

ICSE

**Year 2019
Examination**

Analysis of Pupil Performance

SCIENCE



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**Research Development and Consultancy Division
Council for the Indian School Certificate Examinations
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This document of the Analysis of Pupils' Performance at the ISC Year 12 and ICSE Year 10 Examination is one of its kind. It has grown and evolved over the years to provide feedback to schools in terms of the strengths and weaknesses of the candidates in handling the examinations.

We commend the work of Mrs. Shilpi Gupta (Deputy Head) of the Research Development and Consultancy Division (RD CD) of the Council and her team, who have painstakingly prepared this analysis. We are grateful to the examiners who have contributed through their comments on the performance of the candidates under examination as well as for their suggestions to teachers and students for the effective transaction of the syllabus.

We hope the schools will find this document useful. We invite comments from schools on its utility and quality.

October 2019

Gerry Arathoon
Chief Executive & Secretary

PREFACE

The Council has been involved in the preparation of the ICSE and ISC Analysis of Pupil Performance documents since the year 1994. Over these years, these documents have facilitated the teaching-learning process by providing subject/ paper wise feedback to teachers regarding performance of students at the ICSE and ISC Examinations. With the aim of ensuring wider accessibility to all stakeholders, from the year 2014, the ICSE and the ISC documents have been made available on the Council's website www.cisce.org.

The documents include a detailed qualitative analysis of the performance of students in different subjects which comprises of examiners' comments on common errors made by candidates, topics found difficult or confusing, marking scheme for each question and suggestions for teachers/ candidates.

In addition to a detailed qualitative analysis, the Analysis of Pupil Performance documents for the Examination Year 2019 also have a component of a detailed quantitative analysis. For each subject dealt with in the document, both at the ICSE and the ISC levels, a detailed statistical analysis has been done, which has been presented in a simple user-friendly manner.

It is hoped that this document will not only enable teachers to understand how their students have performed with respect to other students who appeared for the ICSE/ISC Year 2019 Examinations, but also provide information on how they have performed within the Region or State, their performance as compared to other Regions or States, etc. It will also help develop a better understanding of the assessment/ evaluation process. This will help teachers in guiding their students more effectively and comprehensively so that students prepare for the ICSE/ ISC Examinations, with a better understanding of what is required from them.

The Analysis of Pupil Performance document for ICSE for the Examination Year 2019 covers the following subjects: English (English Language, Literature in English), Hindi, History, Civics and Geography (History and Civics, Geography), Mathematics, Science (Physics, Chemistry, Biology), Commercial Studies, Economics, Computer Applications, Economic Applications, Commercial Applications.

Subjects covered in the ISC Analysis of Pupil Performance document for the Year 2019 include English (English Language and Literature in English), Hindi, Elective English, Physics (Theory), Chemistry (Theory), Biology (Theory), Mathematics, Computer Science, History, Political Science, Geography, Sociology, Psychology, Economics, Commerce, Accounts and Business Studies.

I would like to acknowledge the contribution of all the ICSE and the ISC examiners who have been an integral part of this exercise, whose valuable inputs have helped put this document together.

I would also like to thank the RDCD team of Dr. M.K. Gandhi, Dr. Manika Sharma, Mrs. Roshni George and Mrs. Mansi Guleria who have done a commendable job in preparing this document.

October 2019

Shilpi Gupta
Deputy Head - RDCD

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INTRODUCTION

This document aims to provide a comprehensive picture of the performance of candidates in the subject. It comprises of two sections, which provide Quantitative and Qualitative analysis results in terms of performance of candidates in the subject for the ICSE Year 2019 Examination. The details of the Quantitative and the Qualitative analysis are given below.

Quantitative Analysis

This section provides a detailed statistical analysis of the following:

- Overall Performance of candidates in the subject (Statistics at a Glance)
- State wise Performance of Candidates
- Gender wise comparison of Overall Performance
- Region wise comparison of Performance
- Comparison of Region wise performance on the basis of Gender
- Comparison of performance in different Mark Ranges and comparison on the basis of Gender for the top and bottom ranges
- Comparison of performance in different Grade categories and comparison on the basis of Gender for the top and bottom grades

The data has been presented in the form of means, frequencies and bar graphs.

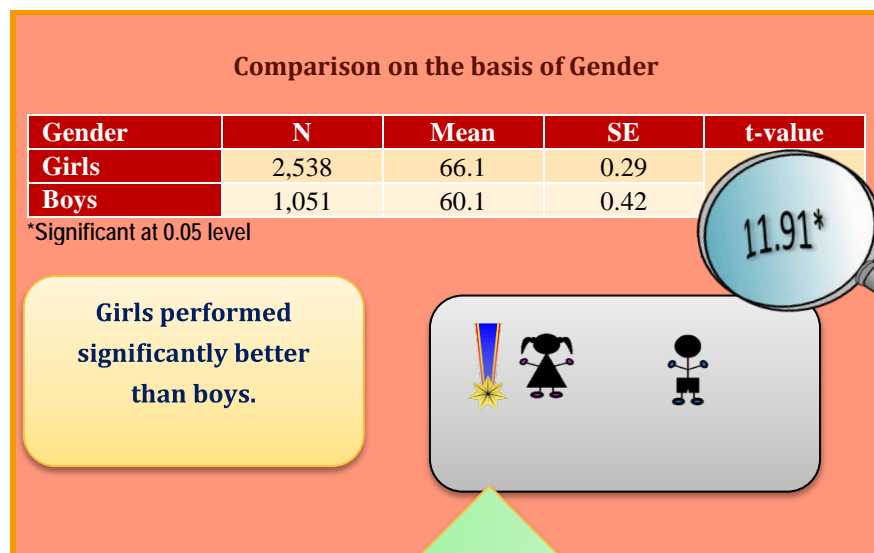
Understanding the tables

Each of the comparison tables shows N (Number of candidates), Mean Marks obtained, Standard Errors and t-values with the level of significance. For t-test, mean values compared with their standard errors indicate whether an observed difference is likely to be a true difference or whether it has occurred by chance. The t-test has been applied using a confidence level of 95%, which means that if a difference is marked as 'statistically significant' (with * mark, refer to t-value column of the table), the probability of the difference occurring by chance is less than 5%. In other words, we are 95% confident that the difference between the two values is true.

t-test has been used to observe significant differences in the performance of boys and girls, gender wise differences within regions (North, East, South and West), gender wise differences within marks ranges (Top and bottom ranges) and gender wise differences within grades awarded (Grade 1 and Grade 9) at the ICSE Year 2019 Examination.

The analysed data has been depicted in a simple and user-friendly manner.

Given below is an example showing the comparison tables used in this section and the manner in which they should be interpreted.



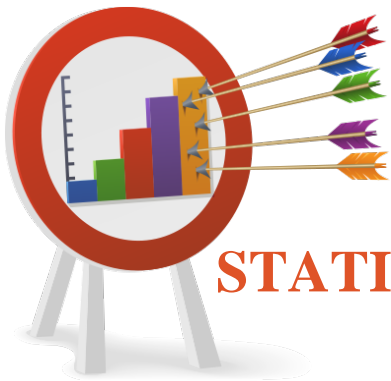
The table shows comparison between the performances of boys and girls in a particular subject. The t-value of 11.91 is significant at 0.05 level (mentioned below the table) with a mean of girls as 66.1 and that of boys as 60.1. It means that there is significant difference between the performance of boys and girls in the subject. The probability of this difference occurring by chance is less than 5%. The mean value of girls is higher than that of boys. It can be interpreted that girls are performing significantly better than boys.

The results have also been depicted pictographically. In this case, the girls performed significantly better than the boys. This is depicted by the girl with a medal.

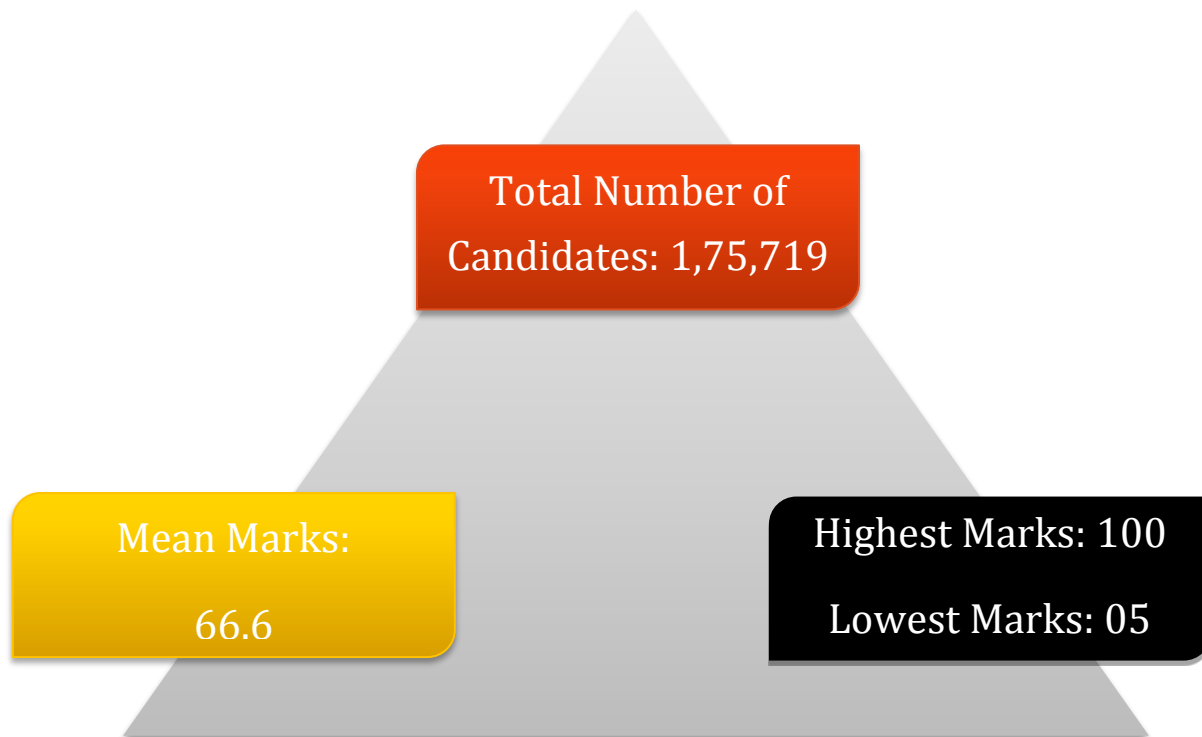
Qualitative Analysis

The purpose of the qualitative analysis is to provide insights into how candidates have performed in individual questions set in the question paper. This section is based on inputs provided by examiners from examination centres across the country. It comprises of question wise feedback on the performance of candidates in the form of *Comments of Examiners* on the common errors made by candidates along with *Suggestions for Teachers* to rectify/ reduce these errors. The *Marking Scheme* for each question has also been provided to help teachers understand the criteria used for marking. Topics in the question paper that were generally found to be difficult or confusing by candidates, have also been listed down, along with general suggestions for candidates on how to prepare for the examination/ perform better in the examination.

QUANTITATIVE ANALYSIS

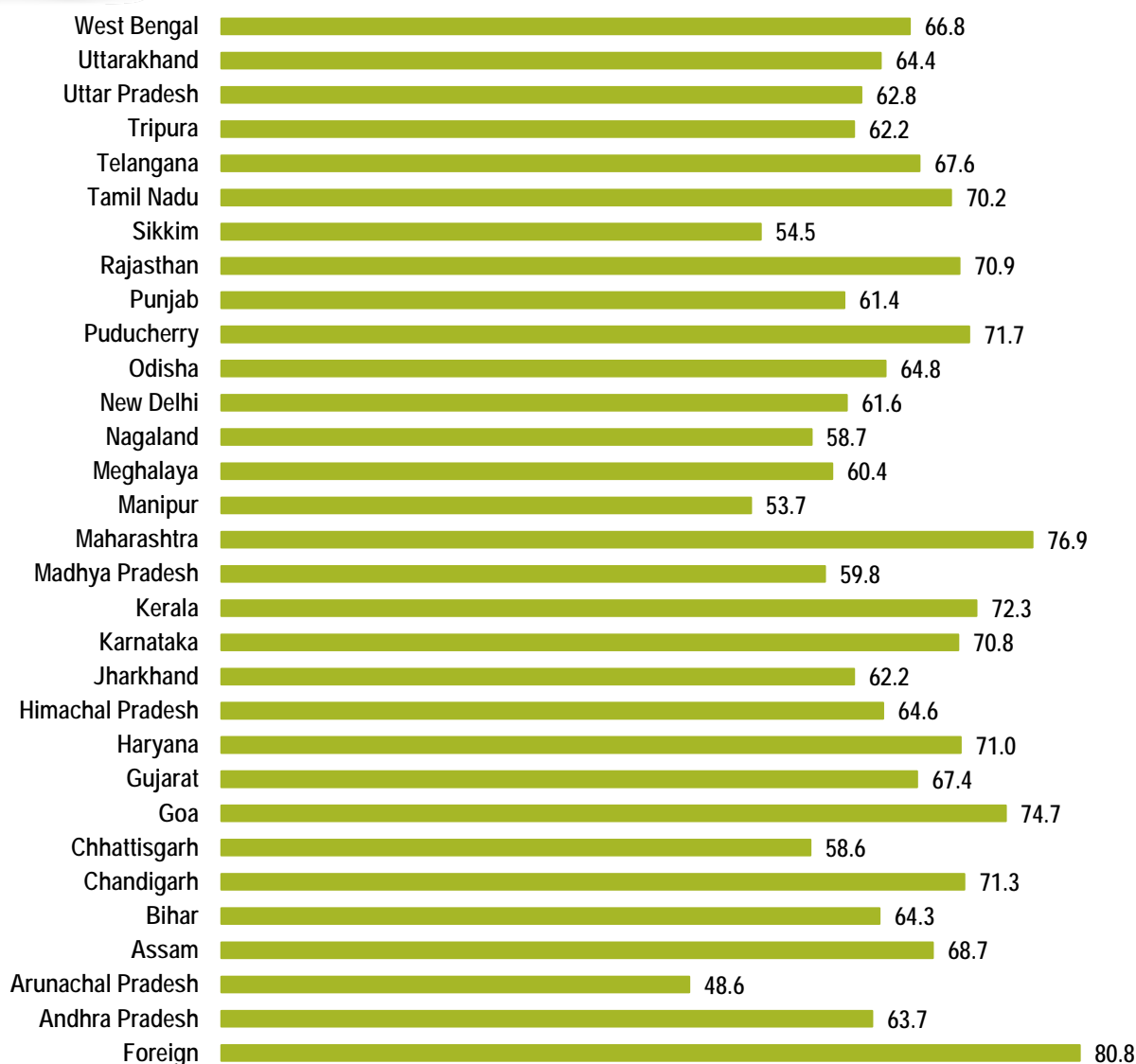


STATISTICS AT A GLANCE





PERFORMANCE (STATE-WISE & FOREIGN)



The States of Maharashtra, Goa and Kerala secured highest mean marks. Mean marks secured by candidates studying in schools abroad were 80.8.



GENDER-WISE COMPARISON



GIRLS

Mean Marks: 67.5

Number of
Candidates: 79,593



BOYS

Mean Marks: 65.8

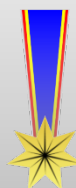
Number of
Candidates: 96,126

Comparison on the basis of Gender

Gender	N	Mean	SE	t-value
Girls	79,593	67.5	0.06	19.78*
Boys	96,126	65.8	0.06	

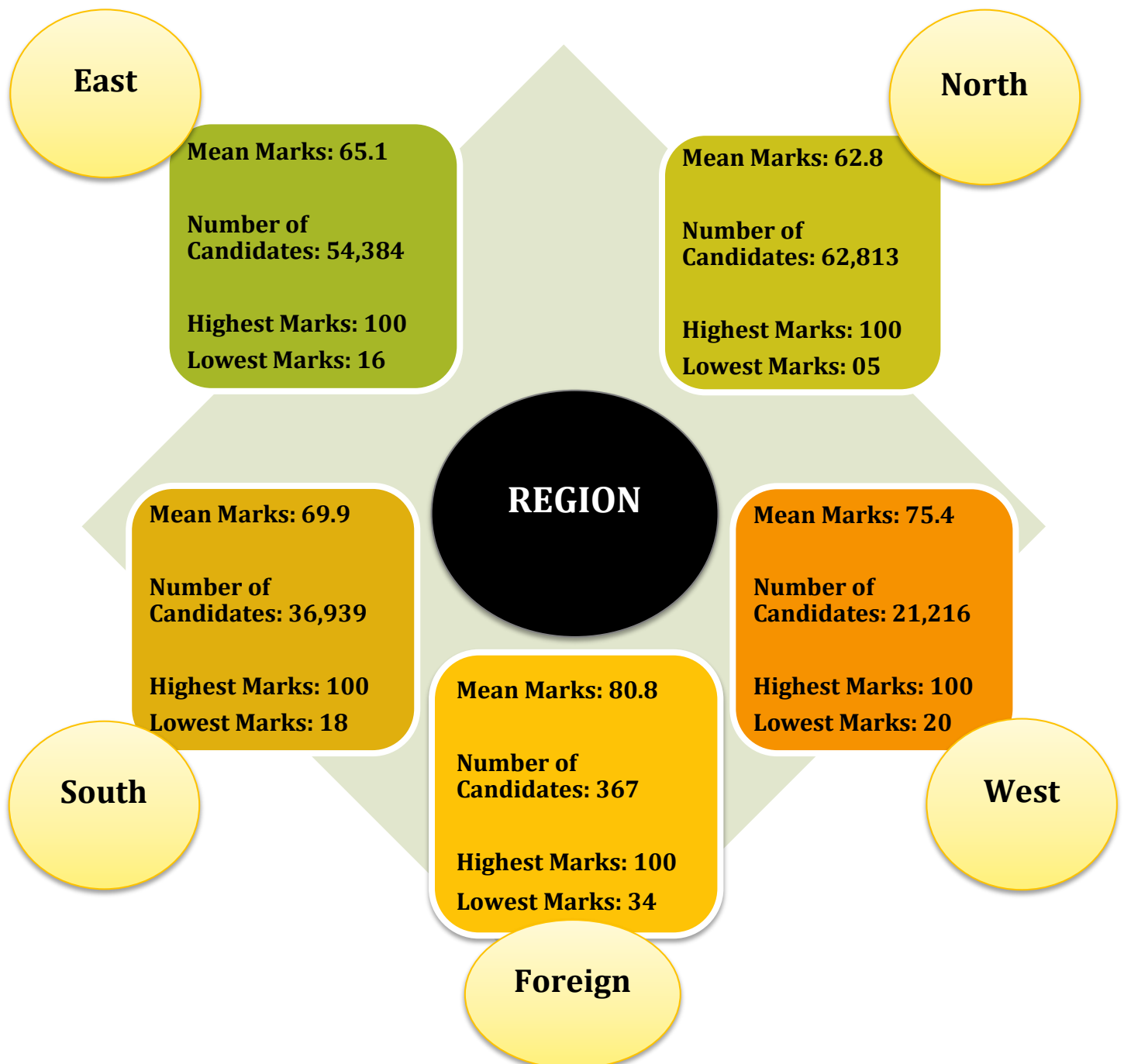
*Significant at 0.05 level

**Girls performed
significantly better than
boys.**

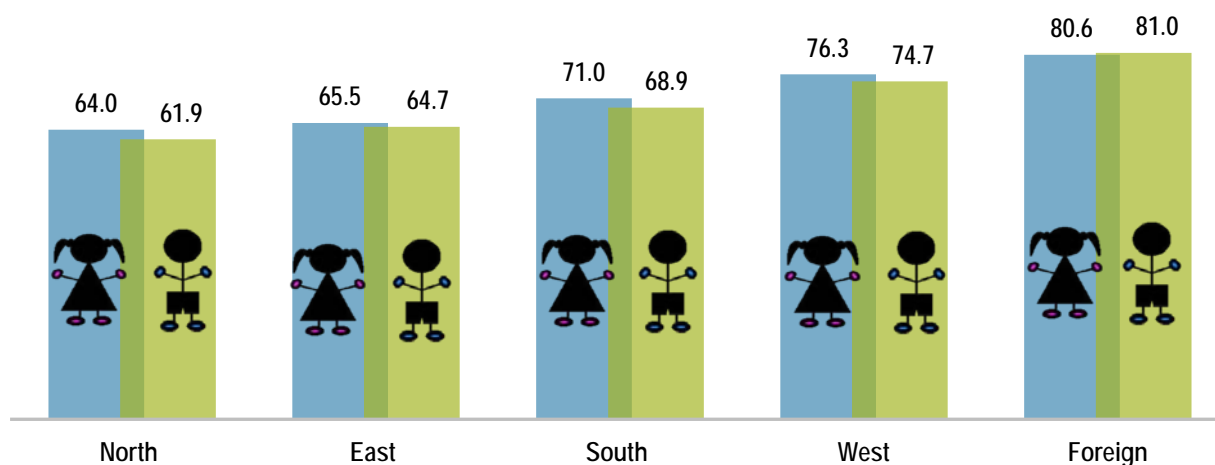




REGION-WISE COMPARISON



Mean Marks obtained by Boys and Girls-Region wise



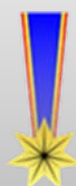
Comparison on the basis of Gender within Region

Region	Gender	N	Mean	SE	t-value
North (N)	Girls	27,400	64.0	0.11	14.21*
	Boys	35,413	61.9	0.10	
East (E)	Girls	24,479	65.5	0.12	4.76*
	Boys	29,905	64.7	0.11	
South (S)	Girls	18,416	71.0	0.12	12.11*
	Boys	18,523	68.9	0.13	
West (W)	Girls	9103	76.3	0.17	6.90*
	Boys	12,113	74.7	0.16	
Foreign (F)	Girls	195	80.6	1.14	-0.21
	Boys	172	81.0	1.27	

*Significant at 0.05 level

The performance of girls was significantly better than that of boys in all the regions except foreign region.

REGION (N, E, S, W)





MARK RANGES : COMPARISON GENDER-WISE

Comparison on the basis of gender in top and bottom mark ranges

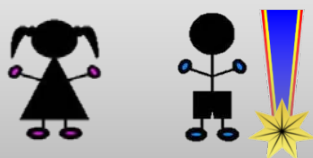
Marks Range	Gender	N	Mean	SE	t-value
Top Range (81-100)	Girls	23,588	89.3	0.03	-3.69*
	Boys	26,967	89.5	0.03	
Bottom Range (0-20)	Girls	6	18.8	0.54	0.76
	Boys	23	18.2	0.68	

*Significant at 0.05 level

Marks Range (81-100)

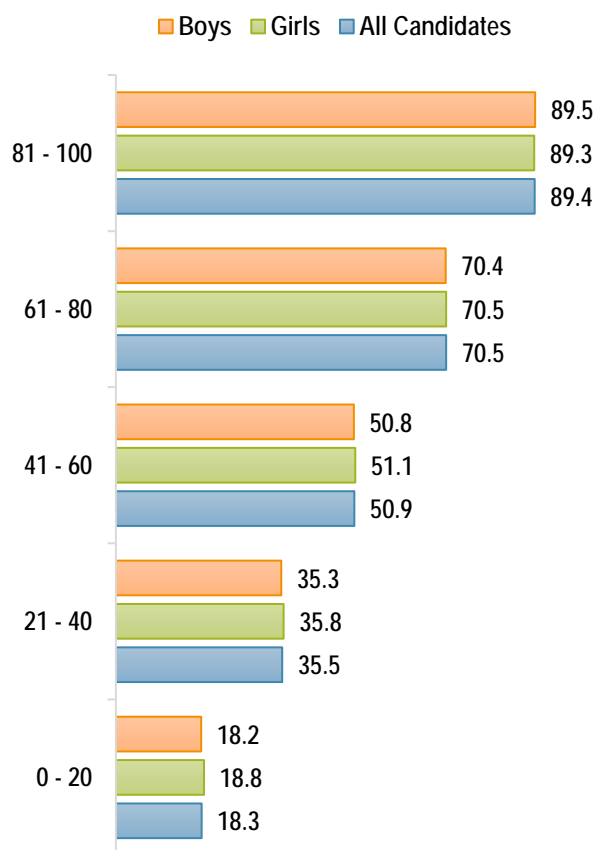
Performance of boys was significantly better than the performance of girls.

Marks Range (81-100)



Marks Range (0-20)

No significant difference was observed between the average performance of girls and boys.



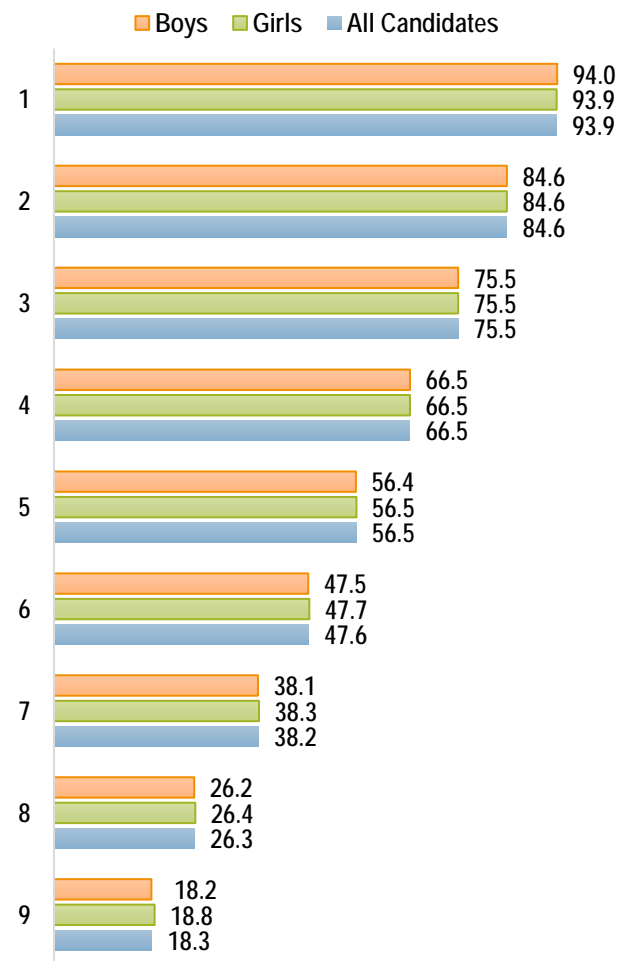


GRADES AWARDED : COMPARISON GENDER-WISE

Comparison on the basis of gender in Grade 1 and Grade 9

Grades	Gender	N	Mean	SE	t-value
Grade 1	Girls	11,373	93.9	0.03	-1.69
	Boys	13,480	94.0	0.02	
Grade 9	Girls	6	18.8	0.54	0.76
	Boys	23	18.2	0.68	

No significant difference was observed between the average performance of girls and boys.



QUALITATIVE ANALYSIS

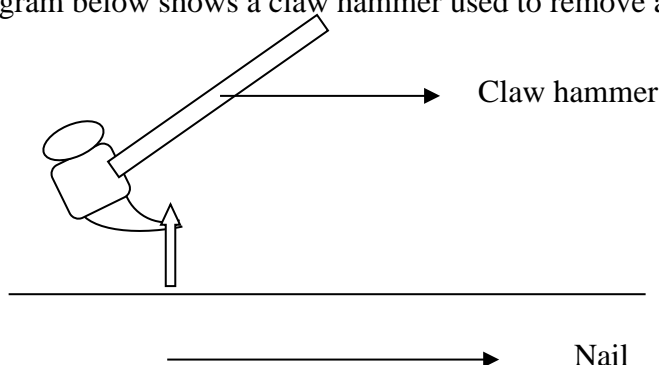
PHYSICS (PAPER-I)

SECTION I (40 Marks)

*Attempt **all** questions from this Section*

Question 1

- (a) The diagram below shows a claw hammer used to remove a nail: [2]



- (i) To which class of lever does it belong?
- (ii) Give one more example of the **same class** of lever mentioned by you in (i) for which the **mechanical advantage is greater than one**.
- (b) Two bodies A and B have masses in the ratio 5:1 and their kinetic energies are in the ratio 125:9. Find the ratio of their velocities. [2]
- (c) (i) Name the physical quantity which is measured in calories. [2]
(ii) How is calorie related to the S.I unit of that quantity?
- (d) (i) Define couple. [2]
(ii) State the S.I. unit of moment of couple.
- (e) (i) Define critical angle. [2]
(ii) State one important factor which affects the critical angle of a given medium.

Comments of Examiners

- (a) (i) Most of the candidates could identify the class of lever but some could not identify the position of fulcrum hence made a mistake.
- (ii) Gave example of class two levers. Some gave example of class I lever, but its mechanical advantage was not greater than 1.
- (b) Many candidates could not do substitution in the ratio form. Some candidates did not express the final answer in the ratio form with lowest term.
- (c) (i) Most candidates named the physical quantity which is measured in calories correctly. But some wrote the physical quantity such as work or energy. Some of them even wrote as joule as they were confused between physical quantity and unit.
- (ii) Most of the candidates wrote the relation between calorie and the S.I unit of that quantity correctly but some of them reversed it and wrote it as $1 \text{ J} = 4.2/4.186 \text{ calorie}$.
Some even wrote
 $1 \text{ cal} = 0.4 \text{ J}$
- (d) (i) In many answer scripts key words/terms such as two, equal, parallel, opposite, not acting along the same line etc. were missing which made the definition incomplete or meaningless. Some of them defined moment of couple or torque instead of couple.
- (ii) Many candidates wrote the SI. unit of moment of couple correctly, but some candidates wrote joule in place of Nm or N or dyn or N/m or N m^{-1}
- (e) (i) Many candidates defined critical angle correctly. But quite a number of candidates made following errors.
- key words such as rarer, denser were missing.
 - did not make it clear that it is the angle of incidence.
 - 90° was missing.
- (ii) Many candidates wrote it correctly but quite a number of candidates wrote
- conditions of total internal reflection.
 - factor as angle of incidence/frequency.
 - additional point/s which were incorrect.

Suggestions for teachers

- Explain the types of levers with real life examples with respect to the positions of Fulcrum, Load and Effort, their mechanical advantage, velocity ratio etc.
- Give enough practice of ratio based numerical to the students.
- Clarify the difference between a unit and a physical quantity to the students.
- Train students to focus on key words in definitions. Explain them the meaning of a definition with key words or without key words.
- Differentiate between factors affecting total internal reflection and conditions of total internal reflection clearly with the help of a diagram or by using a media file.

MARKING SCHEME

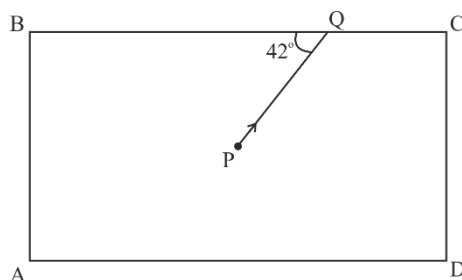
Question 1

(a)	(i) Class I lever
	(ii) Crow bar / pliers / any other correct example/diagram with name (only scissors not accepted) , explanation to imply $M_A > 1$.
(b)	$E_1/E_2 = 1/2 m_1 v_1^2 / 1/2 m_2 v_2^2 = (m_1/m_2) \times (v_1/v_2)^2$ $125/9 = (5/1) \times (v_1/v_2)^2$

	$(v_1/v_2)^2 = (125/9) \times (1/5) = 25/9$ $(v_1/v_2) = 5/3$
(c)	(i) Heat energy (ii) 1 calorie = 4.2 J / 4.186 J / 4.18 J
(d)	(i) Two equal and opposite parallel forces, not acting along the same line, form a couple. (ii) N m
(e)	(i) Critical angle is the angle of incidence in the denser medium for which the angle of refraction in the rarer medium is 90° . (ii) Colour / wavelength of light and temperature / refractive index/ optical density of the medium/material/nature of the medium/ pairing media /speed of light.

Question 2

- (a) An electromagnetic radiation is used for photography in fog. [2]
 (i) Identify the radiation.
 (ii) Why is this radiation mentioned by you, ideal for this purpose?
- (b) (i) What is the relation between the refractive index of water with respect to air (${}_a\mu_w$) [2]
 and the refractive index of air with respect to water (${}_w\mu_a$).
 (ii) If the refractive index of water with respect to air (${}_a\mu_w$) is $\frac{5}{3}$.
 Calculate the refractive index of air with respect to water (${}_w\mu_a$).
- (c) The specific heat capacity of a substance A is $3,800 \text{ J kg}^{-1} \text{ K}^{-1}$ and that of a substance B [2]
 is $400 \text{ J kg}^{-1} \text{ K}^{-1}$. Which of the two substances is a good conductor of heat? Give a reason
 for your answer.
- (d) A man playing a flute is able to produce notes of different frequencies. If he closes the [2]
 holes near his mouth, will the pitch of the note produced, increase or decrease? Give a
 reason.
- (e) The diagram below shows a light source P embedded in a rectangular glass block ABCD [2]
 of critical angle 42° . Complete the path of the ray PQ till it emerges out of the block.
 [Write necessary angles.]



Comments of Examiners

- (a) (i) Most of the candidates wrote the name of the correct radiation but some candidates wrote incorrect name of the electromagnetic radiation used for photography in fog. Some wrote infar instead of infra.
- (ii) In some scripts, the reasons for mentioned radiation were as follows:
- high penetrating power
 - used generalized irrelevant words such as deviation, penetrate, dispersion etc.
 - gave uses of infrared radiations.
- (b) (i) Many candidates wrote separate expression or definition for each ${}_a\mu_w$ and ${}_w\mu_a$ but did not give the relation between the two.
- (ii) In spite of writing an incorrect answer in the first part, most of the candidates were able to give a correct answer in the second part.
- Some candidates wrote the equation of refractive index in terms of speed of light, substituted values and then obtained the answer through long calculations. Some of the candidates also wrote answer as 1.
- (c) A large number of candidates did not name the good conductor of heat out of the two given substances. Also, many were unable to write the reason for naming one of the given substances as a good conductor of heat on the basis of their specific heat capacities.
- (d) Very few candidates answered it correctly. Many candidates could not write the reason about the holes present on the flute and its relation with the frequency (pitch) of the sound produced. Some of them even related it to the loudness. Some of them answered first part of the question correctly but failed to give the explanation.
- (e) Many candidates could complete the path of first reflected ray correctly but made a mistake in completing the path of the second ray after total internal reflection.

Following lapses were observed in the diagram:

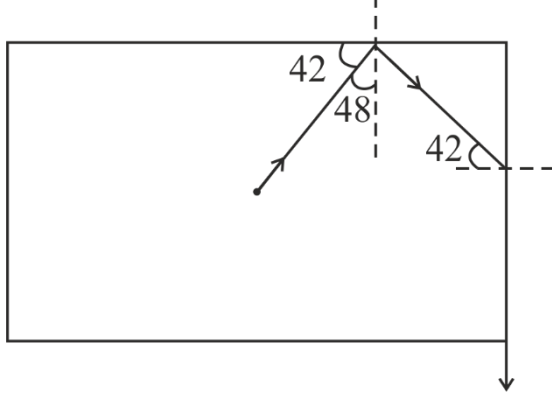
- Assuming 42° as the angle of incidence some candidates showed the first refracted ray along the surface.
- Many candidates did not calculate the angle of incidence at the new surface they showed incorrect path (refracting out or going along the normal) of the second ray.
- Angle of incidence was not marked and written.
- Arrows were missing on the rays.

Suggestions for teachers

- Explain the phenomena scattering, reflection, refraction dispersion etc. exhaustively to the students.
- Teach electromagnetic radiations, their properties, uses and the methods of detection intensively to the students and frequently revise the topic.
- Clarify principle of reversibility involved in the relation ${}_a\mu_b = \frac{1}{{}_b\mu_a}$ to the students. Insist on expressing the final answer in decimal.
- Train students to interpret the natural phenomena involving specific heat capacities of the substances and consequences of high specific heat capacity. Use the given table of specific heat capacities of different substances.
- Teach students to apply the relation $f \propto \frac{1}{l}$ in case of different musical instruments involving air columns. Demonstrate experimentally this by using tuning fork of different frequencies and resonating them with different lengths of the air column.
- Drill students in completing the path of the ray through different optical media. Also, train them to calculate the angle of incidence when the ray strikes at every new surface and then complete the path of the ray.
- Instruct students to mark arrow in all ray diagrams.
- Spell out the concept of total internal reflection to the students intensively.

MARKING SCHEME

Question 2

(a)	<p>(i) Infra-Red</p> <p>(ii) They have long wavelength hence less scattered and can travel through the fog.</p>
(b)	<p>(i) They are inversely proportional.</p> <p>Or</p> $a\mu_w = \frac{1}{w\mu_a}$ <p>(ii) $w\mu_a = \frac{1}{a\mu_w} = \frac{3}{5} = 0.6$</p>
(c)	<p>Substance B is a good conductor of heat</p> <p>Because specific heat capacity of B is less than that of A and specific heat capacity is the heat energy required to raise the temperature of 1 kg of a substance by 1°C, so substance B gets heated faster.</p>
(d)	<p>Decrease</p> <p>Frequency is inversely proportional to the length of the air column.</p>
(e)	

Question 3

- (a) (i) If the lens is placed in water instead of air, how does its focal length change? [2]
- (ii) Which lens, thick or thin has greater focal length?
- (b) Two waves of the same pitch have amplitudes in the ratio 1:3. [2]
- What will be the ratio of their:
- (i) intensities and
- (ii) frequencies?
- (c) How does an increase in the temperature affect the specific resistance of a: [2]
- (i) Metal and
- (ii) Semiconductor?

- (d) (i) Define resonant vibrations. [2]
- (ii) Which characteristic of sound, makes it possible to recognize a person by his voice without seeing him?
- (e) Is it possible for a hydrogen (${}^1_1\text{H}$) nucleus to emit an alpha particle? [2]
Give a reason for your answer.

Comments of Examiners

- (a) (i) Many candidates could not comprehend the question correctly. Some candidates answered that focal length changes, but they could not give the correct reason. Several candidates could not write about the effect on the focal length of the lens due to change in the refractive index of the outside medium.
- (ii) While many candidates answered it correctly, quite a few could not comprehend it. They wrote convex lens as a thicker lens and concave lens as a thinner lens. Some candidates wrote thicker lens has greater focal length.
- (b) Most of the candidates answered it correctly but some of the candidates made following errors in both the sub parts (i) and (ii).
- expressed the same ratio.
 - expressed the answer in the fractional form.
 - wrote reverse ratio.
- (c) (i) Most of the candidates wrote the effect of an increase in the temperature on the specific resistance of a metal, increases which was a correct answer. But following answers were also observed that is the specific resistance of a metal does not change or decreases.
- (ii) Most of the candidates answered it correctly but some candidates wrote that with the increase in temperature, the specific resistance of a semiconductor increases or remains the same.
- (d) (i) In the definition of resonant vibrations following glitches were observed
- keyword such as increase in amplitude was missing.
 - natural frequency matching with forced vibration was written instead of frequency of forced vibration.
- (ii) Many candidates wrote it correctly as Quality but quite a number of candidates also wrote as loudness, pitch, frequency.
- (e) Most of the candidates wrote first part correctly as 'No' barring some of them who wrote 'Yes'. But they found it difficult to give reason for the same. Various reasons were observed

Suggestions for teachers

- Demonstrate an increase in the focal length of a convex lens when it is placed in water.
- Devise an activity to show the relation between radius of curvature and the focal length of a lens clearly.
- Teach students the relation between the intensity of a wave and its amplitude or frequency clearly. Give enough practise on related numerical.
- Instruct students that a fraction cannot be accepted in place of a ratio. Stress upon expressing final answer in the asked form in the question like in ratio or in decimal form up to required decimal places or significant figures etc.
- Explain the difference between a semiconductor and a metal and effect of temperature on the specific resistance of metals and semiconductors.
- Stress upon writing the key words while defining the scientific terms/key words.
- Discuss the characteristics of sound with a number of examples.
- Discuss the terms nucleus, its structure, atomic number, mass-number, radioactivity, changes within the nucleus in detail giving ample number of examples.

such as Hydrogen is not a radioactive substance, after Alpha emission atomic number decreases by 2 and mass number decreases by 4, Hydrogen has one proton and one neutron or hydrogen has one proton and one electron. Some candidates gave irrelevant explanation. Very few candidates attempted it to explain with a nuclear reaction.

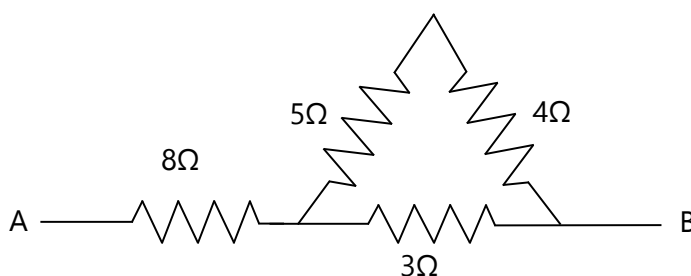
MARKING SCHEME

Question 3

(a)	(i) The focal length of the lens will increase in water (Focal length of the lens depends on the refractive index of the material of lens relative to its surrounding medium) (ii) thinner
(b)	(i) $I_1/I_2 = (a_1/a_2)^2 = (1/3)^2 = 1/9 \therefore I_1 : I_2 = 1 : 9$ (ii) 1:1 (because pitch is same)
(c)	(i) Increases (ii) Decreases
(d)	(i) Vibrations of greater amplitude when frequency of forced vibration is equal to the frequency of free vibration. (ii) Quality / Timbre
(e)	No. The nucleus does not contain two protons and two neutrons

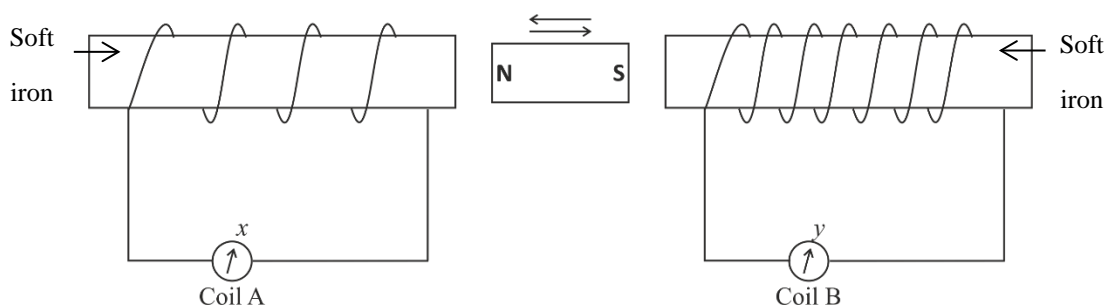
Question 4

- (a) Calculate the effective resistance across AB: [2]



- (b) (i) State whether the specific heat capacity of a substance remains the same when its state changes from solid to liquid. [2]
(ii) Give one example to support your answer.

- (c) A magnet kept at the centre of two coils A and B is moved to and fro as shown in the diagram. The two galvanometers show deflection. [2]



State with a **reason** whether:

$$x > y$$

or

$$x < y. \quad [x \text{ and } y \text{ are magnitudes of deflection.}]$$

- (d) (i) Why is a nuclear fusion reaction called a thermo nuclear reaction? [2]
 (ii) Complete the reaction:



- (e) State two ways to increase the speed of rotation of a D.C. motor. [2]

Comments of Examiners

- (a) Majority of the candidates answered this subpart correctly. However, some candidates were confused in understanding the series and parallel combination of resistors. Some made calculation errors. Some of them wrote an incorrect expression at stage 1 (instead of $\frac{1}{R}$ as L.H.S they wrote R) hence, in the last step mathematical result was incorrect. Some candidates left the final answer in improper fraction.
- (b) (i) Most of the candidates answered it correctly but some of them made the following errors:
- wrote specific heat capacity remains the same.
 - got confused with latent heat and specific heat capacity.
 - got confused between specific heat capacity and specific resistance.
- (ii) Some of them wrote example of water and ice but they did not mention the values. Those who said specific heat capacity remains the same on changing the state of a substance, validated the

Suggestions for teachers

- Give sufficient practice of numerical problems based on series and parallel combination of resistors.
- Explain the meaning of specific heat capacity of a substance in detail giving some examples.
- Discuss the values of specific heat capacity of water and specific heat capacity of ice and explain why these values are different.
- Clarify to the students the difference between a coil and number of turns of coil.
- Revise conceptual questions based on electromagnetic induction in the class through oral questioning and regular written tests.
- Familiarize students with the technical terms and insist on its use in the answers.

same even in examples. Several candidates made mistakes while stating the units of the values of specific heat capacities.

(c) Almost all the candidates answered it correctly. But while giving reason some candidates wrote the statement which was not conveying the correct meaning.

(d) (i) Majority of the candidates wrote about large amount of heat energy being released during the reaction but did not talk about the reaction taking place at very high temperature. Some candidates explained nuclear fusion reaction in terms of heat released.

(ii) Some candidates could balance the reaction correctly but majority of them could not do so. They could not apply the principle of conservation of mass number and atomic number in completing the reaction. Some candidates wrote He in place of H.

(e) Many candidates could answer correctly but the following errors were observed:

- Use of correct technical terms was missing
- Some got confused with the induction.
- wrote number of coils in place of number of turns of a coil

- Interpret nuclear fusion comprehensively to the students.
- Drill students to write nuclear reactions.
- Teach in depth to the students about the DC motor like purpose, principle, main parts, brief description, and the ways to increase the speed of rotation of a DC motor.

MARKING SCHEME

Question 4

(a)	$R_1 = \frac{9 \times 3}{9 + 3}$ $= \frac{27}{12} = \frac{9}{4} \Omega$ $\therefore R = 8 + \frac{9}{4} = \frac{32 + 9}{4} = \frac{41}{4} = 10.25 \Omega$
(b)	<p>(i) No, it changes</p> <p>(ii) Specific heat capacity of ice = 2.1 J/g °C and that of water is 4.2 J/g °C</p>
(c)	<p>$x < y$</p> <p>Induced e.m.f. is directly proportional to the number of turns of the coil.</p>
(d)	<p>It requires extremely high temperature to take place.</p> ${}^3\text{He}_2 + {}^2\text{H}_1 \rightarrow {}^4\text{He}_2 + {}^1\text{H}_1 + \text{Energy}$
(e)	<ul style="list-style-type: none"> – increasing the number of turns of the coil. – increasing the strength of the magnetic field. – increasing the area of the coil. – increasing the current through the coil <p style="text-align: right;">(Any two points)</p>

SECTION II (40 Marks)

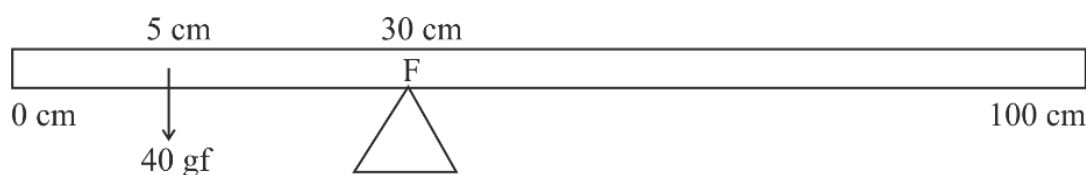
Attempt any four questions from this Section

Question 5

- (a) A body of mass 10 kg is kept at a height of 5 m. It is allowed to fall and reach the ground. [3]

- What is the total mechanical energy possessed by the body at the height of 2 m assuming it is a frictionless medium?
- What is the kinetic energy possessed by the body just before hitting the ground? Take $g = 10 \text{ m/s}^2$.

- (b) A uniform meter scale is in equilibrium as shown in the diagram: [3]



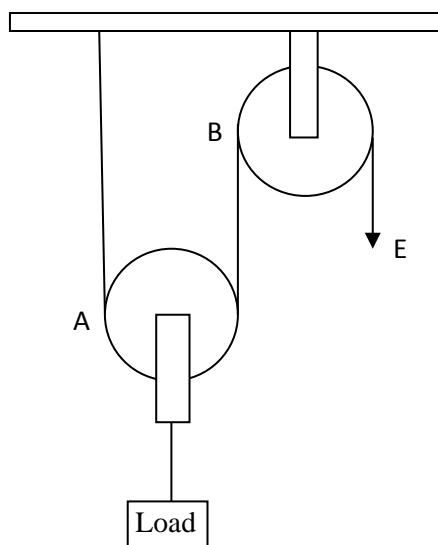
- Calculate the weight of the meter scale.
- Which of the following options is correct to keep the ruler in equilibrium when 40 gf wt is shifted to 0 cm mark?

F is shifted towards 0 cm.

or

F is shifted towards 100 cm.

- (c) The diagram below shows a pulley arrangement: [4]



- Copy the diagram and mark the direction of tension on each strand of the string.
- What is the velocity ratio of the arrangement?

- (iii) If the tension acting on the string is T, then what is the relationship between T and effort E?
- (iv) If the free end of the string moves through a distance x, find the distance by which the load is raised.

Comments of Examiners

(a) (i) A large number of candidates answered correctly. However, in some scripts the following mistakes were observed:

- For calculation of potential energy height was taken as 2 m in place of 5 m.
- Did not mention about the use of principle of conservation of energy.
- Calculated kinetic energy and potential energy separately but for finding velocity they took the distance travelled to be 2 m in place of 3 m. They added this to get the total mechanical energy which was asked in the second part and therefore, even the second answer went incorrect.

(ii) Some candidates made mistakes due to improper conversion of units. i.e. mass was taken in gram in place of kg.

Some adopted the longer way by calculating the velocity at the bottom and then calculating the kinetic energy.

Some candidates calculated 200 J in subpart (i), by applying the principle of conservation of energy, and stated the same answer in subpart (ii).

Some candidates substituted 5 metre in place of velocity and calculated kinetic energy using $\frac{1}{2}mv^2$.

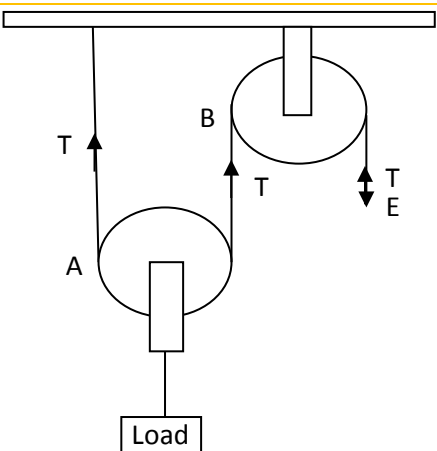
- (b) (i) Many candidates used 100 cm in place of 50 cm for the calculation of the torque on the other side. Some candidates got confused between the unit of mass and weight that is g and gf.
- (ii) Some candidates wrote that F is shifted towards 100 cm. They failed to understand that since the forces are same, the moment can be equalised by adjusting their torque arms.
- (c) (i) Most of them marked arrows correctly but some of them marked the arrows in two different directions on the two strands.
- (ii) Majority of the candidates answered correctly. Some of them derived and obtained the answer.
- (iii) Most of them answered it as $E = T$ but some of them due to lack of clarity answered it as $E = 2T$. Some even answered using inequality.
- (iv) Many candidates answered correctly as $\frac{x}{2}$ but some of them wrote it as $2x$. Some wrote in terms of L. The concept that the velocity ratio depends upon the number of strands supporting the load was missing.

Suggestions for teachers

- Give adequate practice of numerical problems based on the principle of conservation of energy.
- Teach students conversion of units.
- Stress upon the concept of clockwise and anticlockwise moment.
- Instruct students to read the question carefully and answer as per the requirement of the question.
- Explain in detail about the pulley system. Also, discuss diagram-based questions on Pulley system.
- Drill students in drawing labelled diagrams of pulley systems.
- Discuss the procedure to obtain the relation between the tension in the strand and Load as well as Effort for different pulley systems.

MARKING SCHEME

Question 5

(a)	<p>(i) Total mechanical energy possessed by the body at the height 2 m $= \text{P.E at the maximum height or pr. of conservation of energy implied.}$ $= 10 \times 10 \times 5 = 500 \text{ J}$</p> <p>(ii) K.E possessed by the body just before hitting the ground $= \text{P.E at the maximum height} = 500 \text{ J}$</p>
(b)	<p>(i) By pr. of moments $40 \times 25 = w \times 20$ $\therefore w = \frac{40 \times 25}{20} = 50 \text{ gf}$</p> <p>(ii) F is shifted towards 0 cm</p>
(c)	<p>(i)</p>  <p>(ii) V.R. = No. of stands supporting load = 2</p> <p>(iii) $E = T$</p> <p>(iv) $\text{V.R.} = \frac{d_E}{d_L} \therefore 2 = \frac{x}{d_L} \therefore d_L = \frac{x}{2}$</p>

Question 6

- (a) How does the angle of deviation formed by a prism change with the increase in the angle of incidence? [3]
 Draw a graph showing the variation in the angle of deviation with the angle of incidence at a prism surface.
- (b) A virtual, diminished image is formed when an object is placed between the optical centre and the principal focus of a lens. [3]
 (i) Name the type of lens which forms the above image.
 (ii) Draw a ray diagram to show the formation of the image with the above stated characteristics.
- (c) An object is placed at a distance 24 cm in front of a convex lens of focal length 8 cm. [4]
 (i) What is the nature of the image so formed?

- (ii) Calculate the distance of the image from the lens.
- (iii) Calculate the magnification of the image.

Comments of Examiners

- (a) (i) Most candidates answered this subpart correctly. However, a few made following errors:
- gave incorrect relation between the angle of incidence and the angle of deviation.
 - drew diagram of prism instead of graph.
 - incorrect graph showing the variation in the angle of deviation with the angle of incidence
 - incorrect labelling on the graph.
- (b) Many candidates named the type of lens correctly as a concave lens. Some candidates were tricked by the words ‘object between the optical centre and the principal focus of a lens as well as virtual image’ and they did not pay attention to the characteristic that image is virtual and diminished. Those who identified the lens correctly drew correct ray diagram but those who identified the lens incorrectly, draw incorrect ray diagram. Some candidates did not draw arrows on the rays in the diagram.
- (c) (i) Many candidates identified the nature of image correctly but some of the candidates wrote as real and virtual or real and erect or real and magnified.
- (ii) Several candidates applied mirror formula in finding the distance of the image from the lens. Many candidates were not clear about the sign convention. In the final answer unit was also missing.
- (iii) Many candidates got this part incorrect because their previous answer was incorrect. Some candidates made calculation errors. Several candidates expressed answer in fraction.

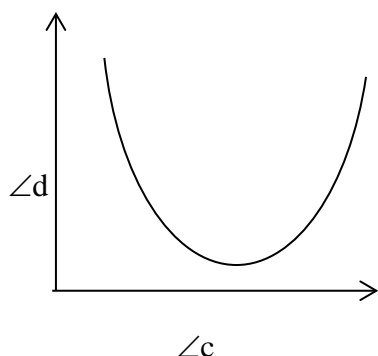
Suggestions for teachers

- Allow students to have first-hand experience of verifying the variation in the angle of deviation with the angle of incidence at a prism surface experimentally.
- Clarify students that while drawing the graph, label the axes correctly.
- Advise students to read the question prudently taking note of all the information given in the question.
- Instruct students to practice the ray diagrams keeping in mind that arrow should be marked before and after refraction and virtual image should be shown by a dotted line. Apparent intersection of the rays should be shown by dotted lines.
- Explain the sign convention properly to the students. Give adequate practice of the lens related problems.
- Instruct students to express the final answer in decimal form or in ratio form but not to leave it as a fraction.

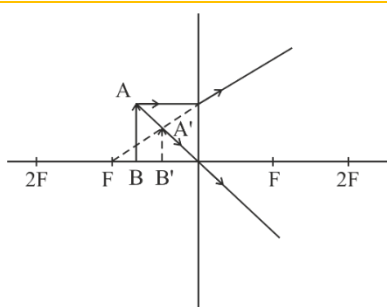
MARKING SCHEME

Question 6

- (a) Angle of deviation decreases, reaches to minimum value and then increases.



- (b) (i) Concave lens



- (ii) Correct ray diagram with one ray passing through optical centre which goes undeviated
Another ray parallel to the principal axis undergoing refraction and appears to pass through the principal focus.
(Dotted line for virtual image and extended refracted rays & arrows marked on the rays)

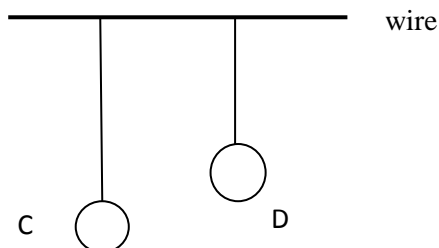
- (c) (i) Real, inverted diminished
(ii) $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$
 $\frac{1}{v} = \frac{1}{8} + \frac{1}{(-24)}$
 $\frac{1}{v} = \frac{3}{24} - \frac{1}{24}$
 $\frac{1}{v} = \frac{2}{24}$
 $v = \frac{24}{2} = 12 \text{ cm}$
(ii) $m = \frac{+v}{-u} = \frac{12}{-24} = -\frac{1}{2} = -0.5$

Question 7

- (a) It is observed that during march-past we hear a base drum distinctly from a distance compared to the side drums. [3]
- (i) Name the characteristic of sound associated with the above observation.
- (ii) Give a reason for the above observation.
- (b) A pendulum has a frequency of 4 vibrations per second. An observer starts the pendulum and fires a gun simultaneously. He hears the echo from the cliff after 6 [3]

vibrations of the pendulum. If the velocity of sound in air is 340 m/s, find the distance between the cliff and the observer.

- (c) Two pendulums C and D are suspended from a wire as shown in the figure given below. Pendulum C is made to oscillate by displacing it from its mean position. It is seen that D also starts oscillating. [4]



- (i) Name the type of oscillation, C will execute.
- (ii) Name the type of oscillation, D will execute.
- (iii) If the length of D is made equal to C then what difference will you notice in the oscillations of D?
- (iv) What is the name of the phenomenon when the length of D is made equal to C?

Comments of Examiner

- (a) (i) Some candidates answered it correctly as loudness but majority of them wrote pitch or quality. It seems candidates were unaware about base drums and side drums.
- (ii) Very few could relate the answer to the surface areas of the two drums and therefore the difference in the loudness, but majority of the candidates wrote vague answers.
- (b) Many candidates attempted it correctly but, in some scripts, following errors were noticed:
- could not calculate the time taken from the number of oscillations of the pendulum.
 - formula applied $v = \frac{d}{t}$ in place of $v = \frac{2d}{t}$.
 - did not write the unit.
 - velocity of sound was substituted as 320 m s⁻¹ instead of 340 m s⁻¹.
- (c) (i) Many candidates could identify it as free oscillations but some of them wrote it forced oscillations.
- (ii) Several candidates answered it correctly as forced oscillation but some of them wrote it resonance. But for others conceptual understanding was missing between free and forced oscillations.

Suggestions for teachers

- Explain characteristics of sound comprehensively relating them with examples from daily life.
- Clarify the basic mathematics required to solve the numerical problems related to reflection of sound waves.
- Give enough practice in numerical of different types to the students.
- Stress upon the importance of unit.
- Demonstrate to the students about the free vibrations, forced vibrations and resonance for better understanding of the concept.

- (iii) Many candidates failed to write about increased amplitude but talked about increase in frequency. Some also mentioned that oscillations remain the same. Some of them missed the keyword amplitude.
- (iv) Almost all the candidates wrote correctly as resonance but some of them wrote it forced oscillations.

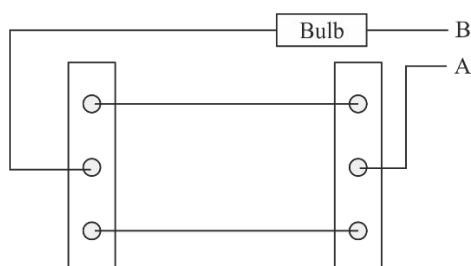
MARKING SCHEME

Question 7

(a)	(i) Loudness (ii) Base drum has greater surface area compared to the side drums. Loudness is increased with the increase in surface area of vibration.
(b)	\because 4 vibrations in 1s \therefore 6 vibrations =? $\therefore t = \frac{6}{4} = \frac{3}{2} = 1.5 \text{ s}$ $V = \frac{2d}{t} \therefore 340 = \frac{2d}{1.5}$ $\therefore d = \frac{340 \times 1.5}{2} = 255 \text{ m}$
(c)	(i) Free vibration / damped vibrations (ii) Forced vibrations (iii) D vibrates with the same amplitude as C or C and D vibrate with maximum amplitude alternately. (iv) Resonance.

Question 8

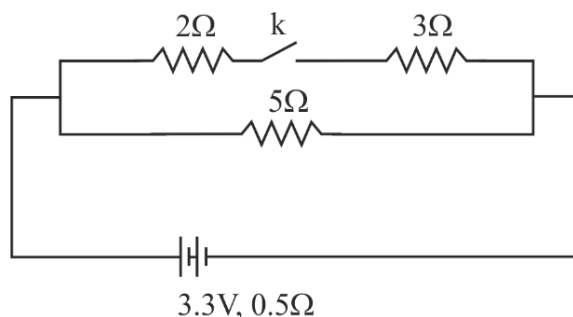
- (a)
 - (i) Write one advantage of connecting electrical appliances in parallel combination. [3]
 - (ii) What characteristics should a fuse wire have?
 - (iii) Which wire in a power circuit is connected to the metallic body of the appliance?
- (b) The diagram below shows a dual control switch circuit connected to a bulb. [3]



- (i) Copy the diagram and complete it so that the bulb is switched ON.
- (ii) Out of A & B which one is the live wire, and which one is the neutral wire?

(c)

[4]



The diagram above shows a circuit with the key k open. Calculate:

- (i) the resistance of the circuit when the key k is open.
- (ii) the current drawn from the cell when the key k is open.
- (iii) the resistance of the circuit when the key k is closed.
- (iv) the current drawn from the cell when the key k is closed.

Comments of Examiners

- (a) (i) Many candidates wrote one advantage of connecting electrical appliances in parallel combination correctly. However, some candidates supplied vague answers like
- advantages of series combination.
 - current received is 220 volts.
 - work on the same current in place of voltage.
 - wrote about advantages of ring system of wiring.
 - same thickness of wire can be used.
 - monthly Power bill is reduced.
- (ii) A large number of candidates wrote characteristics of a fuse wire correctly but some of the candidates wrote only one point. Some candidates answered high melting point and low resistivity. Some even expressed about good conductance or low specific heat capacity which was irrelevant.
- (iii) Many candidates answered correctly as Earth wire. It was also observed that some of the candidates had written about neutral and live wire and their combinations. Quite a few candidates had answered as fuse wire.
- (b) (i) Several candidates copied the diagram of dual control switch circuit connected to a bulb correctly and also completed the circuit correctly but many of them kept the circuit incomplete or completed it incorrectly.

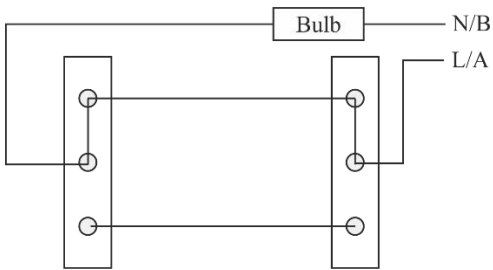
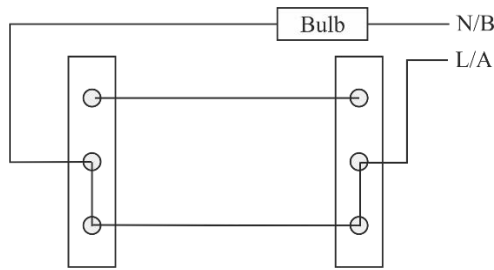
Suggestions for teachers

- Explain clearly to the students about the advantages of connecting the appliances in parallel combination
- Interpret the difference between current and voltage clearly to the students.
- Teach clearly to the students:
 - The characteristics of a fuse wire.
 - working of dual control switches with the diagrams.
 - the connections of live, neutral and earth wire to the appliance.
- Point out the difference between the open circuit and the open key with reference to the different circuit diagrams.
- Give ample practice to the students to solve the numerical problems based on the topic electricity.

- (ii) Some candidates answered correctly as A - live wire and B - neutral wire. Quite a few candidates interchanged this answer. Some candidates made careless errors by interchanging the markings A and B while copying the diagram.
- (c) Some candidates solved this question correctly but many of them could not comprehend it properly. Candidates did not take into consideration the position of the key in the circuit. They did not realise that when the key is closed and when it is open, the resistance present in the circuit differs, so the resistance of the circuit is different in both cases and therefore, the current is also different in both the cases. Many candidates blindly wrote current is zero when the key k is open. The difference between open circuit and open key was not clear to the candidates. Some of the candidates did not write the units for the answers. It was also observed in some scripts that candidates were not trained in dealing with the internal resistance.

MARKING SCHEME

Question 8

(a)	<p>(i) Each appliance will be working at the same potential; each appliance can operate independently.</p> <p>(ii) high resistivity and low melting point.</p> <p>(iii) earth wire.</p>
(b)	<p>(i)</p> <div style="display: flex; align-items: center; justify-content: space-around;">  <p>Or</p>  </div> <p>(ii) A – Live and B – Neutral</p>
(c)	<p>(i) $R = 5 + 0.5 = 5.5 \, \Omega$</p> <p>(ii) $I = \frac{3.3}{5.5} = \frac{3}{5} = 0.6 \, A$</p> <p>(iii) $R_1 = \frac{5 \times 5}{5 + 5} = 2.5 \, \Omega$ $\therefore R = 2.5 + 0.5 = 3 \, \Omega$</p> <p>(iv) $I = \frac{3.3}{3} = 1.1 \, A$</p>

Question 9

- (a) (i) Define Calorimetry. [3]
- (ii) Name the material used for making a Calorimeter.
- (iii) Why is a Calorimeter made up of thin sheets of the above material answered in (ii)?

- (b) The melting point of naphthalene is 80°C and the room temperature is 30°C . A sample of liquid naphthalene at 100°C is cooled down to the room temperature. Draw a temperature time graph to represent this cooling. In the graph, mark the region which corresponds to the freezing process. [3]
- (c) 104 g of water at 30°C is taken in a calorimeter made of copper of mass 42 g. When a certain mass of ice at 0°C is added to it, the final steady temperature of the mixture after the ice has melted, was found to be 10°C . Find the mass of ice added. [Specific heat capacity of water = $4.2 \text{ Jg}^{-1}\text{C}^{-1}$; Specific latent heat of fusion of ice = 336 Jg^{-1} ; Specific heat capacity of copper = $0.4 \text{ Jg}^{-1}\text{C}^{-1}$] [4]

Comments of Examiners

- (a) (i) Several candidates in the definition of calorimetry wrote the key word study in place of measurement. In many scripts candidates stated the principle of calorimetry.
- (ii) Almost all the candidates answered the name of the material used for making a Calorimeter correctly. Very few candidates gave options other than copper such as wood, mercury, iron and steel.
- (iii) Many candidates answered this subpart of the question correctly. Some candidates wrote the answer as good conductor of electricity instead of good conductor of heat. They also missed the keyword Heat capacity. They did not take into consideration the word **thin** sheet.
- (b) Majority of the candidates could not attempt this question correctly. The graph drawn was not correct. Some candidates drew the graph correctly. Some candidates have even shown the graph line being parallel to x-axis three times.
- (c) A large number of the candidates solved this numerical correctly. However, following errors were noticed in many scripts:
- substitution errors
 - substitution was correct but made mistakes in calculation.
 - for ice considered only melting and not increase in the temperature there after.
 - did not take into consideration the heat absorbed by the calorimeter.
 - did not write unit for the final answer.

Suggestions for teacher

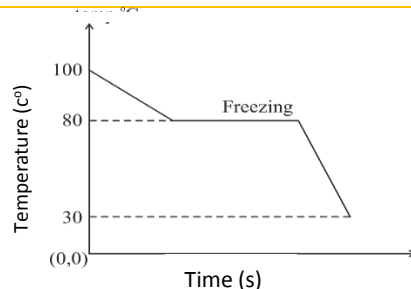
- Emphasise on
 - keywords/terms in the definition.
 - difference between calorimeter and calorimetry.
 - reason for making the copper calorimeter of thin sheet.
- Train students to read the question carefully to utilise judiciously every bit of information given in the question while answering.
- Explain the heating curve to the students thoroughly and its science of reasoning to draw on the basis of information given.
- Teach students the logic of framing equations involving change of state and principle of mixtures as well as substitution in the equation exhaustively. Also, interpret the use of heating curve to construct an equation.
- Instruct students to express final answer with correct unit.

MARKING SCHEME

Question 9

- (a) (i) The measurement of the quantity of heat is called Calorimetry
 (ii) Copper
 (iii) Specific heat capacity of copper is low and by making the vessel thin its mass and heat capacity becomes low therefore it takes a negligible amount of heat from the contents to attain the temperature.

(b)



(c) By principle of mixtures

$$m_{\text{ice}} L + m_{\text{ice}} c_w t = m_w c_w (t_i - t_f) + m_{\text{cu}} c_{\text{cu}} (t_i - t_f)$$

$$m (336 + 4.2 \times 10) = 104 \times 4.2 \times (30 - 10) + 42 \times 0.4 \times (30 - 10)$$

$$\therefore m \times 4.2 (80 + 10) = 4.2 \times (104 + 4) \times 20$$

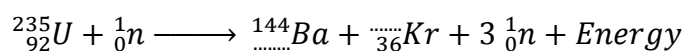
$$\therefore m = \frac{108 \times 20}{90} = 24g$$

Question 10

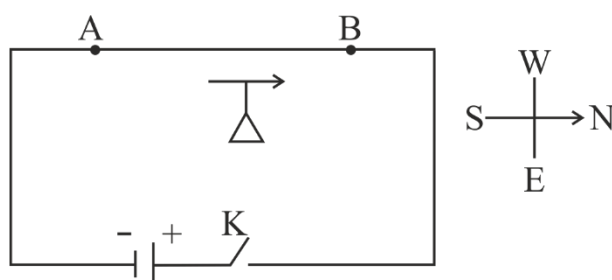
(a) Draw a neat labeled diagram of an A.C. generator. [3]

(b) (i) Define nuclear fission. [3]

(ii) Rewrite and complete the following nuclear reaction by filling in the atomic number of Ba and mass number of Kr:



(c) The diagram below shows a magnetic needle kept just below the conductor AB which is kept in North South direction. [4]



- (i) In which direction will the needle deflect when the key is closed?
- (ii) Why is the deflection produced?
- (iii) What will be the change in the deflection if the magnetic needle is taken just above the conductor AB?
- (iv) Name one device which works on this principle.

Comments of Examiners

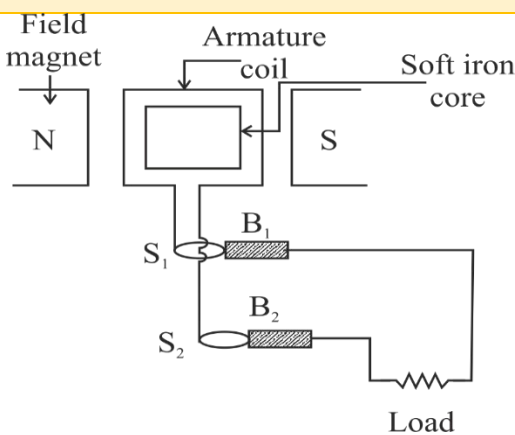
- (a) Some candidates drew correct diagram of an A.C. generator but in many scripts the following anomalies were noticed:
 - drew battery in place of load.
 - in place of slip ring they showed split rings.
 - drew transformer diagram.
 - drew slip rings correctly but labelled them as split ring.
 - drew DC motor diagram.
- (b) (i) Many candidates defined nuclear fission correctly but the common errors observed in many scripts were
 - related it to the size of the nucleus instead of the mass of the nucleus
 - splitting of an atom instead of nucleus.
 - defined nuclear fusion.
- (ii) A large number of candidates wrote atomic number and mass number correctly. By and large, it was observed that majority of them found the atomic number correctly, but while finding the mass number, did not take into consideration mass of three neutrons.
- (c) (i) Majority of the candidates could not apply right hand thumb rule correctly and instead of writing towards east, various incorrect answers for example, North-South, South-East, West, North, clockwise etc. were observed.
- (ii) Many candidates identified it as magnetic effect of current but quite a number of candidates wrote:
 - that current is flowing through the conductor.
 - about electromagnetic induction.
 - about Lorentz Force.
 - about electric field instead of magnetic field.
- (iii) This part of the question was dependent on the first part, therefore, the candidates who wrote opposite or reversed or towards west were benefited. But several candidates wrote other answers which were incorrect.
- (iv) Almost all the candidates had given correct example which means that they had identified the magnetic effect of current but failed to apply it in the given situation.

Suggestions for teacher

- Train students to differentiate between AC generator and DC motor.
- Explain principle of conservation of atomic number and mass number involved in balancing the nuclear equations clearly to the students.
- Give intensive practice in balancing the nuclear equations.
- Demonstrate Oersted's experiment on the magnetic effect of electric current in the laboratory to make students clear about the effect of the magnetic field on the magnetic needle.
- Discuss application-based questions on the magnetic effect of the current with the students frequently.

MARKING SCHEME

Question 10

(a)	
(b)	<p>(i) Combination of two or more lighter nuclei to form heavier nucleus.</p> <p>(ii) ${}_{92}^{235}\text{U} + {}_0^1\text{n} \longrightarrow {}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + 3{}_0^1\text{n} + \text{Energy}$</p>
(c)	<p>(i) Towards east</p> <p>(ii) Magnetic effect of current</p> <p>(iii) Deflection in the opposite direction / towards west</p> <p>(iv) Electric Bell, Electromagnet</p>

Note: For questions having more than one correct answer/solution, alternate correct answers/solutions, apart from those given in the marking scheme, have also been accepted.

GENERAL COMMENTS

Topics found difficult/ confusing by candidates

- Understanding of lever of class 1 with M.A. greater than 1 and class 2 lever.
- Physical quantity and unit.
- Specific heat capacity and Specific resistance
- Ratio concept in solving numerical.
- Factors affecting critical angle and conditions for total internal reflection.
- Correlation between the holes present on the flute and the frequency of sound produced.
- Connection of live, neutral and earth wire with the appliance.
- Nuclear fusion reaction is called as thermonuclear reaction?
- Identification of lenses when virtual images are formed.
- Change in the focal length when the refractive index of the outside medium changes.
- The diagram of AC generator and DC motor.
- Difference between the number of turns of the coil and just coils.

Suggestions for candidates

- Underline the keywords in the definition or in answering reasoning questions.
- Always write the correct unit for the final answer and express the final answer as per the requirement of the question.
- Express the answer only in SI units unless otherwise asked.
- Comprehend the key terms/technical terms/ keywords, laws and principles before memorisation.
- Practise concept based and application-based questions regularly.
- Practise numerical problems starting from simple to complex that is from direct formula based to application/understanding based.
- Give more emphasis on solving numerical problems with understanding.
- Emphasise on practice by writing rather than just reading.
- Practise diagrams regularly.
- Think logically before drawing ray diagrams.
- Discourage yourself from drawing rough hand sketches when diagram is asked in the question.
- Use first 15 minutes of reading time judiciously to understand what is asked in the question. Keep in mind or note every bit of information given in the question.
- Write to the point rather than beating around the bush.
- Do not change the numbering system given in the question paper while writing the answers on the answer sheet.
- Practise beginning a new question on a fresh page, or after leaving 8 to 10 lines.
- Practise solving previous years' ICSE question papers.

QUALITATIVE ANALYSIS

CHEMISTRY (PAPER-2)

SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

(a) Choose the correct answer from the options given below: [5]

(i) An *electrolyte* which completely dissociates into ions is:

- A. Alcohol
- B. Carbonic acid
- C. Sucrose
- D. Sodium hydroxide

(ii) The most *electronegative element* from the following elements is:

- A. Magnesium
- B. Chlorine
- C. Aluminium
- D. Sulphur

(iii) The reason for using *Aluminium* in the alloy duralumin is:

- A. Aluminium is brittle.
- B. Aluminium gives strength.
- C. Aluminium brings lightness.
- D. Aluminium lowers melting point.

(iv) The *drying agent* used to dry *HCl* gas is:

- A. Conc. H_2SO_4
- B. ZnO
- C. Al_2O_3
- D. CaO

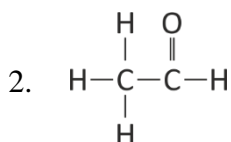
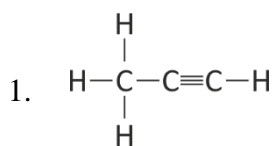
(v) A hydrocarbon which is a *greenhouse gas* is:

- A. Acetylene
- B. Ethylene
- C. Ethane
- D. Methane

- (b) Fill in the blanks with the choices given in brackets: [5]
- (i) Conversion of *ethanol to ethene* by the action of *concentrated sulphuric acid* is an example of _____. (dehydration / dehydrogenation / dehydrohalogenation)
 - (ii) When *sodium chloride* is heated with *concentrated sulphuric acid below 200°C*, one of the products formed is _____. (sodium hydrogen sulphate / sodium sulphate / chlorine)
 - (iii) *Ammonia* reacts with *excess chlorine* to form _____. (nitrogen / nitrogen trichloride / ammonium chloride)
 - (iv) *Substitution reactions* are characteristic reactions of _____. (alkynes / alkenes / alkanes)
 - (v) In Period 3, the *most metallic* element is _____. (sodium / magnesium / aluminium)
- (c) Write a balanced chemical equation for each of the following reactions: [5]
- (i) Reduction of copper (II) oxide by hydrogen.
 - (ii) Action of dilute sulphuric acid on sodium hydroxide.
 - (iii) Action of dilute sulphuric acid on zinc sulphide.
 - (iv) Ammonium hydroxide is added to ferrous sulphate solution.
 - (v) Chlorine gas is reacted with ethene.
- (d) State one observation for each of the following: [5]
- (i) Concentrated nitric acid is reacted with sulphur.
 - (ii) Ammonia gas is passed over heated copper (II) oxide.
 - (iii) Copper sulphate solution is electrolysed using copper electrodes.
 - (iv) A small piece of zinc is added to dilute hydrochloric acid.
 - (v) Lead nitrate is heated strongly in a test tube.
- (e) (i) Calculate: [5]
1. The number of moles in 12g of oxygen gas. [O = 16]
 2. The weight of 10^{22} atoms of carbon.
[C = 12, Avogadro's No. = 6×10^{23}]

(ii) Molecular formula of a compound is $C_6H_{18}O_3$. Find its empirical formula.

(f) (i) Give the IUPAC name of the following organic compounds: [5]



(ii) What is the special feature of the structure of ethyne?

(iii) Name the saturated hydrocarbon containing two carbon atoms.

(iv) Give the structural formula of Acetic acid.

(g) Give the appropriate term defined by the statements given below: [5]

(i) The formula that represents the simplest ratio of the various elements present in one molecule of the compound.

(ii) The substance that releases hydronium ion as the only positive ion when dissolved in water.

(iii) The tendency of an atom to attract electrons towards itself when combined in a covalent compound.

(iv) The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.

(v) The covalent bond in which the electrons are shared equally between the combining atoms.

(h) Arrange the following according to the instructions given in brackets: [5]

(i) K, Pb, Ca, Zn. (In the increasing order of the reactivity)

(ii) Mg^{2+} , Cu^{2+} , Na^{1+} , H^{1+} (In the order of preferential discharge at the cathode)

(iii) Li, K, Na, H (In the decreasing order of their ionization potential)

(iv) F, B, N, O (In the increasing order of electron affinity)

- (v) Ethane, methane, ethene, ethyne. (In the increasing order of the molecular weight) [H = 1, C = 12]

Comments of Examiners

- (a) (i) This question was attempted well by majority of the candidates. Some candidates selected *Carbonic acid* instead of *Sodium hydroxide*.
- (ii) Most of the candidates answered this question correctly. A few chose *Sulphur* over Chlorine.
- (iii) A few candidates made the error of selecting the option *Aluminium is brittle*. Most candidates chose the correct option.
- (iv) A few candidates got confused between the drying agent of ammonia and HCl gas and selected *CaO* instead of *conc.H₂SO₄*.
- (v) Most candidates answered correctly, but some chose *Ethane* over *Methane*.
- (b) (i) Several candidates were confused between dehydration and dehydrogenation.
- (ii) Many candidates wrote *Chlorine* instead of *Sodium hydrogen Sulphate*. Some made errors in writing the correct name by missing out the third word 'sulphate' which was printed on the next line.
- (iii) A large number of candidates did not select the correct option.
- (iv) Most candidates answered correctly but some wrote *alkenes* instead of *alkanes*.
- (v) Almost all candidates attempted this subpart correctly.
- (c) (i) Most candidates wrote the balanced chemical equation correctly. However, a few made the error of writing *CuO₂* for copper (II) oxide (CuO) and *2H* instead of *H₂*.
- (ii) Some candidates wrote the formula of the product as *NaSO₄*.
- (iii) Several candidates represented Zinc sulphide incorrectly as *ZnSO₃* or *ZnSO₄*. Some carelessly used HCl instead of *H₂SO₄*.
- (iv) A large number of candidates made errors in writing the formula of ammonium sulphate or ferrous sulphate. In several cases, the equation was not balanced.
- (v) Some candidates wrote the product as *C₂H₂Cl₂* instead of *C₂H₄Cl₂* in the chemical equation.
- (d) (i) Many candidates either wrote the equation or named the product formed instead of stating the observation.

Suggestions for teachers

- Teach the concept of complete ionization and partial ionization with examples to give the thorough understanding of strong and weak electrolytes.
- Explain the trends in the properties of elements across a period/group with reference to the variation in electronic configuration.
- Familiarise students with the role of each metal used in an alloy.
- Make students aware of the impact of various gases on our environment.
- Explain the meaning of the terms with relevant examples.
- Emphasise on the variation of products when temperature conditions change.
- Advise students to reproduce the word correctly from the choices given.
- Explain the logic behind the products formed in the reaction between ammonia and chlorine with the varying conditions, as to, which one is in excess.
- Explain the concept of saturation and unsaturation to give them the understanding of the type of reaction (addition or substitution) that a particular organic substance would undergo.
- Ensure students have clarity regarding *molecules*, *moles* and *molecular weight*.
- Acquaint students with the following terms: number of moles, Avogadro's numbers of atoms/molecules, Relative atomic mass (RAM), Relative molecular mass (RMM), molar mass, molar volume, etc.

- (ii) Several candidates incorrectly wrote the colour of copper as red or reddish or brown.
- (iii) While most candidates answered correctly, some common incorrect responses were as follows:
- Cathode diminishes in size.
 - Blue colour of copper sulphate fades.
- In a few cases, the change was noted without mention of the electrode.
- (iv) Instead of stating the test for the gas evolved, a large number of candidates identified it as H_2 . Some candidates stated that the gas burns with a blue flame instead of stating that a burning splint is put off with a pop sound.
- (v) On heating lead nitrate strongly in a test tube, products formed were listed by many candidates without any noticeable observations.
- (vi) Some candidates wrote *yellow precipitate of PbO* is obtained instead of *yellow residue*.
- (e) (i) Many candidates took the mass of one mole of oxygen gas as 16 instead of 32 and hence, could not calculate number of moles correctly. In a number of cases, calculations for weight of 10^{22} atoms of carbon were incorrect indicating inadequate understanding of the concept.
- (ii) Many candidates attempted well barring some who carried out elaborate calculations using percentage composition but ultimately could not write the empirical formula.
- (f) (i) (1) Most candidates attempted this part well. However, some were confused between “yne” and “ene”.
- (2) In writing IUPAC name of the organic compound, many candidates wrote *ethanol* (alcohol) which was incorrect.
- (ii) Some candidates mentioned the presence of a linear planar structure or three covalent bonds rather than presence of *triple covalent bond*. Some gave incorrect answers such as, unsaturated compound or, undergoes addition reaction and so on.
- (iii) Most candidates answered correctly while some stated it as *ethene* or *ethyne* instead of *ethane*. A few candidates gave the general name for the homologous series instead of specific name.
- (iv) Several candidates wrote the structural formula of acetic acid correctly. However, some candidates wrote the condensed formula of CH_3 and $COOH$.
- (g) (i) Most candidates answered this question correctly. Some candidates wrote the abbreviation as **EF**.

- Drill in the minds of the students that the Empirical formula can be obtained from the Molecular formula by reducing it to the simplest ratio. Give relevant examples.
- Point out to students that the carbon atom C with the double or triple bond or functional group, must be expressed in the lowest number.
- Stress on the difference between structural formula of alcohol and that of aldehyde. Give practice for greater clarity.
- Emphasise on the differences between saturated and unsaturated compounds /that saturated have all single bonds and unsaturated ones either have double or triple bonds.
- Advise students to draw comparative tables which include name, molecular formula, condensed formula and structural formula of various compounds differing in functional groups.
- Advise students to use standard abbreviations and symbols only in answering the questions.
- Draw the attention of the students to the two ways in which bond pair of electrons is shared, with relevant examples.
- Advise students to read the questions carefully, answer specifically, with reference to what has been asked and to use the option given in the question paper while writing the final answer.

- (ii) Instead of stating the general term 'Acid' many candidates gave the specific name of an acid which were not acceptable.
 - (iii) Most candidates gave the appropriate term as *electron affinity* instead of *electronegativity*. Some candidates simply written the abbreviation form of *electronegativity*.
 - (iv) Most candidates mentioned the process correctly. However, a few candidates confused it with *roasting*.
 - (v) Many candidates incorrectly termed it as *polar covalent bond*.
- (h) In subparts (i) – (v), several candidates used the greater than (>) or less than (<) symbols incorrectly to arrange the given items according to the instructions given in the question, which was not required.
- Some candidates simply arranged the items given in subparts (i) – (v), in reverse order.
- In subpart (v), some candidates made unnecessary use of formula instead of choosing the names given.

MARKING SCHEME

Question 1

(a)	(i) D or Sodium Hydroxide or NaOH (ii) B or Chlorine or Cl ₂ (iii) C or Aluminium brings lightness (iv) A or Concentrated H ₂ SO ₄ (v) D or Methane or CH ₄
(b)	(i) Dehydration (ii) Sodium hydrogen sulphate or NaHSO ₄ (iii) Nitrogen trichloride or NCl ₃ (iv) Alkanes (v) Sodium
(c)	(i) $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$ (ii) $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ (iii) $\text{ZnS} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\text{S} \uparrow$ (iv) $\text{FeSO}_4 + 2\text{NH}_4\text{OH} \rightarrow (\text{NH}_4)_2\text{SO}_4 + \text{Fe}(\text{OH})_2$ (v) $\text{H}_2\text{C} = \text{CH}_2 + \text{Cl}_2 \rightarrow \text{H}_2\text{C} - \text{CH}_2$ <div style="text-align: center;"> $\begin{array}{cc} & \\ \text{Cl} & \text{Cl} \end{array}$ </div> <p style="text-align: center;"><i>Or</i></p> $\text{C}_2\text{H}_4 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_4\text{Cl}_2$

(d)	<p>(i) Reddish brown or brown gas of nitrogen dioxide is formed.</p> <p>(ii) The black copper (II) oxide turns into a pink or reddish-brown substance.</p> <p>(iii) The colour of the electrolyte remains blue / anode diminishes in size or becomes thinner / cathode becomes thicker.</p> <p>(iv) Brisk effervescence / A gas given out extinguishes burning splinter and itself burns with pop sound.</p> <p>(v) A decrepitating sound is heard / A reddish brown gas is given out / A yellow residue is left behind.</p>
(e)	<p>(i) 1. Number of moles in 12 g of oxygen gas = $\frac{12}{32} = 0.375$ moles</p> <p>2. Weight of 10^{22} atoms of C = $\frac{12 \times 10^{22}}{6 \times 10^{23}} = 0.2$ g</p> <p>(ii) Its empirical formula is C_2H_6O</p>
(f)	<p>(i) 1. Propyne</p> <p>2. Ethanal</p> <p>(ii) Triple bond between 2 carbon atoms / $H - C \equiv C - H$</p> <p>(iii) Ethane</p> <p>(iv) $\begin{array}{c} H & O \\ & \\ H-C & -C-OH \\ \\ H \end{array}$</p>
(g)	<p>(i) Empirical formula</p> <p>(ii) Acid</p> <p>(iii) Electronegativity</p> <p>(iv) Calcination</p> <p>(v) Non-polar covalent bond</p>
(h)	<p>(i) Pb, Zn, Ca, K</p> <p>(ii) Cu^{2+}, H^{1+}, Mg^{2+}, Na^{1+}</p> <p>(iii) H, Li, Na, K</p> <p>(iv) B, N, O, F</p> <p>(v) Methane, ethyne, ethene, ethane</p>

SECTION II (40 Marks)

Attempt any four questions from this Section

Question 2

- (a) Draw the electron dot structure of: [3]
- (i) Nitrogen molecule [N = 7]
- (ii) Sodium chloride [Na = 11, Cl = 17]
- (iii) Ammonium ion [N = 7, H = 1]
- (b) The pH values of three solutions A, B and C are given in the table. Answer the following questions: [3]

Solution	pH value
A	12
B	2
C	7

- (i) Which solution will have no effect on litmus solution?
- (ii) Which solution will liberate CO_2 when reacted with sodium carbonate?
- (iii) Which solution will turn red litmus solution blue?
- (c) Study the extract of the Periodic Table given below and answer the questions that follow. Give the alphabet corresponding to the element in question. [4]
DO NOT repeat an element.

[illegible]

- (i) Which element forms electrovalent compound with G?
- (ii) The ion of which element will migrate towards the cathode during electrolysis?
- (iii) Which non-metallic element has the valency of 2?
- (iv) Which is an inert gas?

Comments of Examiners

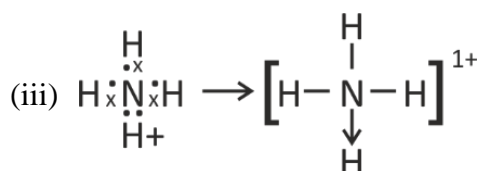
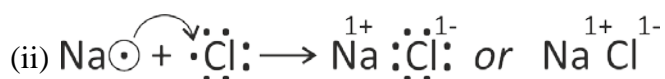
- (a) While a number of candidates drew the electron dot structures asked for correctly, others committed the following errors:
- Candidates drew the orbital structure or showed electron pairs along with the bonds. Some forgot the lone pair of electrons of N.
 - Electrons of sodium were not differently represented from chlorine; transfer of electron and ion formation was not shown. A few candidates drew the orbital diagram instead of the electron dot diagram.
 - Coordinate bond was not shown by some candidates. Overall positive charge was not shown on the ion in a few cases. Some drew the structure of *ammonia* instead of *ammonium*.
- (b) Most candidates answered the pH value related questions correctly. However, some candidates failed to associate the nature of the substance with the correct pH value. Some attached names to the solutions instead of using the symbols A, B and C.
- (c) Some candidates identified the elements instead of using the given letters of alphabets. In a few cases, the position of metals and non-metals was not clear. Despite the clear instructions not to repeat elements some candidates repeated certain elements.

Suggestions for teachers

- Clarify the difference between electron dot and orbital diagram and explain that after bonding, each atom must have an octet structure. Compare dot structure with structural formula for shared pairs. Emphasise that lone pair must not be missed out.
- Ask students to differentiate between electrons of unlike atoms. Lay emphasis on writing the positive charge on the ion.
- Show the association between pH scale and the nature of substances clearly to the students. Explain clearly the properties of acids and alkalis.
- Instruct students to read the questions carefully and answer as per instructions given. Guided practice will assist students in performing better.

MARKING SCHEME

Question 2



(b) (i) C / pH 7

(ii) B / pH 2

(iii) A / pH 12

(c)	(i) B
	(ii) A
	(iii) E
	(iv) F

Question 3

(a) Name the particles present in: [3]

- (i) Strong electrolyte
- (ii) Non- electrolyte
- (iii) Weak electrolyte

(b) Distinguish between the following pairs of compounds using the reagent given in the bracket. [3]

- (i) Manganese dioxide and copper (II) oxide. (using concentrated HCl)
- (ii) Ferrous sulphate solution and ferric sulphate solution. (using sodium hydroxide solution)
- (iii) Dilute hydrochloric acid and dilute sulphuric acid. (using lead nitrate solution)

(c) Choose the method of preparation of the following salts, from the methods given in the list: [4]

[List: A. *Neutralization* B. *Precipitation*
 C. *Direct combination* D. *Substitution*]

- (i) Lead chloride
- (ii) Iron (II) sulphate
- (iii) Sodium nitrate
- (iv) Iron (III) chloride

Comments of Examiners

- (a) Majority of the candidates named the particles present in Strong electrolyte, Non-electrolyte and Weak electrolyte correctly. However, some candidates listed examples instead of stating the presence of ions or molecules depending on the type of electrolyte.
- (b) (i) Some of the candidates gave the equation instead of writing the observation to distinguish between the given pairs of compounds. With the reagent given, the result of adding it to one substance was specified by several candidates but not for the other substance.
- (ii) Some candidates interchanged the colours of the two ions, ferrous and ferric.
- (iii) White precipitate was mentioned by several candidates but the effect of heat on both was not mentioned.
- (c) (i) Several candidates incorrectly chose *neutralization* instead of *precipitation*.
- (ii) Some candidates erred by writing *precipitation* instead of *substitution*.
- (iii) This subpart of the question was attempted correctly by most candidates.
- (iv) Most candidates attempted this subpart correctly.

Suggestions for teachers

- Discuss in detail the types of electrolytes on the basis of dissociation /ionization whether complete/partial or no dissociation/ionization.
- Ask students to specify the effect of the reagent on both the substances when a single test is used.
- Supplement theory adequately with practical work, which may be done by the students themselves or through demonstration. Instruct students to record observations.
- Never disregard the importance of practical work.

MARKING SCHEME

Question 3

(a)	<p>(i) Only ions</p> <p>(ii) Only molecules</p> <p>(iii) Both molecules and ions</p>
(b)	<p>(i) On adding concentrated hydrochloric acid if a greenish yellow gas is evolved it is Manganese dioxide. If no gas is evolved it is CuO.</p> <p>(ii) On adding sodium hydroxide solution if a dirty green precipitate is formed it is ferrous sulphate solution. If a reddish-brown precipitate is formed, it is Ferric sulphate solution.</p> <p>(iii) On adding lead nitrate solution, if white precipitate is formed which dissolves on heating, then it is dilute HCl. If white precipitate formed does not dissolve on heating, it is dilute H₂SO₄.</p>
(c)	<p>(i) B or Precipitation</p> <p>(ii) D or Substitution</p> <p>(iii) A or Neutralization</p> <p>(iv) C or Direct combination</p>

Question 4

- (a) Complete the following equations: [3]
- (i) $S + \text{conc. HNO}_3 \rightarrow$
 - (ii) $C + \text{conc. H}_2\text{SO}_4 \rightarrow$
 - (iii) $\text{Cu} + \text{dil. HNO}_3 \rightarrow$
- (b) Write a balanced chemical equation for the preparation of: [3]
- (i) Ethene from bromoethane
 - (ii) Ethyne using calcium carbide
 - (iii) Methane from sodium acetate.
- (c) Name the following organic compounds: [4]
- (i) The compound with 3 carbon atoms whose functional group is a carboxyl.
 - (ii) The first homologue whose general formula is C_nH_{2n} .
 - (iii) The compound that reacts with acetic acid to form ethyl ethanoate.
 - (iv) The compound formed by complete chlorination of ethyne

Comments of Examiners

- (a) (i) A large number of candidates made errors in balancing of the equation and/or writing the products. Many candidates wrote SO_2 as a product instead of H_2SO_4 .
- (ii) Although CO_2 was the product, several candidates wrote H_2CO_3 .
- (iii) Many candidates wrote NO_2 as a product instead of NO .
- (b) (i) In writing a balanced chemical equation for the preparation of Ethene from bromoethane, the formula for bromoethane was written as C_2H_6Br in place of C_2H_5Br by some candidates.
Several candidates used chloroethane instead of bromoethane.
- (ii) In writing a balanced chemical equation for the preparation of Ethyne using calcium carbide, some candidates wrote the product as CaO instead of $Ca(OH)_2$.
- (iii) The formula of *sodium acetate* was written incorrectly by some candidates.
- (c) (i) Some candidates incorrectly drew the structural formula when the name of the organic compound was asked.
- (ii) Several candidates gave incorrect answers like, alkene, ethyne or acetylene.
- (iii) For the compound that reacts with acetic acid to form ethyl ethanoate, reactants listed by many candidates were incorrect.
- (iv) Most candidates answered this subpart correctly. However, some candidates wrote incorrect numbering of the C atoms having the chlorine atoms.

Suggestions for teachers

- Give adequate practice in writing of balanced chemical equations with necessary conditions. Use of structural formulae for organic compounds will help students to write equations correctly.
- Ask students to prepare a chart on various homologous series with the first member listed along with other properties.
- Ensure that students know the common names along with the IUPAC names, wherever possible.

MARKING SCHEME

Question 4

(a)	<p>(i) $S + 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$</p> <p>(ii) $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$</p> <p>(iii) $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$</p>
(b)	<p>(i) $C_2H_5Br + KOH \rightarrow C_2H_4 + KBr + H_2O$ (alc.)</p> <p>(ii) $CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2$</p> <p>(iii) $CH_3COONa + NaOH \rightarrow CH_4 + Na_2CO_3$</p>
(c)	<p>(i) Propanoic acid</p> <p>(ii) Ethene or ethylene</p> <p>(iii) Ethanol or ethyl alcohol</p> <p>(iv) 1, 1, 2, 2 – tetra chloro ethane</p>

Question 5

(a) Give the chemical formula of: [3]

- (i) Bauxite
- (ii) Cryolite
- (iii) Sodium aluminate

(b) Answer the following questions based on the extraction of aluminium from alumina by **Hall-Heroult's Process**.: [3]

- (i) What is the function of cryolite used along with alumina as the electrolyte?
- (ii) Why is powdered coke sprinkled on top of the electrolyte?
- (iii) Name the electrode, from which aluminium is collected.

(c) Match the alloys given in column I to the uses given in column II: [4]

COLUMN I	COLUMN II
(i) Duralumin	A. Electrical fuse
(ii) Solder	B. Surgical instruments
(iii) Brass	C. Aircraft body
(iv) Stainless Steel	D. Decorative articles

Comments of Examiners

- (a) In writing the chemical formula of bauxite, many candidates either wrote incorrect number of water molecules or did not write them at all. In subparts(ii) and (iii), some candidates wrote incorrect formulae.
- (b) Most candidates answered this question correctly.
- (c) Some candidates mismatched Column I and Column II, as they were not sure of the uses of alloys.

Suggestions for teachers

- Give regular practice through class tests, games, quizzes to ensure that students learn the details.
- Teach students metallurgy in detail.
- Frequently revise names of common ores of aluminium, iron and zinc.
- Discuss the questions based on the extraction of aluminium from alumina by Hall-Heroult's process in class.

MARKING SCHEME

Question 5

(a)	(i) $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ (ii) Na_3AlF_6 (iii) NaAlO_2
(b)	(i) Cryolite reduces the fusion temperature of the mixture / Cryolite increases the mobility of the ions / increases the conductivity of the electrolyte / Acts as solvent for alumina. (ii) Powdered coke protects the graphite rods of the anode from oxidation by oxygen released at the anode / Powdered coke prevents the loss of heat from the electrolyte. (iii) Cathode
(c)	(i) Duralumin: C or Aircraft body. (ii) Solder: A or Electrical fuse (iii) Brass: D or Decorative articles (iv) Stainless Steel: B or surgical instruments

Question 6

- (a) Identify the substances underlined: [3]
- The catalyst used to oxidise ammonia.
 - The organic compound which when solidified, forms an ice like mass.
 - The dilute acid which is an oxidizing agent.
- (b) Copper sulphate solution reacts with sodium hydroxide solution to form a precipitate of copper hydroxide according to the equation: [3]
- $$2\text{NaOH} + \text{CuSO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{Cu}(\text{OH})_2 \downarrow$$
- What mass of copper hydroxide is precipitated by using 200 gm of sodium hydroxide?
[H = 1, O = 16, Na = 23, S = 32, Cu = 64]
 - What is the colour of the precipitate formed?
- (c) Find the **empirical formula** and the **molecular formula** of an organic compound from the data given below: [4]
- C = 75.92%, H = 6.32% and N = 17.76%
- The vapour density of the compound is 39.5.
- [C = 12, H = 1, N = 14]

Comments of Examiners

- (a) (i) Most candidates identified the catalyst used to oxidise ammonia correctly. However, a few candidates mentioned incorrect catalyst such as Fe/ V₂O₅/CaO.
- (ii) Almost all candidates answered correctly.
- (iii) Many candidates listed HCl or H₂SO₄ as an oxidising agent instead of nitric acid.
- (b) (i) Some candidates used Gay Lussac's law instead of mole concept or calculated the molecular mass incorrectly. Some candidates failed to use the stoichiometric coefficients i.e. 2 in the case of NaOH.
- (ii) Most of the candidates attempted this part well.
Some candidates incorrectly wrote the colour of the precipitate as brown or white.
- (c) Many candidates determined the empirical formula correctly but failed in calculating the value of *n* and hence, erred in the molecular formula.

Suggestions for teachers

- Maintain a comparative chart for the various processes consisting of reactants, catalysts, temperature / pressure condition, equation, etc.
- Teach students the fact that only nitric acid in dilute and concentrated form can act as an oxidizing agent.
- Train students to answer the molar relationship using the coefficients in the equation and compute the answer accurately.
- Instruct students to focus on practical work and the noting of results.
- Insist on stepwise working of numerical problems and give adequate practice.

MARKING SCHEME

Question 6

(a)	<p>(i) Platinum or Pt.</p> <p>(ii) Acetic acid or ethanoic acid or CH₃COOH</p> <p>(iii) HNO₃ or nitric acid.</p>
(b)	<p>(i) RMW of NaOH = 40, Cu(OH)₂ = 98 $\therefore 2 \times 40 \text{ g precipitate} = 98 \text{ g}$ $\therefore 200 \text{ g precipitate} = \frac{98 \times 200}{80} = 245 \text{ g}$</p> <p>(ii) Pale blue</p>

(c)	Element	% composition	Atomic weight	Relative no. of atoms	Simplest Ratio
	C	75.92	12	$75.92/12 = 6.32$	$6.32/1.26 = 5$
	H	6.32	1	$6.32/1 = 6.32$	$6.32/1.26 = 5$
	N	17.76	14	$17.76/14 = 1.26$	$1.26/1.26 = 1$

Empirical formula is: C_5H_5N

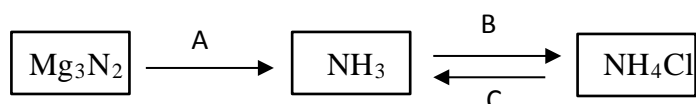
Empirical formula weight = $60+5+14 = 79$

$$n = \frac{\text{molecular weight}}{\text{empirical formula weight}} = \frac{2 \times 39.5}{79} = \frac{79}{79} = 1$$

Molecular formula = C_5H_5N

Question 7

- (a) Name the gas evolved in each of the following cases: [3]
- Alumina undergoes electrolytic reduction.
 - Ethene undergoes hydrogenation reaction.
 - Ammonia reacts with heated copper oxide.
- (b) Study the flow chart given and give balanced equations to represent the reactions **A**, **B** and **C**: [3]



- (c) Copy and complete the following table which refers to the **industrial method for the preparation** of ammonia and sulphuric acid: [4]

Name of the compound	Name of the process	Catalytic equation (with the catalyst)
Ammonia	(i)_____	(ii)_____
Sulphuric acid	(iii)_____	(iv)_____

Comments of Examiners

- (a) (i) Some candidates wrote the name of the gas evolved on electrolytic reduction of alumina as CO_2 instead of O_2 . A few candidates wrote the symbol of nascent oxygen, that was not acceptable.
- (ii) Several candidates wrote H_2 is evolved in the hydrogenation reaction of ethene, which was an incorrect answer.
- (iii) In the reaction of ammonia with heated copper oxide, the gas evolved was incorrectly written as N, NO or NO_2 .
- (b) After studying the given flow chart, many candidates gave correct balanced equations to represent reactions A, B and C. However, in some scripts following errors were noticed:
- For reaction A, MgO was written as the product instead of $Mg(OH)_2$
 - For reaction C, some candidates failed to use an alkali.
- (c) The table referring to the **industrial method for the preparation** of ammonia and sulphuric acid was completed correctly by a number of candidates. Some common errors made by candidates:
- (i) Name of the process was incorrectly written as Ostwald's process/Baeyer's process
- (ii) The catalyst listed was platinum/nickel, etc.
- (iii) Haber's Process was written instead of Contact Process.
- (iv) Incorrect equation was given.

Suggestions for teachers

- Train students to learn the reactions in terms of reactants, products, conditions, equations and observations.
- Give enough practice to students in writing the different types of balanced chemical reactions.
- Explain to students that a metal nitride with warm water gives metal hydroxide and ammonia; an ammonium salt reacts with an alkali and gives NH_3 gas.
- Motivate students to prepare comparative charts, power point presentations or quizzes, etc to study facts.
- Clarify industrial methods for the preparation of ammonia and sulphuric acid thoroughly.
- Give frequent revision tests.

MARKING SCHEME

Question 7

(a)	(i) Oxygen gas or O_2 (ii) Ethane gas or C_2H_6 (iii) Nitrogen or N_2
(b)	A. $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$ B. $NH_3 + HCl \rightarrow NH_4Cl$ Or $8NH_3 + 3Cl_2 \rightarrow 6NH_4Cl + N_2$ C. $NH_4Cl + NaOH \rightarrow NaCl + NH_3 + H_2O$ Or with any other alkali.
(c)	(i) Haber's Process (ii) $N_2 + 3H_2 \xrightarrow{Fe} 2NH_3$ (iii) Contact Process (iv) $2SO_2 + O_2 \xrightarrow{V_2O_5} 2SO_3$ Or $2SO_2 + O_2 \xrightarrow{Pt} 2SO_3$

GENERAL COMMENTS

Topics found
difficult/
confusing by
candidates

- Observations based on practical chemistry.
- Writing correct balanced chemical equations.
- Methods of preparation of salts.
- Structural formulae of compounds with functional groups and IUPAC nomenclature.
- Distinguishing between substances on the basis of test/reagent given.
- Numerical problems based on mole concept.
- Conversion of molecular formula to empirical formula.
- Electron dot diagram.
- Arranging elements as per the trends in properties across a period and down a group.
- Difference between the terms dehydration and dehydrogenation.
- Identification of terms such as electronegativity etc. on the basis of descriptions given.
- Catalysts used in various industrial processes.
- Components of alloys and their application.
- Difference in structure of an aldehyde and alcohol.
- Connecting the type of solution to its pH value based on certain observations.

**Suggestions
for
candidates**

- Avoid selective study.
- Learn definitions and highlight key words.
- Learn symbols of elements and their valencies. Practice writing balanced chemical equations with necessary conditions.
- Practice drawing of dot diagrams.
- Practice drawing of Structural formulae of organic compounds.
- Create charts with a comparative study on Hydrocarbons – alkanes, alkenes and alkynes including the equations and conditions and various industrial processes.
- Learn trends in properties across a period and draw a group.
- Be thorough with observations in practical chemistry and use colours to highlight observations along with tests to differentiate between substances.
- In a chemical equation, write an acid with its strength(dilute/concentration) Name organic chemical compounds only using IUPAC nomenclature.
- Select only one reagent when distinguishing between substances and state the result with each substance.
- Follow confirmatory test for colourless gases.
- Focus on observations such as specific smell or specific colour of precipitate or change in colour between reactants and products.
- Understand the role of substances used in the extraction of metals in metallurgy.
- Practice numerical problems regularly, solve numericals stepwise with correct formula and write the answer with correct unit.
- Pay special attention to reactions involving variations in products formed when conditions change using the same reactants.
- Solve the previous years' papers to become familiar with the mode of questioning and marking system.
- Read the questions carefully and then answer accordingly what has been asked.

QUALITATIVE ANALYSIS

BIOLOGY (PAPER-3)

SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

- (a) Name the following: [5]
- (i) The layer of the eyeball that provides nourishment to the eye.
 - (ii) One gaseous compound which depletes the ozone layer.
 - (iii) The structure which connects the placenta and the foetus.
 - (iv) A pair of corresponding chromosomes of the same shape and size and derived one from each parent.
 - (v) The compound formed when haemoglobin combines with carbon dioxide in blood.
- (b) Correct and *rewrite the statements* by changing the biological term that is underlined for each statement: [5]
- (i) The theory of Inheritance of Acquired Characters was proposed by Watson and Crick.
 - (ii) The protective sac which develops around the developing embryo is called the Pericardium.
 - (iii) Maintaining balance of the body and coordinating muscular activities is carried out by the cerebrum.
 - (iv) The kidney is composed of number of neurons.
 - (v) The part of the eye which can be donated from a clinically dead person is the Retina.

(c) Give suitable *biological reasons* for the following statements: [5]

- (i) The birth rate in India is very high.
- (ii) Carbon monoxide is dangerous when inhaled.
- (iii) Root hairs become flaccid and droop when excess fertilizers are added to the moist soil around them.
- (iv) Acid rain is harmful to the environment.
- (v) All life on Earth is supported by Photosynthesis.

(d) Match the items given in Column A with the most appropriate ones in Column B and [5]
REWRITE the correct matching pairs:

Column A		Column B	
(i)	Cranial nerves	–	Testosterone
(ii)	Leydig cells	–	Natural reflex
(iii)	Acetylcholine	–	12 pairs
(iv)	Spinal nerves	–	Prolactin
(v)	Sneezing	–	Neurotransmitter
		–	18 pairs
		–	31 pairs
		–	Conditioned reflex

(e) Choose the correct answer from the four options given below: [5]

- (i) While recording the pulse rate, where exactly does a doctor press on our wrist?
 - A. Nerve
 - B. Vein
 - C. Artery
 - D. Capillary
- (ii) In a human male, a sperm will contain:
 - A. Both X and Y chromosomes
 - B. Only Y chromosome
 - C. Only X chromosome
 - D. Either X or Y chromosome

- (iii) A muscular wall is absent in:
- A. Capillary
 - B. Venule
 - C. Arteriole
 - D. Vein
- (iv) On which day of the menstrual cycle does ovulation take place?
- A. 5th day
 - B. 28th day
 - C. 14th day
 - D. 1st day
- (v) Which one of the following does not affect the rate of transpiration?
- A. Light
 - B. Humidity
 - C. Wind
 - D. Age of the plant

- (f) Identify the **ODD** term in each set and name the **CATEGORY** to which the remaining three belong: [5]

Example: glucose, starch, cellulose, calcium

Odd term: calcium

Category: others are different types of carbohydrates.

- (i) Addison's disease, Cushing's Syndrome, Acromegaly, Leukemia.
 - (ii) Insulin, Adrenaline, Pepsin, Thyroxine.
 - (iii) Axon, Dendron, Photon, Cyton.
 - (iv) Chicken pox, Colour blindness, Haemophilia, Albinism.
 - (v) Polythene bag, Crop residue, Animal waste, Decaying vegetable.
- (g) Expand the following biological abbreviations: [5]
- (i) ABA
 - (ii) IAA
 - (iii) ATP
 - (iv) DNA
 - (v) TSH

(h) Study the picture given below and answer the following questions:

[5]



- (i) Identify the type of pollution.
- (ii) Name one pollutant that causes the above pollution.
- (iii) Mention the impact of this pollution on human health.
- (iv) State one measure to control this pollution.
- (v) What is a 'Pollutant'? Explain the term.

Comments of Examiners

- (a) (i) Most candidates named the layer of the eyeball that provides nourishment to the eye correctly. However, some candidates could not spell it correctly.
- (ii) Majority of the candidates performed well barring some who were not sure and wrote CO_2 .
- (iii) Many candidates attempted this sub-part of the question well. However, some spelt it as 'Amblical cord'.
- (iv) Most candidates answered it correctly. However, some wrote *Homozygous* instead of *Homologous*.
- (v) Incorrect answer was written by most candidates. They wrote *carboxyhaemoglobin* instead of *carbaminohaemoglobin*.
- (b) (i) Most candidates wrote *Mendel* and *Darwin* instead of *Lamarck*.
- (ii) This was a well attempted question.
- (iii) Most candidates answered this sub-part of the question correctly. However, in several scripts spelling errors were noticed.
- (iv) Answered correctly by most candidates.

Suggestions for teachers

- Advise students to read the instructions given for each question carefully.
- Explain the parts and functions of eye and brain using charts, models and interactive boards.
- Clarify the difference between carboxyhaemoglobin and carbaminohaemoglobin, Endosmosis and Exosmosis.
- Emphasise on the discoveries made by Watson and Crick, Mendel, Lamarck and Darwin.
- Acquaint students with the hormones secreted by endocrine glands and the disorders caused due to their Hypo and Hyper secretions.

- (v) Majority of the candidates answered correctly. However, a few candidates wrote *Choroid* instead of *Retina*.
- (c) (i) Most candidates wrote the correct biological reason for the given statement.
- (ii) Most of the candidates were vague in their answers. Supply of oxygen to tissues being cut off, was not mentioned by many candidates.
- (iii) Many candidates wrote the correct reason. However, some could not explain using technical terms.
- (iv) A valid reason was given by most candidates.
- (v) Majority of the candidates wrote the correct reason. A few could not give the significance of food and O₂ provided by green plants.
- (d) Most candidates wrote correct matching pairs of items given in column A and B. However, a few candidates were not sure of the number of *Cranial nerves* and *Spinal nerves*.
- (e) (i) Most of the candidates wrote the correct option. Some wrote *vein* instead of *artery*.
- (ii) Majority of the candidates wrote incorrect options. They were unaware that sperms are of two types.
- (iii) Most candidates chose the correct answer from the given options.
- (iv) The correct answer was written by most candidates.
- (v) All candidates wrote the correct option.
- (f) (i) Most candidates were able to identify the odd term but could not identify the category correctly.
- (ii) Most candidates answered correctly.
- (iii) Answered correctly by most candidates.
- (iv) The odd term was identified correctly, but the category was mentioned as *eye diseases* by many candidates.
- (v) This subpart of the question was well attempted.
- (g) (i) Many candidates could not spell *Abscisic acid* correctly.
- (ii) Many candidates were not sure of the abbreviation IAA and hence wrote *Indone* for *Indole* and did not mention the number '3'.
- (iii) Most candidates wrote the correct answer.
- (iv) Several candidates wrote the correct answer. However, some candidates wrote *dioxy* for *deoxy*.
- (v) Majority of the candidates answered correctly. However, a few wrote *Thyroxine* for *Thyroid*.

- Explain the number of cranial and spinal nerves.
- Advise students to practice the diagrams of stomatal apparatus and the experiment to prove that O₂ is released by green plants during photosynthesis.
- Insist upon learning the correct spellings of the biological terms with their correct meaning.
- Explain to the students to differentiate between
 - placenta and umbilical cord.
 - homologous chromosomes and homozygous condition along with the meanings of 'zygous' and 'logous.'
 - the location of amnion and amniotic fluid.
 - Neuron and Nephron by drawing the attention of the students to the fact that Neuron is the fundamental unit of the nervous system while, Nephrons are units of the kidney.
- Discuss in detail the concept of osmosis, exosmosis and endosmosis, with relevant examples of plant cells being subjected to hypertonic and hypotonic mediums/solutions.
- Point out the difference between the natural reflexes and conditioned reflexes giving relevant examples.
- Giving application-based problems in the class regularly.
- Clarify to the students that all ova/egg contain only X chromosome, while, sperms may contain either X or Y chromosome. Thus, teach the concept of sex determination in humans clearly.
- Clarify menstrual cycle with all the four phases with appropriate diagrams.
- Teach clearly the difference between communicable diseases and hereditary diseases.

- (h) (i) The type of pollution was identified correctly by all candidates.
(ii) This subpart of the question was answered correctly by most candidates.
(iii) Most candidates answered correctly.
(iv) Majority of the candidates answered correctly.
(v) Most of the candidates could not explain the term *pollutant*. 'Causes Pollution' was the vague answer written by many candidates.

MARKING SCHEME

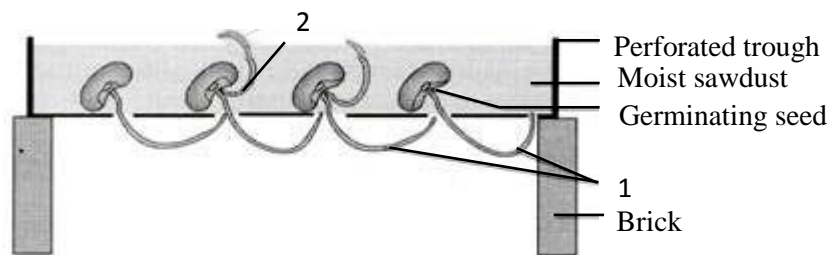
Question 1

(a)	(i) Choroid (ii) Chlorofluorocarbon (CFC) or carbon tetrachloride (iii) Umbilical cord (iv) Homologous chromosomes (v) Carbaminohaemoglobin/HbCO ₂
(b)	(i) Jean-Baptiste Lamarck (ii) Amnion (iii) Cerebellum (iv) Nephrons/ Uriniferous tubules (v) Cornea
(c)	(i) Illiteracy, children are a gift of God, sign of prosperity, due to high infant mortality, more helping hands for family income, do not accept family planning methods, desire for a male child, lack of recreation. (ii) Easily combines with haemoglobin to form carboxyhaemoglobin which cuts off supply of oxygen to tissues. (iii) Formation of hypertonic solution which results in plasmolysis / exosmosis. (iv) Pollutes soil, damages vegetation, buildings, statues, monuments, kills fish and aquatic animals. (v) All organisms depend directly or indirectly on green plants for food, beginning of all food chains, provides oxygen for respiration. (Any alternate correct answer)
(d)	(i) Cranial nerves – 12 pairs (ii) Leydig cells – Testosterone (iii) Acetylcholine – Neuro transmitter (iv) Spinal nerves – 31 pairs (v) Sneezing – Natural reflex
(e)	(i) C. Artery (ii) D. Either X or Y chromosome (iii) A. Capillary (iv) C. 14 th day (v) D. Age of the plant

(f)	<p>(i) O – Leukemia C – Hormonal / Endocrinal disorders</p> <p>(ii) O – Pepsin C – Hormones</p> <p>(iii) O – Photon C – Parts of neuron / nerve cell</p> <p>(iv) O – Chicken pox C – Genetic diseases</p> <p>(v) O – Polythene bag C – Biodegradable wastes</p>
(g)	<p>(i) Absciscic acid</p> <p>(ii) Indole 3-acetic acid</p> <p>(iii) Adenosine triphosphate</p> <p>(iv) Deoxyribo nucleic acid</p> <p>(v) Thyroid stimulating hormone</p>
(h)	<p>(i) Water pollution/ Marine pollution</p> <p>(ii) Detergents, sewage, domestic waste, oil spills from tankers, industrial wastes, hot water from thermal power plants, polythene covers, plastic bottles, dead bodies, insecticides, etc.</p> <p>(iii) Enters food chain to harm health, cause diseases like typhoid, dysentery, jaundice, skin allergies, etc.</p> <p>(iv) Treating industrial wastes and sewage before letting into water bodies, recycling plastic, metal and glass material</p> <p>(v) Any constituent that harms the environment / deteriorates the natural quality of air, water, soil. <i>(Any alternate correct answer)</i></p>

Question 2

- (a) Given below is an experimental setup to demonstrate a particular tropic movement in germinating seeds. Study the diagram and answer the questions that follow: [5]



- (i) Label the parts 1 and 2.
- (ii) Name the tropic movement shown by part 1.
- (iii) Part 1 is affected by two stimuli. Name them.
Which one of the two is stronger?
- (iv) What is Thigmotropism? Give one example.
- (v) What is meant by 'Positive' and 'Negative' tropic movements in plants?

(b) Mention the exact location of the following:

[5]

- (i) Testis
- (ii) Incus
- (iii) Thylakoids
- (iv) Amniotic fluid
- (v) Corpus callosum

Comments of Examiners

- (a) (i) Most of the candidates labelled the parts 1 and 2 correctly. However, some candidates labelled the parts as, *root* and *shoot*, respectively.
- (ii) The tropic movement shown by part 1 was named correctly by most candidates.
- (iii) Most candidates wrote the tropic movements instead of the *stimuli*.
- (iv) Most of the candidates answered this subpart correctly. However, some candidates wrote the example of Nastic movements which was incorrect.
- (v) Majority of the candidates answered correctly. A few were unable to give a clear differentiation between the '*Positive*' and '*Negative*' tropic movements in plants.
- (b) In sub-parts(ii)-(iv), most of the candidates wrote the exact location of the asked questions. However, in sub-parts (i), and (v), many candidates could not give the exact location. They wrote vague answers such as, *outside the abdomen* in subpart (i) and *in the brain, in the cerebrum* in subpart (v)

Suggestions for teachers

- Give a simplified explanation of Tropic movements in plants.
- Explain the difference between Tropic movement and stimulus, Positive and negative tropic movements.
- Give suitable examples for tropic movements.
- Emphasise on the importance of prepositions while teaching the exact location of organs and structures.
- Clarify to the students the difference between
 - radicle and root, plumule and shoot.
 - corpus callosum and corpus luteum.

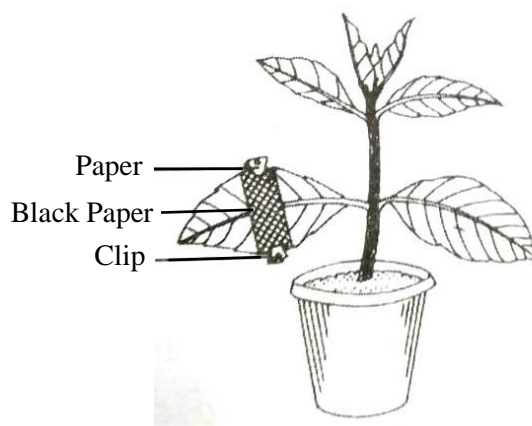
MARKING SCHEME

Question 2

(a)	<p>(i) 1. Radicle 2. Plumule</p> <p>(ii) Hydrotropism</p> <p>(iii) Gravity, water / moisture Water is stronger</p> <p>(iv) Movement of plant in response to touch stimulus. Pea, Vines, Cuscuta, cucumber</p> <p>(v) Movement towards stimulus is positive. Movement away from stimulus is negative.</p>
(b)	<p>(i) Inside scrotal sac</p> <p>(ii) Middle ear / between malleus and stapes</p> <p>(iii) In chloroplast</p> <p>(iv) Between amnion and foetus / surrounds the foetus</p> <p>(v) Between the cerebral hemispheres.</p>

Question 3

- (a) The diagram given below represents an experiment to prove the importance of a factor [5]
in photosynthesis. Answer the questions that follow:



- (i) Name the factor studied in this experiment.
- (ii) What will you observe in the experimental leaf after the starch test?
- (iii) Explain the process of Photosynthesis.

- (iv) Give a balanced chemical equation to represent the process of photosynthesis.
- (v) Draw a neat, labelled diagram of an experimental setup to show that oxygen is released during photosynthesis.
- (b) State the main functions of the following: [5]
- (i) Medulla Oblongata
 - (ii) Cytokinins
 - (iii) Tears
 - (iv) Coronary Artery
 - (v) Seminal Vesicles

Comments of Examiners

- (a)(i) Most candidates did not name the factor studied in the asked experiment. They wrote the *process* instead of the *factor*.
- (ii) Many candidates could not give a clear explanation of the starch test. They did not specify the colour change in the covered and uncovered parts of the experimental leaf.
- (iii) Majority of the candidates explained the process of Photosynthesis.
- (iv) Most candidates wrote the correct equation. A few balanced it by taking $6\text{H}_2\text{O}$ instead of $12\text{H}_2\text{O}$.
- (v) Most candidates drew an incorrect diagram using a mouse and bell jar instead of taking a hydrilla plant submerged in water.
- (b) (i) Few candidates stated the main function of Medulla Oblongata correctly. Majority of them confused it with the function of cerebellum.
- (ii) Most candidates answered correctly.
- (iii) This was correctly answered by most candidates.
- (iv) Most candidates wrote incomplete answers. They did not specify *oxygenated blood*.
- (v) Majority of the candidates wrote the correct answer. A few wrote the function of testis instead of seminal vesicles.

Suggestions for teachers

- While teaching starch test in Photosynthesis emphasise on the colour change in the parts of the experimental leaf.
- Advise students to practice the chemical equation for Photosynthesis.
- Guide students that any factor tested for an experiment needs to be proved at the end. Hence, using a mouse and plant under a bell jar cannot prove the release of O_2 during photosynthesis since oxygen cannot be tested. Instruct students to setup the experiment using twigs of hydrilla to prove the release of oxygen.
- Clarify the difference between the *factor* and the *process* studied in an experiment.
- Ensure that students are clear about the main functions of the structures asked in the question paper.

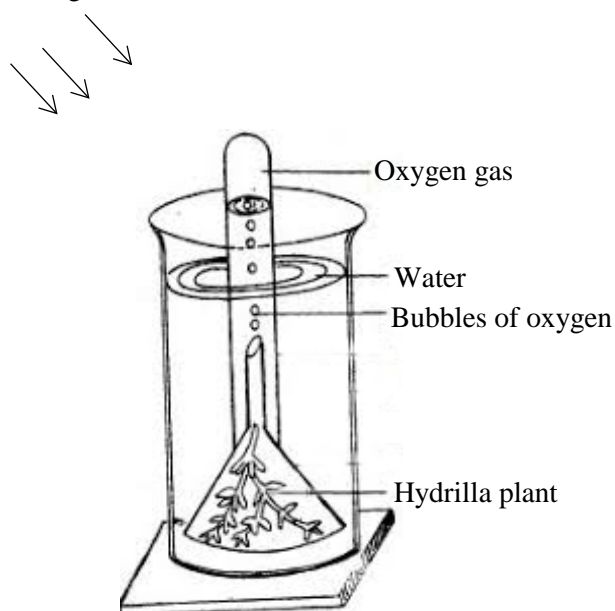
MARKING SCHEME

Question 3

- (a)
- (i) Sunlight
 - (ii) – Part of leaf covered by black paper turns brown, absence of starch.
– Parts of leaf exposed to sunlight turns blue black, presence of starch.
 - (iii) Plant cells having chlorophyll, use water and carbon dioxide to produce glucose in the presence of sunlight.



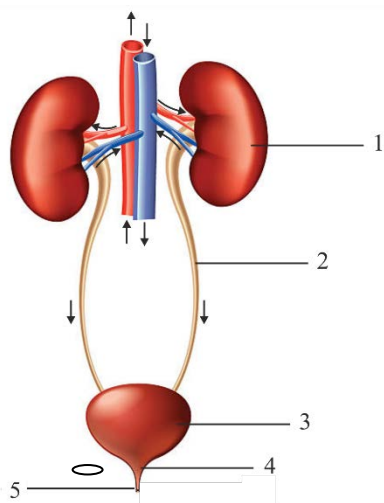
- (v) Sunlight



- (b)
- (i) Regulates activities of internal organs like breathing, heartbeat, peristalsis.
 - (ii) Stimulates cell division, plant growth, prevents ageing, expansion of cotyledons in seeds, breaks seed dormancy, promotes synthesis of chloroplasts, delays senescence.
 - (iii) Lubricates surface of eye, washes away dust, kill germs, keeps surface of eye moist, lysozyme kills bacteria.
 - (iv) Supplies oxygenated blood to the walls of the heart.
 - (v) Activates sperms, forms a medium for transportation of sperms.

Question 4

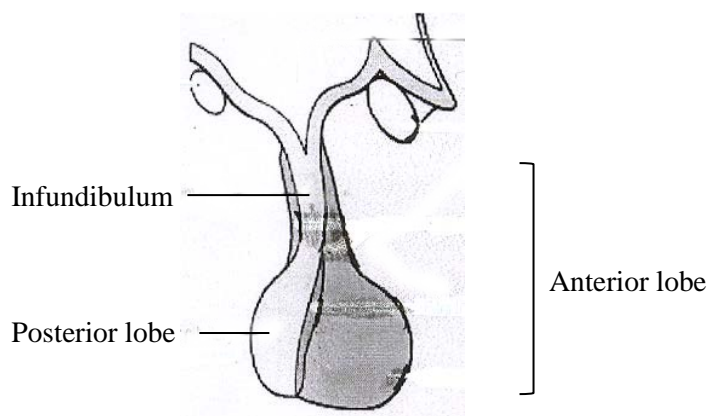
- (a) The diagram given below represents an organ system in the human body. [5]
Study the same and answer the questions that follow:



- (i) Identify the system.
- (ii) Label the parts marked 2 and 4. Mention the function of part 5.
- (iii) Name the structural and functional units of the part marked 1.
- (iv) What is the fluid that accumulates in part 3?

Which is the main nitrogenous waste present in it?

- (v) Draw a neat, labelled diagram showing the longitudinal section of part 1.
- (b) The diagram given below represents an endocrine gland in the human body. Study the diagram and answer the following questions: [5]



- (i) Identify the endocrine gland. Where is it located?
- (ii) Why is the above gland referred to as the 'Master gland'?

- (iii) Name the hormone which in deficiency causes Diabetes Insipidus.
How does this disorder differ from Diabetes Mellitus?
- (iv) Explain the term 'Hormone'.
What is the role of Tropic hormones in the human body?
- (v) Which lobe of the above gland secretes:
1. Oxytocin
 2. ACTH
 3. Growth hormone

Comments of Examiners

- (a) (i) Most candidates identified the system correctly. 'Urinogenital system' was written as an incorrect answer by a few candidates.
- (ii) Most candidates labelled part 2 and 4 and mentioned the function of part 5 correctly. However, a few did not study the diagram carefully and labelled part 4 as *urethra*.
- (iii) This part of the question was answered correctly by most candidates.
- (iv) Majority of the candidates wrote the name of the fluid that accumulates in part 3 correctly. However, some candidates could not mention the main nitrogenous waste present in urine.
- (v) The longitudinal section of part 1 was drawn correctly by most candidates. However, a few candidates could not show a clear differentiation between renal cortex and medulla.
- (b) (i) Most candidates identified the endocrine gland correctly. However, a large number of candidates could not give the exact location of the gland.
- (ii) Most candidates answered this subpart correctly.
- (iii) This subpart was attempted well by most candidates.
- (iv) Majority of the candidates explained the term 'Hormone' correctly but were unable to give the role of Tropic hormones in the human body.
- (v) Many candidates wrote incorrect answers as they were uncertain of the hormones secreted by the two lobes of the Pituitary gland.

Suggestions for teachers

- Familiarise students with the parts and functions of the Urinary system.
- Encourage students to draw neat, labelled and accurate diagrams showing all parts clearly.
- Explain the location of the Pituitary gland with the help of a suitable/interactive board.
- Interpret the differences between the two types of Diabetes with respect to hormones and symptoms. Also clarify the keywords *mellitus* and *insipidus*.
- Explain to the students the difference between an organ and an organ system.
- Give a list of organic and inorganic constituents of urine.
- Give a comparison of the four endocrine glands, their secretion, disorders caused due to hyposecretion and hypersecretion.

MARKING SCHEME

Question 4

(a) (i) Excretory system/Urinary system

(ii) 2 – Ureter

4 – Sphincter

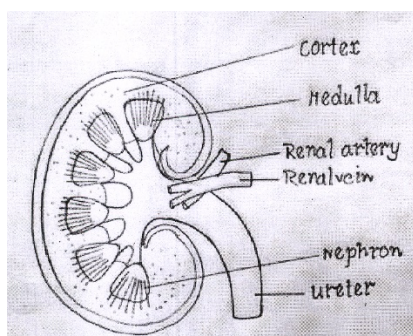
5 – Expels urine

(iii) Nephrons

(iv) Urine

Urea

(v)



(Any other correct labelling)

(b) (i) Pituitary gland

Hangs from hypothalamus

(ii) Controls the secretions of other endocrine glands/regulates the activities of other endocrine glands.

(iii) Vasopressin / ADH

Diabetes mellitus is due to deficiency of insulin/ high level of sugar in blood, urine has sugar.

Diabetes insipidus: Normal sugar in blood, urine free of sugar / urine loaded with water.

(iv) It is the secretion of an endocrine gland, which is transported by blood and acts on target organs or cells.

Secreted by pituitary gland and stimulates other endocrine glands to secrete their hormones.

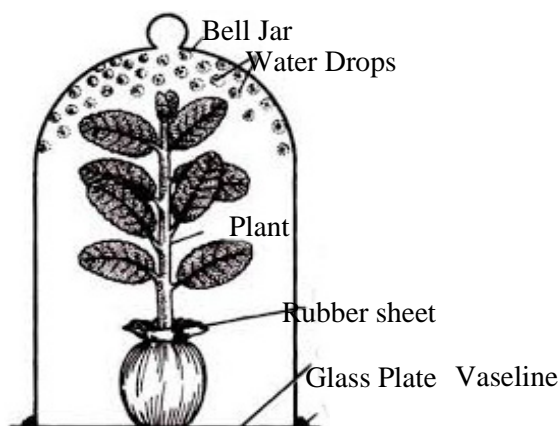
(v) 1 – Posterior/ neurohypophysis

2 – Anterior / adenohypophysis

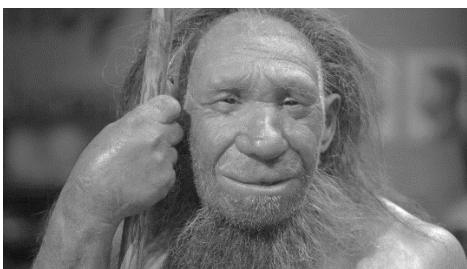
3 – Anterior /adenohypophysis

Question 5

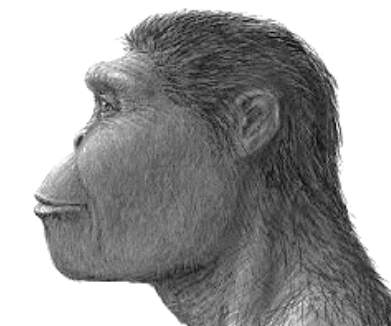
- (a) Given below is an apparatus which was setup to investigate a physiological process in plants. The setup was placed in bright sunlight. Answer the questions that follow: [5]



- Name the process being studied. Define the process.
 - Why was the pot enclosed in a rubber sheet?
 - Mention two external factors which can accelerate the above process.
 - List two adaptations in plants to reduce the above process.
 - Draw a neat, labelled diagram of a stomatal apparatus.
- (b) Given below are two stages in the evolution of man. [5]
Study them and answer the questions that follow:



A



B

- Identify Australopithecus and Neanderthal man from the above pictures.

- (ii) Mention two characteristic features each for the two stages.
- (iii) Who proposed the theory of 'Natural Selection'?
- (iv) Name the organism used as an example to explain 'Industrial Melanism'.
- (v) Give two examples of Vestigial organs in humans.

Comments of Examiners

- (a) (i) Most candidates answered correctly. However, a few wrote *Photosynthesis* instead of *Transpiration*.
- (ii) Few candidates could attempt this subpart correctly. Most of them wrote that transpiration occurs in soil, which is incorrect.
- (iii) Though most candidates wrote the external factors, they failed to mention their intensity which will accelerate the process.
- (iv) Majority of the candidates listed the two adaptations in plants correctly.
- (v) Few candidates drew a neat, labelled diagram of a stomatal apparatus. Most candidates did not draw epidermal cells surrounding the guard cells.
- (b)(i) Most candidates identified the pictures correctly.
- (ii) Most candidates wrote the two characteristic features each for the two stages correctly.
- (iii) Many candidates were unsure of the name of the scientist who proposed Natural Selection. They wrote Lamarck instead of Darwin.
- (iv) Most candidates could not write the common name or scientific name of the organism.
- (v) Most candidates wrote the two examples of Vestigial organs in humans correctly.

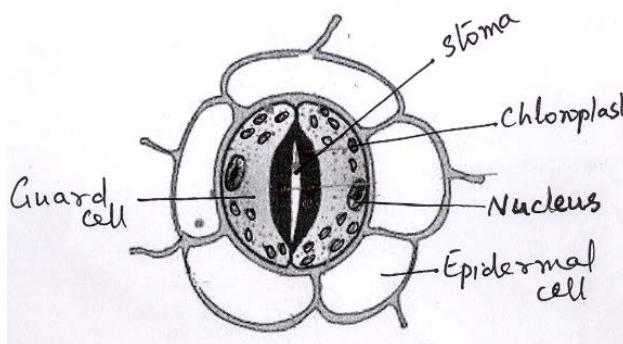
Suggestions for teachers

- Train students in conceptual learning. Advise students to take practical work seriously, to understand the difference between Transpiration and Photosynthesis. Insist on drawing complete diagrams.
- Clarify the importance of epidermal cells surrounding guard cells.
- Instruct students to express the acceleration of physiological processes in plants using adverbs such as "more or less".
- Advise students to comprehend what is asked in the question before answering.
- Explain the difference between a duct and a tubule.
- Teach Human Evolution giving basic characteristics of each stage. Illustrate each stage using pictorial representation of models of evolution of man exhibiting the characteristic feature of the various stages of human evolution.
- Spell out Lamarck's and Darwin's contribution towards study of evolution clearly.
- Explain the meaning of vestigial organ clearly with many examples pertaining to human beings.

MARKING SCHEME

Question 5

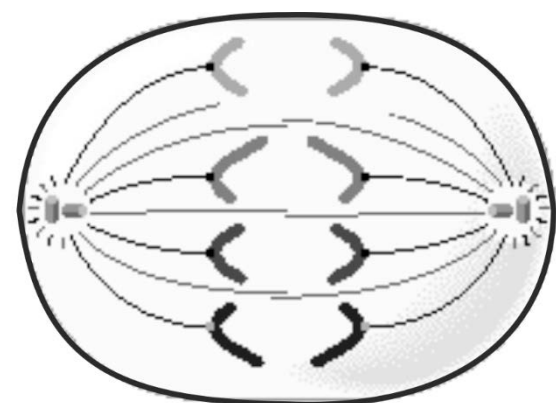
- (a)
- (i) Transpiration
It is the loss of water as water vapour from the aerial parts of the plant.
 - (ii) To prevent evaporation of water from the pot/ soil.
 - (iii) Bright sunlight, high temperature, high velocity of wind, low humidity.
 - (iv) Thick cuticle, loss of leaves, narrow leaves, fewer stomata, sunken stomata, leaves modified into spines, multiple layers of epidermal cells.
 - (v)



- (b)
- (i) A – Neanderthal man
B – Australopithecus
 - (ii) A – absolute bipedalism, large head, broad, flat, sloping forehead, less hair on body, large cranial capacity 1,500 cm³,
B – Protruding face, Chin absent, prominent eyebrow ridges, flat nose, projecting face, cranial capacity (450- 600 cm³).
(Any other correct characteristic feature.)
 - (iii) Charles Darwin
 - (iv) Peppered moth / Biston betularia
 - (v) Pinna of ear, wisdom teeth, vermiform appendix, coccyx or tailbone, arrector pili, plica semilunaris, body hair, male nipples.

Question 6

- (a) In Mendel's experiments, tall pea plants (T) are dominant over dwarf pea plants (t). [5]
- (i) What is the phenotype and genotype of the F_1 generation if a homozygous tall plant is crossed with a homozygous dwarf plant?
 - (ii) Draw a Punnett square board to show the gametes and offspring when both the parents are heterozygous for tallness.
 - (iii) What is the phenotypic ratio and genotypic ratio of the above cross in (ii)?
 - (iv) State Mendel's Law of Dominance.
 - (v) What is a Dihybrid Cross?
- (b) Given below is a diagram representing a stage during the mitotic cell division. Study [5]
the diagram and answer the following questions:



- (i) Identify the stage by giving a suitable reason.
- (ii) Is it a plant or an animal cell? Give a reason to support your answer.
- (iii) Draw a neat, labelled diagram of the stage which follows the one shown in the diagram.
- (iv) How many chromosomes will each daughter cell have after the completion of the above division?
- (v) Name the four nitrogenous bases.

Comments of Examiners

- (a) (i) Most candidates answered correctly. However, a few mentioned shapes of seed and position of flower instead of height of plant.
- (ii) Many candidates drew the Punnett square. A few used a criss-cross method to answer.
- (iii) Most candidates wrote phenotypic ratio and genotypic ratio of the above cross in (ii) correctly.
- (iv) Majority of the candidates stated Mendel's Law of Dominance correctly.
- (v) Most candidates could explain Dihybrid cross. However, a few confused it with Monohybrid cross.
- (b) (i) Majority of candidates could identify the stage during the mitotic cell division correctly but could not give a valid reason.
- (ii) This part of the question was answered correctly by most candidates
- (iii) Many candidates did not draw the correct diagram of Telophase. Daughter nuclei with nuclear membrane was not shown.
- (iv) Majority of the candidates wrote 46 chromosomes instead of 4 as they did not observe the diagram properly.
- (v) Most candidates named the four nitrogenous bases correctly. A few wrote *Thiamine* and *Adenosine* as incorrect answers.

Suggestions for teachers

- Train students to clearly distinguish between Chromosome and Chromatid.
- Draw diagrams on the blackboard to help students comprehend and develop the required skill.
- Give a clear understanding of technical terms like Phenotype, Genotype, Phenotypic ratio and Genotypic ratio.
- Stress upon the difference between Monohybrid and Dihybrid cross, F_1 and F_2 generations.
- Explain the stages of mitosis with the help of well labelled diagrams.
- Lay importance on the position and number of chromosomes in the diagrams.
- Train students to draw labelled diagrams of the phases of mitosis in animal cells and plant cells.
- Instruct students to maintain number of chromosomes in the diagrams drawn for mitosis.
- Give regular practice by giving similar type of questions in unit tests/terminal examinations and clarify the errors.

MARKING SCHEME

Question 6

(a)

(i) Phenotype – all are tall plants

Genotype – All are hybrid / heterozygous dominant

(ii)

	T	t
T	TT	Tt
t	Tt	tt

(iii) Phenotypic ratio – 3 : 1

Genotypic ratio – 1 : 2 : 1

(iv) Out of a pair of contrasting characters, the one that is expressed is dominant and the one that is not expressed is recessive.

(v) It is breeding plants taking two pairs of contrasting characters.

(b)

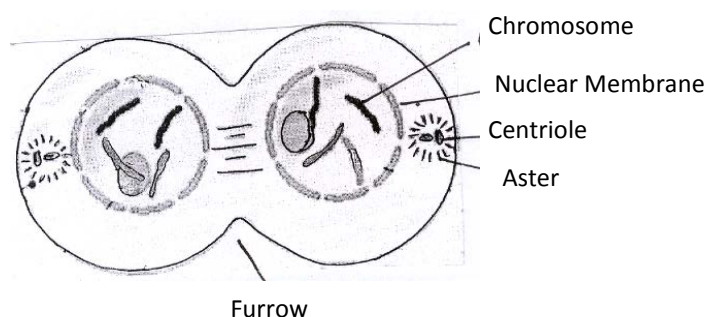
(i) Anaphase

Chromatids are being pulled towards the opposite poles.

(ii) Animal cell

Cell wall is absent, centrioles are present, asters are present.

(iii)



(iv) 4

(v) Adenine, Thymine, Cytosine, Guanine.

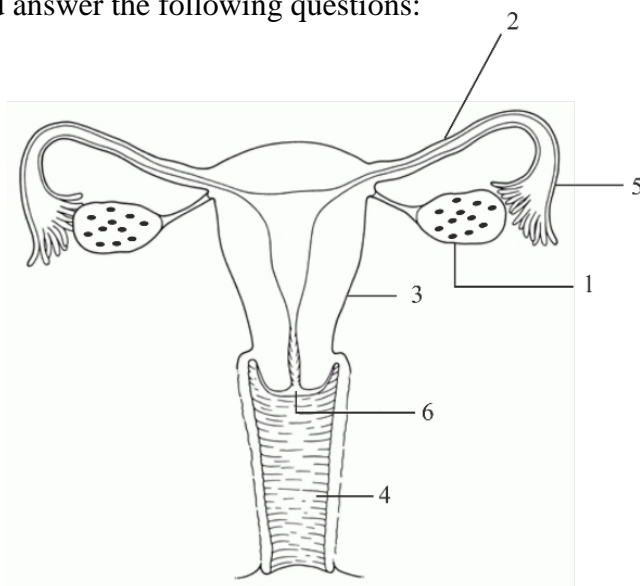
Question 7

(a) Answer the following questions briefly: [5]

- (i) How are the cytons and axons placed in the brain and the spinal cord?
- (ii) Which part of the human ear gives 'Dynamic balance' and 'Static balance' to the body?
- (iii) Explain how the human eye adapts itself to bright light and dim light.
- (iv) What is Parthenocarpy? Give one example.
- (v) Mention any two objectives of 'Swachh Bharat Abhiyan'.

(b) The diagram given below represents a system in the human body. [5]

Study the diagram and answer the following questions:



(b) (i) Identify the system. [5]

(ii) Label the parts marked 5 and 6.

(iii) Name the two hormones secreted by 1.

(iv) Mention the number and the name of the part involved in fertilization and implantation from the above diagram.

(v) Mention the surgical methods of contraception in:

- 1. Human males.
- 2. Human females.

Comments of Examiners

- (a) (i) Most candidates wrote incorrect answers. They were unsure of the placement of cytons and axons in brain and spinal cord.
- (ii) Majority of the candidates answered this sub part of the question correctly.
- (iii) Few candidates wrote correct answers. Many candidates did not write the role of *rhodopsin* for adaptation of eye.
- (iv) Most candidates could not give a clear explanation of the term 'Parthenocarp'. However, the example was written correctly by some candidates.
- (v) Most candidates mentioned the two objectives of 'Swachh Bharat Abhiyan' correctly.
- (b) (i) Most candidates wrote the correct answer. A few candidates did not mention the word *female* while identifying the system.
- (ii) Majority of the candidates labelled part 5 correctly. However, part 6 was identified as Vagina instead of Cervix.
- (iii) Most candidates wrote the names of the two hormones secreted by 1 correctly.
- (iv) Majority of the candidates did not write the number and name of the part involved in fertilization and implantation.
- (v) Most candidates answered correctly the surgical methods of contraception in Human males and females.

Suggestions for teachers

- Give a clear understanding of the structure and functions of the parts of ear and eye using charts, models and interactive boards.
- Explain the arrangement of Cytons and Axons, Grey matter and white matter in brain and spinal cord.
- Teach the functions of sensory cells of retina, emphasising on the pigments of rods and cones and their function in bright and dim light.
- Advise students to comprehend the definitions/ operative terms and then learn.
- Use neatly labelled diagrams and charts to explain the parts of the male and female reproductive system. Stress on the location and function of various parts.
- Teach in detail the definition, site and physiology of fertilization, implantation and gestation.
- Clarify Vasectomy and Tubectomy with suitable illustrations.

MARKING SCHEME

Question 7

- | | |
|-----|--|
| (a) | <p>(i) Brain - Outer, grey matter has cytons and inner white matter has axons.
Spinal Cord - Outer, white matter has axons and inner grey matter has cytons.</p> <p>(ii) Dynamic - semi-circular canals/ducts/tubes
Static - utricle, saccule, utricle, saccule, vestibule</p> <p>(iii) Bright light - Pupils constrict, Rhodopsin is bleached.
Dim light - Pupils dilate, Rhodopsin is regenerated.</p> |
|-----|--|

	<p>(iv) Formation of fruit without fertilisation e.g. grapes, water melon, banana, papaya.</p> <p>(v) – To clean roads, streets and buildings in cities and towns.</p> <ul style="list-style-type: none"> – To eliminate open defecation – To build and monitor the use of latrines – To manage solid and liquid waste
(b)	<p>(i) Female reproductive system</p> <p>(ii) 5 – Oviducal funnel</p> <p>6 – Cervix</p> <p>(iii) Oestrogen, Progesterone.</p> <p>(iv) Fertilisation – 2, Oviduct/Fallopian tube</p> <p>Implantation – 3, Uterus</p> <p>(v) 1 – Vasectomy</p> <p>2 – Tubectomy</p>

Note: For questions having more than one correct answer/solution, alternate correct answers/solutions, apart from those given in the marking scheme, have also been accepted.

GENERAL COMMENTS

Topics found difficult / confusing by candidates

- Parts of eyeball and their functions.
- Gases causing depletion of ozone layer.
- Difference between carbaminohaemoglobin and Carboxyhaemoglobin.
- Discoveries of Mendel, Watson, and Crick, Lamarck and Darwin.
- Parts of brain and their functions.
- Experiments on Photosynthesis and significance of Photosynthesis.
- Number of Cranial and Spinal nerves.
- Chromosomes in sperm.
- Disorders caused due to Hypo and Hypersecretion of hormones.
- Genetic diseases.
- Abbreviations.
- Difference between Stimulus and Tropic movement.
- Location of Testis and Corpus callosum.
- Functions of blood vessels and male accessory glands.
- Diagram of Stomatal apparatus.
- Organism for industrial melanism.
- Monohybrid and dihybrid cross.
- Placement of Cytons and Axons in brain and spinal cord.
- Fertilization and Implantation in female reproductive system.

Suggestions for candidates

- Read the scope and syllabus prescribed for ICSE Biology.
- Revise the topics repeatedly for better understanding of concepts.
- Prepare a list of abbreviations you come across the syllabus, absorb them mentally.
- Learn the keywords/biological terms/definitions with conceptual clarity.
- Practise drawing neat and labelled diagrams.
- Give importance to biological and technical terms.
- Revise previous years question papers.
- Use the 15 minutes reading time to understand and assimilate the questions.
- Read the rubric attentively and choose the questions as per the rubrics, plan and organize your thoughts accordingly to give your best.
- Follow carefully the instructions given for each question.
- Attempt only the number of questions asked for in the question paper.
- Write the correct question number before answering.
- Be methodical and organized while answering.
- Do not separate the subsections of the question.
- Write in a neat and legible handwriting.
- Be confident and rely only on yourself.