

## **Part II**

### **2. Information on questions and answers**

#### **2.1 Question Paper I and information on answers to Paper I**

##### **2.1.1 Structure of the Paper I**

Time is 01 hour. Total mark is 40.

- ★ This question paper consists of 40 multiple choice questions each with four options. For questions from 1 - 40, the candidates were expected to select the correct or the most suitable option from the options (1), (2), (3) and (4).
- ★ Questions have been set as follows. 1 - 12 from Biology; 13 - 24 from Chemistry; 25- 36 from Physics; and 37 - 40 from current phenomena.
- ★ Responding to all the questions is expected.

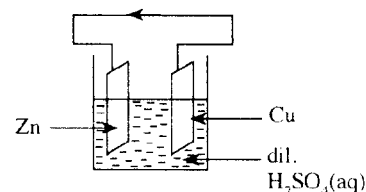
## 2.1.2 Paper I

1. Which of the following plants is a non-flowering plant with seeds?  
(1) Cycas (2) Nephrolepis (3) Paddy (4) Grass
2. Select the answer which correctly gives the scientific name of pea plant, according to the binomial nomenclature.  
(1) *Pisum Sativum* (2) Pisum Sativum (3) *Pisum sativum* (4) Pisum sativum
3. Which of the following is a non-living structure of a plant cell?  
(1) Chloroplast (2) Cell wall (3) Golgi body (4) Ribosome
4. Number of premolar teeth on both sides of the upper jaw of a healthy adult is  
(1) two. (2) four. (3) six. (4) eight.
5. When a bottle of cinnamon oil is opened the smell of cinnamon oil spreads in the air. To which transport method does this belong?  
(1) Mass flow (2) Osmosis (3) Evaporation (4) Diffusion
6. Increase of which of the following factors does **not** increase transpiration?  
(1) Humidity of air (2) Speed of wind  
(3) Temperature of the Environment (4) Light intensity
7. In the human digestive system, which enzyme in the pancreatic juice digests protein?  
(1) Trypsin (2) Peptidase (3) Pepsin (4) Lipase
8. The class teacher was unable to attend school for two days due to reddishness of the throat, pain in the throat and loss of voice. What could be the illness that she had?  
(1) Asthma (2) Gastritis (3) Tuberculosis (4) Laryngitis
9. A person who does not have any visual defect sees an object clearly in general, when its image is formed,  
(1) very close to the lens of the eye.  
(2) in between lens of the eye and the retina.  
(3) on the retina.  
(4) behind the retina.
10. "Both sons born to particular parents are suffering from colour blindness." Which of the following, can **exactly** be said regarding this statement?  
(1) Mother is suffering from colour blindness.  
(2) Father is suffering from colour blindness.  
(3) Either mother or father is suffering from colour blindness.  
(4) Both mother and father are suffering from colour blindness.
11. A student observed the specimens A and B under the compound microscope and identified their tissues as parenchyma and sclerenchyma respectively. Which of the following plant parts would be the specimens A and B respectively?  
(1) a potato, a carrot (2) mid rib of a bitter gourd leaf, a carrot  
(3) a potato, a pear fruit (4) a seed of coffee, a pear fruit
12. "Organisms with more suited genetic variations will live longer." This statement can be explained by the  
(1) theory of special creation. (2) theory of spontaneous generation.  
(3) theory of use and disuse. (4) theory of natural selection.
13. Which metal is used to galvanise Iron?  
(1) Copper (2) Lead (3) Aluminium (4) Zinc
14. In the experiments done in the school laboratory, oxygen gas is collected by the  
(1) downward displacement of water. (2) downward displacement of air.  
(3) upward displacement of air. (4) upward displacement of water.
15. An element X reacts with  $\text{Cl}_2$  gas and forms the ionic compound  $\text{XCl}_2$ . The electronic configuration of X could be  
(1) 2, 6 (2) 2, 8 (3) 2, 8, 1 (4) 2, 8, 2
16. When a particular gas is bubbled into a colourless aqueous solution, the solution turns milky. The solution and the gas would be  
(1)  $\text{CuSO}_4$  and  $\text{O}_2$  (2)  $\text{Ca(OH)}_2$  and  $\text{CO}_2$  (3)  $\text{ZnSO}_4$  and  $\text{O}_2$  (4)  $\text{CaCO}_3$  and  $\text{CO}_2$

- Use the simple voltaic cell in the figure given below to answer the questions No. 17 and 18.

17. The direction of the arrow in the external circuit shows

- the direction of flow of electrons.
- the direction of flow of the standard current.
- the direction of flow of ions.
- the direction of flow of electrons and the standard current.



18. What is the anodic reaction of the cell?

- $\text{Cu}^{2+}(\text{aq}) + 2\text{e} \longrightarrow \text{Cu}(\text{s})$
- $\text{Zn}^{2+}(\text{aq}) + 2\text{e} \longrightarrow \text{Zn}(\text{s})$
- $\text{Zn}(\text{s}) \longrightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}$
- $2\text{H}^{+}(\text{aq}) + 2\text{e} \longrightarrow \text{H}_2(\text{g})$

19. Consider the following statements made regarding a certain element.

- Occurs in allotropic forms in nature.
- Has a high melting point.
- It is used in the extraction of metals.

What would this element be?

- K
- Al
- C
- S

20. Select the answer which shows the colour of the blue and red litmus papers, when they are dipped in a vinegar solution and in a table salt solution separately.

|     | Litmus paper | Colour in Vinegar solution | Colour in Table salt solution |
|-----|--------------|----------------------------|-------------------------------|
| (1) | Red          | Blue                       | Red                           |
| (2) | Blue         | Red                        | Blue                          |
| (3) | Red          | Red                        | Blue                          |
| (4) | Blue         | Blue                       | Blue                          |

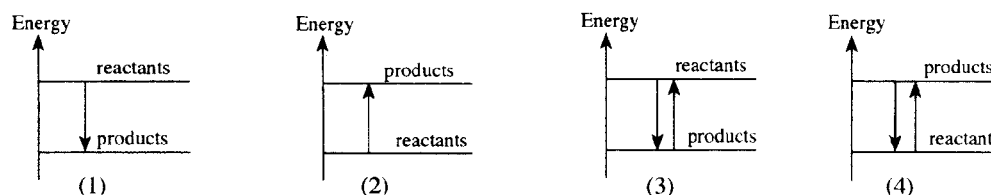
- Consider the following statement and answer the questions No. 21 and 22.

"An amount of heat 1.47 kJ has evolved when 1g of solid NaOH completely reacted with a solution of dil. HCl."

21. What is the amount of heat evolved when 1 mol of solid NaOH completely reacted with a HCl solution? (Na = 23, O = 16, H = 1)

- 1.47 kJ
- 5.88 kJ
- 58.80 kJ
- 147.00 kJ

22. What is the correct energy diagram relevant to the reaction mentioned in the statement above?



23. Some plants in Hakgala botanical garden in Sri Lanka are grown in a glass house. For plants, this glass house provides

- sufficient  $\text{O}_2$  gas.
- suitable temperature.
- sufficient  $\text{CO}_2$  gas.
- sufficient light.

24. A student was able to observe a green coloured layer on the surface of a water body where waste water removed from a vegetable bed gets collected. He made the following statements according to the observation.

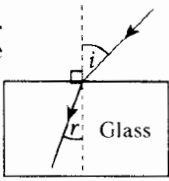
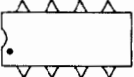
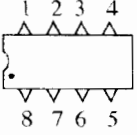
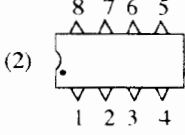
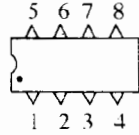
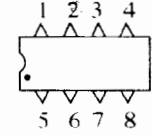
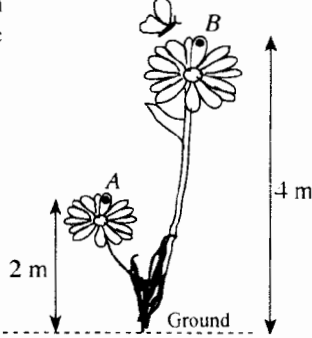
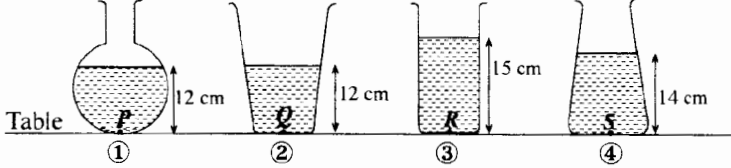
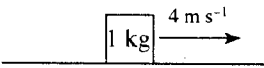
- A - Excessive amount of inorganic fertilizers have been used highly for the cultivation of vegetables.  
 B - The green layer is concentrated with algae.  
 C - BOD value of water in the water body has become low.

Of the above, statements

- only A and B are correct.
- only A and C are correct.
- only B and C are correct.
- all A, B and C are correct.

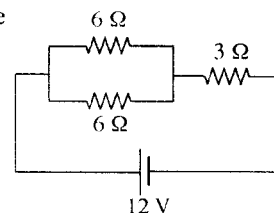
25. The average temperature of the human body is  $37^\circ\text{C}$ . This temperature in the Kelvin scale is

- 236.
- 273.
- 310.
- 337.

26. Which of the following elements can be doped with a piece of pure Silicon to convert it into an *n*-type semiconductor?  
 (1) Boron (2) Aluminium (3) Phosphorous (4) Germanium
27. As shown in the figure, a ray of light is incident on a block of glass which is kept in air. When the magnitude of the angle of incidence is gradually increased up to  $90^\circ$  the magnitude of the angle of refraction will  
 (1) increase.  
 (2) decrease.  
 (3) increase and then decrease.  
 (4) not change.
- 
28. In which of the following ways is the terminals of this integrated circuit numbered correctly?
- 
- (1)  (2)  (3)  (4) 
29. The volume of gold of a gold chain which was presented by a father to his daughter is said to be  $2 \text{ cm}^3$ . If the density of that gold is  $18 \text{ g cm}^{-3}$ , what is the mass of the chain, the daughter received?  
 (1) 9 g (2) 18 g (3) 27 g (4) 36 g
30. As shown in the figure, a small butterfly of mass 5 g ( $0.005 \text{ kg}$ ) flew from a point A on one flower to a point B on another flower. What is the change in potential energy of the butterfly when it flew from A to B? (acceleration due to gravity =  $10 \text{ m s}^{-2}$ )  
 (1) 0.01 J  
 (2) 0.10 J  
 (3) 0.20 J  
 (4) 0.50 J
- 
31. Consider the following containers ①, ②, ③ and ④. The four containers are filled with pure water up to the heights of 12 cm, 12 cm, 15 cm and 14 cm respectively.
- 
- P, Q, R and S are points located at the bottom of the containers. Of the points, which point experiences the maximum pressure due to water?  
 (1) P (2) Q (3) R (4) S
32. As shown in the figure an object of mass 1 kg moving at a uniform velocity of  $4 \text{ m s}^{-1}$  subsequently came to rest due to uniform deceleration. If the time that it decelerated is 2 s, select the answer which gives its deceleration and the momentum before the deceleration starts, respectively.  
 (1)  $2 \text{ m s}^{-2}$ ,  $4 \text{ kg m s}^{-1}$  (2)  $4 \text{ m s}^{-2}$ ,  $2 \text{ kg m s}^{-1}$  (3)  $8 \text{ m s}^{-2}$ ,  $1 \text{ kg m s}^{-1}$  (4)  $4 \text{ m s}^{-2}$ ,  $4 \text{ kg m s}^{-1}$
- 
33. Consider the following statements.  
 A - Pair of scissors is a second order lever.  
 B - Mechanical advantage of a simple machine is given by the ratio  $\frac{\text{effort}}{\text{load}}$ .  
 C - When a work is done with a non-moving single pulley, the velocity ratio of the pulley is 1.  
 Of the above statements,  
 (1) only B is true. (2) only C is true.  
 (3) only A and C are true. (4) all A, B and C are true.

34. What is the potential difference between the terminals of the  $3\ \Omega$  resistor in the given circuit?

(1) 3 V  
(2) 6 V  
(3) 9 V  
(4) 12 V

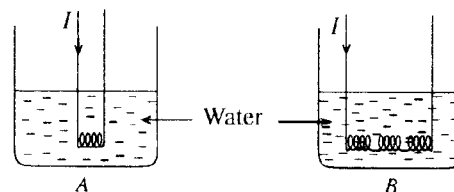


35. A child heard the thunder 5 seconds after he saw a flash of lightning. If the speed of sound in air is  $330\text{ m s}^{-1}$ , what is the distance between the place where the child was and the place where the lightning has occurred?

(1) 1500 m                      (2) 1650 m                      (3) 2000 m                      (4) 2200 m

36. Two similar beakers *A* and *B* contain similar volumes of water. **One** of four similar nichrome coils is immersed in beaker *A* and the other **three** coils connected in series are immersed in beaker *B* as shown in figures. The same current *I* is passed through the coils for the same period of time as shown in figures. If the increase in temperature of water in *A* and *B* are  $t_1$  and  $t_2$  respectively and there is no heat loss, which of the following is correct with regard to the temperatures?

(1)  $t_2 = t_1$   
(2)  $t_2 = 2t_1$   
(3)  $t_2 = 3t_1$   
(4)  $t_2 = \frac{t_1}{3}$



37. The Department of Registration of Persons expects to issue electronic identity cards to citizens in Sri Lanka. This is a result of which of the following technologies?

(1) Information technology                      (2) Nanotechnology  
(3) Molecular biotechnology                      (4) Genetic engineering technology

38. Consider the following statements.

*P* – Fulfilling the basic requirements of animals including human  
*Q* – Maintaining the natural cycles like carbon cycle and water cycle  
*R* – Improving the beauty and cultural values of the country

The services of biodiversity in Sri Lanka are

(1) only *P* and *Q*.                      (2) only *P* and *R*.                      (3) only *Q* and *R*.                      (4) all *P*, *Q* and *R*.

39. Which of the following suggestions is most suitable to solve more efficiently and effectively the environmental and social problems that have arisen due to the equipment such as televisions, computers and telephones removed from the rapidly developing world under global village concept?

(1) Minimizing the use of those equipment  
(2) Minimizing the amount of those equipment produced  
(3) Creating substitutions for those equipment  
(4) Taking action to repair those equipment for reuse by the manufacturers themselves

40. What is the theme of world science day in the year 2015?

(1) Science for technology                      (2) Science for health and well-being  
(3) Science for a sustainable future                      (4) Science for exploration of the universe

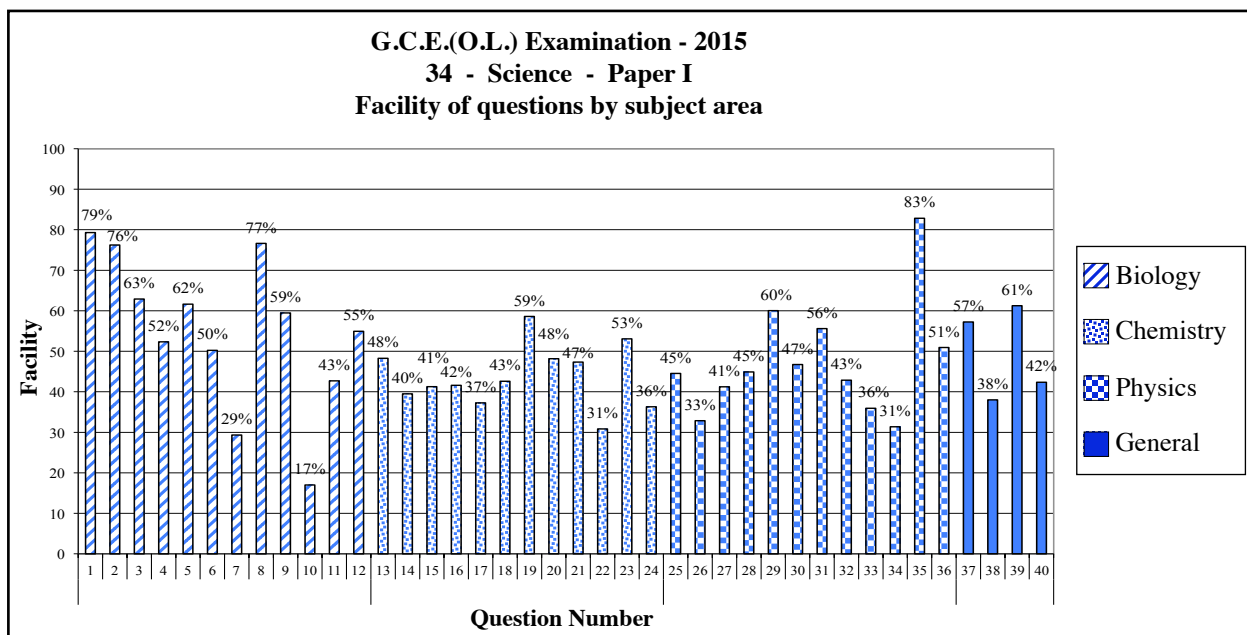
### 2.1.3 Expected answers and the marking scheme for Paper I

| Question No. | Answer     | Question No. | Answer     |
|--------------|------------|--------------|------------|
| 01.          | 1<br>..... | 21.          | 3<br>..... |
| 02.          | 3<br>..... | 22.          | 1<br>..... |
| 03.          | 2<br>..... | 23.          | 2<br>..... |
| 04.          | 2<br>..... | 24.          | 1<br>..... |
| 05.          | 4<br>..... | 25.          | 3<br>..... |
| 06.          | 1<br>..... | 26.          | 3<br>..... |
| 07.          | 1<br>..... | 27.          | 1<br>..... |
| 08.          | 4<br>..... | 28.          | 2<br>..... |
| 09.          | 3<br>..... | 29.          | 4<br>..... |
| 10.          | 1<br>..... | 30.          | 2<br>..... |
| 11.          | 3<br>..... | 31.          | 3<br>..... |
| 12.          | 4<br>..... | 32.          | 1<br>..... |
| 13.          | 4<br>..... | 33.          | 2<br>..... |
| 14.          | 1<br>..... | 34.          | 2<br>..... |
| 15.          | 4<br>..... | 35.          | 2<br>..... |
| 16.          | 2<br>..... | 36.          | 3<br>..... |
| 17.          | 2<br>..... | 37.          | 1<br>..... |
| 18.          | 3<br>..... | 38.          | 4<br>..... |
| 19.          | 3<br>..... | 39.          | 4<br>..... |
| 20.          | 2<br>..... | 40.          | 3<br>..... |

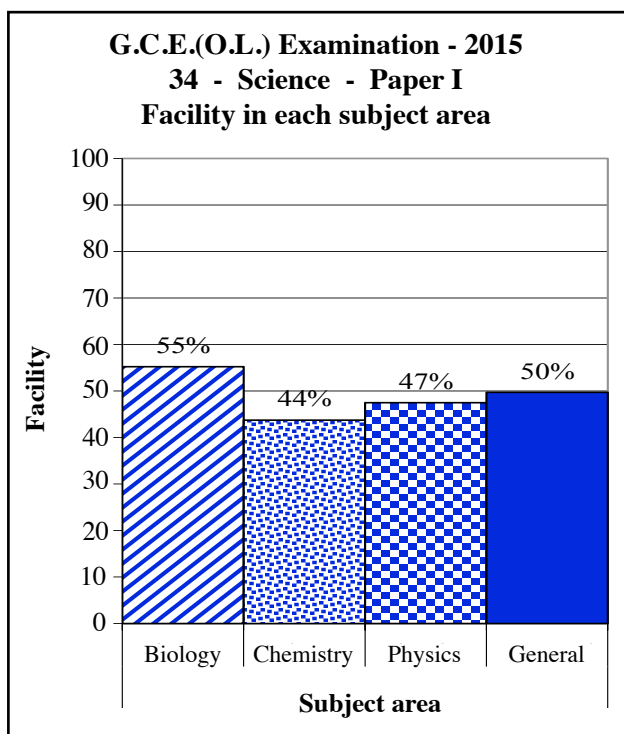
**Each correct answer carries 02 marks, amounting the total to 80.**

$$\text{Final mark for Paper I} = \frac{80}{2} = 40$$

## 2.1.4 Observations on the responses to Paper I (by subject area) :



| Question Number | Subject area | The question of highest facility and its facility | The question of lowest facility and its facility |
|-----------------|--------------|---|--|
| 1 - 12          | Biology      | 1 (79%)   | 10 (17%)   |
| 13 - 24         | Chemistry    | 19 (59%)  | 22 (31%)   |
| 25 - 36         | Physics      | 35 (83%)  | 34 (31%)   |
| 37 - 40         | General      | 39 (61%)  | 38 (38%)   |



Of the major subject areas on which Paper I was set, Biology had been an easier section for 55% of the students. The facility for general questions based on current phenomena (General) is 50%. The most difficult subject theme in Paper I is Chemistry. Its facility is 44%.

On the whole, the facility of paper I is 49%.

### 2.1.5 Responses to the options in Paper I - as a percentage

| Question Number | Correct Answer | Percentage of students selecting each option |     |     |     |
|-----------------|----------------|--|-----|-----|-----|
|                 |                | 1  | 2   | 3   | 4   |
| 1               | 1              | 79%  | 7%  | 11% | 3%  |
| 2               | 3              | 9%   | 7%  | 76% | 8%  |
| 3               | 2              | 10%  | 63% | 12% | 15% |
| 4               | 2              | 11%  | 52% | 21% | 16% |
| 5               | 4              | 4%   | 8%  | 26% | 62% |
| 6               | 1              | 50%  | 23% | 11% | 16% |
| 7               | 1              | 29%  | 17% | 42% | 12% |
| 8               | 4              | 5%   | 3%  | 15% | 77% |
| 9               | 3              | 7%   | 26% | 59% | 8%  |
| 10              | 1              | 17%  | 13% | 40% | 30% |
| 11              | 3              | 25%  | 23% | 43% | 9%  |
| 12              | 4              | 8%   | 29% | 8%  | 55% |
| 13              | 4              | 16%  | 18% | 18% | 48% |
| 14              | 1              | 40%  | 17% | 22% | 21% |
| 15              | 4              | 15%  | 16% | 28% | 41% |
| 16              | 2              | 13%  | 42% | 10% | 35% |
| 17              | 2              | 27%  | 37% | 11% | 25% |
| 18              | 3              | 22%  | 23% | 43% | 12% |
| 19              | 3              | 10%  | 22% | 59% | 9%  |
| 20              | 2              | 22%  | 48% | 21% | 9%  |
| 21              | 3              | 20%  | 20% | 47% | 13% |
| 22              | 1              | 31%  | 27% | 26% | 16% |
| 23              | 2              | 8%   | 53% | 16% | 23% |
| 24              | 1              | 36%  | 11% | 25% | 28% |
| 25              | 3              | 11%  | 29% | 45% | 15% |
| 26              | 3              | 19%  | 19% | 33% | 29% |
| 27              | 1              | 41%  | 36% | 9%  | 14% |
| 28              | 2              | 16%  | 45% | 20% | 19% |
| 29              | 4              | 24%  | 9%  | 7%  | 60% |
| 30              | 2              | 13%  | 47% | 22% | 18% |
| 31              | 3              | 26%  | 11% | 56% | 7%  |
| 32              | 1              | 43%  | 26% | 19% | 12% |
| 33              | 2              | 19%  | 36% | 25% | 20% |
| 34              | 2              | 17%  | 31% | 22% | 30% |
| 35              | 2              | 6%   | 83% | 7%  | 4%  |
| 36              | 3              | 13%  | 13% | 51% | 23% |
| 37              | 1              | 57%  | 25% | 7%  | 11% |
| 38              | 4              | 29%  | 17% | 16% | 38% |
| 39              | 4              | 10%  | 12% | 17% | 61% |
| 40              | 3              | 18%  | 19% | 42% | 21% |

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



## 2.1.6 Overall observations, conclusions and suggestions regarding the answers to Paper I

Out of Biology questions, there is a facility of more than 50% for questions 1, 2, 3, 4, 5, 6, 8, 9 and 12. Facility of questions 7, 10 and 11 is less than 50%. No Biology question has a facility more than 80%.

Question number 1 has the highest facility and it is 79%. This question has tested about the nonflowering seedless plants.

62% of students have selected the correct choice (4) for question number 5. 26% of students have selected the wrong choice (3). It is important to plan lessons with examples and practical experiments when teaching about modes of transportation so that they explain the differences among them.

Facility of question 7 is 29%. Trypsin and pepsin both are proteases. Only 29% have selected that trypsin is the protease secreted by the pancreas. 42% have selected the choice (3). It shows though they identify proteases, majority has failed to identify the place which secretes trypsin. So it is important to teach these things using tables containing enzyme, place of secretion and the substrates.

Facility of question 9 is 59%. But 26% have selected the choice (2). It should be taught that the image of a healthy eye is formed on the retina and in eye defects lenses are used to focus the image on to the retina.

Question 10 is the one having the least facility and it is 17%. Though the correct choice is (1), 40% have selected the choice (3) and 30% have selected the choice (4). It should be clearly taught that genes on X chromosome cause sex-linked defects and sons inherit X chromosome from the mother and all sons born to a diseased mother are also diseased. Genetic diagrams should be used where necessary.

The correct choice of question 11 is (3). Its facility is 43%. But 25% and 23% have respectively selected the choices (1) and (2). Identifying plant parts used to observe parenchyma and collenchyma is the objective of this question. It should be emphasized on location of plant tissues in addition to the tissues studied.

The correct choice of question 12 is (4) and 55% have selected that. 29% have selected the choice (2). It seems that choice (2) has been selected because the difference between theory of spontaneous generation and the theory of natural selection has not been understood.

Questions from 13 to 24 are based on chemistry. Only questions 19 and 23 have facility more than 50%. Facility of questions 13, 14, 15, 16, 17, 18, 20, 21, 22 and 24 have a facility less than 50%.

Though the correct choice of question 14 is (1), only 40% have selected it. 22% and 21% have respectively selected the choices (3) and (4). This has inquired understanding about the experiment done to prepare oxygen in the laboratory. Lessons should be planned with practical. This weakness can be overcome by letting students do this type of activities.

Though the correct choice of question 15 is (4), 28% have selected the choice (3). This has tested the knowledge about finding the group of an element using valency and writing the electronic configuration. Knowledge and understanding of students about how electrons are exchanged when elements form compounds and how to determine the valencies of elements using formulae is not satisfactory. Teaching aids like models and diagrams should be used when teaching to show the transfer of electrons and more exercises should be given to give a better understanding.

While 42% have selected the correct choice of question 16, 35% have selected the choice (4) which is wrong. Lack of knowledge on correct chemical compounds is the reason for this. Even though they have known that limewater turns milky due to carbon dioxide, they have not understood that limewater is calcium hydroxide,  $\text{Ca(OH)}_2$ . So, teacher should write the chemical compounds on the board with their chemical formulae and let students also write them.

The correct choice of question 17 is (2) and 37% have selected it. Meanwhile 27% and 25% have respectively selected the wrong choices (1) and (4). It should be explained that electrons lost by the zinc plate flow towards the copper plate through the external circuit and the conventional current flows in the opposite direction. Through this teacher should make students understand that copper is the positive terminal while zinc is the negative terminal.

The correct choice of question 18 is (3). Its facility is 43%. But, 22% and 23% have respectively selected the choices (1) and (2). It should be emphasized that oxidation takes place at the anode of the cell and losing of electrons takes place there.

Facility of question 19 is 59%. Its correct choice is (3). But, 22% have selected the choice (2). When teaching and learning about elements it is important to show their specimens and discussing about their properties and applications.

Question 20 is based on a simple activity. Facility of this based on using litmus is 48%. But 22% and 21% have selected the (1) and (3) choices. Teaching process should be planned in order so that students understand the colour changes of litmus in acidic and basic media.

Facility of questions 21 and 22 is less than 50%. It has inquired the knowledge on heat changes in a chemical reaction. Students should be given the chances to solve this type of problems and their mistakes should be shown. Students should be given a clear understanding about placing reactants and products correctly in energy level diagrams related to endothermic and exothermic reactions.

The correct choice of question 24 is (1). Its facility is 36%. But, 25% and 28% have respectively selected the choices (3) and (4). It has inquired the knowledge on eutrophication in water. When teaching this it is important to take students to a water body with eutrophication or at least showing them a water sample with eutrophication. This will facilitate better understanding.

Questions from 25 to 36 are based on physics. Questions 31 and 35 have a facility more than 50%. Questions 25, 26, 27, 28, 30, 32, 33 and 34 have a facility less than 50%.

The correct choice of question 25 is (3). Its facility is 45%. But, 29% have selected the choice (2). It has tested the knowledge on how to convert Celsius into Kelvin. Teacher should give students more exercises on that type of conversions.

The correct choice of question 26 is (3) and its facility is 33%. Most of the students (29%) have selected the choice (4) as the correct choice. This question has inquired the knowledge on doping of semiconductors. It shows the knowledge of students about semiconductors and the difficulty in identifying elements used to make n-type semiconductors. It should be emphasized that elements belonging to Group V of the periodic table like phosphorus should be used when making n-type semiconductors.

The correct choice of question 27 is (1). Its facility is 41%. But, 36% have selected the choice (2). These activities should not only be teacher demonstrations, but also give experiences to students. Through that, experiences should be given about the changing of the angle of incidence of the dense medium according to that of the rare medium.

The correct choice of question 28 is (2). But, 20% have selected the wrong choice (3). Teacher should plan lessons including activities about reduction of integrated circuits.

Though 60% have selected the correct choice of question 29, 24% have selected the choice (1). It has inquired how to calculate mass when volume and density of a substance are given. Teaching - learning process should be planned to guide students to solve more problems related to this.

Question 31 has tested the fact that liquid pressure increases as the depth increases. 56% have known that the pressure increases as the depth of a liquid increases. But, 26% have selected the choice (1). Teacher should definitely plan activity based lessons to give opportunities to students to do the activity. It should be emphasized here that shape of the vessel has no effect on liquid pressure.

Though the correct choice of question 32 is (1), only 43% have selected it. 26% have selected (2) which is a wrong choice. This is due to the problem in order as two factors have been tested. This could be corrected by preparing the evaluation procedure with this type of problems.

Question 33 has tested about simple machines. The number of students who did not know the lever class of pair of scissors and the mechanical advantage of a simple machine is a higher value like 64%. The percentage of students who knew that the velocity ratio when using a single pulley was 36%. Lessons should be planned with simple devices and diagrams to explain simple subject matter in physics to overcome this type of problems.

The correct choice of question 34 is (2) and its facility is 31%. 51% have selected (3) and (4) as the correct choices. It is observed here that there is no understanding on the voltage between the terminals of resistors connected in parallel and series. Knowledge of students regarding this should be improved through exercises about how voltage divides among resistors when connected in series and parallel.

The correct choice of question 36 is (3) and its facility is 51%. But, 23% have selected (4) which is a wrong choice. It seems that calculation has become difficult. So, more chances should be given in the classroom to solve this type of problems.

The correct choice of question 37 is (1) and its facility is 57%. But, 25% have selected the choice (2). It is seen that students have a poor knowledge on information technology. Students should be motivated to read extra books. Class teachers should give opportunities to students to use class libraries and libraries.

When taken as a whole for 7 out of 12 Biology questions, 20% have selected one wrong choice. It is 9 out of 12 for Chemistry and 11 out of 12 for Physics.

Questions 37, 38, 39 and 40 are based on current phenomena. Questions 37 and 39 exceed a facility of 50% and facility of questions 38 and 40 is less than 50%.

## 2.2 Paper II and information on answers

### 2.2.1 Structure of the Paper II

**Time 03 hours. Total mark for Paper II is 60.**

This paper consists of two parts A and B.

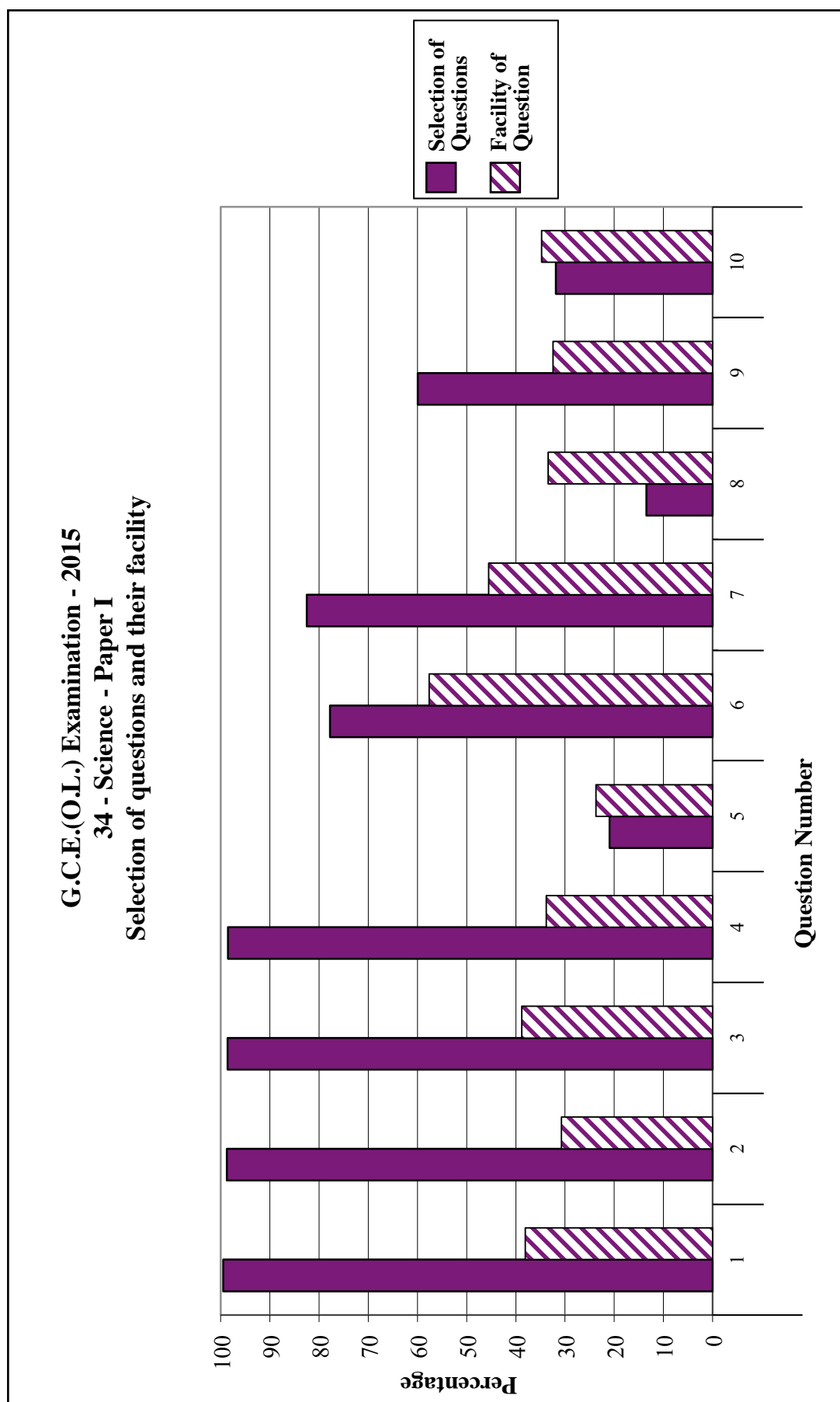
**Part A** – This contains four structured essay questions and all the questions should be answered in the paper itself. First question is set integrating sections from Biology, Chemistry and Physics. Other three questions are set on Biology, Chemistry and Physics. Each question carries 15 marks and the total mark is 60.

**Part B** – This comprises six questions, with two questions each from, the sections Biology, Chemistry and Physics. The candidate should select at least one question from each part and answer three questions. Mark allocated for each question is 20, so the total mark is 60.

$$\begin{aligned}\text{Total mark for Paper II} &= 60 + 60 \\ &= 120\end{aligned}$$

$$\text{Final mark for Paper II} = \frac{120}{2} = 60$$

## 2.2.2 Selection and facility of questions in Paper II



## 2.2.2 Expected answers, marking scheme and observations and conclusions related to paper II

- ★ The observation related to the answers for paper II have been presented by graphs 2, 3, 4.1, 4.2 and 4.3. The graphical part related to a question is given along with the observations and conclusions on that question.

### Part A - Structured Essay

#### Objectives of question 1

- Testing the ability of distinguishing tropic movements.
- Identifying the phyla of seashore organisms.
- Testing the knowledge on resources obtained from inshore areas in Sri Lanka and their uses.
- Testing the ability to identify mechanical waves.
- Testing the understanding on concepts related to upthrust and its applications.
- Testing the knowledge on causes of pollution of the sea and its associated environment and actions taken to conserve the seashore.

#### Question 1

- I. A coastal area of Sri Lanka in the Indian Ocean is given in the following figure.



- (i) (a) As shown in the figure, the coconut trees which grow closer to the coast, bend towards the ocean as a result of a particular tropic movement. Identify that tropic movement and write the stimulus relevant to it.

Tropic movement : Positive (+) phototropic (01) Stimulus: Light/Sun light (01) .....  
(02 marks)

- (b) The animals given in the table live in the Indian ocean and its coastal areas. State the phylum of each of those animals.

| Animal      | Phylum                     |
|-------------|----------------------------|
| Sea anemone | Coelenterata/Cnidaria (01) |
| Rag worm    | Annelida (01)              |

(02 marks)

- (ii) The valuable mineral Ilmenite is contained in the sand of the ocean.

- (a) Out of the coastal areas in Sri Lanka, name an area which has Ilmenite in abundance. ....

Pulmudai/North of Trincomalee/Kaluwella (in Galle)/Nilaweli ..... (01 mark)

- (b) Name an industry in Sri Lanka, which uses Ilmenite. ....

Paper industry/paint industry/pigment production ..... (01 mark)

- (iii) Sodium metal is extracted from sea water. Name the method which is used to extract sodium metal and mention the reason for using that method.

- (a) Method: Electrolysis (of fused Sodium Chloride/fused NaCl) ..... (01 mark)

- (b) Reason: exist the top of the activity series/reactivity of sodium is very high ..... (01 mark)

- (iv) Which type of mechanical waves do the small water waves formed on the surface of the ocean belong?

Transverse Waves

(01 mark)

- (v) A ship sailing in the Indian ocean is in the figure above.

- (a) The mass of the ship is 75 000 kg. When the ship floats in still water of the ocean, what is the upthrust acting on it? (Take the acceleration due to gravity as  $10 \text{ m s}^{-2}$ )

$$(75\,000 \text{ kg} \times 10 \text{ m s}^{-2}) = 750\,000 \text{ (N)}$$

or

$$= 7.5 \times 10^5 \text{ (N)} / 75 \times 10^4 \text{ (N)}$$

(Give Marks only for the final answer) (01 mark)

- (b) Items made of iron having a small volume sink in water, but the ships made by the same material float in the ocean. State the reason for this.

To have a larger volume, ship has been made with a large hollow (01)

The upthrust acting on the ship/the weight of the water displaced by the ship is equal to the weight of the ship. (01) Therefore the ship floats in water.

(02 mark)

- (vi) (a) Pollution of ocean and its environment is a major problem faced by our country at present. Mention **two** reasons which influence this environmental pollution.

\* Mixing oil removed by ships, with water

\* Using dynamite for fishing

\* Industrial waste water being added to sea water

\* Mixing detergents to sea water

\* Mixing agro - chemicals with sea water through rivers

\* Poluthene/plastic/garbage/faecal matter/being added with environment associated with ocean.

\* Breaking coral deposits

\* Unauthorized construction adjoining the coastal belt.

Give marks for two acceptable reasons as above

(02 marks)

- (b) State a suggestion that can be implemented for the conservation of the ocean and its coast.

\* Protect mangrove environment

\* Avoid unsystematic constructions

\* Releasing waste water after purifying

\* Banning sand mining from estuaries

\* Enforcement of rules and regarding coastal conservation

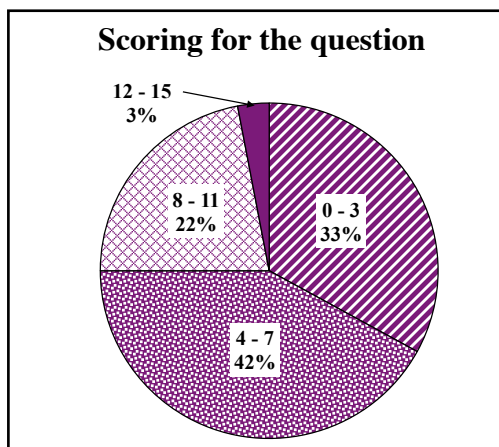
\* Awareness of the community about coastal conservation

Give marks for two acceptable reasons as above

(01 mark)

**Total marks 15**

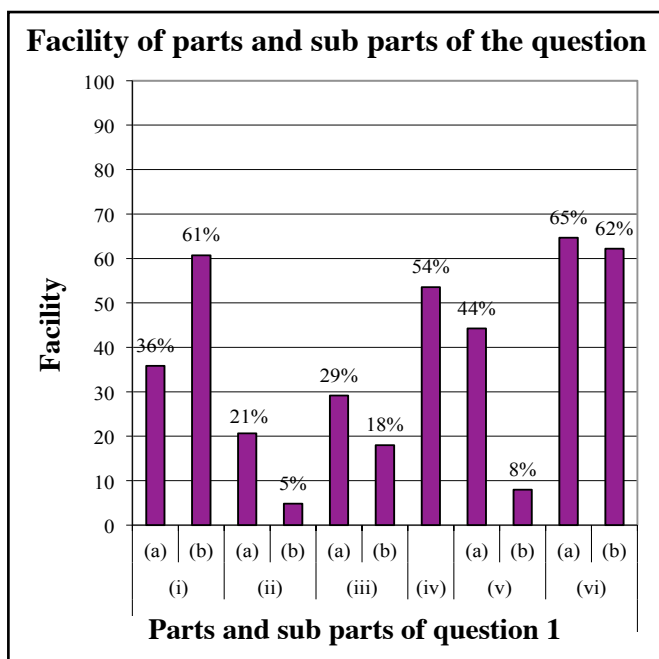
## Overall observations, conclusions and suggestions regarding the answers to Question 1 :



Though question 1 is compulsory, only 99.5% have answered it. The question carries 15 marks. The percentages of candidates scoring within the following four intervals for this question are :

|         |       |
|---------|-------|
| 0 - 3   | – 33% |
| 4 - 7   | – 42% |
| 8 - 11  | – 22% |
| 12 - 15 | – 3%  |

The percentage scoring above 12 for this question is 3% while 33% have scored less than 3 marks.



This question contains 11 sub parts of which the facility of 4 is above 50%. The sub part with minimum facility is (ii)(b) for which the facility is 5%. The most facile sub part (vi)(a) has the facility of 65%.

(i)(a) Facility is 36%. It has tested the ability to identify tropic movements using the diagram. But understanding about that is not at a considerable level. Students have not understood that bending of coconut trees towards light is a positive tropic movement. Teacher should emphasize that tropic movements towards stimuli are positive and those that are away from the stimulus are negative. There is a wrong attitude in students that they identify stimuli as sources. Students should be made to understand that the sun is a source and light is the stimulus obtained from the sun.

(i)(b) Facility is 61%. It has inquired the phyla of sea anemone and *Nereis*. It is important to give a further understanding on common characteristics of phyla to which each organism belongs. The skill of distinguishing organisms according to the common characteristics should be developed in students.

(ii)(a) This has tested the knowledge on distribution of natural resources in Sri Lanka. Its facility is 21%. It is important to develop in students by showing a map the skill to identify areas where a given mineral can be found.

(ii)(b) Facility is 5%. It has tested the knowledge in the textbook about the industries in Sri Lanka based on the natural resources. Teacher should direct students to name the industries based on a given mineral. It will help increase the facility.



(iii)(a) Facility is 29% and that of (iii) (b) is 18%. It has inquired the method used to extract sodium. It should be explained that sodium is extracted by electrolyzing molten sodium chloride. Students should be made to clearly understand that reactive metals like K, Na and Ca are extracted by electrolysis. Memory of students regarding this could be improved by displaying a poster of the reactivity series and the methods used to extract metals in it in the classroom.

(v)(a) Facility is 44%. It has inquired the knowledge on the instance where the weight of an object becomes equal to the upthrust. It would have been better if it is understood that upthrust becomes equal to the weight when an object floats. Teacher should explain the students that the mass and weight are two different quantities and weight could be obtained by multiplying the mass by acceleration due to gravity. Students should be given the understanding regarding upthrust by letting them do relevant laboratory activities.

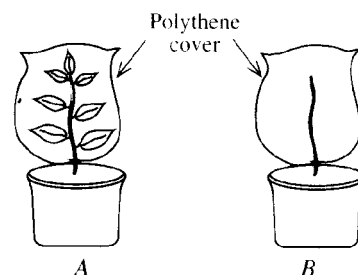
(v)(b) Facility is 8%. It has inquired about the connection between the weight of an object and the weight of a fluid displaced by the object. An object submerges in a fluid when the weight of the fluid displaced by the object is equal to the weight of the object.

### Objectives of question 2

- Testing the knowledge on plant parts where transpiration takes place.
- Testing the ability to obtain observations from practical experiments.
- Testing the ability to identify the modes of nutrition of organisms in an ecosystem.
- Testing the understanding about adaptations of flowers to avoid self-pollination.
- Testing the ability to construct food chains possible according to organisms in an ecosystem.
- Testing the knowledge on biodiversity conservation.

### Question 2

2. (A) The two setup A and B arranged by grade 10 students of a school to demonstrate that transpiration in plants take place mainly by leaves are given here. They kept the two setup in the sun for 5 hours and took down the observations.



- (i) Mention the observations which confirms the transpiration takes place mostly from leaves.

More water/liquid droplets collected in the (inner surface of the) polythene cover in A (01)

Less amount of water/Liquid droplets collected in the (inner surface of the) polythene cover in B (01)

More water droplets in polythene cover A rather than B (02) (02 marks)

- (ii) From which structure in the leaves does transpiration mostly take place?

Stomata (01 mark)

- (iii) What is the transpiration which takes place in setup B called?

Lenticel transpiration/Cuticular transpiration (01 mark)

- (iv) From the above two setup, what is the setup relevant to the control experiment? .....

B/setup without leaves (01 mark)

- (v) After removing the polythene cover in A above, upper and lower surfaces of a part of a leaf were covered with two dry cobalt chloride papers. After that, the two cobalt chloride papers were covered with 2 glass slides and tightened with clips and kept for some time.

(a) State the observations made in this situation.

The Pink colour of the Cobalt chloride at the Lower surface is more than that of upper surface/The Cobalt chloride paper of the lower surface turns pink colour first

(02 marks)

(b) What is the conclusion that could be arrived at through the observation?

Transpiration occur through the lower surface more than the upper surface/  
The lower surface has more stomata

(01 mark)

- (B) A group of students who visited Sinharaja forest, prepared a list of plants and animals observed by them. A part of that list is given below.

*P* - A species of mushroom that grew on a decaying log

*Q* - Orchid plants with flowers which grew on trees

*R* - Snails on branches of a tree covered with mosses.

*S* - A coucal (Atikukula/Shenbagam), perched on a branch of a tree

*T* - A cobra moving on the ground

(i) How does the mushroom stated in *P*, fulfil its nutrition requirements?

Absorbing the materials from the log by converting complex materials to simple materials/decomposition or from the decaying log or from the log that the mushroom grown

(01 mark)

(ii) Mention an adaptation shown by orchid flowers to prevent self pollination.

Hercogamy/having the stamens and stigma away from each other

(02 marks)

(iii) (a) By considering the above list, write down a food chain which can exist in the Sinharaja forest.

Mosses → Snail → Coucal or

Orchid → Snail → Coucal

Give marks for the 'plant' instead of first link

Give marks for the 'cobra' as the fourth link

(02 marks)

(b) In that food chain, who is the first level consumer? Snail

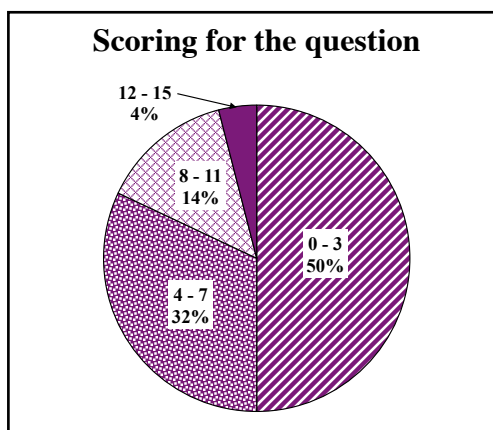
(01 mark)

(iv) What is the method of biodiversity conservation, used for the conservation of an ecosystem such as Sinharaja forest, called? in-situ conservation

(01 mark)

**Total marks 15**

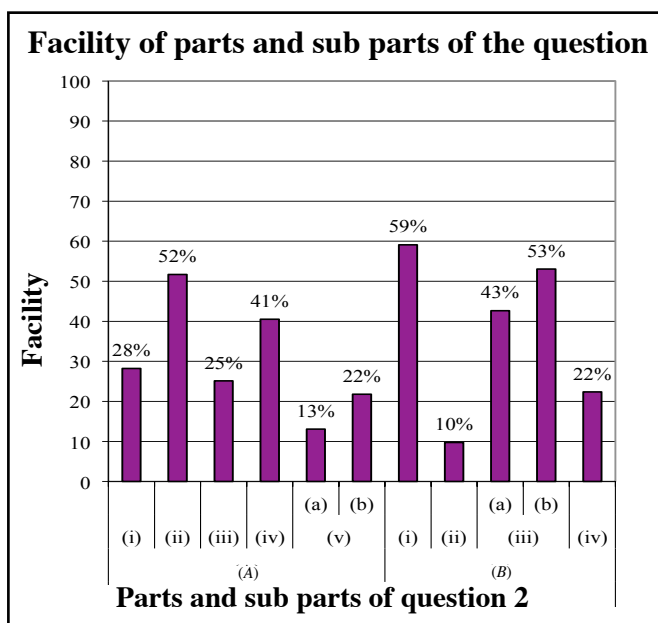
## Overall observations, conclusions and suggestions regarding the answers to Question 2 :



Question 2 is compulsory, yet only 98.7% have answered it. The question carries 15 marks. The percentages of candidates scoring within the following four intervals for this question are :

|         |   |     |
|---------|---|-----|
| 0 - 3   | – | 50% |
| 4 - 7   | – | 32% |
| 8 - 11  | – | 14% |
| 12 - 15 | – | 4%  |

The percentage scoring above 12 for this question is 4% while 50% have scored less than 3 marks.



This question is composed of 11 sub parts of which 3 report a facility greater than 50%. The most difficult sub part (B)(ii) has a facility of 10%.

(A)(i) Facility is as low as 28%. It has tested the knowledge on evaporation of water from plant leaves. The fact that water vapour cannot be observed but water droplets is not understood. This should be clarified using the observations obtained from an experiment.

(iii) Facility is 25%. It has tested the knowledge on that transpiration takes place not only through leaves but also through other surfaces. It could be explained to students using the leafless plant in which lenticular and cuticular transpiration have taken place.

(iv) has tested the skill of distinguishing between the control and main experiments when arranging practical experiments. Its facility is 41%. It is needed to recall testing of hypotheses learned in Grade 9.

(v)(a) and (b) Facility is as low as 13% and 22% respectively. What they have tested is that identifying the leaf surface from which more transpiration takes place. It is needed to improve the skill of identifying the leaf surface from which more transpiration takes place based on the rate at which blue cobalt chloride paper turns pink.

Accordingly, students should be given the chance to arrive at the conclusion that more transpiration takes place through the lower surface of the leaf than the upper surface.

(B)(ii) Facility is 10%. It has inquired about the adaptation of orchid flower to avoid self - pollination. It could be concluded here that even though the adaptations to avoid self - pollination are known there is no enough knowledge to name the adaptation of a given flower to avoid self - pollination. So, students can be directed to observe different flowers in the environment and record their observations.

(iii)(a) Facility is 43%. It has tested the skill of constructing a food chain using a set of organisms given. 57% of students have not understood that the first link of a food chain should be a producer. Understanding should be given that moss on any plant is a producer. Teacher should give opportunities to students to construct food chains.

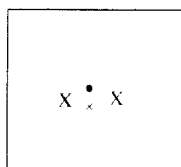
(b) Facility is 22%. It has tested the knowledge on the method of biodiversity conservation in Sinharaja Forest. Teacher should guide the students to identify the method of biodiversity conservation of a given ecosystem.

### Objectives of question 3

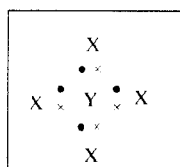
- Testing the knowledge related to identify valency, molecular formulae and type of bonds using Lewis structures.
- Testing the ability to recall the products of chemical reactions.
- Testing the ability to write balanced chemical equations.
- Testing the knowledge on behaviour of gases with the temperature.

### Question 3

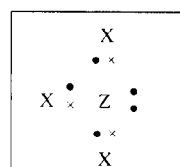
3. (A) The Lewis structures of three molecules which are formed by the atoms X, Y and Z are shown in the following figures (1), (2) and (3). X, Y and Z are **not** standard symbols of the atoms.



(1)



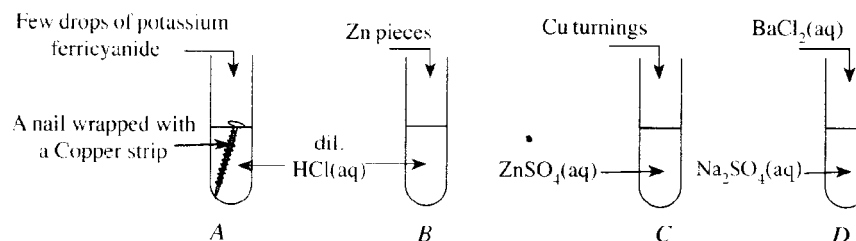
(2)



(3)

- (i) What is the valency of atom Y? ..... 4/Four ..... (01 mark)
- (ii) What is the number of the figure which shows a homoatomic molecule? (Number) 1 ..... (01 mark)
- (iii) Write the molecular formula of the molecule shown in figure (3). .....  $ZX_3$  ..... (01 mark)
- (iv) What is the type of bonds found in each molecule shown in the figures above? Covalent bonds ..... (01 mark)
- (v) If the atomic numbers of the atoms X, Y and Z are less than 10, identify each atom.  
X : H / Hydrogen (01)      Y : C / Carbon (01)      Z : N / Nitrogen (01)  
(No marks  $H_2$  /  $N_2$ ) (03 marks)

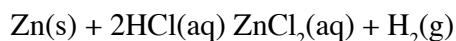
- (B) As shown in the following figures, potassium ferricyanide, Zn pieces, Cu turnings and  $\text{BaCl}_2(\text{aq})$  are added to the four test tubes A, B, C and D respectively, which contain different chemicals.



Considering the chemical reactions which may occur in the test tubes, answer the following questions.

- (i) (a) In which test tube can gas bubbles be observed clearly? B / Tube with Zn / Zinc pieces (01)  
 (b) In which test tube **cannot** a change be observed? C / Tube with Cu / copper turnings (01)  
 (c) In which test tube does a precipitate form? D / Tube with  $\text{BaCl}_2$  / Barium chloride (01)  
 (03 marks)

- (ii) Write the balanced chemical equation for the reaction that occurs in the test tube B.



(If the equation is not balanced, no marks)

(no need to show the physical states) (01 mark)

- (iii) Due to the formation of which ions, could an observation be made in the test tube A, when few drops of potassium ferricyanide are added? Ferrous /  $\text{Fe}^{2+}$  /  $\text{Fe}^{++}$  (01 mark)

- (C) An experiment planned by Grade 11 students in a school is given below.

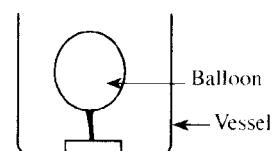
- A balloon filled with a gas, is fixed to the bottom of a vessel as shown in the figure and kept at room temperature. After that, the vessel with the balloon is kept in a refrigerator which is at a temperature of  $10^\circ\text{C}$ .

- (i) What happens to the volume of the gas in the balloon after keeping it in the refrigerator?

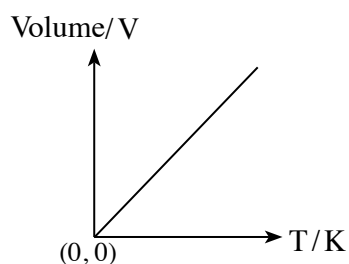
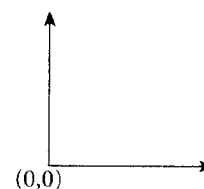
Decreases (01 mark)

- (ii) State the name of the law of gases that can be explained by this experiment.

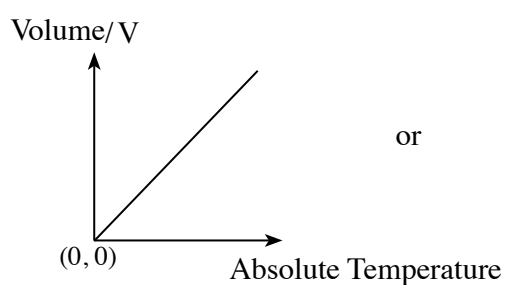
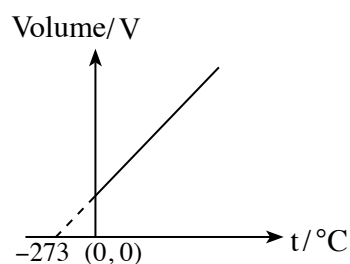
Charles' law (01 mark)



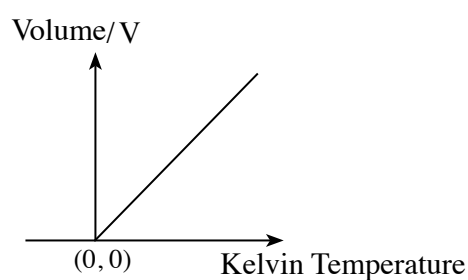
- (iii) According to the experiment, draw the graph relevant to the law of gases mentioned by you in (ii) above, on the axes given. Label the axes.



or



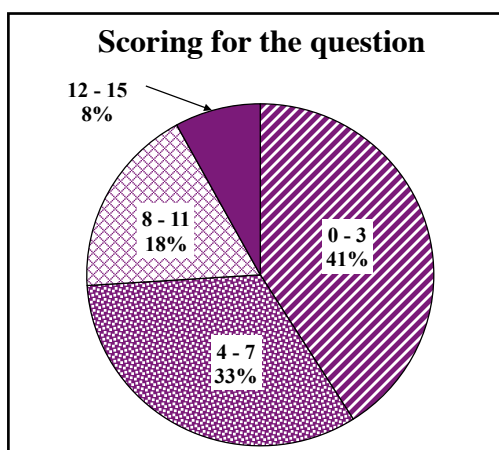
or



(01 mark)

**Total marks 15**

### Overall observations, conclusions and suggestions regarding the answers to Question 3 :

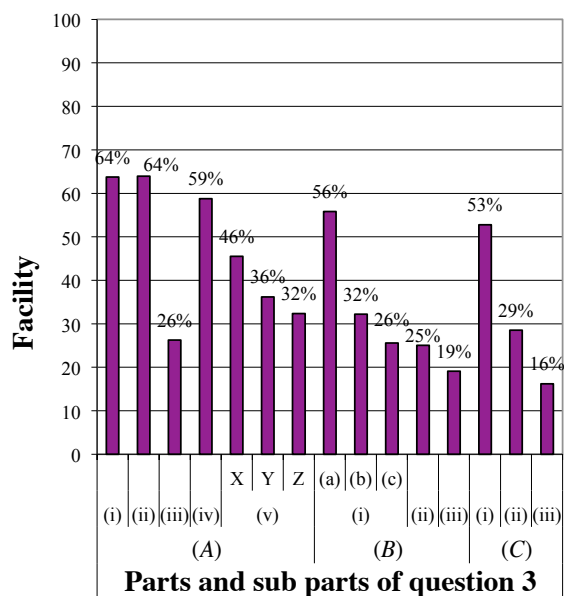


The Question 3, also compulsory was responded by 98.6%. The total mark the question embodies is 15. Scoring spreads as follows among the selected intervals :

|         |   |     |
|---------|---|-----|
| 0 - 3   | - | 41% |
| 4 - 7   | - | 33% |
| 8 - 11  | - | 18% |
| 12 - 15 | - | 8%  |

The percentage scoring above 12 for this question is 8% while 41% have scored less than 3 marks.

### Facility of parts and sub parts of the question



There are 13 sub parts in the question. Of them, the facility of 5 parts is above 50%. The most facile sub part (A)(i) and (ii) has the facility of 64%. The sub part with minimum facility is (C)(iii) for which the facility is 16%.

(iii)(a) Facility is 26%. It has checked the competency of writing molecular formulae using dot-cross diagrams. It seems that students have failed to write the molecular formulae using dot-cross diagrams. They should find the valency of atoms to write the molecular formulae. It is important to do exercises in a way so that they learn to find the valency using the dot-cross diagrams.

(v) Facility is 32%. It is given to identify elements according to the number of valence electrons. It is important to engage students in activities to identify the elements based on the number of valence electrons.

(B)(i)(b) Facility is 32%. It shows that students have a poor understanding about displacement of a less reactive element by a more reactive element in the activity series. The ability to get observations could be improved by practical experiments like the ones given above.

(c) Facility is as low as 26%. Even though double displacement reactions were known to students they had not known that  $\text{BaCl}_2$  is a precipitate. Students should be given the chance to identify precipitations through experiments.

(ii) Facility is 25%. It has tested the ability to write balanced chemical equations. It is important to engage students in exercises to write balanced chemical equations.

(iii) This has a facility of 19% as the competency of doing practical experiments is weak. It is expected to identify  $\text{Fe}^{2+}$  ions. It should be explained through an experiment that it is because of  $\text{Fe}^{2+}$  ions that the potassium ferricyanide solution turns blue.

(c) (ii) Facility is 29%. It is a very weak condition. It should be explained through an experiment that according to Charles' Law that the volume of a fixed mass of a gas is directly proportional to the temperature.

(iii) Facility is 16%. It is expected to label axes and draw the graph according to the law. It is important to give the practice to students to draw the graph according to the law with labeled axes.

#### Objectives of question 4

- Testing the knowledge on the concept of moment of forces.
- Testing the knowledge related to the magnetic field around a current carrying wire.
- Testing whether the students have got the scientific knowledge about appliances and methods used in day to day life.
- Testing the ability to draw circuits using standard symbols.
- Testing the basic knowledge on electronic devices used nowadays.

#### Question 4

4. (A) If each of the following statements is correct, mark (✓) and if it is incorrect, mark (x) in the brackets in front of the statement.

(i) A door can be opened more easily by applying a force perpendicular to the surface of the door very close to the hinge. (...X...) (01 mark)

(ii) When an electric current flows through a conductor, a magnetic field is formed around it. (...✓...) (01 mark)

- (B) Five activities being performed in a school at a certain time are given below.

| Place                   | Activity   |
|-------------------------|--|
| Main Hall               | The prefects, decorating the hall using curtains made of thick material.   |
| Library                 | An office assistant, photocopying pictures using the photo copying machine.  |
| Biology Laboratory      | Students, observing the cells of onion tissue using compound microscope.   |
| Home science Laboratory | A labourer, pushing a cupboard placed on the floor by applying a force of 150 N on the cupboard parallel to the floor. |
| Physics Laboratory      | In the science seminar held for grade 11 students, a teacher explaining the way of verifying Ohm's Law with a circuit. |

(i) In which place was an activity done with an instrument which uses electrostatic charges?  
In the Library (01 mark)

(ii) Which place has a strategy used to prevent the echo?  
Main Hall (01 mark)

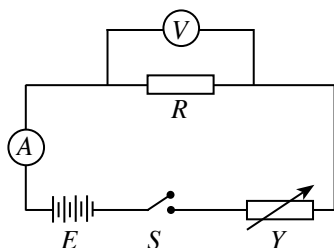
(iii) What are the special names used to identify the two convex lenses in the microscope which was used to identify the cells of onion tissue?  
(a) lens closest to the onion tissue : Objective lens (01)  
(b) lens closest to the eye : Eye piece (01) (02 marks)

(iv) If the frictional force between the floor and the cupboard is 135 N, what was the unbalanced force acting on the cupboard when it was pushing?  
(150 N – 135 N) = 15 (N)

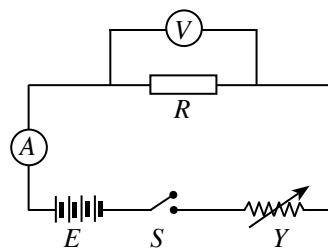
Give marks only for the final answer (01 mark)



(v) (a) With usual notations, draw the standard circuit used by the teacher in the physics laboratory.



or



If  $\textcircled{V}$  is connected parallel to  $R$  (01)

If  $\textcircled{A}$  is connected in series with  $R$  (01)

Give marks if a bulb is used instead of  $R$

For all six circuit symbols (01) (03 marks)

(b) When using the circuit drawn in (a) above to verify Ohm's law, the teacher has stated that after taking one reading the switch should be kept open for some time before taking the next reading. What is the reason for making this statement by the teacher?

- To minimize the increase of temperature / heat dissipation in the resistor / circuit when a current flows / To minimize the heating of the resistor (01)

- Readings should be taken under constant temperature (01)

(Five 2 marks for any one of above) (02 marks)

(C) Telephone and computer have become the most popular electrical equipment in the present world.

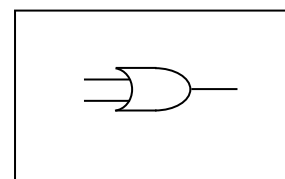
(i) Name the **two** main parts (two main circuits) of a mobile phone.

Transmitter circuit (01)

Receiver circuit (01) (02 marks)

(ii) Logical gate circuits are used to perform various activities inside computers. Inside the given box draw the symbol of a 2-input OR gate which is used for such purposes.

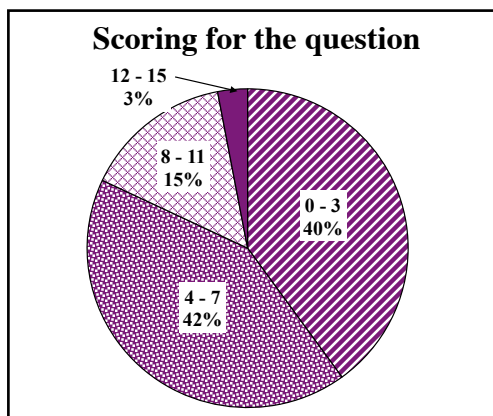
Correct shape of the symbol is essential



(01 mark)

**Total marks 15**

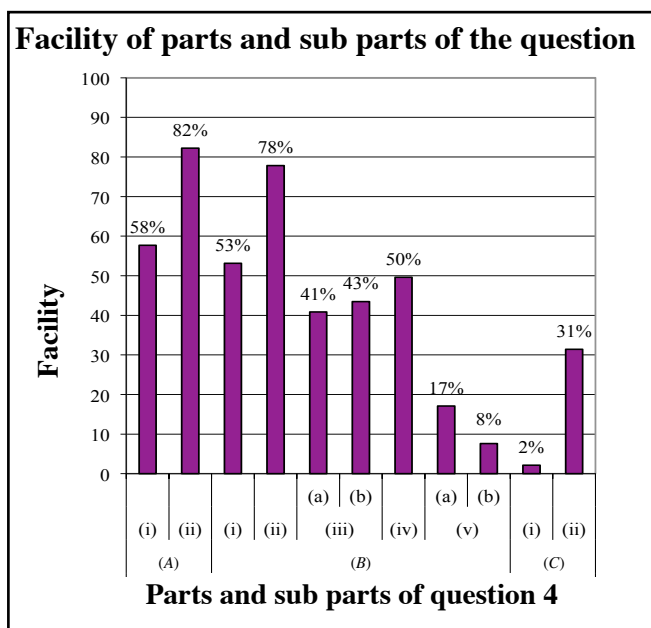
## Overall observations, conclusions and suggestions regarding the answers to Question 4 :



Despite the Question 4 is compulsory, it has been responded by 98.53%. The question carries 15 marks. The percentages of scores falling within the selected percentages are :

|         |       |
|---------|-------|
| 0 - 3   | – 40% |
| 4 - 7   | – 42% |
| 8 - 11  | – 15% |
| 12 - 15 | – 3%  |

3% have scored above 12 for this question and the percentage getting less than 3 marks is 40%.



This question contains 11 sub parts of which the facility of 5 is above 50%. The sub part with minimum facility is (C)(i). The most facile sub part (A)(ii).

(iii)(a) Facility is 41%. It has tested the skill of identifying the eye piece and objective of a microscope. It should be explained to students using a microscope or a diagram of a microscope that the eye piece is the lens close to the eye while that of close to the specimen is the objective.

(v)(a) Facility is 17%. It is expected to draw an electric circuit correctly with symbols and placing electrical appliances correctly in a circuit. The ability of connecting electrical circuits, taking readings and drawing circuits using symbols should be developed in students. It should also be explained that the voltmeter should be connected in parallel with a circuit.

(b) Facility is as low as 8%. It is expected that students understand that temperature should be constant in Ohm's Law. Teacher should give the students the knowledge and skill regarding this through discussion while mentioning that the switch should be open to avoid the increase of temperature of the conductor.

(c)(iii) Facility is as low as 2%. It has inquired about telephones used in day-to-day life. Though mobile phones are used, as students have no understanding about their basic parts, it is important to give them an understanding through a diagram.

(ii) Facility is as low as 31% due to the lack of skill of drawing the symbols of logic gates. The ability to identify the symbols of logic gates may develop in students if poster with the symbols is displayed so that they can see them always.

## Part B - Essay Questions

- Answer **three** questions, selecting **one question** each from the sections Biology, Chemistry and Physics.

### Biology

#### Objectives of question 5

- Testing the ability to distinguish underground stems by observing the diagrams given.
- Testing the knowledge related to identify uses of food stored in underground stems.
- Testing the contribution of meiosis in human reproduction process.
- Testing the knowledge and understanding about compatibility of blood groups in transfusion.
- Testing the contribution of hormones in human reproduction.

#### Question 5

5. (A) Figures (1) and (2) given below show the underground stems of Ginger and Potato respectively.

- (i) State the types of underground stems to which ginger and potato belong respectively.
- (ii) Write down a common feature that helps to identify these stems as underground stems.
- (iii) By which method of reproduction do these underground stems produce new plants?
- (iv) What is the importance of storage of food in these underground stems?

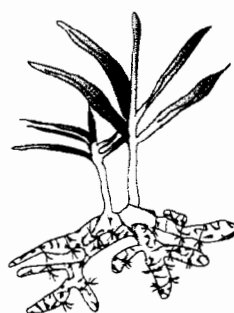


Figure (1)

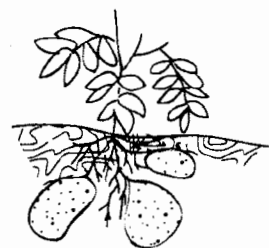


Figure (2)

(B) Generating a new organism is an important phenomenon common to the entire living world. Producing organisms that are more suited to the environment, helps to maintain the continuity of life.

- (i) Name respectively the male and female gametes which contribute to the process of human reproduction.
- (ii) (a) What is the type of cell division that occurs in the formation of gametes which helps to transmit parental characteristics to a child?  
(b) State one advantage of that type of cell division.
- (iii) During the period of pregnancy blood tests are carried out in maternal clinics and the blood group of the mother is identified.  
(a) In an emergency, blood of which groups can be transfused to a mother with blood group B?  
(b) In addition to the blood groups, what is the other factor that has to be considered essentially in blood transfusion to prevent blood clotting?
- (iv) (a) State the function of progesterone hormone soon after the fertilization.  
(b) State the function of oxytocin hormone after a child birth.

5 (A) (i) Rhizome, Stem tubers  
(01) (01)

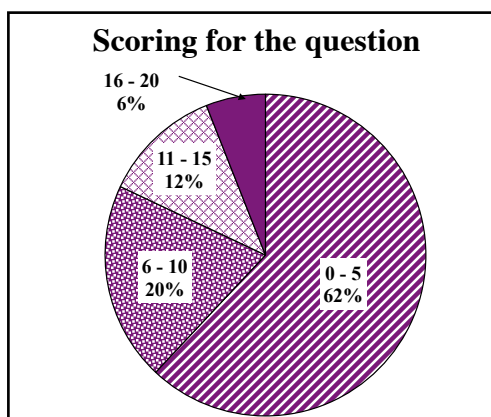
Two answers should be given according to the order.  
If only rhizome is given as the answer give 01 mark,  
no marks when the answers are interchanged (02 marks)

- (ii) Presence of axial buds/presence of scale leaves (02 marks)
- (iii) (Natural) Vegetative propagation/Asexual reproduction (01 mark)
- (iv) Under ground stem survive to grow new plant if the areal part is destroyed under the unfavourable conditions/Perennation/supply nutrition for the new plant to grow. (02 marks)

- (B) (i) Sperm, Ova  
(01) (01) (Correct order is essential) (02 marks)
- (ii) (a) Meiosis (02 marks)
- (b) • Produce offspring with more suitable characteristics for successful survival in the environment.  
• To obtain haploid chromosomes for gametes  
• To the maintenance of the constant number of Chromosomes of a Species  
• Help in evolution by creating genetic variations  
• Producing organisms with new variations (by producing new characteristics)  
(Two marks for any one of the above) (02 marks)
- (iii) (a) B (group) (01)  
O (group) (01) (02 marks)
- (b) Rh factor/ Rhesus factor (01 mark)
- (iv) (a) • Ovulation of any more ova is prevented / temporary suspended of menstrual cycle.  
• Growth of the uterine wall / increases the thickness  
(Give marks if an answer is given as preventing further production of ova.) (02 marks)
- (b) Stimulate the secretion of breast milk / Controlling the reflex actions to secrete breast milk (by mammary glands) (02 marks)

**Total marks 20**

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

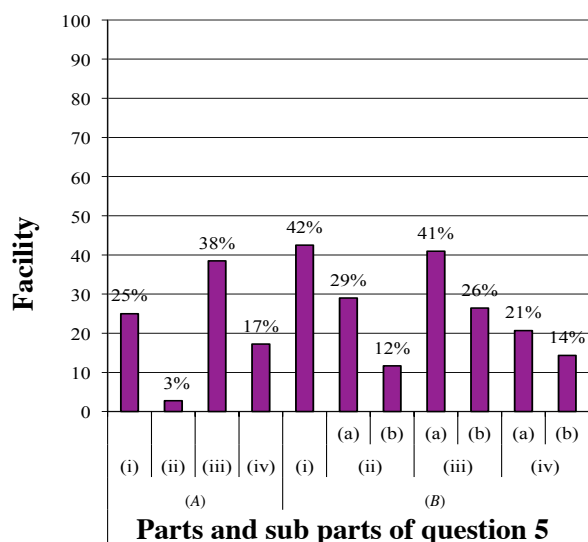


21% of the candidates have selected this question. Marks allocated for this question are 20. The percentages of students obtaining marks in the following intervals are :

|         |   |     |
|---------|---|-----|
| 0 - 5   | - | 62% |
| 6 - 10  | - | 20% |
| 11 - 15 | - | 12% |
| 16 - 20 | - | 6%  |

6% have scored above 16 for this question while the percentage scoring below 5 is 62%.

### Facility of parts and sub parts of the question



This question contains 11 sub parts of which the facility of 6 is above 50%. The sub part with minimum facility is (A)(ii) for which the facility is 3%. The most facile sub part (B)(i) has the facility of 42%.

Only 21% of students have selected this question out of the two biology questions. It is unsatisfactory that 62% of students have scored less than 5 marks.

(A) (i) Facility is as low as 25% due to the inability of distinguishing underground stems. Students should be made aware of how to group underground stems while observing them in the environment.

(ii) Only 3% have identified the underground stems. The competency related to this could be developed by using live specimens.

(iii) Facility is as low as 38%. There is a lack understanding on parts of a plant which carry out sexual and asexual reproduction. Teaching-learning process should be organized in a way to ensure that students deal with the environment. It is important that students understand that the flower carries out sexual reproduction while vegetative parts carry out asexual reproduction.

(iv) This part has a low facility as 17%. It has paid attention on underground stems in the surrounding environment. Students should be made to understand through observations that even though aerial parts die during the unfavourable seasons, they grow as the conditions become favourable.

(B)(i) Even though students have the knowledge on male and female gametes, they have not identified them as cells contributing to human reproduction. Facility of this is 42%. Students should be made to understand through discussions how to introduce male and female gametes.

(ii)(a) has a low facility as 29% and (b) has a facility of 12%. There is no sufficient knowledge on meiosis taking place in gametogenesis. The process of meiosis should be explained to students using suitable diagrams/videos.

(iii)(a) Facility is 41% and that of (b) is 26%. Understanding on blood groups and Rhesus factor (Rh) should be improved. It should be explained that production of blood groups takes place as a result of antibody-antigen reaction.

(iv)(a) Facility is 21% and that of (b) is 14%. This is at a very low level. There is a poor ability to explain the contribution of hormones in human reproduction. Knowledge should be given on hormones and their functions.

### Objectives of question 6

- Testing the knowledge on characteristics of phyla to classify organisms.
- Testing the knowledge of students on evolution.
- Testing the understanding on parts and functioning of central nervous system in nervous coordination.
- Testing the ability to identify a given reflex action.

### Question 6

6. (A) Birds and mammals successfully live in terrestrial, aquatic and aerial environments.
- (i) Write **two** features that are common to mammals and birds.
  - (ii) What is the special shape of the body that the birds have for flying?
  - (iii) To which organs have the fore limbs of birds modified for flying?
  - (iv) Birds and mammals are two groups of vertebrates.
    - (a) Name the other **three** groups that belong to vertebrates except these two groups.
    - (b) According to the evolutionary evidences, state the group of vertebrates that first came onto the land.
- (B) Cerebrum, cerebellum, medulla oblongata, thalamus and hypothalamus can be identified as the major parts of the human brain.
- (i) From the parts given above, write down the **two** parts that are found at the hind part of the human brain.
  - (ii) State separately, which part from the four parts given above, performs the following actions.
    - (a) controlling the memory
    - (b) controlling of the heart beat
    - (c) controlling of respiration
    - (d) coordination of muscle movements
    - (e) regulation of body temperature
    - (f) identifying sensation such as vision and hearing
  - (iii) Reflex actions are made by the organs brain and the spinal cord.
    - (a) By which organ, is the reflex actions need instant responses made?
    - (b) State by which organ the following reflex actions are made.
      - (I) The adjustment of the pupil of the eye as a result of the eye receiving strong and weak light
      - (II) Taking away of the hand when it comes into contact with something hot
- 6 (A) (i)
- Warm blooded animals / Homeothermic
  - Presence of four chambered heart
  - Respiration through lungs
  - Having a vertebral column
- (Give two marks for any two of above) (02 marks)
- (ii) Streamlined body shape (01 mark)
- (iii) Wings (01 mark)
- (iv) (a) Pisces / Fish, Amphibia (Amphibians), Reptillia (Reptiles) (03 marks)
- (b) Amphibians (02 marks)

(B) (i) Cerebellum, Medulla oblongata  
(01) (01)

(02 marks)

- (ii) (a) Cerebellum  
(b) Medulla oblongata  
(c) Medulla oblongata  
(d) Cerebellum  
(e) Hypothalamus  
(f) Cerebrum

(06 marks)

(iii) (a) Spinal cord / Brain

(01 mark)

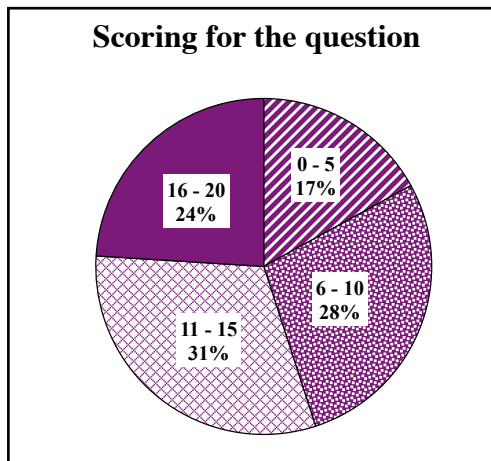
(b) (I) Brain (01)

(II) Spinal cord (01)

(02 marks)

**Total marks 20**

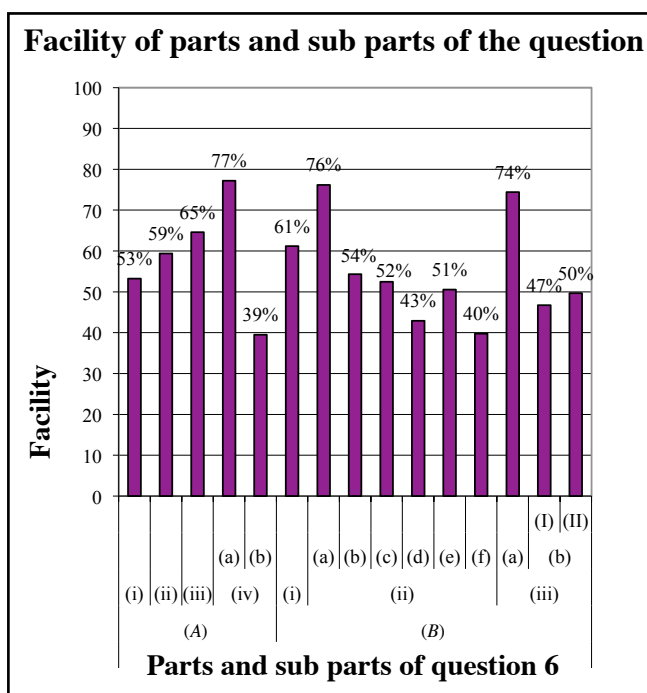
### Overall observations, conclusions and suggestions regarding the answers to Question 6 :



Nearly 78% have selected question 6. Of the two Biology questions in section B, this is the less popular. The question carries 20 marks. The percentages of candidates falling into the four selected intervals are :

|         |   |     |
|---------|---|-----|
| 0 - 5   | – | 17% |
| 6 - 10  | – | 28% |
| 11 - 15 | – | 31% |
| 16 - 20 | – | 24% |

The percentage scoring above 16 for this question is 24% while 17% have scored below 5.



This question contains 15 sub parts. Of them, 5 sub parts hold a facility above 60%. The sub part of lowest facility is (A)(iv)(b) and its facility is 39%. The sub part (A)(iv)(a) holds the highest facility of 77%.

Out of biology question 5 and 6, 78% of students have selected the question number 6. It is only about 17% of students who have obtained a low proficiency level. Facility stays at a satisfactory level as 40% or more than 40%.

(A)(iv)(b) Facility is 39%. It is expected to test students' knowledge on evolution. This facility is not satisfactory even though this simply tests the knowledge.

(B)(ii)(f) Facility is 40%. It has inquired about the parts of the central nervous system. As a whole, responses to parts of the central nervous system are at a satisfactory level. The relevant competency level could be achieved through teacher- student discussions on parts of the central nervous system and their functions.

## Chemistry

### Objectives of question 7

- Testing the ability to compare the rate of reactions using the observations.
- Testing the attention on chemical reactions related to day to day activities.
- Testing the skill to use factors to extinguish a fire.
- Testing the ability to find the rate of reactions using a practical activity.
- Testing the ability to calculate the amount of a chemical substance needed for an experiment.

### Question 7

7. Consider the following chemical reactions.

- |  |                              |
|--|------------------------------|
| * Rusting of iron                      | * Toddy turning into vinegar |
| * Ripening of fruits                   | * Petrol catching fire       |
| * Reaction of Mg with diluted HCl acid |                              |

(i) From the above reactions,

- write down a reaction that occurs slowly.
- write down a reaction that occurs fast.

(ii) (a) Among all the reactions given above, which reaction requires the involvement of micro-organisms?

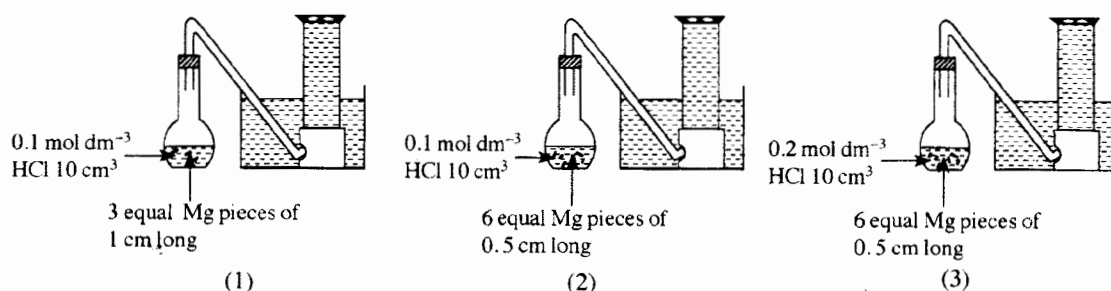
(b) Write the chemical equation for the reaction you mentioned in (a) above.

(iii) Petrol catching fire is a combustion reaction.

- Write down the factors which are required to create a fire.
- Name a fire extinguisher which is most suitable to extinguish a petrol fire.
- When using the fire extinguisher you mentioned in (b) above, for what reason is the fire extinguished?



- (iv) The experimental setup relevant to an experiment for the determination of the factors affecting the rate of a reaction, using Mg and diluted HCl as reactants are given below as (1), (2) and (3). The initial states of the experiment are shown here.



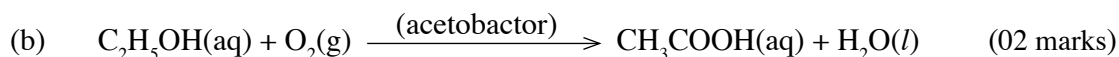
Gases evolved from the reaction during a constant time interval are collected as shown in the setup.

- Out of the given three setup, in which setup does the reaction occur at the highest rate?
- What factor that affects the rate of a reaction is tested in each of the following pairs of experimental setup?
  - by setup (1) and (2)
  - by setup (2) and (3)
- If 2.4 g of Mg is used in the above experiments, calculate the mole amount of Mg used (Mg = 24).
- If you don't have any facilities to collect the gas that evolves during this experiment, how would you identify the reaction which occurs at the highest rate?

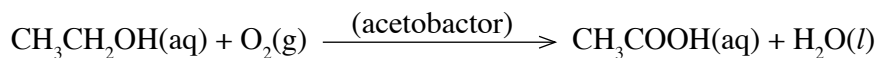
- 7 (i) (a)
  - Rusting of iron
  - Ripening of fruit
  - Toddy turning into Vinegar (Two marks for any one of above) (02 marks)

- (b)
  - Reaction of Mg with diluted HCl acid
  - Petrol catching fire (Two marks for any one of above) (02 marks)

- (ii) (a) Toddy turning into Vinegar (01 mark)



or



(Give marks even though the physical states are not mentioned)

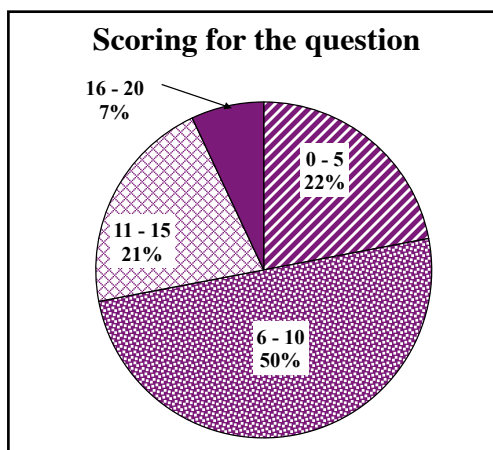
(No marks for word equation) (02 marks)

- (iii) (a)
  - Presence of a combustible substance (01)
  - Heating the combustible substance to it's ignition point (01)
  - Supply of supporter of combustion / Oxygen (gas) /  $\text{O}_2$  (gas) (01) (03 marks)
- (b) Foam fire extinguisher (01 mark)
- (c) Foam spread on oil and preventing contact with supporter of combustion / Oxygen with oil / combustible substance (01)  
As the evolved  $\text{CO}_2$  is not a supporter of combustion (01) (02 marks)

- (iv) (a) 3 (01 mark)
- (b) I. Physical nature of reactants / surface area of reactants (01 mark)  
 II. Concentration (of reactants) (01 mark)
- (c)  $\frac{2.4(\text{g})}{24(\text{g mol}^{-1})}$  (01)  
 0.1 mol / 0.1 (01) (02 marks)
- (d) • Counting the number of gas bubbles evolve in a constant time period.  
 • Comparing masses of remaining Mg in a constant time period.  
 • Comparing the time taken to disappear Mg strips.  
 • Identifying the setup which evolves gas bubbles at a higher rate.  
*(Give two marks for any of the above)* (02 marks)

**Total marks 20**

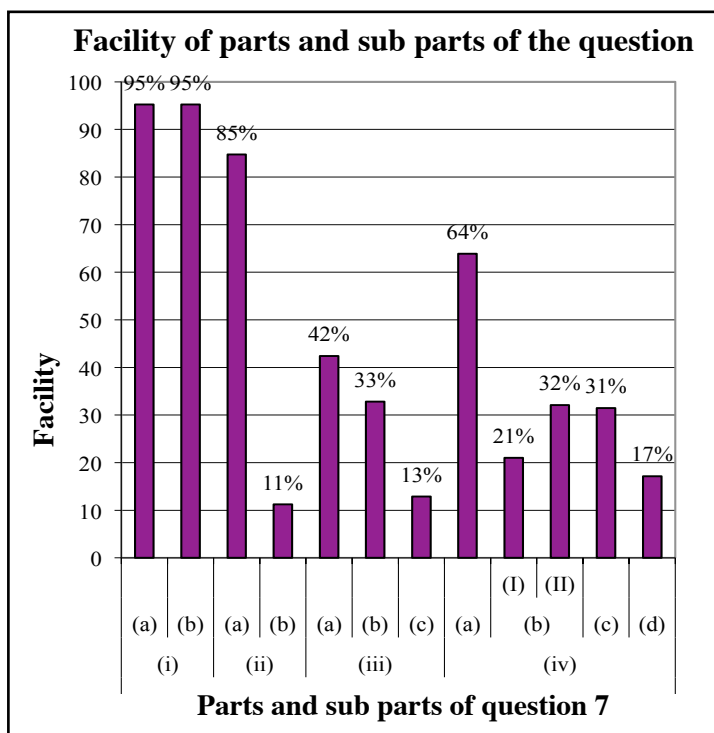
**Overall observations, conclusions and suggestions regarding the answers to Question 7 :**



The percentage selecting question 7 is 83%. Of the two Chemistry questions in part B, this is the one selected by less number of candidates. Allocated to this question are 20 marks. The following percentages of candidates have scored within the given intervals for this question.

|         |   |     |
|---------|---|-----|
| 0 - 5   | - | 22% |
| 6 - 10  | - | 50% |
| 11 - 15 | - | 21% |
| 16 - 20 | - | 7%  |

As regards this question, 7% have scored above 16 while 22% have scored below 5.



This question contains 12 sub parts. Of them, 4 sub parts hold a facility above 60%. The facility of the 4 sub parts is below 30%. The sub part of lowest facility is (ii)(b) and its facility is 11%. The sub part (i)(a) and (b) holds the highest facility of 95%.

Out of the two chemistry questions, 83% of students have selected this question. 22% of students have scored 5 or less than 5.

(i) Facility of both (a) and (b) is 95%. The ability to compare the rate of reactions is at a higher level.

(ii)(a) Facility is as good as 85% while that of (b) is 11%. It seems that the ability to write chemical equations is low. Teacher should plan lessons in a way so that students develop the competency of writing chemical equations when they engage in exercises to write balanced chemical equations.

(iii)(b) Facility is 33% due to the lack of knowledge on selecting a fire extinguisher based on the type of fuels. Teacher should plan lessons in way so that students get the understanding on selecting fire extinguishers.

(c) Facility is as low as 13%. This is due to the lack of knowledge and understanding on actions taken to avoid the factor needed for fire. Teaching regarding this should be further improved.

(iv)(a) Facility is 64% and that of (b) (i) and (ii) are 25% and 32% respectively. This is because even though there is an understanding on factors affecting reaction rate, the skill to make decisions based on data and information given is weak.

(c) Facility is 31% due to the lack of ability to do calculations related to moles. Teacher should engage students in more exercises to improve the facility.

(d) It is important to develop the skill to arrive at conclusions based on alternative methods in instances where it is impossible to do it using direct observations.

### Objectives of question 8

- Testing the ability to calculate the amount of substances using the concept of solubility.
- Testing the ability to identify solutions using the concept of solubility.
- Testing the knowledge on factors affecting solubility.
- Testing the ability to obtain different observations related to each experiment.
- Testing the understanding on factors affecting the solubility of a gas in a solvent.

### Question 8

8. (A) (i) A solution of 100 g is prepared by dissolving, a mass of 30 g of solid  $\text{MgCl}_2$  in pure water at  $25^\circ\text{C}$ .
- (a) State the reason for selecting water to prepare the  $\text{MgCl}_2$  solution.
  - (b) Calculate the composition of the  $\text{MgCl}_2$  solution prepared above, as a percentage by mass (w/w).
- (ii) (a) A small amount of  $\text{MgCl}_2$  was deposited at the bottom of the beaker, when another 30 g of  $\text{MgCl}_2$  was added to the  $\text{MgCl}_2$  solution prepared in (i) above, stirred well and kept for a short time. What is the special name used to introduce this type of solutions?
- (b) The beaker with the solution in (a) above was heated up to a temperature of about  $60^\circ\text{C}$ . State an important observation that could be made here.
  - (c) Explain the reason relevant to the observation stated in (b) above.
- (iii) A student has taken 100 g of water at  $20^\circ\text{C}$  into a beaker. Then this beaker containing water was heated up to a temperature of about  $80^\circ\text{C}$ . He observed the evolution of gas bubbles in this situation.
- Explain the reason relevant to the observation made by the student.

(B) Some steps followed during the construction of a particular house are given below.

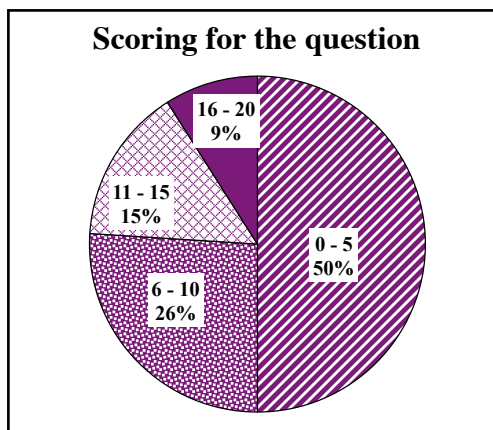
- \* Preparing a concrete mixture
  - \* Placing the concrete mixture on a steel skeleton above the walls
  - \* Applying mortar on the walls
  - \* Colour washing (painting) of the walls
- (i) (a) What is the alloy used in the construction of the above house?  
(b) State the major component in the alloy.
  - (ii) In which step has a mixture consisting calcium oxide been used?
  - (iii) As soon as the concrete mixture was prepared, it should have been placed on the steel skeleton. What is the reason for this?
  - (iv) Name a heavy metal ion that could be released to the environment when certain kinds of paints are used.
  - (v) Natural resources are used for the construction of houses and buildings. State **two** environmental damages that would occur when getting these resources from the environment.

- 8 (A) (i) (a) •  $\text{MgCl}_2$  is an ionic compound /  $\text{MgCl}_2$  is a Polar solute (01)  
Water is a polar solvent (01)  
or  
• As Polar compounds dissolve in polar solvents,  $\text{MgCl}_2$  dissolves in water (02)  
(02 marks)
- (b)  $\frac{30(\text{g})}{100(\text{g})} \times 100$  (01)  
 $= 30\%(\text{w/w})$  (01) (02 marks)

- (ii) (a) Saturated solution (02 marks)
- (b) Deposited  $\text{MgCl}_2$  at the bottom of the beaker dissolves gradually /  
Disappearance of  $\text{MgCl}_2$  /  
Decreases the amount of  $\text{MgCl}_2$  deposited at the bottom (02 marks)
- (c) When the temperature increases, the solubility / rate of reaction of  
 $\text{MgCl}_2$  increases. (02 marks)
- (iii) Since the solubility of dissolved gases in water decreases when the temperature  
increases.  
(When temperature increases the dissolved gasses in water evolved as gas bubbles) (02 marks)
- (B) (i) (a) Steel (01 mark)
- (b) Iron / Fe (01 mark)
- (ii) The step of applying motor on the walls / 3<sup>rd</sup> step (01 mark)
- (iii) As the concrete mixture / cement mixture solidified immediately. (02 marks)
- (iv)  $\text{Pb}^{2+}$  / Pb ions / Lead ions (give marks when the answer is given as Pb, Lead)  
 $\text{Cd}^{2+}$  / Cadmium ions (give marks for Cd or cadmium) (01 mark)
- (v) • Destruction of forests (for timber)  
• Damage to the bio - diversity  
• Disorder of the natural cycles  
• Destruction of coral beds  
• Land slide  
• Soil erosion  
• Sea erosion  
• Spread infectious diseases caused by mosquitoes  
(Two marks for any two of above or any acceptable answers) (02 marks)

**Total marks 20**

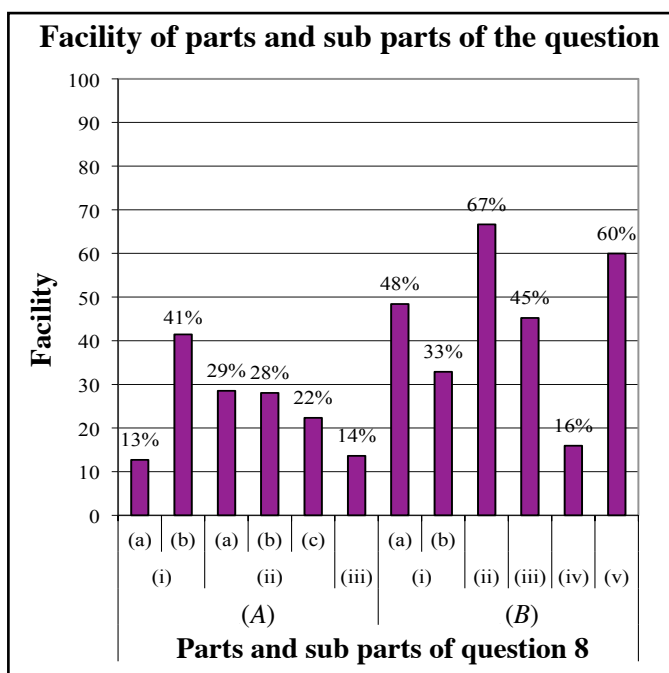
## Overall observations, conclusions and suggestions regarding the answers to Question 8 :



13% have selected question 8 which embodies 20 marks. The percentage of candidates whose marks fall into the four selected intervals are :

|         |   |     |
|---------|---|-----|
| 0 - 5   | – | 50% |
| 6 - 10  | – | 26% |
| 11 - 15 | – | 15% |
| 16 - 20 | – | 9%  |

The percentage scoring above 16 for this question is 9% while 50% have scored below 5.



This question contains 12 sub parts of which the facility of 5 is above 40%. The facility of the 6 sub parts is below 30%. The sub part with minimum facility is (A)(i)(a) for which the facility is 13%. The most facile sub part (B)(ii) has the facility of 67%.

Out of the two chemistry questions in part B, only 13% of students have selected this question. Candidates have not selected this question as the facility of part 1 is as low as 13%.

$\text{MgCl}_2$  is an ionic solute and water is a polar solvent. Teacher should teach emphasizing that water is used here since ionic compounds are soluble in polar solvents. As the same time, knowledge regarding nonpolar solvents and nonpolar solutes should be given to students with examples.

(ii)(a) Facility is 29% due to lack of knowledge and comprehension on the concept of saturated solution. Practical knowledge on the fact that solubility of liquids increases as the temperature increases is low. Due to this facility of (b) is 28%. This should be done through experiments. Facility of (c) is also 22% due to the same reason like above. So, it is important to give students the knowledge regarding this by engaging them in experiments.

(iii) Facility is 14% due to the lack of understanding on the fact that solubility of gases decreases as the temperature increases. So, it is important to give the understanding on factors affecting solubility of a gas in a solvent. As an example it could be shown that the gases dissolved before heating water go away when heated or increasing the temperature.

(B)(iv) Facility is 16%. Teacher should explain the students that the paints used in day - to - day life contain ions of heavy metals like lead, cadmium etc.

## Physics

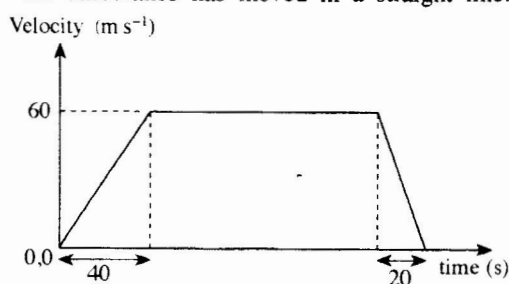
### Objectives of question 9

- Testing the knowledge on applications of electromagnetic waves after identifying their properties.
- Testing the understanding on simple calculations related to sound.
- Testing the understanding on uses of mirrors in day to day life.
- Testing the ability to solve problems related to motion using graphs.
- Testing the understanding on actions taken to prevent accidents caused when using electricity.

### Question 9

9. Chamod who was frightened when a sudden fire broke out in the house due to an electrical leakage fell-down and hurt his head badly while trying to run away. Chamod was first admitted to a base hospital where he had to undergo various tests including an X-ray test. Considering the seriousness of the injury, the doctors decided that he has to undergo an emergency surgery and transferred him by an ambulance to the general hospital.

- (i) Due to which property of X-rays, are X-rays used in the medical field?
- (ii) The driver in the ambulance had to take the patient to the general hospital as soon as possible.
  - (a) When an ambulance is travelling on the road, drivers who are ahead of the ambulance, identify the special sound produced by the ambulance (sound emitted by the siren) and give way for it. From what characteristic of the sound would the other drivers identify it as an ambulance?
  - (b) The wavelength of the sound produced by the ambulance above is 0.44 m and the speed of the sound in air is  $330 \text{ m s}^{-1}$ , calculate the frequency of the sound emitted by the ambulance.
  - (c) The English word AMBULANCE is written in front of the ambulance as  $\text{ƆO⅃A⅃U8MΛ}$  for other drivers ahead to identify it as an ambulance. Explain how other drivers easily identify this word.
- (iii) The velocity-time graph relevant to the motion of the above ambulance from the base hospital to the general hospital is given below.  
Answer the questions given below using the velocity-time graph or by any other method. (For your calculations, assume that the ambulance has moved in a straight line.)



- (a) What is the uniform velocity with which the ambulance has travelled?
  - (b) If the displacement of the ambulance with uniform velocity is 15 km (15 000 m), find the time that it travelled with uniform velocity.
  - (c) Find the distance between the two hospitals.
  - (d) The surgery had to be started within 30 minutes, from the instant the patient has been transferred from the base hospital. If the doctors in the general hospital were ready and other necessities were fulfilled for the surgery, were the doctors able to start the surgery in time? Explain your answer.
- (iv) (a) What is the component used in household circuits to prevent electrical shock due to an electrical leakage?
  - (b) What is the function of the component you have mentioned in (a) above?
  - (v) State **three** facts that can be included in an article that you are planning to write to the school science magazine on the topic "The safety precautions that can be taken to prevent accidents by electricity at home."

- 9 (i) Can detect only bones / coloured tissues (02) or  
As these rays contain great deal of energy / frequency (01) they are able to penetrate through the body (01)  
(01 mark)

- (ii) (a) Quality of sound (01 mark)

(b)  $v = f\lambda$

or

$$f = \frac{330 \text{ m s}^{-1}}{0.44 \text{ m}} \quad (01)$$

$$f = 750 \text{ Hz} / 750 \text{ Hertz} / 750 \text{ number of cycles per second} / 750 \text{ s}^{-1}$$

(Correct answer with unit - 01) (02 marks)

- (c) As the image formed by side mirrors / mirrors (01) of the vehicle is latterly inverted (01) the word can be read easily.  
(02 marks)

- (iii) (a)  $60 (\text{m s}^{-1})$  (01 mark)

(b) Displacement = Area of the rectangle  
or  
 $15\,000 (\text{m}) = 60 (\text{m s}^{-1}) \times t$   
or  
 $t = \frac{15\,000 (\text{m})}{60 (\text{m s}^{-1})}$   
 $t = 250 (\text{s})$  or  
 $= 4.17 \text{ min} \text{ or } 0.069 \text{ hours} \quad (01)$

or

When using equations

$$s = ut + \frac{1}{2} at^2$$

$$t = \frac{s}{u} \text{ or}$$

$$t = \frac{15\,000 (\text{m})}{60 (\text{m s}^{-1})} \quad (01)$$

$$t = 250 (\text{s}) \text{ or}$$

$$= 4.17 \text{ min} \text{ or } 0.069 \text{ hours} \quad (01)$$

When the time is given in minutes or hours, give the final mark only for the answer with units.  
(02 marks)



(c) Distance between two hospitals = Area of the trapezium  

$$= \frac{1}{2} (250 + 310) \times 60$$
or  

$$= \left( \frac{1}{2} \times 40 \times 60 \right) + (60 \times 250) + \left( \frac{1}{2} \times 20 \times 60 \right)$$
or

When it is found using the equation  $s = ut + \frac{1}{2} at^2$

$$\begin{aligned} \text{Total distance} &= \left\{ \frac{1}{2} \frac{(60 - 0)}{40} \times 40^2 \right\} + (60 \times 250) + \left\{ \frac{1}{2} \frac{(60 - 0)}{40} \times 20^2 \right\} \quad (01) \\ &= 16\,800 \text{ (m)} / 16.8 \text{ km} \quad (01) \end{aligned}$$

Give 01 mark for the correct substitution in part (c) even though the answer in iii(b) is incorrect

(02 marks)

(d) Yes / able (01)

Time taken by the ambulance to travel between the two hospitals = 310 seconds

$$\begin{aligned} &= \frac{310(\text{s})}{60(\text{s})} \\ &= 5.16 \text{ min} \quad (01) \end{aligned}$$

Therefore the doctors were able to start the surgery as the patient could have been taken to the hospital before 30 minutes (01)

(03 marks)

(iv) (a) Trip switch / miniature circuit breaker / MCB (01 mark)

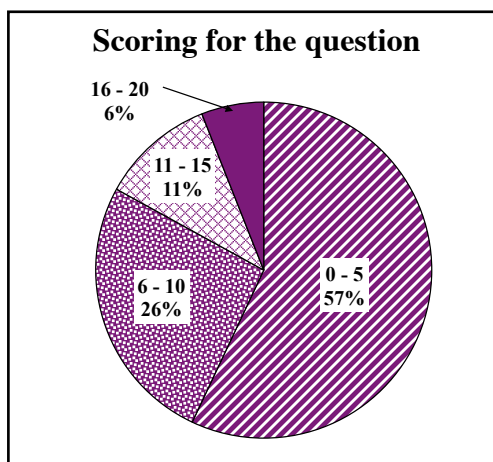
(b) The house hold circuit opens automatically / disconnect as the leakage current earthling / As soon as the leakage current from a part of the household circuit is earthling, this switch automatically opens and disconnects the power supply. (01 mark)

- (v)
- Use fuse wires of appropriate ampere value not exceeding the maximum current in the circuit.
  - Do not connect number of electrical appliances consuming high amounts of electricity to the same plug base using multiplug.
  - Use the earth connection when connecting apparatus with metal cover to the supply.
  - Test once in few time, whether the trip switch is working by pressing the test button.
  - In an emergency electric fire, use main switch to disconnect the power supply.
  - When using electric appliances with metal covering like electric iron it is safer to stand on a rubber carpet or wear rubber slippers.
  - For necessary maintenance, get the service of a trained electrician.
  - Replace new components instead of damage plugs / plug bases / holders
  - When the electric appliances are not used, remove the plug from the plug base.

(Give 03 marks for any acceptable scientific reasons as above) (03 marks)

**Total marks 20**

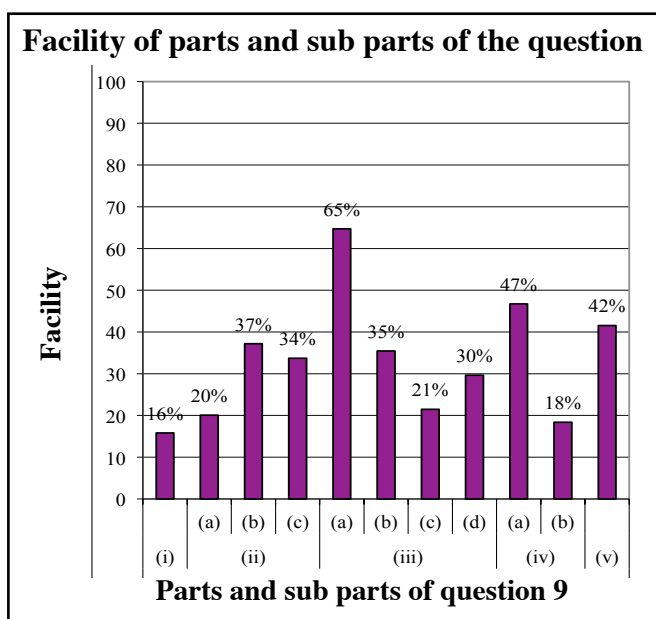
## Overall observations, conclusions and suggestions regarding the answers to Question 9 :



The percentage of candidates answering this question is 60%. The question carries 20 marks. The percentage obtaining marks in the following four intervals are :

|         |   |     |
|---------|---|-----|
| 0 - 5   | – | 57% |
| 6 - 10  | – | 26% |
| 11 - 15 | – | 11% |
| 16 - 20 | – | 6%  |

The percentage scoring above 16 for this question is 6% while 57% have scored below 5.



This question contains 11 sub parts. Of them, 3 sub parts hold a facility above 40%. The facility of the 6 sub parts is below 35%. The sub part with minimum facility is (i) for which the facility is 16%. The most facile sub part (iii)(a) has the facility of 65%.

9(i) Facility is as low as 16%. Students have failed to understand the property of X- rays used in medical field. X-rays can penetrate the body as they have a lot of energy or a high frequency. This could be explained by showing an X-ray photograph of a bone fracture. It could be further explained that X-rays cannot go through bones but through flesh.

(ii)(a) Facility is 20%. It has tested the ability to identify characteristics of sound. Knowledge on characteristics of sound should be demonstrated using suitable instruments.

(ii)(b) Facility is 37%. It has tested the ability to do calculations using  $v = f\lambda$ . It could be improved by engaging students in more exercises. Writing the answer with the correct units should be emphasized.

(iii)(b) Facility is 35%. It has tested the ability to solve problems using graphs of motion. Teacher should make students engage students in drawing graphs of motion using given data and solving problems using graphs.

(iv)(b) Facility is 18%. It has tested the knowledge on electrical accessories used in household circuit and their functioning. Teaching process should be done to clearly explain the functioning of trip switch.

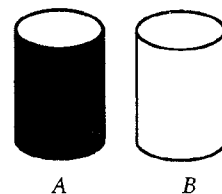
### Objectives of question 10

- Testing the understanding on the methods of heat transfer.
- Testing the ability to explain the phenomena caused by refraction of light.
- Testing the skill to calculate the amount of heat absorbed using mass, specific heat capacity of a substance and temperature change.
- Explaining that the amount of heat absorbed by radiation changes according to the nature of the surface.
- Testing the ability to identify an electronic device using the symbol.
- Testing the understanding on basic concepts about a given electronic device.

### Question 10

10. The Sun emits light and heat in all directions.

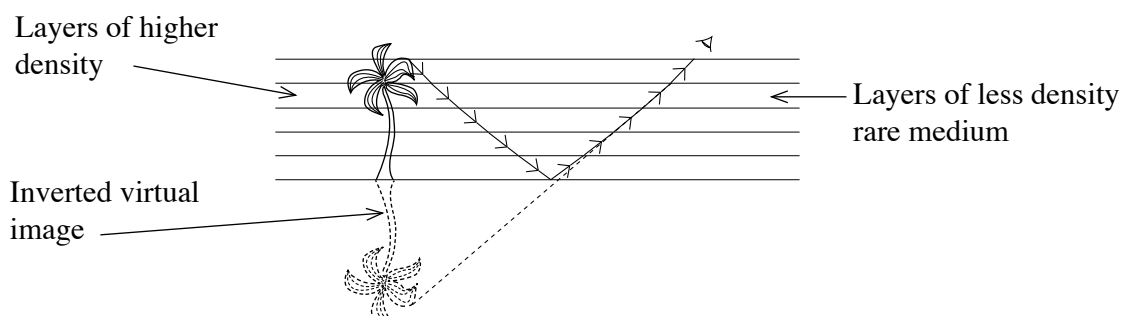
- (i) (a) By which method of heat transfer, does the heat from Sun reach the Earth?  
(b) How does the method you have mentioned in (a) above differ from the other heat transferring methods?
- (ii) On a hot sunny day, Sujith came home after school by walking on a tarred road.  
(a) When Sujith was walking along the road he saw there appeared to be a pool of water at the far end of the road. Explain briefly the phenomenon seen by him.  
(b) The roof of Sujith's house is sheltered with 40 asbestos sheets of 30 kg each. Due to the sun shine the temperature of the sheets increased from 35 °C to 40 °C. (Specific heat capacity of asbestos is 1050 J kg<sup>-1</sup> K<sup>-1</sup>)  
(I) Calculate the solar heat absorbed by one asbestos sheet.  
(II) Calculate the total amount of solar heat absorbed by all the sheets.
- (c) Sujith has activated a 0.1 kW electric fan for  $\frac{1}{2}$  an hour since the house was warm. Calculate the electrical energy consumed by the electric fan.
- (d) There were equal volumes of water in two equal cylindrical metal tanks A and B kept outside the house under the sun. The outer surface of tank A was painted with black paint and the outer surface of tank B was shiny.
- (I) Out of the two tanks, if Sujith wanted to have a bath with lesser warm water, which tank should he select?  
(II) Explain briefly the reason for the water in the two tanks to have different temperatures.
- (iii) Solar cells are used to generate electricity from the energy of sunlight. Solar cells are photodiodes constructed in a special way.  
(a) Draw the symbol of a photodiode and mark its positive (+) terminal and negative (–) terminal.  
(b) Name a compound that is used to increase the light sensitive property of a photodiode.  
(c) What is the optical component in a photodiode used to focus light onto the p-n junction.



- 10 (i) (a) Radiation (02 marks)
- (b) Medium is not essential for the heat transfer from radiation / The other heat transmissions occur through material media but in this method heat transmission can occur through vacuum. (01 mark)

- (ii) (a)
- Became a rarer medium / decreases the density of air layer near the hot road because of heating. (01)
  - Density of higher layers of air comparatively increases / became a denser medium. (01)
  - When a ray of light refracts from up to down, at the layer closer to tarred road, the incident angle will be greater than the critical angle. (01)
  - As it takes place, and total internal reflection occurs, the mirage forms. (01)

or



Represent the rays in correct way (01)

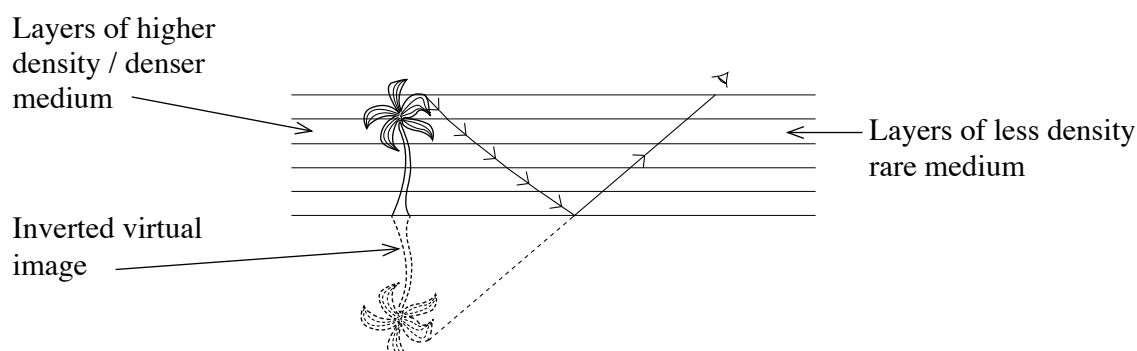
Represent the difference of densities of air layers (01)

Total internal reflection occurs (01) when the incident angle is greater than the critical angle (01)

(04 marks)

or

Give marks if the following figure is given instead of the figure above.



(b) I. Amount of heat absorbed by a sheet =  $mc\theta$

or

$$= 30 \times 1050 \times 5 \quad (01)$$

$$= 157500 \text{ (J)} / 157.5 \text{ kJ} \quad (01)$$

(02 marks)

II. Total amount of heat absorbed by 40 sheets =  $157500 \times 40 \quad (01)$

$$= 6300000 \text{ (J)} = 6.3 \times 10^6 \text{ (J)}$$

or

$$= 6300 \text{ kJ} = 6.3 \times 10^3 \text{ (kJ)} \quad (01)$$

Give one mark for correct substitution if the answer is wrong in (i) above.

(02 marks)

$$(c) \text{ Energy} = 0.1(\text{kW}) \times \frac{1}{2}(\text{h}) \quad (01)$$

$$= 0.05 \text{ kWh} / 0.05 \text{ kilo watt - hours} \quad (01)$$

or

$$\text{Power} = \frac{\text{Energy}}{\text{Time}}$$

$$0.1 \times 1000 (\text{W}) = \frac{\text{Energy}}{30 \times 60 (\text{s})}$$

or

$$\text{Energy} = 0.1 \times 1000 \times 30 \times 60 \quad (01)$$

$$\text{Energy} = 180000 \text{ J} / 18 \times 10^4 \text{ J} / 1.8 \times 10^5 \text{ J} / 180 \text{ kJ} \quad (01)$$

*Give the final mark for the correct answer with the unit. (02 marks)*

(d) I. tank B / tank with shiny surface (01 mark)

II. Black surfaces absorb thermal radiation with a higher rate than the shiny surfaces (02)

or

the rate absorption of thermal radiation by the black surfaces is higher than the shiny surfaces (02)

or

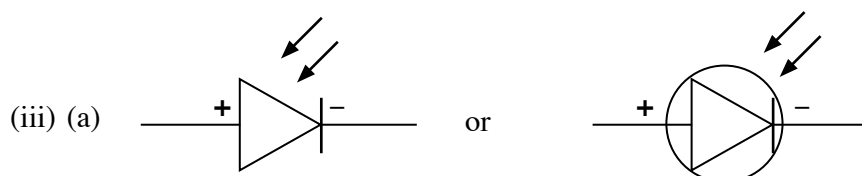
The rate of absorption of thermal radiation by the black surfaces is high (01)

The rate of absorption of thermal radiation by shiny surfaces is less (01)

or

The shiny surfaces reflect more thermal radiation rather than black surfaces (02)

(02 marks)



for symbol (01)

naming terminals (01)

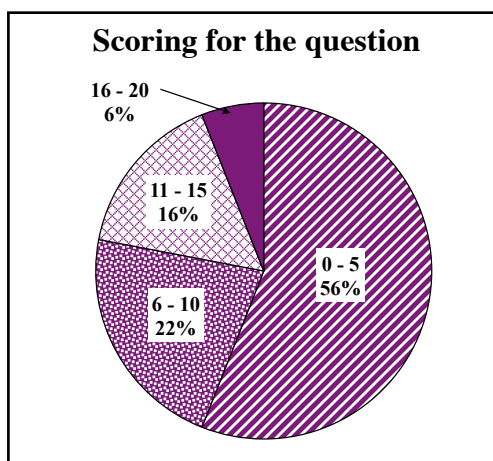
(02 marks)

(b) Cadmium sulphide / Cadmium selenide / Cds / Cdse (01 mark)

(c) Convex lens / Converging lens (01 mark)

**Total marks 20**

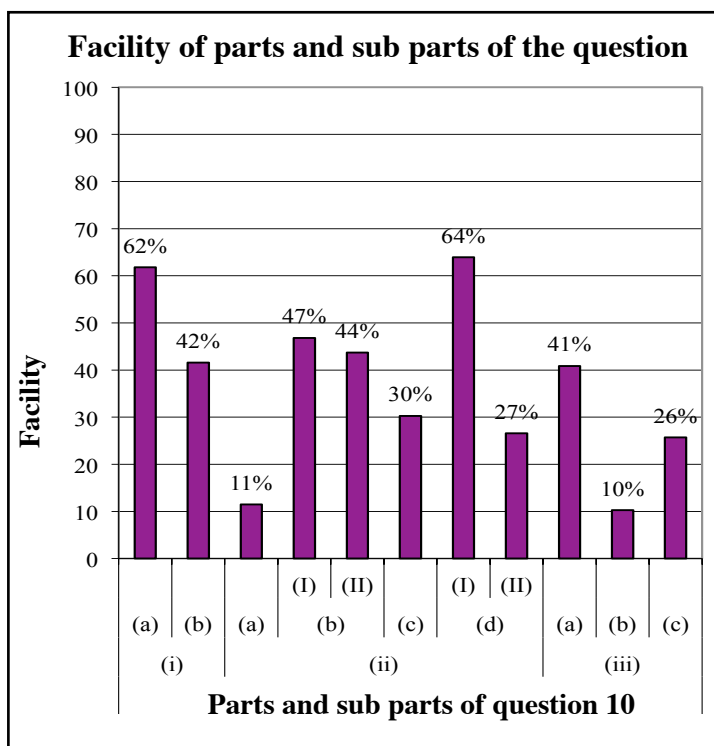
## Overall observations, conclusions and suggestions regarding the answers to Question 10 :



The percentage of candidates who have chosen question 10 is 32%. The percentage obtaining marks in the respective intervals are :

|         |   |     |
|---------|---|-----|
| 0 - 5   | – | 56% |
| 6 - 10  | – | 22% |
| 11 - 15 | – | 16% |
| 16 - 20 | – | 6%  |

The percentage scoring above 16 for this question is 6% whereas the percentage scoring below 5 is 56%.



There are 11 sub parts in the question. Of them, the facility of 6 stands above 40%. The facility of the 4 sub parts is below 30%. The sub part with minimum facility is (iii)(b) for which the facility is 10%. The most facile sub part (d)(I) has the facility of 64%.

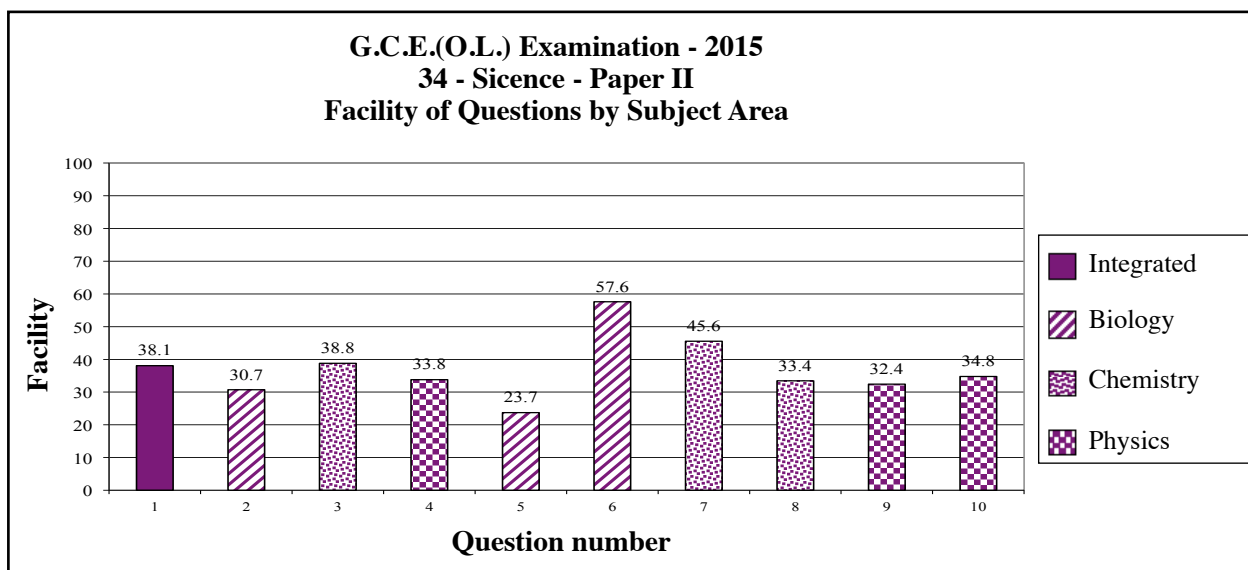
(ii)(a) Facility is 11%. It has tested the scientific basis behind the occurrence of mirage. A diagram should be drawn on the board to ensure the occurrence of this phenomenon. Examples should be given for other instances where total internal reflection takes place.

(ii)(c) Facility is 30%. It is important to do more calculations on power of electrical appliances and the amount of energy used according to the time duration that they are used for. Students should be trained to calculate the electricity consumption in kilowatt hours and energy in Joules.

(ii)(d)(II) Facility is 27%. It has tested the fact that absorption of heat by radiation depends on the nature of the surface. Students should be directed to write comparative answers in instances like this. It should also be emphasized that it is not heat but heat radiation which is absorbed.

(iii)(c) Facility is 26% because of the inability to identify optical instruments. It has inquired the devices used to focus light. It should be emphasized that it is the convex lens which could be used in any instance to focus light.

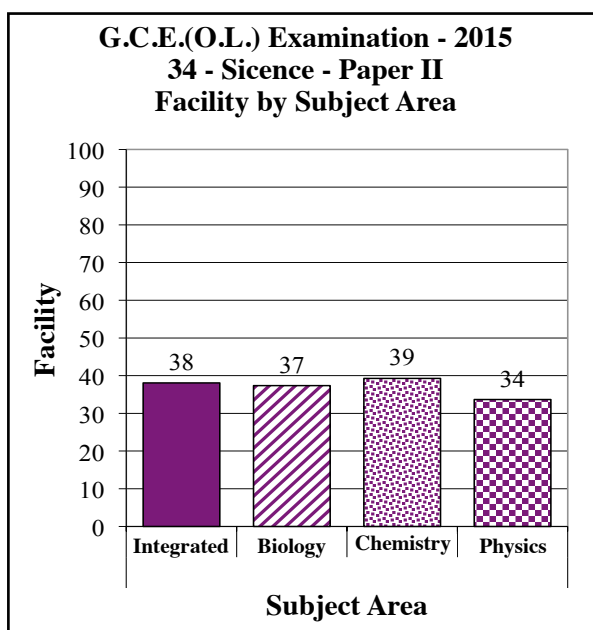
## 2.2.4 Overall observations and conclusions regarding the answers to paper II :



Chemistry question shows the highest facility in structured essay paper and it is 38.8%. Biology questions the lowest facility and it is 30.7%.

When considering essay questions, question 5 has a facility of 23.7% and question 6 has a facility of 57.6%. Out of Chemistry questions 45.6% have successfully answered question 7 and the facility of question 8 is 33.4%.

Physics questions 9 and 10 respectively show a facility of 32.4% and 34.8%.



When considering the facilities of subject areas in paper II in the G.C.E.(O.L.) Examination 2015, the percentages presenting correct answers for the respective subject areas are as follows.

|            |     |
|------------|-----|
| Biology    | 37% |
| Chemistry  | 39% |
| Physics    | 34% |
| Integrated | 38% |

Accordingly, if teaching - learning process is planned identifying difficult areas, performance in science can be improved.

## Part III

### 3 Facts to be considered when answering questions and suggestions :

#### 3.1. Facts to be considered when answering :

##### **Common instructions :**

- \* The candidates should read well and understand the basic instructions given in the question paper. They should be considerate as to the facts such as how many questions be answered in each section, which questions are compulsory, what time is affordable and how much can be scored. They also should read the questions carefully and select the questions with a clear mind set.
- \* When responding to the questions in Paper I, one response which is the most correct needs to be selected. Also, only one cross must be marked clearly.
- \* When answering questions in Paper II, every new question should be started on a new page.
- \* Answers should be written in clear and correct handwriting.
- \* The candidate's index number should be written in every page in the relevant box.
- \* Numbers of questions, parts and sub parts should be indicated correctly.
- \* Long descriptions shouldn't be given when short specific answers are expected. Similarly short answers should be avoided in places where descriptive answers are preferred.
- \* According to the way the question is posed, facts should be presented logically and analytically.
- \* When answering Paper II, all the sub parts given under the main question should be read carefully and only the target answer relevant to each sub part should be written.
- \* Care should be taken to manage time properly when answering questions.
- \* Corrector fluid should not be used when writing answers.
- \* Candidates shouldn't use red and green pens in writing answers.
- \* When handing over the answer scripts, all the pages should be arranged so that answers for the same question come in correct sequence and tied up securely.

##### **Special instructions :**

- \* The technical terms in science should be used in appropriate places.
- \* When diagrams are needed, they should be drawn very clearly and labeled.
- \* In calculations, each and every step should be indicated clearly.
- \* Units should be used correctly where necessary.
- \* Standard forms should be used when writing scientific names and symbols.
- \* When writing chemical equations at relevant places, they should always be balanced.
- \* When drawing graphs, the 'x' and 'y' axes should be named correctly and where necessary the units too should be stated.



### 3.2. Comments and suggestions about the teaching learning process :

- \* Science is a process of producing knowledge. It is an exercise that depends both on careful observations made on existing events as well as the theories formulated to give meaning to such observations. The body of knowledge in science is subject to constant change as a result of man's curiosity about the environment and the process of looking inquisitively and rationally at the world for understanding. Scientific knowledge transcends the limits of the knowledge in common range which most of the people have.
- \* The major outcome of science education is the inculcation in students the competencies and understanding about action and scientific information, scientific attitude, interest toward science, scientific appreciation, science literary and the ethics of science. The science teacher should teach science in such as way that the students develop such competencies.
- \* When imparting knowledge in science, unlike in other subjects, the most appropriate methods should be adopted. The principal aim of teaching science is to accustom students to apply the process in science. The scientific method comprises the main steps, initial observation, assumption, building up hypotheses, testing hypotheses, retesting and arriving at conclusion. Identification of the process of science and getting students to use it when learning science is the task of the teacher. Through this the students are oriented to apply the scientific method and solve problems.
- \* When teaching science, adoption of appropriate methodologies set out in Teacher Instruction Manuals and using them by the teacher would create a successful learning teaching program. The normal learning teaching process taking place in the classroom as well as many pursuits such as group activities, laboratory experiments, field work, projects, field trips and exhibitions are connected with this subject. In all such events, the teacher should organise his learning teaching process ensuring maximum and correct involvement of students giving opportunities to use different media and try outs.
- \* The students can understand most of the abstract concepts he/she encounters in science only if he/she is offered opportunities to form the basic concepts which lays foundation for them methodically. Use of learning aids appropriately and inquiring into experiences and previous knowledge are also important in this regard.
- \* In order to reinforce the knowledge and understanding gained through the classroom learning teaching process, much support can be drawn from laboratory experiments, and concept maps constructed on the black board. Formulae, equations, diagrams and all the new words should be written or drawn on the board. When solving problems using formulae, it is advisable that the teacher first solves the problem on the board stepwise followed by offering the students an opportunity to solve it. It is required that only the relevant equipments be used in laboratory experiments as well as classroom activities. When using them, students' concern should be drawn towards their own safety as well as the safety of the apparatus. If alternatives are used in absence of the required equipment, raising awareness about them is also of import.
- \* Care should be taken to use standard symbols, units and formulae and draw accurate diagrams with correct labelling. Standard practices should be followed in this regard.

- \* Within the classroom, opportunities should be offered to assimilate knowledge through different methods under the teacher's supervision. Learning events should be organised to promote qualities such as cooperation, cordiality, leadership, respecting others and reconciliation.
- \* When adopting teaching methods it is more appropriate that subject matter relating to the main areas of science - that is physics, chemistry and biology - is taught in an integrated context. This would promote scientific temper in students so that they can present logical answers.
- \* Sometimes when some of the subject matter is tested by question papers the explanations are expected only in gist. But it is important that they should be given full treatment during teaching within the limits of the syllabi regardless of limits imposed during marking.