |
| 25% | 25% | 25% | 25% | |

Therefore (1) and (5) choices can be rejected

When consider (2) and (4) responses

carrier female × haemophillic male

$X^HX^h$ ↓ $X^HY$ — P

| $X^HX^H$ | $X^HX^h$ | $X^HY$ | $X^hY$ | — $F_1$ |
|---|---|---|---|---|
| normal female | carrier female | normal male | haemophillic male | |
| 25% | 25% | 25% | 25% | |

According to this, we can conclude that (2) response incorrect and (4) response is correct.

When consider (3) response

normal female × haemophillic male

$X^HX^H$ ↓ $X^hY$ — P

$X^HX^h$ $X^HY$ — $F_1$

carrier female normal male

50% 50%

According to this (3) response can be rejected

* 32 question was given to select the incorrect statement about the period of origin of different groups of organisms on the earth. The answer was (5)th response. The facility was 22.3%. But 32.12% candidates selected the (1)st response as the answer.

* Eras and periods in which organisms originated can be presented as following.

| era | Period | group of organisms originated |
|---|---|---|
| Archeozoic | | |
| Paleozoic | Cambrian | |
| | Odovicean | |
| | Silurian | |
| | Devonian | |
| | Carboniferous | — Insects |
| | Permean | — Conifers |
| Mesozoic | Triassic | — Dinosaurs and first mammals |
| | Jurassic | |
| | Cretaceous | — Modern fish, placental mammals |
| Cenozoic | Tertiary | |
| | Quatanary | |

Subject matter can be achieved successfully by using above type drafts in learning teaching process instead of presenting separately. According to above conifers originated in Paleozoic era, not in Mesozoic era. Hence the answer is $(5)^{th}$ response.

* $35^{th}$ question was given to select the correct statement about six given species. The answer is $(2)^{nd}$ response, and the facility of it is 41.04%.
  - of the species given, only *Lantana camara* is invasive
  - *Puntius nigrofasciatus* and *Garcinia quaesita* are endemic.
  - *Dermochelys coriacea* (leather back turtle) is a critically endangered (CR) organism.
  - *Caretta caretta* (loggerhead turtle) is an endangered (EN) organism.
  - *Elephas maximus* (asian elephant) is a vulnerable (VU) organism

  as mentioned in $(4)^{th}$ response, any organism, which is extincted in original land is not included.

* The genetically modified vaccine type used for active immunization was asked in $38^{th}$ question. The answer was $(2)^{nd}$ response. Facility was 51.82%.
  - When consider given vaccines;
    antirabies and anti tetanus vaccines, used in artificial active immunity are ready made antibody vaccines.
  - Oral polio vaccine and BCG vaccines are atenuated microbial cell/ infective and are used in artificial active immunity.
  - Genetically modified Hepatitis B vaccine mentioned in $(2)^{nd}$ response is used in active immunization.

* In question number 41, the end products of oxidative phosporylation is asked. The correct answer is (2). The facility is 38.07%. Part of energy released in the oxidation of reduced coenzyme NADH into $NAD^+$ is used to synthesize ATP in the oxidative phosporylation. These electrons transmit through some other electron carriers are captured by $O_2$, then $H_2O$ is produced.

  Therefore, end products of this are, ATP, $NAD^+$ and $H_2O$. But 28.28% have selected the $(5)^{th}$ response. They have understood incorrectly that $CO_2$, which is an end product of aerobic respiration is synthesized in the oxidative *phosporylation*.

* Question number 43 has asked about common features of both Chordates and Molluscs. While the answer was (5), the facility of this question was 38.66%. Though Chordates possess endoskeletons, some reptiles such as tortoise, turtle bear an exoskeleton also made of bony plates. Adults of some Chordates such as fishes, salamanders possess gills. Gills/ Ctenidia are located in the manthle cavity of most molluscs. Internal fertilization is carried by most terrestrial Chordates.

But bony fish and some amphibians carry out external fertilization. Though most molluscs carryout external fertilization squids like numbers carry out internal fertilization. Vertebrates among chordates possess well developed eyes.

Some molluscs such as squids and octopus bear complex eyes similar to vertebrate eye. Radula is an identical feature of phylum Mollusca. Therefore, endoskeleton, gills, internal fertilization, well developed eyes are common features for both chordate and molluse groups, Therefore $(5)^{th}$ is the correct response.

* Question number 45 has been presented to select the correct response regarding the sodium potassium pump of a neurone. The answers is $(2)^{nd}$ response. The facility is 30.33%.

  (A) Statement is correct. $Na^+$ and $K^+$ pumps do not occur separately. That is a couple pump occur depending on each other.

  (B) Statement is incorrect. Neurilemma is the plasmamembrane of the schwann cells. Sodium-potassium pump act on the axon membrane.

  (C) Statement is correct. This process might be affected in ATP deficiency because it is an active process which depends on ATP. Unlike in other cells, neurones need energy even at rest to the action of $Na^+$ $K^+$ pump.

  (D) Statement is correct. The resting potential changes due to passive diffusion of $Na^+$ and $K^+$ ions across axon membrace hence, $Na^+$ and $K^+$ pump is essential to keep it constant.

  (E) Statement is wrong. $Na^+$ enter the axon from extra celluar fluid, $Na^+$ / $K^+$ pump is carried out to push $Na^+$ out. Therefore, correct answers are A, C and D, So correct response is (2).

* $50^{th}$ question is related with genetics. The answer is (1). The facility is 28.66%. But majority of candidates such as 31.67% have selected the $(5)^{th}$ response. Alleles are defined as alternative forms of a gene. The site of a gene on a DNA molecule is called Locus. There are four blood groups as A, B, AB and O according to ABO classification, of this examples for codominance are AB group only. Gene act as the hereditory unit in genetics. Objective of a test cross is determining the genotype of an organism having dominant character. The objective of a back cross is obtaining fillials having mostly similar genetic composition to parents. Therefore, those are different in objectives. But in some occasions back cross may practically similar to the test cross.

## 2.2 Paper II and information on answers

### 2.2.1 Structure of the paper II

**Allotted time is 03 hours.**

This question paper consists of two parts, Structured Essay and Essay.

Part **A** – This contains four structured essay questions. **All** the questions should be answered. Each question carries 100 marks, so the total mark is 400.

Part **B** – This contains **six** essay type questions from which four should be answered. Marks allocated for each question is 150. The total mark is 600.

Total mark for Paper II is 1000 ÷ 10 = 100

## 2.2.2. Expected answers, marking scheme and observations, conclusions and suggestions related to answers for Paper II.

The observations related to the answers for Paper II have been presented by the graphs 2, 3, **4.1, 4.2 and 4.3.** The relevant portion of the graph is displayed with observations and conclusions for each question.

### Part A – Structured Essay

**Question 1.**

**01. (A) (i) What are macromolecules?**

- They are (large) molecules with a molecular weight of $10^4$ - $10^{10}$
- made up of large number of monomer units / polymers **(2 × 2½ marks)**

**(ii) Name the three types of macromolecules found in living organisms.**

- Polysaccharides
- Proteins
- Nucleic acids **(3 × 2½ marks)**

**(iii) Name the disaccharide sugar found in the following and indicate the constituent monosaccharide unit of each of them.**

| | Disaccharide | Monosaccharide unit |
|---|---|---|
| **(a) Sugar cane plant** | Sucrose | Glucose and Fructose |
| **(b) Germinating seeds** | Maltose | Glucose |
| **(c) Milk** | Lactose | Glucose and Galactose |

**(3+3) × 2½ marks)**

**(iv) What is the monosaccharide unit found in NAD and ATP?**

- Ribose **(1 × 2½ marks)**

**(v) Lipids are one of the major organic compounds in living organisms. State two important characteristics of lipids which distinguish them from other major biological molecules.**

- Insoluble in water / Soluble in organic solvents
- H:O is greater than 2:1 / less oxygen content **(2 × 2½ marks)**

**(vi) Name five major types of lipids found in organisms.**

- Fats and oils
- Phospholipids
- Terpenes
- Wax
- Steroids

**(5 × 2½ marks)**

**(B) (i) What are mutations?**

- Changes occurring in DNA /Genetic material/ Genome of an organism **(1 × 2½ marks)**

**(ii) State the significance of mutations in evolution.**

- (Beneficial) mutations can produce new variations, leading to more suitable/ or more fitted organism. **(1 × 2½ marks)**

**(iii) Some human disorders are inherited as mutations. State three such genetic disorders indicating the type of mutation in each of them.**

| Disorder | Type of mutation |
|---|---|
| • Colour blindness | • Gene mutation |
| • Haemophelia | • Gene mutation |
| • Albinism | • Gene mutation |
| • Down's Syndrome | • Chromosomal mutation |
| • Klinefelter syndrome | • Chromosomal mutation |
| • Turner's syndrome | • Chromosomal mutation |
| • Thalassemia | • Gene mutations |
| • Hungtingdun's disease | • Gene mutations |
| • Sickle cell anaemia | • Gene mutations |
| • Cystic fibrosis | • Gene mutations |

**(3+3) × 2½ marks)**

**(C) (i) What is Biological Oxygen Demand?**

- Amount of dissolved oxygen needed by aerobic microorganisms to breakdown organic (matter in) waste **(1 × 2½ marks)**

**(ii) What happens when a large amount of waste with high Biological Oxygen Demand (BOD) is discharged into an aquatic ecosystem?**

- Microorganisms consume large amount of oxygen in water for decomposition of waste
- Dissolved oxygen content in water is decreased affecting aquatic organisms

**(2 × 2½ marks)**

**(iii) State two methods used in current waste water treatment plants to reduce Biological Oxygen Demand (BOD) by oxidation of organic matter.**

- Trickling filter method
- Activated sludge method **(2 × 2½ marks)**

**(iv) Solid waste disposal has caused serious environmental issues in Sri Lanka. What are the adverse effects of open dumping of solid waste on land?**

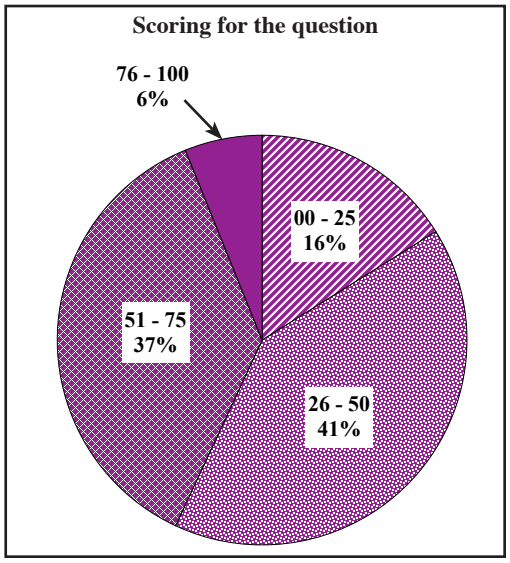
- Develops mosquito breeding grounds
- Produces bad smell due to anaerobic decomposition of waste
- Hazardous/ explosive Methane is produced
- Spreading out of insects/ rodents
- Ground water can be contaminated **(5 × 2½ marks)**

**(v) What are the methods that can be used to minimize the issues of disposal of solid waste?**

- Separation and recycling
- Decomposition of organic matter/composting
- Sanitary landfills **(3 × 2½ marks)**

**(Total 40 × 2½ = 100)**

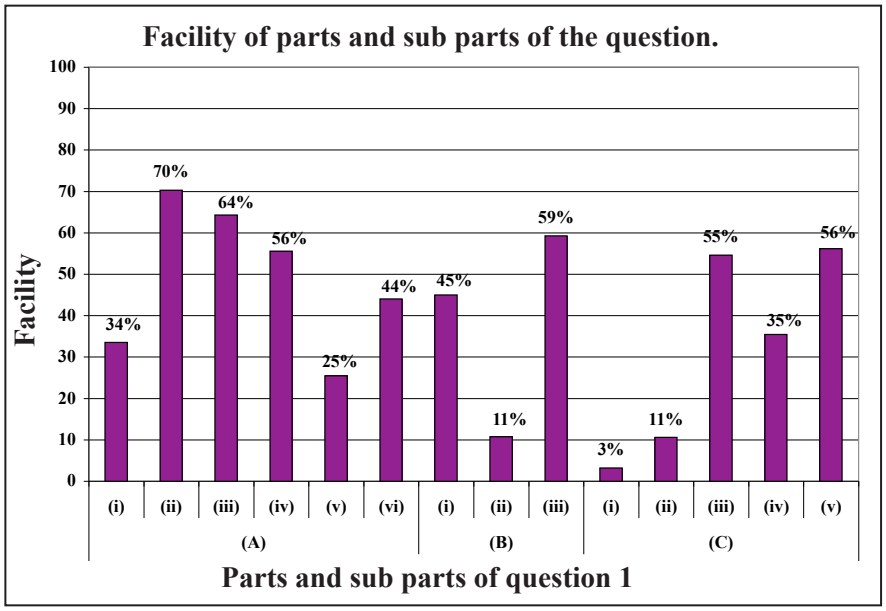
## Overall observations, conclusions and suggestions regarding the answers to question 1:




Although this question is compulsory, only 99% of candidates have answered it. Marks allocated for this question is 100. The percentages of candidates scored within four intervals is as following:

In 00 - 25 marks range ⟶ 16%
In 26 - 50 marks range ⟶ 41%
In 51 - 75 marks range ⟶ 37%
In 76 - 100 marks range ⟶ 6%

The percentage of candidates, scored 76 or above is 6% while 16% were in range below 25. 57% of candidates have scored below 50 marks or below 50.




★ Question 1 has 14 subparts, while facility of 06 subparts is higher than 50% and 8 subparts possess a facility below 50% of the subparts, 3 sub parts possess a low facility beyond 20%. Those are *(B)* (ii), *(C)* (i) and *(C)* (ii). The subpart having least facility in this question is *(C)* (i) and facility was 3%. The subpart having highest facility is *(A)* (ii) and the value is 70%.

A (i) Facility of obtaining marks for this subpart was 34%. regarding the definition of "macromolecules", most candidates have mentioned the molecular mass as $10^4$ - $10^{10}$ answer. But most of them had not mentioned "made of a large number of monomers/ unit molecules/ polymers". Therefore, they couldn't score.

A (ii) facility of obtaining marks for this subpart was 70%. This was the subpart having highest facility and most candidates produced the correct answer. But some could not score due to mentioning "carbohydrates;; instead of "polysaccharides" and "DNA" or "RNA" instead of nucleic acids.

A (iii) facility of obtaining marks for this subparts was 64%. Some candidates were failed to state the disaccharide types in sugar-cane plant, germinating seeds and milk as sucrose, maltose and lactose respectively.

A (iv) facility of obtaining marks for this subparts was 56%. 44% candidates did not know about the monosaccharide type in NAD and ATP is ribose.

A (v) facility of this subparts is 24%. In this question two important characteristics of lipids were asked. 76% of candidates were failed to write correct answer.

A (vi) The facility of this subparts is 44%. Instead of major lipid types, writing different lipids such as glycolipids, cholesterol cutin was the reason not to score.

B (i) the facility of this part is 45%. "mutations are changes occur in DNA/ genetic material/ genome of organisms". Because of the term "**organisms**" was not written they couldn't score. Candidates should aware to use standard terms when define specific concepts.

B (ii) a low facility such as 11% was given to this subparts "mutations produce new variations, leading to more suitable/ or more fitted organisms "most candidates were failed to write this entire answer hence caused to low marks.

B (iii) facility of obtaining marks for this subpart was 59%. Human genetic disorders and type of mutation into which it belong was asked in this question. Though genetic disorders and mutation types were mentioned in teacher manual specifically, presenting above facts in incorrect manner by some candidates, caused to low facility in this subpart. Some candidates were unable to sort out gene mutations and chromosomal mutations.

C (i) the facility of this sub part was 3%. This was the sub part of this question which scored in lowest level 97% of candidates were failed to define "Biological Oxygen Demand"" as the amount of $O_2$ required by aerobic micro-organisms to break down organic matter/ wastes.

C (ii) the facility of this sub part was 11%. Only 11% of candidates were able to write impacts of discharging large amounts of wastes with high BOD into an aquatic ecosystem. "Decreased dissolved oxygen content in water affect aquatic organisms" should be mentioned here. But most candidates wrote as "death of fishes".

C (iii), (iv), (v) the facility of these sub parts were, 55%, 35% and 56% respectively. These questions were asked from the latter parts of the syllabus. Most candidates show weaknesses in answering questions for last few units of the syllabus. This ensures that covering the whole syllabus leaving a sufficient time to prepare for the examination is a must.

## Question 2

**02. (A) (i) What is homeostasis?**

- Maintenance of constant internal environment **(in the body)** **(1 × 2½ marks)**

**(ii) State three factors that are homeostatically regulated in man**

- Body temperature
- Blood Glucose
- Blood Oxygen
- Blood carbon dioxide / $CO_2$
- Blood water content/ osmotic pressure
- Blood pH / $H^+$
- Blood $Na^+$ / $K^+$ / $Ca^{+2}$ / $Cl^-$ / $HCO_3^-$
- Blood pressure **(3 × 2½ marks)**

**(iii) State two advantages of homeostasis in man**

- Maintenance of optimum conditions in tissue fluids / maintain optimum metabolic rate / maintain optimum conditions for enzyme activity
- Maintains steady state
- Person becomes active
- Person becomes healthy **(2 × 2½ marks)**

**(iv) State one disadvantage of homeostasis in man**

- Energy has to be spent / ATP has to be spent **(1 × 2½ marks)**

**(v) Human liver plays a variety of roles in homeostssis. State four such roles**

- Regulation of blood glucose level
- Regulation of lipid content
- Synthesis of non-essential amino acids
- Detoxification
- Thermoregulation
- Elimination / breakdown of sex hormones
- Brakedown / elimination of haemoglobin
- Storing blood
- Storage of vitamins A, D, E, K / fat soluble vitamins
- Synthesis of blood proteins
- Synthesis of cholesterol
- Production of urea **(any 4 × 2½ marks)**

**(vi) Give two examples of positive feedback mechanisms operating in man.**

- Parturition / Oxytocin stimulates myometrial contractions and myometrial contraction increases releases of oxytocin further.
- Milk ejection / Suckling of breasts stimulates oxytocin release which causes milk ejection

**(2 × 2½ marks)**

**(B) (i) What is lactation?**

- Lactation is the synthesis / production and release / ejection of milk from breasts / mammary glands

**(1 × 2½ marks)**

**(ii) What is the most abundant component in human milk?**

- Water

**(1 × 2½ marks)**

**(iii) Name two placental hormones which act on the breasts.**

- Oestrogen
- Progesterone
- Human placental lactogen

**(2 × 2½ marks)**

**(iv) Name two components of colostrum**

- Water
- Immunoglobulin / Globulin / antibodies
- Fats
- Proteins
- cells of mammary glands

**(2 × 2½ marks)**

**(v) What is the role of oxytocin in lactation?**

- Stimulates milk ejection / release

**(1 × 2½ marks)**

**(vi) Name two hormones which inhibit milk production in women.**

- Prolacting inhibiting factor / P I H / P I F
- Progesterone

**(2 × 2½ marks)**

**(vii)State three advantages of breast feeding.**

- Milk is sterile / less prone to infection
- Milk is correctly warmed
- Ensures optimal growth and development (right components in correct proportion)
- Provides antibodies (passive immunity)
- Facilitates iron absorption
- Facilitates development of facial muscles (which are involved in speech)
- Less prone to allergies
- Facilitates development of intimate contact between mother and infant / baby

**(any 3 × 2½ marks)**

**(C) (i) State the three main functions of the human nervous system.**

- Co-ordination
- Integration
- Homeostasis **(3 × 2½ marks)**

**(ii) Name two phyla having animals with double ventral nerve cords.**

- Annelida
- Arthropoda **(2 × 2½ marks)**

**(iii) Name a Phylum having animals with radial nerves.**

- Echinodermata **(1 × 2½ marks)**

**(iv) State two advantages of nervous regulation over endocrine regulation.**

- Quick responses
- Pathway is specific
- Localized responses can be elicited
- Blood system is not required **(any 2 × 2½ marks)**

**(v) What is a receptor?**

- Specialized organ or structure that detects a stimulus **(1 × 2½ marks)**

**(vi) State three features of receptors.**

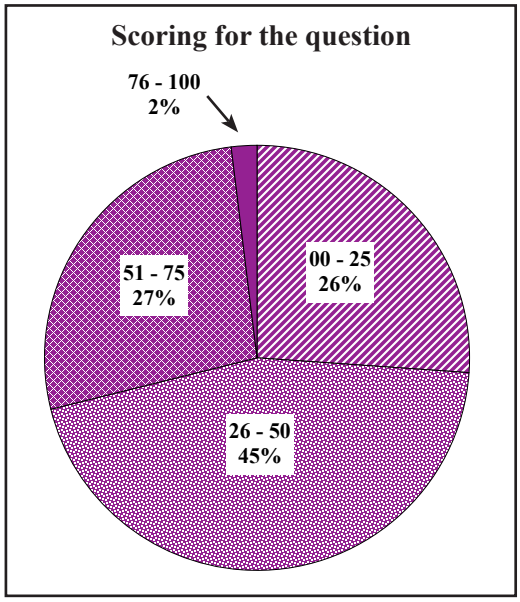
- Designed to receive specific stimuli
- Acts as transducers
- Consists of specialized cells
- Connected to nervous system
- Shows adaptations
- Respond to a minimum threshold level **(2 × 2½ marks)**

**(vii)Name three receptors sensitive to touch.**

- Meissner's corpuscles
- Merkel's discs
- Free nerve ending **(any 3 × 2½ marks)**

**(Total 40 × 2½ = 100)**

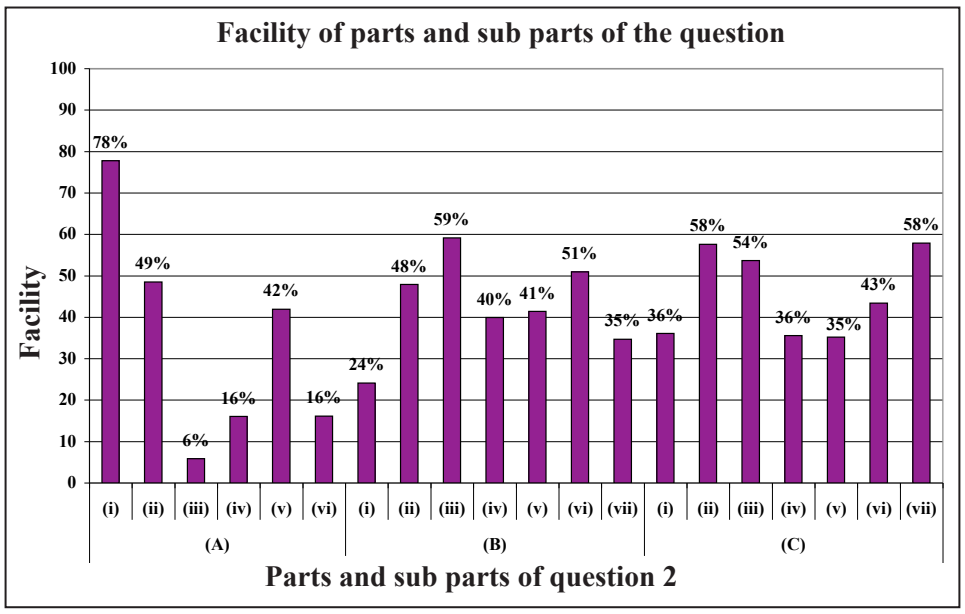
**Overall observations, conclusions and suggestions regarding the answers to question 2:**




Although question 2 is compulsory, only 98%of candidates have answered it. Marks allocated for this question is 100. The percentages of candidates scoring within following four intervals are:

| | | | | | | |
|---|---|---|---|---|---|---|
| In | 00 | - | 25 | marks range | ⟶ | 26% |
| In | 26 | - | 50 | marks range | ⟶ | 45% |
| In | 51 | - | 75 | marks range | ⟶ | 27% |
| In | 76 | - | 100 | marks range | ⟶ | 2% |

the percentage scored 76 marks above was 2% while those who score 25 marks or below was about 26% of candidates 45% have scored between 26 - 50%. Hence 71% of candidates had scored below 50 marks or less than fifty.




- Question number 02 consists of 20 sub parts. The facility of 6 sub parts was higher than 50%. *(A) (i)* possessed the highest facility as 78% and the least facility was for *(A) (iii)* sub part. It was 6% in value.

2 (A) (i), (ii) the facility os these sub parts were 78% and 49% respectively. In this question facts should be presented specifically when write the homeostatically regulated factors.

eg:- Body temperature
Blood .glucose
Blood water content it is essential writing underlined terms as above. Incomplete answers without such adjectives are not scored.

A (iii) and (iv) question parts had a facility of 6% and 16% respectively. These questions inquired about the advantages and disadvantages of homeostasis.

The internal environment of the body/ tissue fluid of a person can be maintained at optimum levels by homeostasis. As a result of it, the person can spend an active life by maintaining metabolic rate an optimum level. Maintaining homeostatis causes the healthyness of the person. Rise of blood glucose level than homeostatic range is a disorder. The knowledge of candidates about these facts seems very poor. They should understand how the homeostatic principles they learned link with the day-today life.

(A) (v) the facility was 42% of this sub part in which the homeostatic roles of liver were asked. 58% candidates were failed to present expected facts to this sub part which was a knowledge based one.

(A) (vi) the facility shown by candidates to this sub parts was a weak levels as 16%. In this sub parts, two examples for positive feed back mechanisms operate in human body were asked.

expected answers were, parturition and milk ejection from mammary glands.

- Parturition - while contractions of myometrius is stimulated by oxytocin, the initial myometrial contractions cause release of oxytocin and it is induced further more and due to positive feed back mechanism, the force of muscle contraction increases, finally labour occurs.

- ejection of milk from mammary glands being stimulated by suckling of the baby, release of oxytocin happens. Milk will be ejected further more according to positive feedback mechanism due to that oxytocin.

(B) (i) and (ii) the facility of these sub parts were 24% and 48% respectively. "Lactation" means the production of milk in mammary glands and ejection. Candidates weren't able to score because they wrote "milk glands" instead of "mammary glands" and "secretion of milk" instead of "release of milk". And the main component of human milk is water, not Lactose. They should confirm that major component of any body fluid is water.

(B) for (iii), (iv), (v) and (vi) sub parts, the facility were 59%, 40%, 41% and 51%. Hormones, act on breasts are estrogen, progesterone and human placental lactogen. Scoring was poor for this part due writing the answer as "plancental lactogen" instead of "human placental lactogen."

Most candidates wrote only "antibodies" as the components of colostrum. They didn't write water, fats, proteins, cells of mammary glands like components and instead of antibodies some had mentioned as "gaining immunity".

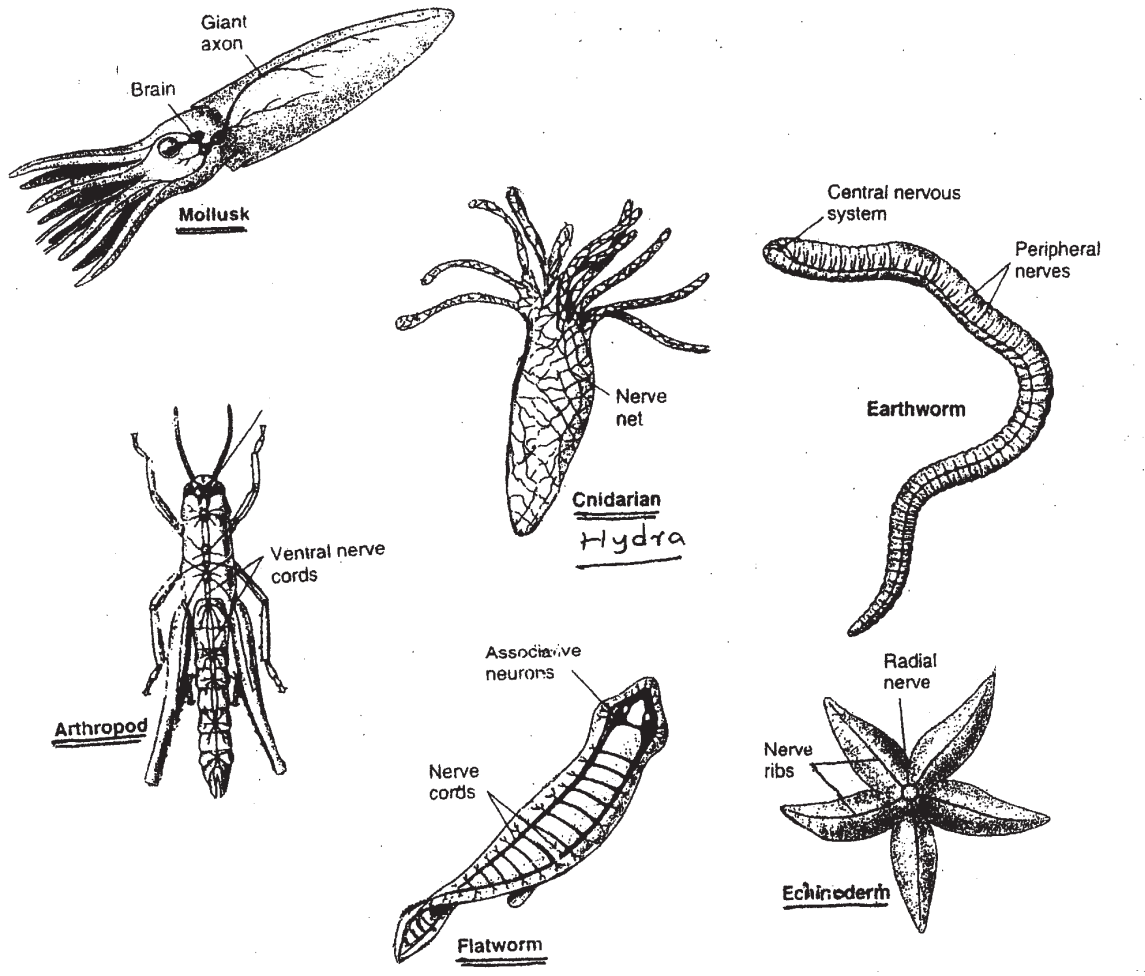
2 (C) (i) sub part has a facility of 36%. Though three main functions of human nervous system had to be stated. Most candidates mentioned "co-ordination" only. Integration and Homeostatic were not written. And most students didn't mention above concepts exactly but explained. Hence they couldn't score.

2 (ii) and (iii) sub parts had a facility of 58% and 54%. These sub parts were based on the nervous systems of invertebrates.

Different animal phyla possess different basic plans in their nervous systems.

eg :-
- ⋆ Annelids and Arthropods have a double ventral solid nerve cord.
- ⋆ Molluses possess a nerve ring with ganglia and two pairs of nerve cords
- ⋆ Echinoderms possess a circular nerve, five radial nerves arise from it and a nerve net.

The differences of nervous systems in different animal phyla can be identified by following diagrams.




2 (C) (iv), (v), (vi) and (vii) sub parts possess facilities of 36%, 35%, 43% and 58%. All of these a sub parts were knowledge based and included in cognitive domain. Most of the candidates were failed to present the subject mater and concepts in correct manner.

## Question 3

**03. (A) (i) Some external features of five invertebrates labeled as A, B, C, D and E are as follows.**

**A – Flattened, bilaterally symmetrical body with eye spots**

**B – Cylindrical radially symmetrical body with a mouth surrounded by tentacles**

**C – Cylindrical , bilaterally symmetrical body with numerous setae and without a clitellum**

**D – Cylindrical , bilaterally symmetrical body with a clitellum**

**E – Umbrella shaped radially symmetrical body with many tentacles around its edge**

**Complete the following dichotomous key using correct numbers and the letters A, B, C, D and E**

| | | |
|---|---|---|
| **1. Bilaterally symmetrical body** | _____ | **2** |
| **Radially symmetrical body** | _____ | **3** |
| **2. Flattened body** | _____ | **A** |
| **Cylindrical body** | _____ | **4** |
| **3. Tentacles around the edge of the body** | _____ | **E** |
| **Tentacles around the mouth** | _____ | **B** |
| **4. Clitellum present** | _____ | **D** |
| **Clitellum absent** | _____ | **C** |

**(8 × 2½ marks)**

**(ii) State the class of each the animals labeled as A, B, C, D and E**

- ***A*** - Turbellaria
- ***B*** - Anthozoa/ Hydrozoa
- ***C*** - Polychaeta
- ***D*** - Oligochaeta
- ***E*** - Scyphozoa **(5 × 2½ marks)**

**(B) (i) Name the parts that can be seen in a longitudinal section of a mature unfertilized ovule of an angiosperm**

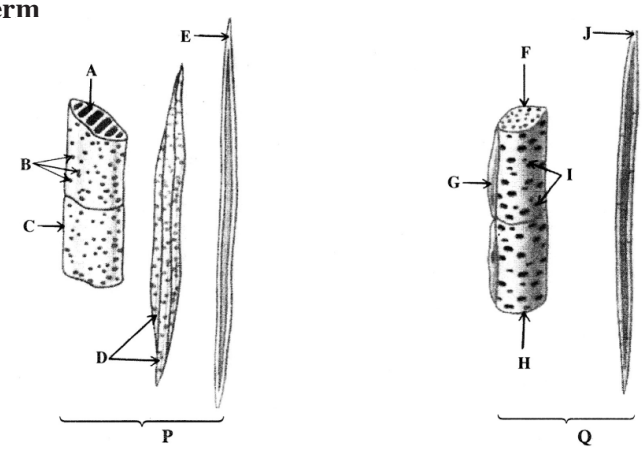
- Chalaza
- Nucellus
- Integument
- Antipodal nucleus
- Micropyle
- Embryo sac
- Polar nuclei / Secondary nucleus
- Egg cell / ovum
- synergids
- Hilum / Funiculus **(10 × 2½ marks)**

**(ii) List the post fertilization changes that take place in the major structures of the angiosperm ovary**

- Zygote develops into embryo
- Endosperm nucleus develops into endosperm
- Integuments develop into seed coat
- Ovule develops into seed
- Ovary develops into fruit

**(5 × 2½ marks)**

**(C) The diagram P and Q given below show some constituent elements of the two vascular tissues in angiosperm**




**(i) Identify the two vascular tissues shown in the diagram**

- P = Xylem
- Q = Phloem

**(2 × 2½ marks)**

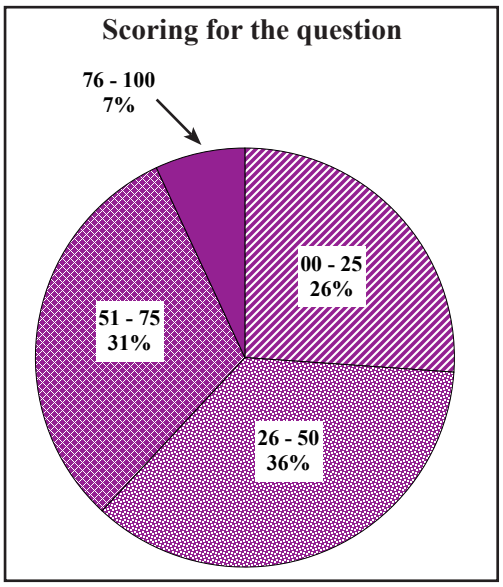
**(ii) Name the constituent elements indicated with arrows**

- **A** = Perforation plate
- **B** = Pits
- **C** = Vessel element/ vessel
- **D** = Trachieds
- **E** = (Xylem) fiber
- **F** = Sieve plate
- **G** = Companion cell
- **H** = Sieve tube element
- **I** = Sieve area
- **J** = (Phloem) fibers

**(10 × 2½ marks)**

**(Total 40 × 2½ = 100)**

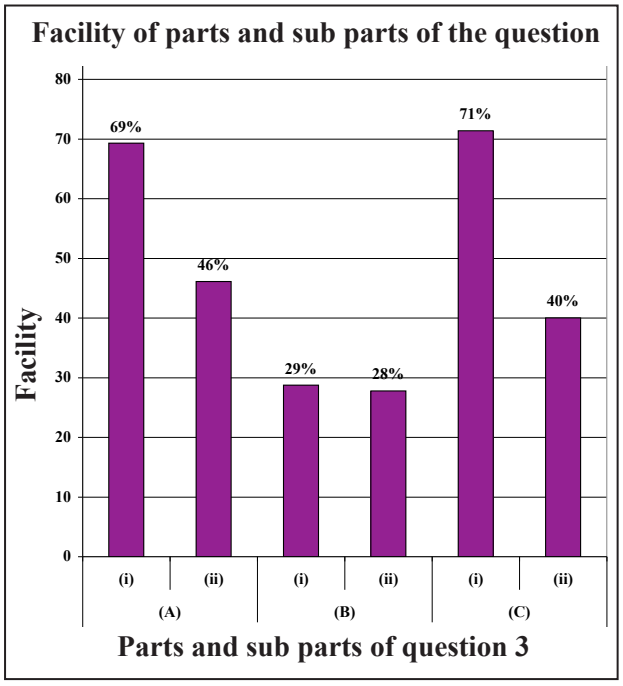
**Overall observations, conclusions and suggestions regarding the answers to question 3 :**




Although question 3 was compulsory, only 98% of candidates had answered. Marks allocated for this question is 100. The percentages of candidates scored within following four intervals are:

| | | | | | | |
|---|---|---|---|---|---|---|
| In | 00 | - | 25 | marks range | ⟶ | 26% |
| In | 26 | - | 50 | marks range | ⟶ | 36% |
| In | 51 | - | 75 | marks range | ⟶ | 31% |
| In | 76 | - | 100 | marks range | ⟶ | 7% |

While 7% of candidates scored 76 marks or more; 26% scored 25 marks or less. 36% of candidates had scored between 26 - 50 marks. 62% of candidates had scored 50 marks of less.




- Six sub parts were included in this question. The facility for all sub parts were below 72%. The sub parts having highest facility was *(C)* (i) and its value was 71%. *(B)* (ii) was the sub part possessed least facility, which was 28%.

3 (A) the facility was 69%. The ability of categorizing organisms according to a dichotomous key had been evaluated in this sub part.

In classifying organisms based on a dichotomous key;

- ⋆ Only external features of organisms should taken into consideration
- ⋆ each step should be given two alternative statements.
- ⋆ The organism explained by the statement should be mentioned in front of each
- ⋆ or the number of next step which guides to identify organisms should be mentioned.
- ⋆ There are some features should not mention in the preparation of a dichotomous key.

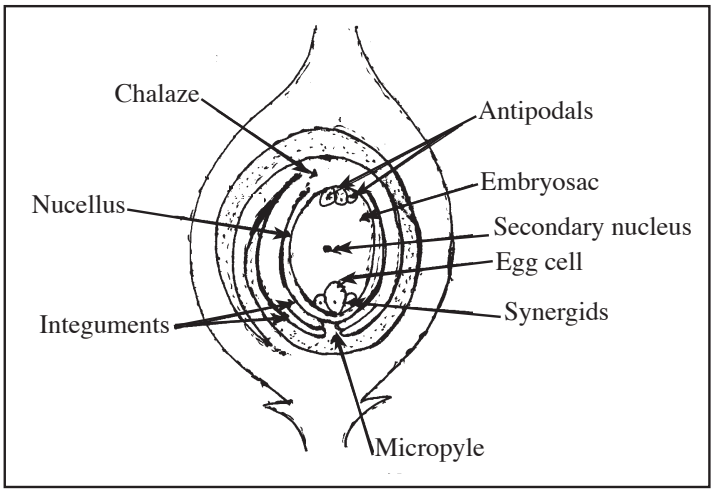
eg:-
- The body colour of organism (may alter according to sexuality)
- The body size (may alter according to sexualicity and maturity)
- Habital

Candidates should possess skills to prepare dichotomous keys based on above criteria.

3 (A) (ii) sub parts has a facility of 46%. Identification of animal class according to external features was evaluated in this sub part. The features of animal phyla and classes mentioned in the teacher's manual also should be studied well for this question.

3 (B) (i) and (ii) sub parts possessed a facility of 29% and 28% respectively. The ability of the candidate to differentiate the parts of a matured ovule of an Anthophyte seed has been examined in this part.

Following is a vertical section diagram of an Anthophyte ovule.




(C) (i) and (ii) sub parts had a facility of 71% and 40% respectively. In these sub parts, identification and naming the Anthophytic complex tissue had to be done. Though most candidates named the two basic tissues, they were unable to answer (C) (ii) sub part in which the ability to identify the detail structural features were measured.

## Question 4

**04. (A) (i) What is an ecosystem?**

- Functional / dynamic unit
- comprising of all living organisms in a community and the abiotic environment that interacts with them **(2 × 2½ marks)**

**(ii) What are the major biotic components of an ecosystem?**

- Primary producers
- Consumers
- Detritivores / decomposers **(3 × 2½ marks)**

**(iii) How are the biotic components of an ecosystem connected with each other?**

- Through feeding
- and energy transfer **(2 × 2½ marks)**

**(iv) Define "ecological niche"**

- Role of an organism in the ecosystem / environment **(1 × 2½ marks)**

**(v) (a) What is meant by gross primary productivity of an ecosystem?**

- Total amount of light energy converted to chemical energy by primary producers within a unit area, within a unit time/per unit time

**(1 × 2½ marks)**

**(b) State the main primary producer of each of the following ecosystem**

| **Ocean** | **Phytoplankton** |
|---|---|
| • Villu | Grass |
| • Patana | Grass |

**(3 × 2½ marks)**

**(B) (i) Explain what is a biome?**

- Widely spread,
- major ecosystems of the world
- classified according to predominant vegetation
- and characterized by regional climatic conditions
- and adaptations of organisms to that particular environment **(5 × 2½ marks)**

**(ii) What are the three main terrestrial biomes in the tropics?**

- Tropical forests
- Deserts
- Savanna **(3 × 2½ marks)**

**(iii) What is the largest terrestrial biome?**

- Taiga / Coniferous forests **(1 × 2½ marks)**

**(iv) What is a keystone species?**

- A species that plays an important role in the stability
- and functioning of an ecosystem.
- If removed system may collapse **(3 × 2½ marks)**

**(v) Explain the concept of flagship species.**

- Publicity is given to few key species which will help to conserve the entire ecosystem (and organisms contained in it **(1 × 2½ marks)**

**(C) (i) What is global warming?**

- Increase of average temperature of the atmosphere **(1 × 2½ marks)**

**(ii) (a) Name five atmospheric gases that contribute to global warming.**

- Carbon dioxide / $CO_2$
- Oxides of nitrogen / $N_2O$ / $NO_2$ / NO / $NO_x$
- Methane / $CH_4$
- Water vapor
- Ozone / $O_3$ **(5 × 2½ marks)**

**(b) Explain how the gases stated in (a) above contribute to global warming.**

- Prevent part of the solar radiation that reaches earth surface being radiated back (to the space) **(1 × 2½ marks)**

**(iii) Explain what is an invasive species.**

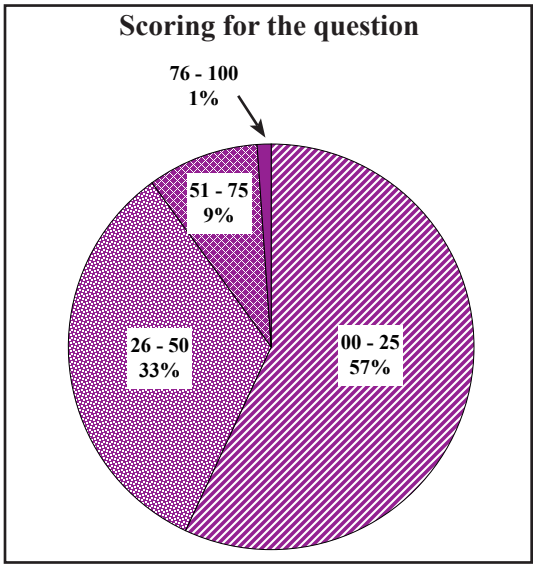
- Non- native species which can spread beyond its introduction site
- and become established in new sites
- where it may cause deleterious effects on local biodiversity. **(3 × 2½ marks)**

**(iv) Explain how agriculture contribute to biodiversity loss**

- Use of few species/varieties (of plants and animals),
- displacement of traditional varieties/breeds/ species
- result in genetic erosion / loss of genetic diversity/ loss of genetic resources
- Habitat loss
- resulting in loss of ecosystem diversity **(5 × 2½ marks)**

**(Total 40 × 2½ = 100)**

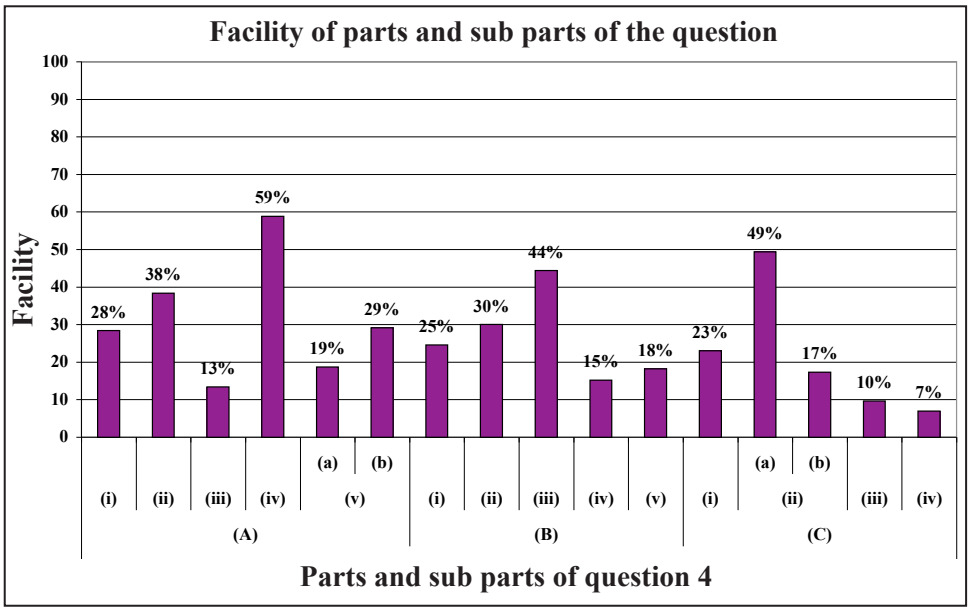
**Overall observations, conclusions and suggestions regarding the answers to question 4 :**




Although question 4 was compulsory, only 99% had answered to this. The allocated mark for this question was 100. Following percentages of candidates had scored within four intervals are:

| | | | | | | |
|---|---|---|---|---|---|---|
| In | 00 | - | 25 | marks range | ⟶ | 57% |
| In | 26 | - | 50 | marks range | ⟶ | 33% |
| In | 51 | - | 75 | marks range | ⟶ | 9% |
| In | 76 | - | 100 | marks range | ⟶ | 1% |

1% of candidates had scored 76 or more marks while 57% had scored 25 marks or less. 33% of candidates had scored between 26-50 the candidate percentage scored 50 or below 50 was 90%.




★ 16 sub parts were included in this question and only one sub part possessed a facility higher than 50%. The facility of it is 59%. *(C)* (iv) was the sub part having least facility as 7%.

4 (A) (i), (ii), (iii) and (iv) sub parts possessed a facility of 28%, 38%, 13% and 59%. Specific facts regarding ecosystems and their components were asked which were knowledge based in these questions.

Though these questions were easy, most candidates avoided answering, hence the overall facility of those were low. The reason to this condition is low attention of candidates to last few units of the syllabus.

4 (A) (v) (a) and (b) sub parts also possessed a low facility as 19% and 29% respectively. According to the way of asked, the primary producers of different ecosystems are different from each other.

| | | | |
|---|---|---|---|
| Example :- | Ocean | - | Phytoplanktons |
| | Villus and Pathana | - | grasses |
| | Forests | - | green plants |
| | Shallow pond | - | aquatic plants |

(B) (i), (ii) and (iii) sub parts had a facility of 25%, 30% and 44%. Defining the "biome", and major biomes of world were asked in these questions.

When name the major biomes of the tropical region it had mentioned as "tropical forests", "deserts" and "savana". They couldn't score in these questions because "tropical rain forests" was mentioned instead of "forests". The largest terrestrial biome of the world is Taiga or coniferous forests. It is a temperate biome. Due to heavy snow in winter they have gained a cone shaped crown to prevent accumulation of snow as an adaptation. Hence conifers have become dominant in this biome.

(B) (iv) and (v) questions possessed a facility of 15% and 18% respectively. The knowledge of students was examined regarding keystone species and flagship species to indicate the environmental significance. This ensured that the knowledge of candidates was low about specific environmental concepts. Instead on explaining the flagship species concept, candidates had defined it.

(C) (i) and (ii) (a) and (b) sub parts possessed a facility of 23%, 49% and 17% respectively. "Global warming" means "rise of normal atmospheric temperature". In this question candidates had used terms such as "earth sphere"/ "earth" instead of the "atmosphere" and they hadn't mentioned "normal" which was the reason not to gain marks.

Some students were failed to state the types of gases contributes in global warming as mentioned in teacher manual.

(C) (iii) and (iv) sub parts had facility as 10% and 7%. Most candidates were failed to define "invasive species" in correct manner.

They were not able to score in (iv) question in which the contribution of agriculture in loss of Biodiversity was asked, because they hadn't a proper understanding about it.

According to above facts the 4th question had a low facility in which questions were given from the environmental biology unit.

## Part B - Essay

**Question 5**

**5. *(a)* Describe the basic chemical nature and general structure of proteins.**

**Chemical nature**

1. Proteins are complex organic compounds.
2. Contain elements C, H, O, N, and S.
3. Macromolecules/ molecules with high molecular weight.
4. Polymers of amino acids.
5. Peptide bonds connect amino acids,
6. forming polypeptide chains.
7. Around 20 amino acids are involved in making proteins.
8. Some proteins form complexes with metal ions Cu/ Iron/ Zn.
9. Different proteins have different sequences of amino acids / Each protein has a specific sequence of amino acids.
10. The sequence of amino acids in a protein is genetically controlled by the DNA (of the cell which it is manufactured) / determined by the base sequence of the DNA strand (which produces the corresponding m-RNA.)
11. The sequence of amino acids in a protein determines its (biological) function.

**General Structure**

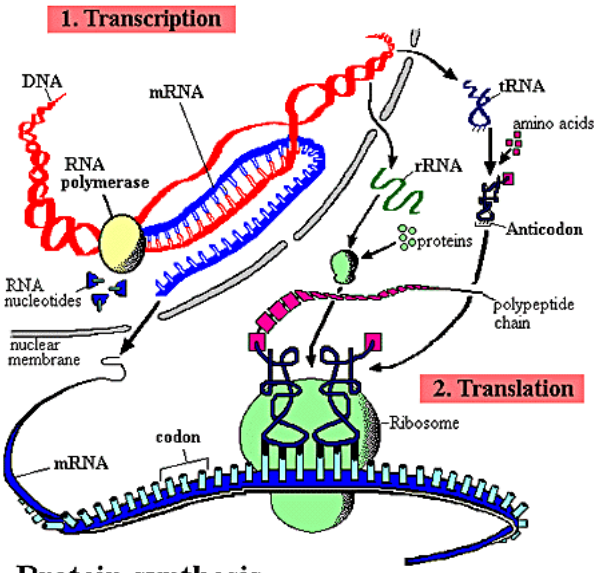
Described in 4 stages / 4 levels of organizations

12. Primary structure
13. Linear sequence of amino acids held together by peptide bonds / in a polypeptide chain.
14. Secondary structure
15. Spiral / Helical ( $\alpha$ -helix) structure
16. formed by hydrogen bonds
17. between adjacent COOH and $NH_2$ groups of amino acids.
18. ex. Keratin
19. Pleated sheet structure / $\beta$ pleated structure
20. Ex. Silk protein
21. Tertiary structure
22. Formed by bending and folding of polypeptide chains.
23. Produce globular shape / structure.
24. Stabilized by many types of bonds / ionic / hydrogen / disulfide bonds.

25. Quaternary structure
26. Globular structure
27. Formed by the aggregation of several polypeptide chains
28. by interaction of hydrogen and ionic bonds.
29. Ex. Haemoglobin

***(b)* Briefly discuss the specific roles of DNA and RNA in protein synthesis**

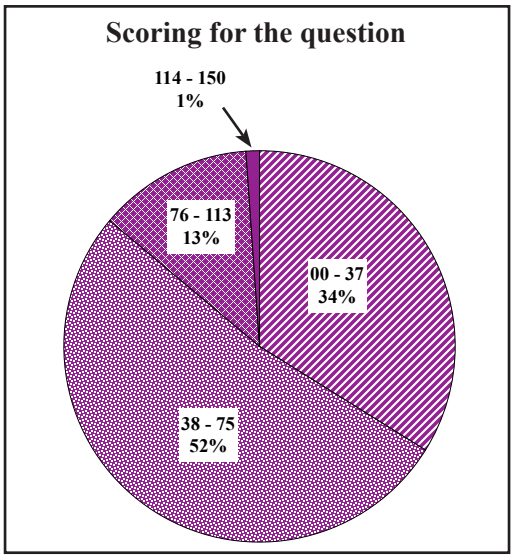
30. DNA carries the genetic information for synthesis of proteins
31. in the form of coded instruction in the (nucleotide) base sequence.
32. Double helix of DNA molecule opens up and
33. acts as a template
34. for the synthesis of m-RNA,
35. which contains (coded / triplet) instructions for synthesis of protein.
36. This is called transcription.
37. It is catalyzed by RNA - polymerase.
38. m-RNA moves in to the cytoplasm and attach to ribosome/ forms polyribosome.
39. Other types of RNA/ t-RNA, r-RNA, synthesized in the nucleus
40. move out in to the cytoplasm.
41. r-RNA reads the m-RNA/ helps to assemble the amino acids/ polypeptide with amino acids.
42. t-RNA brings amino acids to the ribosome/ small unit of the ribosome.
43. Each t- RNA carries a specific amino acid.
44. Ribosome moves along m-RNA,
45. translates the coded massage in the triplet base in mRNA
46. in to a specific sequence of amino acids brought by t-RNA
47. recognized by the anticodon of t-RNA.
48. m-RNA contains a triplet code (AUG) for methionine
49. which functions as a starter/ start codon.
50. Several other codons (UAA, UAG. UGA) act as terminator/stop codon for ending protein synthesis.




**Protein synthesis**

**(50 × 3 = 150)**

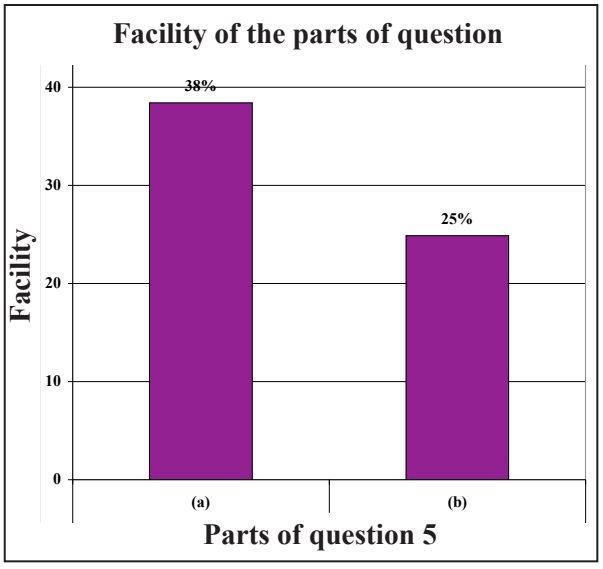
**Overall observations, conclusions, and suggestions regarding the answers to question 5:**




78% of candidates had answered 5th question. Allocated marks for question 5 was 150. Following percentages of candidates had scored within four intervals are:

| | | | | | | |
|---|---|---|---|---|---|---|
| In | 00 | - | 37 | marks range | ⟶ | 34% |
| In | 38 | - | 75 | marks range | ⟶ | 52% |
| In | 75 | - | 113 | marks range | ⟶ | 13% |
| In | 114 | - | 150 | marks range | ⟶ | 1% |

14% of candidates had scored 76 marks or above.
86% of candidates has scored 75 marks or less.




⋆ Two sub parts were included in this question and the facility of both parts were bellow 40%. The sub parts possess higher facility was part *(a)* in which facility was 38% part *(b)* possessed a lesser facility of 25%.

5th question consist of two sub parts as *(a)* and *(b)*. The facility was 38% for part *(a)* in which the basic chemical nature and general structure of proteins had to be described. Part *(b)* asked to discuss briefly, the specific roles of DNA and RNA in protein synthesis and it has a facility of 25%.

The percentage of students scored than 50% in this question was 14%. Highest marks range was between 50 - 60 for this question.

In sub part *(a)* - some common weaknesses could be identified.

- No use of correct terms
- Terms such as primary proteins secondary proteins etc. had been used instead of primary structure, secondary structure as organizational levels of proteins by most candidates.
- They had not used correct examples for proteins.
  - examples for helical and pleted proteins were mentioned being exchanged.
- Most candidates had not understand that some protein make complexes with mineral ions when describe the chemical nature of proteins.

In sub part *(b)* - the role of DNA and RNA in protein synthesis had to describe. Providing incomplete answers caused to low facility. Very important facts included in marking scheme were missed by them and incorrectly compared answers were given. That was a common weakness.

- Though AUG was written as initial cadon, representation of methionine by it was not mentioned.
- It seems that most candidates haven't gained a proper understanding about reaching of all RNA types to the cytoplasm being synthesized within the nucleus.

**Question 6**

**6. *(a)* Describe the location of the human kidney.**

1. In the abdominal cavity,
2. close to posterior wall,
3. below the diaphragm,
4. rectoperitonial (cavity)
5. on either side of the vertebral column,
6. between thoracic and lumber vertebrae.
7. Left kidney slightly above the right kidney.

***(b)* Briefly describe the microscopic structure of a typical human nephron.**

8. Tubule closed at one end and opened at other end.
9. Single layered.

Consists of

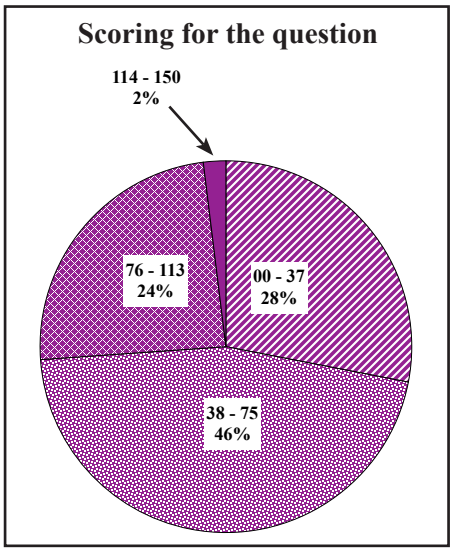
10. Bowman's capsule
11. Proximal convoluted tubule
12. Descending limb of loop of Henle
13. Ascending limb of loop of Henle
14. Distal convoluted tubule
15. Bowman's capsule is cup shaped and
16. consists of inner wall
17. made up of Specialized cells/ Podocytes and
18. outer wall
19. made up of squamous epithelial cells and
20. capsular space.
21. Proximal convoluted tubule is (Irregularly) coiled;
22. Made up of cuboidal epithelial cells
23. with (many) microvilli / projection / brush boarder
24. facing the lumen.
25. Descending limb of loop of Henle is straight;
26. Made up of squamous epithelial cells.
27. Ascending limb of loop of Henle is straight;
28. Made up of cuboidal epithelial cells.
29. Distal convoluted tubule is (Irregularly) coiled;
30. Made up of cuboidal epithelial cells
31. with (few) microvilli / projection / brush boarder
32. facing the lumen.

***(c)*** **Briefly explain how human kidney regulates blood osmatic pressure**

33. When osmotic pressure is increased
34. it is sensed by Osmoreseptors
35. in the Hypothalamus
36. which stimulates posterior pituitary
37. to release ADH.
38. ADH acts on Distal convoluted tubule and
39. collecting duct
40. making them permeable to water;
41. Results in reabsorption of water
42. producing hypertonic/ concentrated urine.
43. Osmotic pressure restored to normal level.
44. Mechanism stops/ negative feed back mechanism.
45. When osmotic pressure falls
46. no stimulations of osmoreseptors;
47. No release of ADH;
48. No reabsorption of water in
49. distal convoluted tubule and
50. collecting duct;
51. Produce hypotonic/ dilute urine.
52. Osmotic pressure restored to normal level.

***(Any 50 × 3 = 150 marks)***

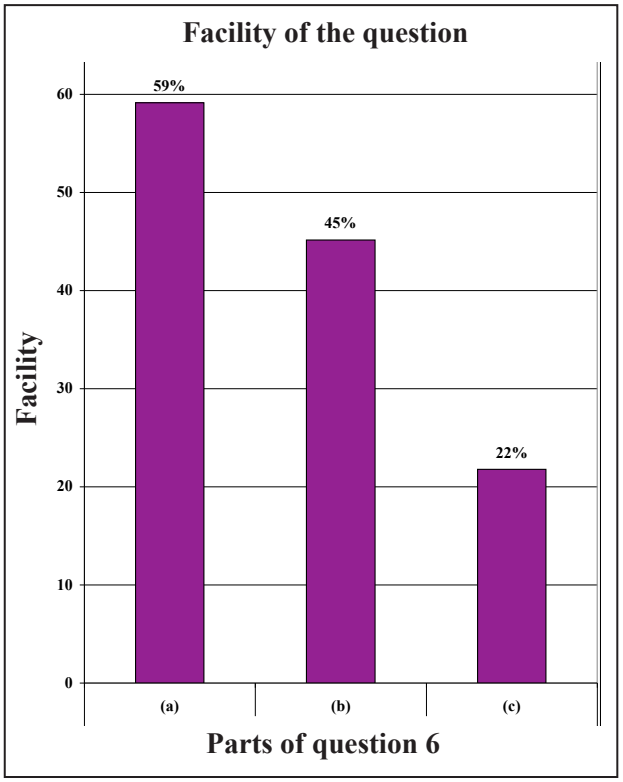
**Overall observations, conclusions and suggestions regarding the answers to question 6 :**




87% of candidates had answered 6th question. Marks Allocated for this is 150. The percentage of candidates scored within four intervals were as following:

| | | | | | |
|---|---|---|---|---|---|
| In | 00 | - 37 | marks range | ⟶ | 28% |
| In | 38 | - 75 | marks range | ⟶ | 46% |
| In | 75 | - 113 | marks range | ⟶ | 24% |
| In | 114 | - 150 | marks range | ⟶ | 2% |

26% of candidates scored 76 marks or over 76 and 46% of candidates scored between 38 - 75 marks. 28% of candidates scored below 37 marks for this question.




⋆ There sub parts were included in this question and the facility was below 60% for all three parts. *(a)* was the sub part possessed highest facility and it was 59%. Sub part having lowest facility was *(c)* and had a facility of 22%.

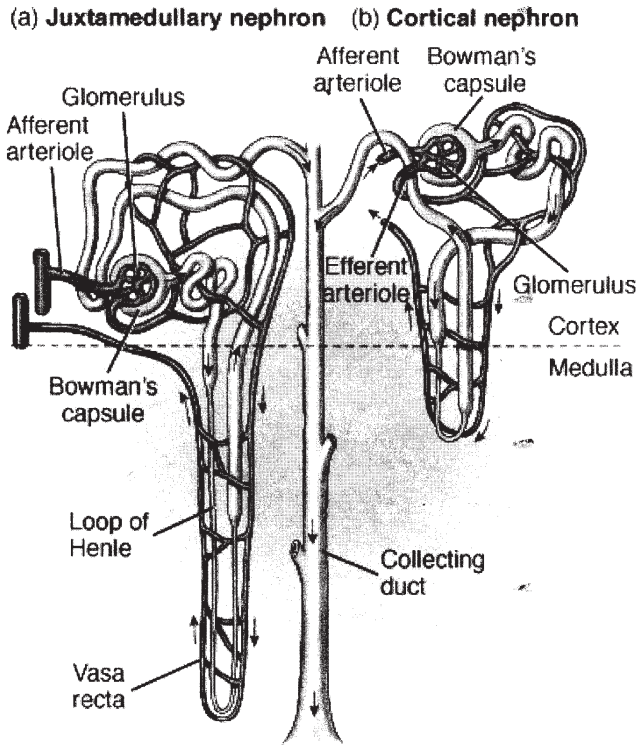
26% of candidates scored higher than 76% in this question.

(a) facility of this sub part was 59%. Though this was the easiest part, due to carelessness of candidates in using terms less achievement level could be seen.

(b) the facility of this sub part was 45%. Few reasons for this low facility could be identified. Facts that should be understood by students are;

- A nephrone is a tubule having opened and closed ends.
- Presence of podocytes on the inner wall of bowman's capsule
- Bowmen's capsule as a hollow structure.
- Presence of micro villi on the cuboidal cells of distal convoluted tubule also.

(c) the facility of this part was 22%. Due to wrong answer about the activity of ADH the facility index was low. Writing "increase the permeability to water" instead of "ADH acts on distal convoluted tubule and collecting duct and make them permeable to water" was one example. Most of the candidates had not mention that the "action of ADH is a negative feed back mechanism". They had presented facts regarding increase and decrease of osmotic pressure being interchanged.



**Question 7**

**7. (*a*) Describe Briefly the nature and distribution of microorganisms in soil.**

1. bacteria
2. fungi
3. algae
4. virus
5. They belong to different genera/ species.
6. Soil provides a suitable chemical environment and
7. a suitable physical environment (for microbial growth.)
8. The number of microorganisms present depends on the soil environment.
9. In the fertile soil bacteria dominates soil microorganisms.
10. Microorganisms use minerals/ mineral nutrients,
11. (decomposing) organic material,
12. gases $CO_2$ / $O_2$ / $N_2$
13. Water in soil for their growth.
14. More microorganisms are found on surface layers of soil / deeper layers contains less microorganisms
15. due to availability of oxygen.

***any 13 × 4 = 52 marks***

***Maximum 50 marks***

***(b)* Discuss the specific role of microorganisms in the natural cycling of carbon and nitrogen in the biosphere.**

In the natural carbon cycle element carbon is cycled in different forms in the environment through living organisms.

1. $CO_2$ in the environment (aquatic and terrestrial) is fixed
2. by chemoautotrophic/ photosynthetic bacteria
3. such as cyanobacteria and
4. Algae
5. by / photosynthesis
6. Dead plant and animal bodies are decomposed by heterotrophic bacteria
7. and fungi
8. and $CO_2$ is released (to the environment)
9. through respiration of microorganisms.

In the natural cycle of nitrogen, element nitrogen is cycled in different forms trough atmosphere, living organisms aquatic and terrestrial environments.

10. soil microorganisms
11. such as *Azotobactor* and
12. *Rhizobium*
13. fix (gaseous) nitrogen
14. in to nitrogenous compounds / protein / $NH_4^+$
15. Decomposition of protein/ organic matter in dead organisms.
16. by heterotrophic microorganisms/ bacteria and fungi
17. produce amino acids (proteolysis) which
18. are converted to $NH_4^+$ (ammonification)
19. Ammonium ions are then converted to nitrite
20. by *Nitrosomonas*.
21. Nitrite is converted to nitrate
22. by *Nitrobactor*.
23. *some nitrates are converted to gaseous nitrogen*
24. by denitrifying bacteria/ *Pseudomonas sp*.

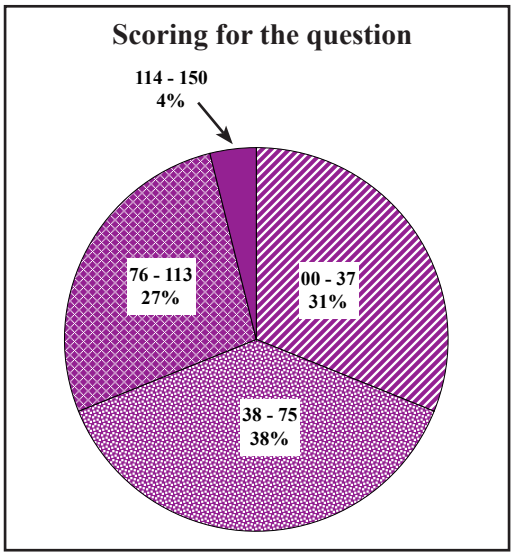
***any 20 × 4 = 80 marks***

***(c)*** **State the significances of interactions of soil microorganisms relevant to plat growth.**

1. Microorganisms are involved in the formation of soil aggregates
2. Symbiotic nitrogen fixation.
3. Mycrorhiza association between roots and fungi improve phosphate nutrition
4. Root surface (rhizosphere) microorganisms produce growth promoting substances and
5. chemicals that inhibit the growth of plant pathogenic bacteria

***any 05 × 4 = 20 marks***

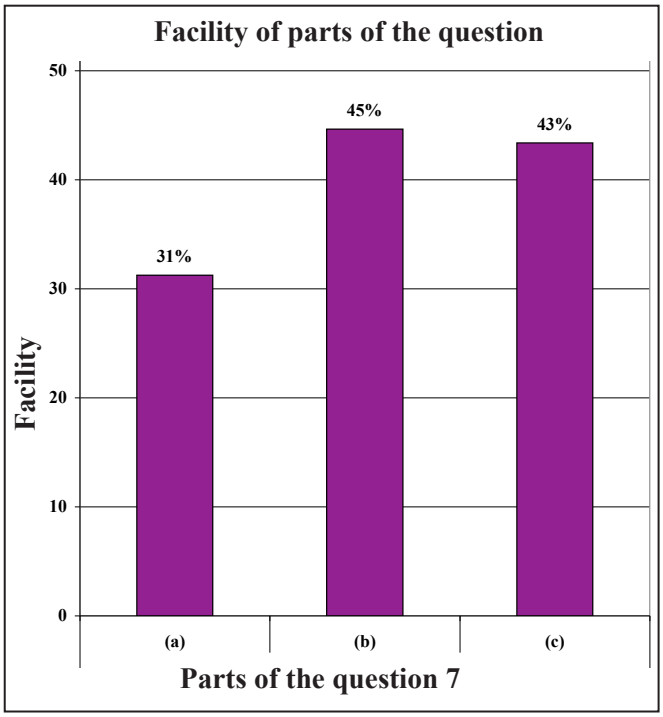
**Overall observations, conclusions and suggestions regarding the answers to question 7 :**




68% of candidates had answered 7th question. Allocated marks for question 07 was 150. The percentage of candidates scored within four intervals were as following:

| | | | | | | |
|---|---|---|---|---|---|---|
| In | 00 | - | 37 | marks range | ⟶ | 31% |
| In | 38 | - | 75 | marks range | ⟶ | 38% |
| In | 75 | - | 113 | marks range | ⟶ | 27% |
| In | 114 | - | 150 | marks range | ⟶ | 4% |

The number of candidates scored 76 marks or more is 31% while 78% of candidates scored between 38 - 75 marks.




★ Three sub parts were included in this question and the facility of all parts were below 45%. Part *(b)* was the sub part having highest facility and it was 45%. Part *(a)* is the sub part having least facility and its value is 31%.

Though 68% of candidates had selected this question, facility is low because candidates hadn't a perfect understanding about the facts of question.

(a) part possesses a facility of 31%. Because of candidates could not understand properly about the nature of micro-organisms some facts were missed in their answers. Most candidates mentioned the names of organisms only. But when microbes are explained;

- ⋆ The chemical and physical nature of the habitats of them.
- ⋆ The factors cause to the abundancy of them.

example :- candidates were failed to state about mineral nutrients. Organic matter, $CO_2$ , $N_2$ , $O_2$ depth of soil

(b) the facility was 45%. Due to errors in writing the scientific names of micro-organisms facility index was low. Most candidates presented carbon and nitrogen cycles using flow diagrams only. Candidates should understand that is not the correct way of answering an essay question.

(c) the facility of this part is 43%. Though candidates wrote the significances of interactions asked, they hadn't mention about the interactions between microbes and plants.

example :- though they wrote as "$N_2$ fixation" it was not written as "symbiotic $N_2$ fixation" which was the expected answers. It caused a low facility index.

**Question 8**

**8. (*a*) What are the general characteristics of plant growth substance?**

1. Organic compounds/chemicals
2. that act in small concentrations.
3. and affect / stimulate physiological processes of plants. ***3 × 04 = 12 marks***

***(b)*** **State the major types of plant growth substance and sites of their production in plants.**

1. Auxins
2. Stem apices / apical meristem
3. Young leaves
4. Gibberellins
5. Root / Shoot tips
6. Young leaves
7. Germinating seeds
8. Cytokinins
9. Root apices / apical meristem
10. dividing cells of many tissues
11. Ethelene
12. Parenchyma cells of tissues
13. (Ripening) fruits

14. Abscisic Acid
15. Root caps
16. Immature seeds

***16 × 04 = 64 marks***

***(c)*** **Explain how natural growth substance regulate growth and development of plants.**

**Auxins**

1. Elongation of cells
2. Maintain apical dominance
3. Regulate trophic movements
4. Induce cambial activity
5. Inhibit leaf abscission
6. Induce root growth
7. Induce growth of fruit

**Cytokinins**

8. Stimulate/ induce cell division (interacting with Auxin)
9. Promote shoot growth
10. Inhibit apical dominance
11. Delay leaf senescence (Aging)

**Gibberellins**

12. (Promote) elongation of stem
13. Activate enzymes in seed germination

**Abscisic Acid**

14. Inhibits seed germination / (control) seed dormancy
15. Closure of stomata
16. Inhibition of bud growth
17. Inhibition of cambial activity of plants (in temperate countries)

**Ethylene**

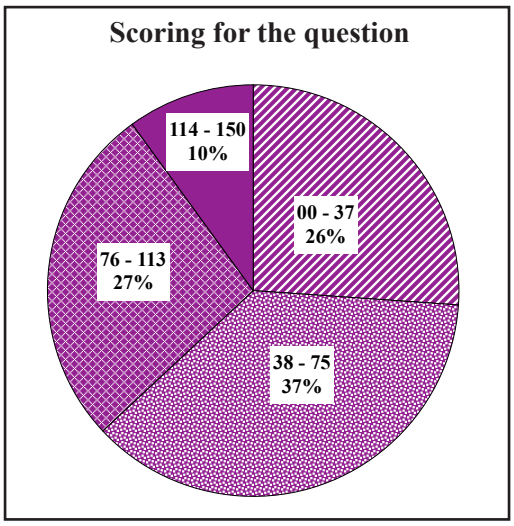
18. Helps in stem elongation
19. Induces ripening of fruit
20. Induces flowering (in some plants)
21. Controls abscission of leaves /flowers/ fruits

***any 19 × 04 = 76 marks***

***12 + 64 + 76 = 152 marks***

***Maximum 150 marks***

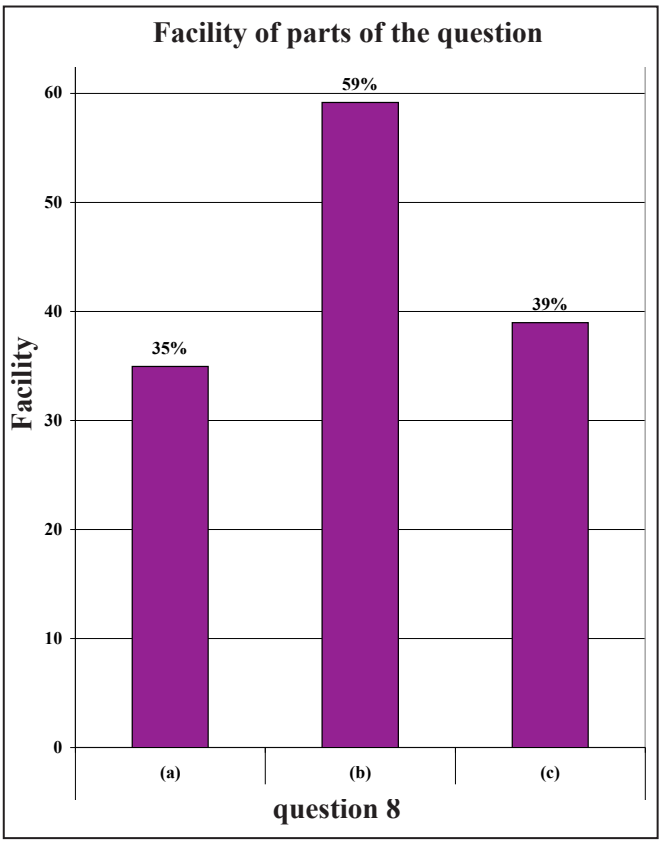
**Overall observations, conclusions and suggestions regarding the answers to question 8 :**




59% of candidates had answered 8th question. Allocated marks for this question was 150. The percentage of candidates scored within four intervals were as following:

In 00 - 37 marks range ⟶ 26%
In 38 - 75 marks range ⟶ 37%
In 75 - 113 marks range ⟶ 27%
In 114 - 150 marks range ⟶ 10%

37% of candidates scored 76 marks or more 37% of candidates scored between 38 - 75 marks.




⋆ Three sub parts were included in this question. Sub part having a highest facility was *(b)* and its facility is 59%. The sub part having lowest facility is *(a)* in which facility was 35%.

This was a knowledge based question. 59% of candidates had answered this question. 37% of candidates scored than 76 marks 37% of candidates scored between 38 - 75 marks.

(a) the facility is 35%. The reason was inability of candidates to express the general features of plant growth substances correctly.

(b) the facility of this part was 59%. The content given in teachers manual is sufficient regarding this part. Therefore, the facility index would be higher than this value if candidates could confirm subject matter properly.

(c) the facility of this part was 39%. Inability of candidates to mention the correct term in correct place when writing the actions of plant growth sunstances low facility was given. And they were failed to compare the action of each growth substance properly.

example :- Instead of "Induction of root growth", "Stimulation of root growth" was mentioned

**Question 9**

**9.** ***(a)*** **What are the for main forest ecosystems in Sri Lanka?**

1. Tropical rain forests
2. Dry mixed evergreen forests
3. Montain forests
4. Thorn forests / shrubs

***(b)*** **Describe the main features of each of these ecosystems with reference to their distribution, rainfall and characteristics of vegetation.**

**Tropical rain forests**

5. Present in the South – Western region
6. Low to mid elevation/ sea level to 1200m
7. Rainfall 2500-5000 mm per Year (or more)
8. Rainfall throughout the year
9. Very high rainfall in May to August and November - December
10. Stratification
11. Emergent trees
12. Canopy
13. Sub canopy
14. Shrubs
15. Herbaceous Plants

16. Plants evergreen
17. Epiphytes
18. Woody climbers/ Lianas are present
19. High endemism

**Dry mixed evergreen forests**

20. Present in the Dry Zone
21. Rainfall 1250 – 1900 mm/year
22. Dry period from May to August
23. No (marked) stratification
24. Trees
25. Shrubs
26. Ground layer / grasses and
27. Climbers (frequent) are present

**Montain forests**

28. In the central massif / high elevation
29. Rainfall 2500- 4000 mm per year / more than 4000 mm per year
30. Trees short
31. with twisted trunks
32. gnarled and
33. covered with lichens / mosses.

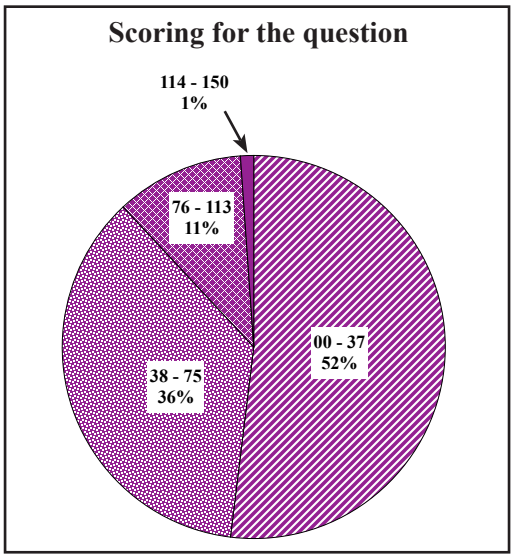
**Thorn forests**

34. In Arid zone
35. In the North West and
36. South - East regions
37. Rainfall <1250 mm / year
38. Drought period from May to September
39. Thorny shrubs
40. with xerophytic characters / fleshy leaves
41. Some trees present
42. which are stunted

***any 38 × 04 = 152 marks***

***Maximum 150 marks***

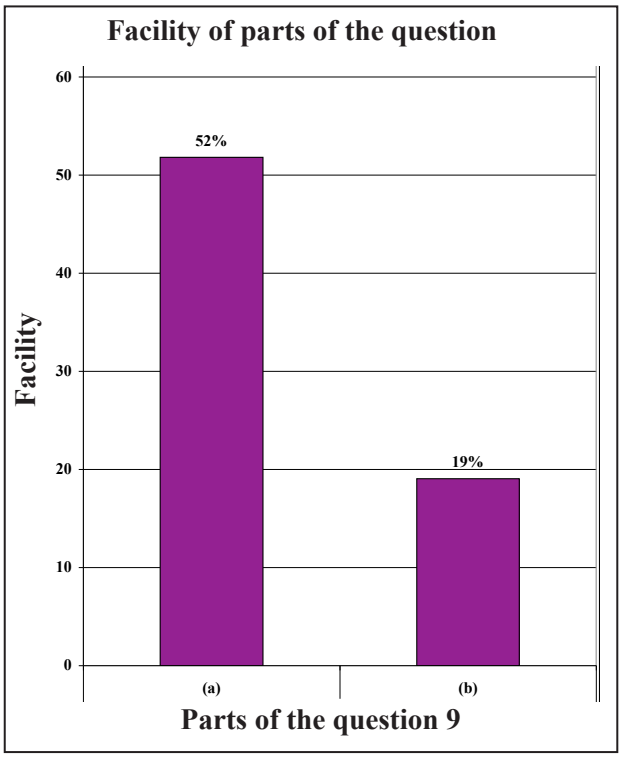
**Overall observations, conclusions and suggestions regarding the answers to question 9:**




31% of candidates had answered 9th question. Allocated marks for question 09 was 150. Percentage of candidates scored within four intervals were as following:

In 00 - 37 marks range ⟶ 52%
In 38 - 75 marks range ⟶ 36%
In 75 - 113 marks range ⟶ 11%
In 114 - 150 marks range ⟶ 1%

12% of candidates scored 76 marks or more; while 36% scored between 38 - 75 marks.




★ There are two sub parts in this question. Sub part *(a)* possessed the highest facility and it was 52%. Sub part *(b)* had a facility of 19% which was lowest.

This question consists of two sub parts as (a) and (b). Only 31% of candidates had selected this sub part.

This question was based on the unit "Environmental Biology", one of last units of the syllabus. The cause to low selection might be incomplete coverage of the syllabus.

(a) the facility was 52%. Because of candidates did not write the names of forest in correct manner, a low facility was given.

example :- writing "monsoon forest" instead of dry mixed evergreen forests".

(b) the facility was 19%. Candidates were unable to score because they hadn't mention the forest type had not given other information correctly. They hadn't mentioned;

- ⋆ values of rainfall
- ⋆ period of gaining rain
- ⋆ areas related in correct manner.

**Question 10**

**10. Write short notes on the following**

***(a)*** **Human pancreas**

1. Located in the abdominal cavity
2. in the curve of duodenum.
3. Consists of head , body and (narrow) tail.
4. Both exocrine and endocrine gland;
5. exocrine part made up of lobules;
6. each lobule is formed of number of small alveoli
7. consisting of acini cells/ secretory cells,
8. which secretes pancreatic juice,
9. consisting of water,
10. mineral salts and
11. enzymes.
12. Enzymes are amylase
13. lipase,
14. trypsinogen /trypsin
15. chymotrypsinogen/ chymotrypsin
16. nucleases and

17. carboxypeptidase/peptidase.
18. Lobules are drained by small ducts
19. which unite to form pancreatic duct.
20. Endocrine part is the Islets of Langerhans
21. formed of $\alpha$ and $\beta$ cells.
22. $\alpha$ cells secrete glucogan.
23. $\beta$ cells secrete insulin.

### *(b)* Biodiversity hotspots

24. The areas with high concentration of endemic species
25. facing exceptional/ high levels of threats/ under threats.
26. There are 25 biodiversity hotspots in the world
27. eg: Western Ghats of India and
28. (fragmented) rain forests of southwest of Sri Lanka

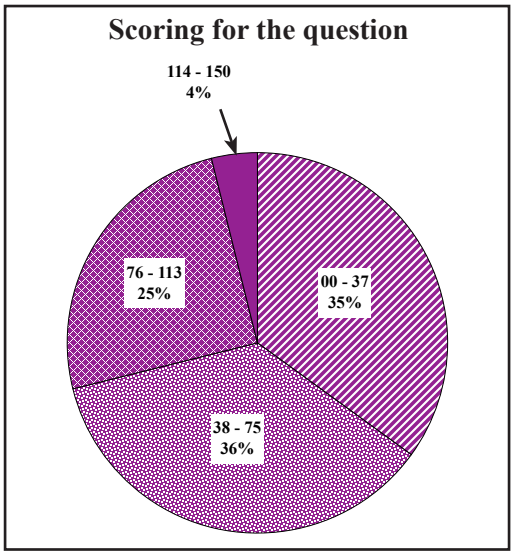
### *(c)* Mechanism of stomatal closure and opening

29. Starch sugar conversion hypothesis
30. During photosynthesis
31. $CO_2$ concentration decrease in guard cells
32. raising pH in guard cells.
33. Hydrolysis of starch to sugar (by enzymes)
34. increase solute potential and
35. decrease water potential in guard cells.
36. Water enters in to guard cells
37. from surrounding epidermal cells
38. by osmosis.
39. Increase in turgor causes opening of stomata.
40. At night reverse action occurs and close stomata.
41. $K^+$ intake /$K^+$ influx hypothesis
42. In the presence of light
43. active intake of $K^+$ into guard cells.
44. increases solute potential and
45. decreases water potential in guard cells.
46. Water enters in to guard cells (from surrounding epidermal cells)
47. by osmosis.
48. Increase in turgor causes opening of stomata.

49. Exit of $K^+$ from guard cells at night closes stomata.
50. Closure of stomata under water stress condition.
51. Occurs due to Abscisic acid

***any 50 × 3 = 150 marks***

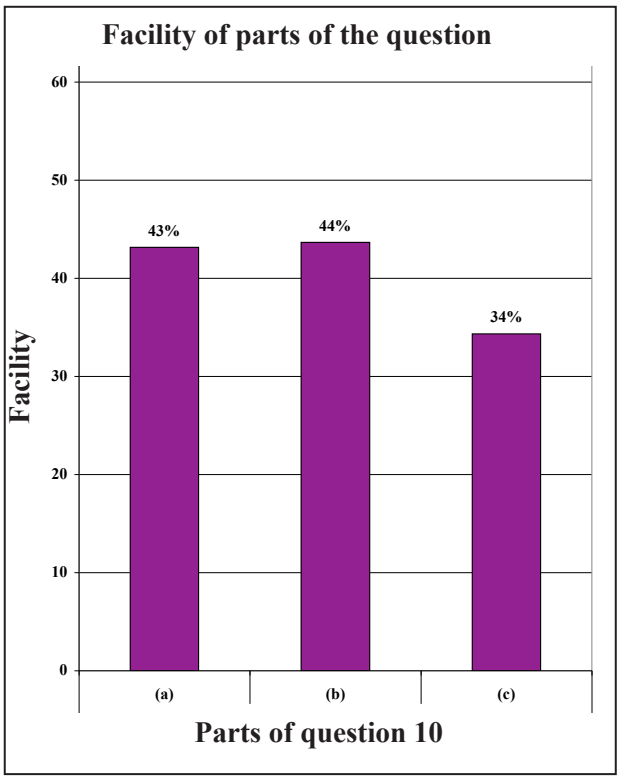
**Overall observations, conclusions and suggestions regarding the answers to question 10 :**




62% of candidates had answered 10th question. Allocated marks for this question was 150. Percentage of candidates scored within four intervals were as following:

| | | | | | | |
|---|---|---|---|---|---|---|
| In | 00 | - | 37 | marks range | ⟶ | 35% |
| In | 38 | - | 75 | marks range | ⟶ | 36% |
| In | 75 | - | 113 | marks range | ⟶ | 25% |
| In | 114 | - | 150 | marks range | ⟶ | 4% |

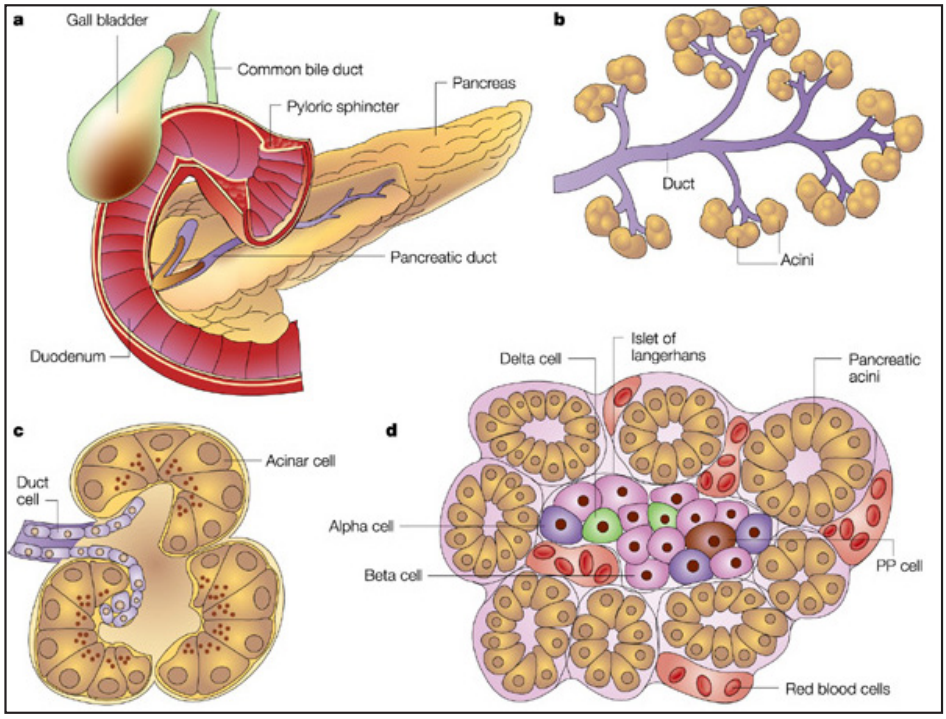
29% of candidates scored 76 marks or more; 36% of candidates scored between 38 - 75 marks.




★ Three sub parts were included in this question. Sub part *(b)* possessed a facility of 44% which was the highest. The lest facility was 34% which of the sub part *(c)*.

This question was selected by 62% of candidates 29% of candidates scored 76 marks or more. 36% of candidates scored between 38 - 75. Those who selected this question as their last question, they could not able to answer properly due to poor time management.

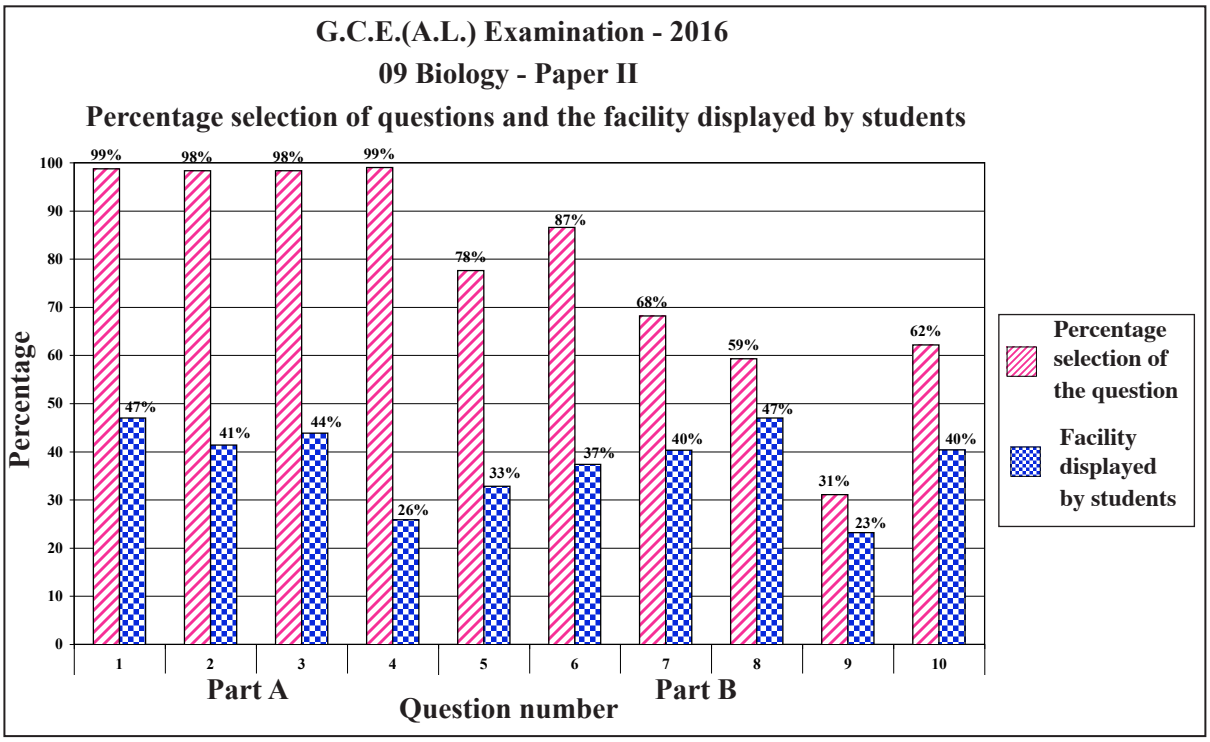
The facility of part (a) was 43%. Though location of pancreas was mentioned correctly, the structure was not explained properly. Candidates were failed to write all ingredients of pancreatic juice. It caused to low facility.




(b) the facility of this part is 44%. Candidates were unable to score because they didn't give answers according to the syllabus.

(c) the facility of this part is 34%. Some candidates didn't explain this mechanism orderly. It caused to low facility of this part. Students should understand that the sequential order is important when explain a mechanism.

### 2.2.3. Overall observations, Conclusions and suggestions regarding the answers to Paper II.




The highest facility 47% was shown for question 01 of part A, compulsory four structured essay questions. Of the part B, essay questions the highest facility was 47% which was for 8$^{th}$ question. But highest selection of Part B was 6$^{th}$ question. The facility of that question was 37%.

According to overall analysis, a facility lower than 48% was gained for all essay questions. It indicates a common weakness in answering to essay questions. Therefore students should be guided to answer more essay questions.

# Part III

## 3. Factors to be considered when answering questions and suggestions:

### 3.1 Factors to be considered when answering :

**Common instructions:**

- Basic instructions of the paper should be read and understood well. Attention should be given to the number of questions that must be answered from each part, what the compulsory questions are, allocated time for the paper and the questions should be read well to have a clear understanding before selecting the questions to answer.
- Index number of the candidate should be written on each page on the relevant place.
- Write the number of the questions and sub-numbers correctly.
- Depending on the way the question is asked, facts should be presented logically and analytically.
- When a definite short answer is to write, one should not include lengthy details and similarly, when detailed descriptions are to be given, one should not provide short answers.
- One should write answers with correct and clear hand writing
- When answering questions in Paper I, one answer which is more appropriate or correct should be selected and it should be marked with clearly on the answer sheet using one cross (X mark).
- In paper II, Part A, when answering the questions in structured essay paper, it is necessary to make sure that all 4 questions are answered with proper time management. Each sub-parts coming under main question should be read well and only the relevant, targeted answer for each sub-part should be written.
- In Paper II, Part B - when answering essay question paper, it is necessary to make sure that the required number of questions only are answered with correct management of time allocated for Part B.
- In Paper II, when answering the questions of Part B, answers written for each main question should be started in a new page.
- Answers should be written either in blue or black color; other colors should not be used to write answers.

**Special instructions:**

- Read the questions and understand well.
- After understanding, spend some time to collect the facts to write.
- Make sure to present the answer including all relevant facts in detail without writing irrelevant facts. If spent on writing irrelevant facts, time may not be sufficient to answer 4 essay questions which seemed to be a common difficulty encountered; this is the reason mostly for answering only 3 essay questions by students.
- Time management is important. Generally, 30 minutes should be spent for each essay question and about 15 minutes should be spent for a structured essay question.
- Skill of presenting a correct diagram with correct shape, in correct proportion should be improved to be used in describing structures.
- When presenting an answer glossary terms, used in the subject Biology, should be included at relevant places.
- When there is a calculation, each step should be written clearly to show how the final answer was obtained.
- Where necessary, correct standard units should be used.
- In presenting scientific names correct spellings should be written while following the international laws of nomenclature. Rules of binomial nomenclature such as underlining, when using hand writings, must be followed thoroughly.
- In places where chemical equation should be written, they should be presented as a balanced equation.
- When drawing graphs X and Y axis should be named correctly, units should be stated at required places and correct shape of the graph should be illustrated.
- In answering essay questions of the subject, Biology, answers should not be presented only by concise methods such as tables, flow diagrams and equations.
- When presenting answers to essay questions, facts should not be presented as separate points with numbers or asterisks. Answers should be written in essay form by separating paragraphs as required.
- Answers should not be presented using short symbols.

  Examples: "e" for electron,
  ( ↓ ) to show a decrease
  ( ↑ ) to show an increase
  RER for rough endoplasmic reticulum

### 3.2 Comments and suggestions on learning – teaching process :

- ⋆ Biology is a subject in which one should master theoretical as well as practical skills relevant for the subject and therefore, new syllabus for teaching Biology with competency based approach is presented. In a science subject, the method of generating knowledge is the scientific method. Accordingly, experiments should be carried out to test the hypothesis developed in order to solve the problems identified, based on regular observations. Then the data should be analyzed to come to conclusions. Science subject like Biology is based on the theories discovered by these methods. Therefore, in order to maintain productivity of subject proficiency at a higher level, it is necessary to teach the subject more practically to give the training on scientific method which is the discovering methodology of the subject. Knowledge based education is a barrier to achieve above mentioned aims of this subject.

- ⋆ Practical activities are very important in developing attitudes and skills in students related to science subjects. For this, a teachers' guide included with recommended practical experiments are given to schools for the use of teachers. To fulfill the above aims, students should be engaged in practical activities so that they would get an opportunity to develop skills. The weaknesses of students in answering questions related to practical activities could be reduced by preparing questions related to practical activities & giving them to students to present answers, examining their answers and guiding them to follow correct procedures through discussions.

- ⋆ In confirming the subject related theoretical and practical abilities modern technologies such as video clips, computer software, internet and multimedia projectors would be more fruitful depending on the available facilities.

- ⋆ School based assessments and term tests could be utilized to train students on writing answers for the questions related to new sections of the syllabus.

- ⋆ Students should be guided to participate in workshops, seminars, projects and assignments in order to update the subject related knowledge on new information that are relevant for day to day life. School activities carried out parallel to the subject activities as well as extra-curricular activities could be utilized for this. Example: annual science day, environmental day, subject camping, exhibitions, etc.

- ⋆ Student should be guided to improve their skill of presenting a diagram in relevant correct shape with correct proportion to be used in describing structures. If the shape is completely wrong, marks will not be given even though the labeling is correct.

  Examples :-
  - Human heart should have a cone shape.
  - Guard cells of stomata should have the shape of a bean.

- ⋆ Student should be guided to do assignments and assessments that could improve their abilities in analyzing and synthesizing. For this, students should be encouraged to make use of accepted, subject related text books as well as to collect information related to syllabus through internet.

- ⋆ After reading and understanding the learning outcomes and objectives, lesson planning should be done by the teacher to achieve them (by deciding the subject content and depth). Students also should be made aware of the expected learning out comes.

- ⋆ It is important to have a pre-plan in carrying out the learning - teaching process so that the role of the teacher could be discharged well.

- ⋆ During the learning – teaching process, in addition to teaching, teacher should be able to hold the attention of students as well as should make arrangements to confirm that subject matter is understood by having assessments on learned matters (specially, after assessing answers for structured essay and essay questions, corrections should be made).

- ⋆ Further, opportunities should be provided for students to improve skills of presenting specific factors definitely and necessary support should be given so that the students will win at competitive examinations.