Analysis of Pupil Performance

Year 2018 Examination

ICSE

SCIENCE

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Pioneering Excellence in Education

Research Development and Consultancy Division

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Year 2018

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FOREWORD

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 (RDCD) 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.

Gerry Arathoon
Chief Executive & Secretary

October 2018

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 answer and suggestions for teachers/ candidates.

In addition to a detailed qualitative analysis, the Analysis of Pupil Performance documents for the Examination Year 2018 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 2018 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 2018 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 2018 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.

Shilpi Gupta
Deputy Head - RDCD

October 2018

CONTENTS

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 2018 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 2018 Examination.

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

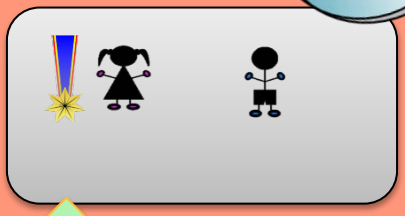
Given below is an example showing the comparison tables used in this section and the manner in which they should be interpreted.

Comparison on the basis of Gender

Gender	N	Mean	SE	t-value
Girls	2,538	66.1	0.29	11.91*
Boys	1,051	60.1	0.42	

*Significant at 0.05 level

Girls performed significantly better than boys.



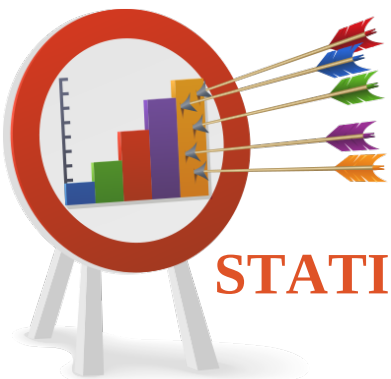
The table shows comparison between the performances of boys and girls in a particular subject. The t-value of 11.91 is significant at 0.05 level (mentioned below the table) with a mean of girls as 66.1 and that of boys as 60.1. It means that there is significant difference between the performance of 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

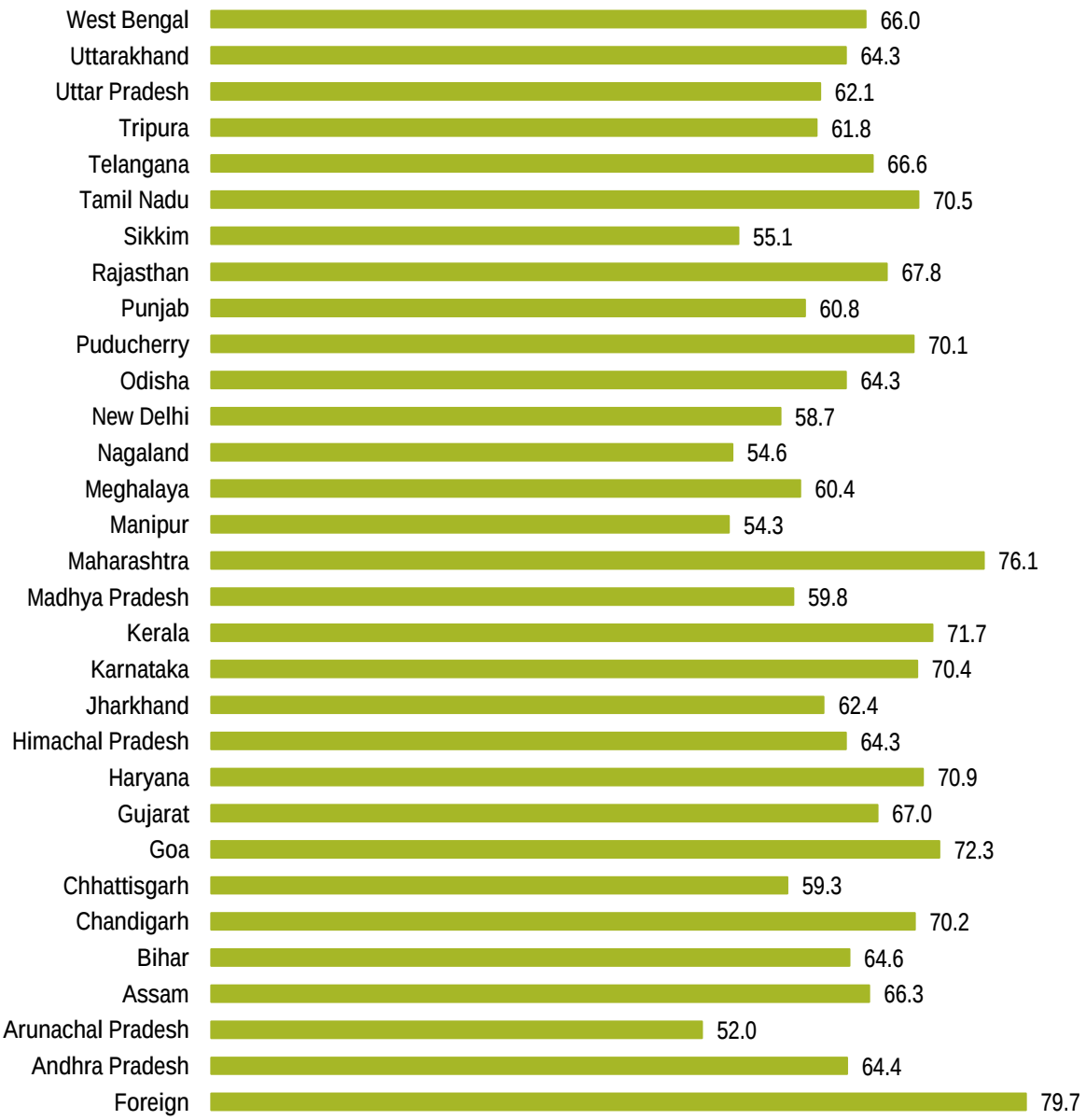
Total Number of Candidates: 1,65,331

Mean Marks: 66.0

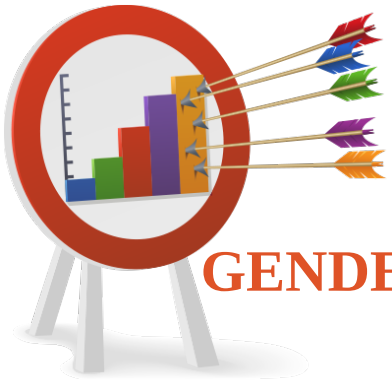
Highest Marks: 100

Lowest Marks: 06

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 79.7.



GENDER-WISE COMPARISON

GIRLS

Mean Marks: 67.0

Number of Candidates: 74,430

BOYS

Mean Marks: 65.3

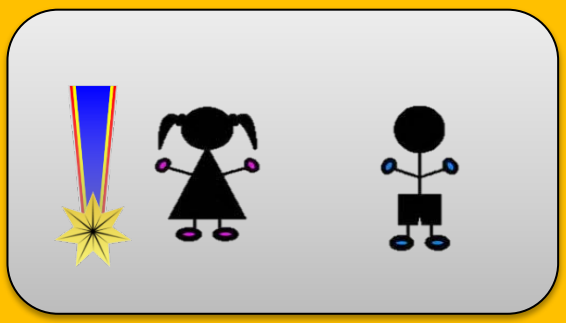
Number of Candidates: 90,901

Comparison on the basis of Gender

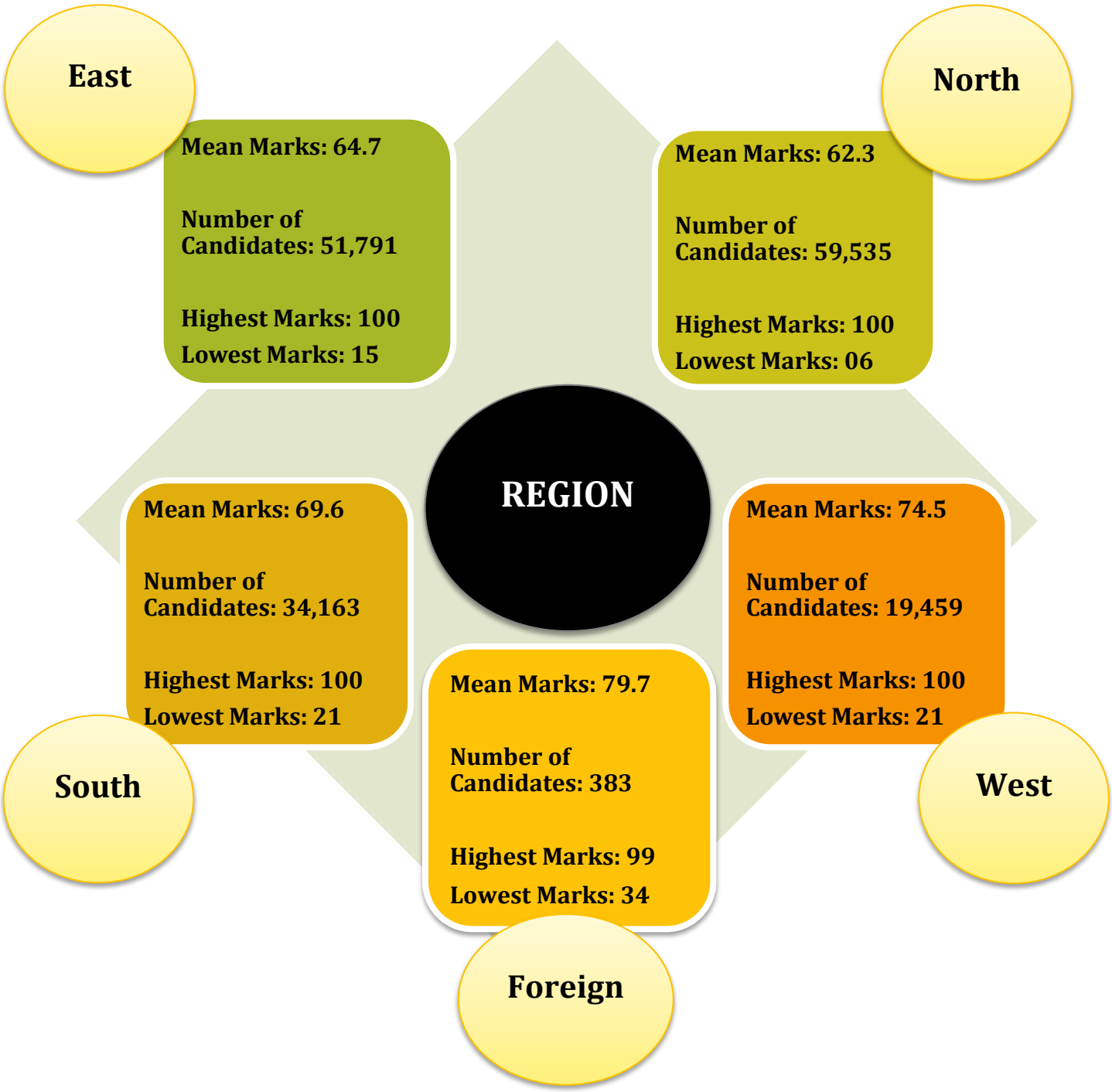
Gender	N	Mean	SE	t-value
Girls	74,430	67.0	0.07	18.74*
Boys	90,901	65.3	0.06	

*Significant at 0.05 level

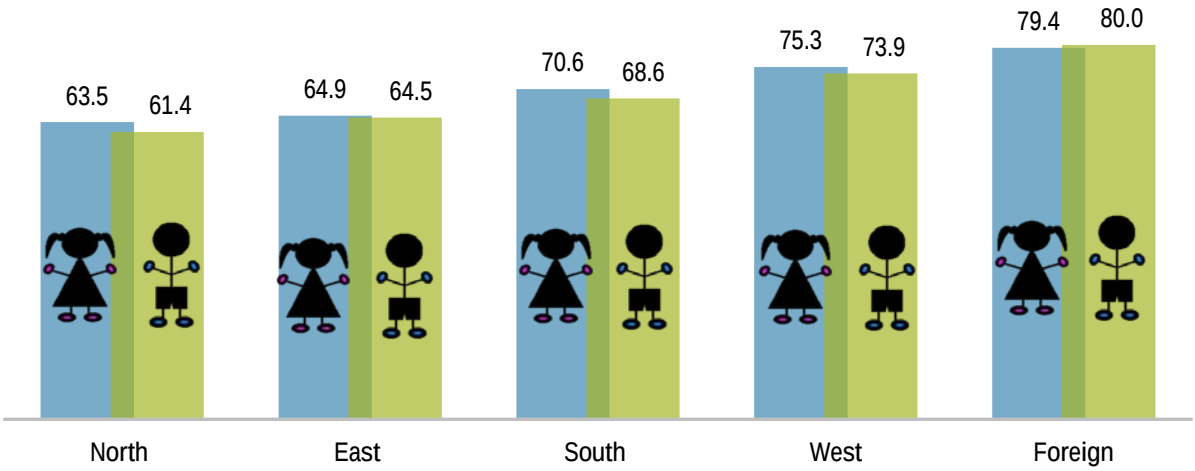
Girls performed significantly better than boys.



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	25,454	63.5	0.11	13.74*
	Boys	34,081	61.4	0.10	
East (E)	Girls	23,030	64.9	0.12	2.78*
	Boys	28,761	64.5	0.12	
South (S)	Girls	17,092	70.6	0.13	10.85*
	Boys	17,071	68.6	0.13	
West (W)	Girls	8,666	75.3	0.18	5.37*
	Boys	10,793	73.9	0.17	
Foreign (F)	Girls	188	79.4	1.09	-0.37
	Boys	195	80.0	1.21	

*Significant at 0.05 level

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

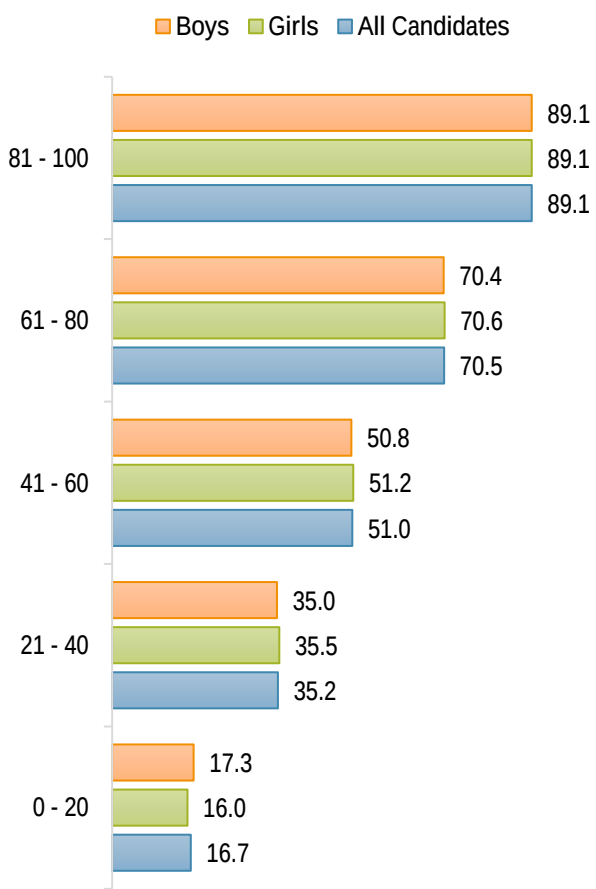
REGION (N, E, S, W)

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	21,201	89.1	0.03	-0.13
	Boys	24,395	89.1	0.03	
Bottom Range (0-20)	Girls	6	16.0	2.18	-0.49
	Boys	7	17.3	1.48	

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

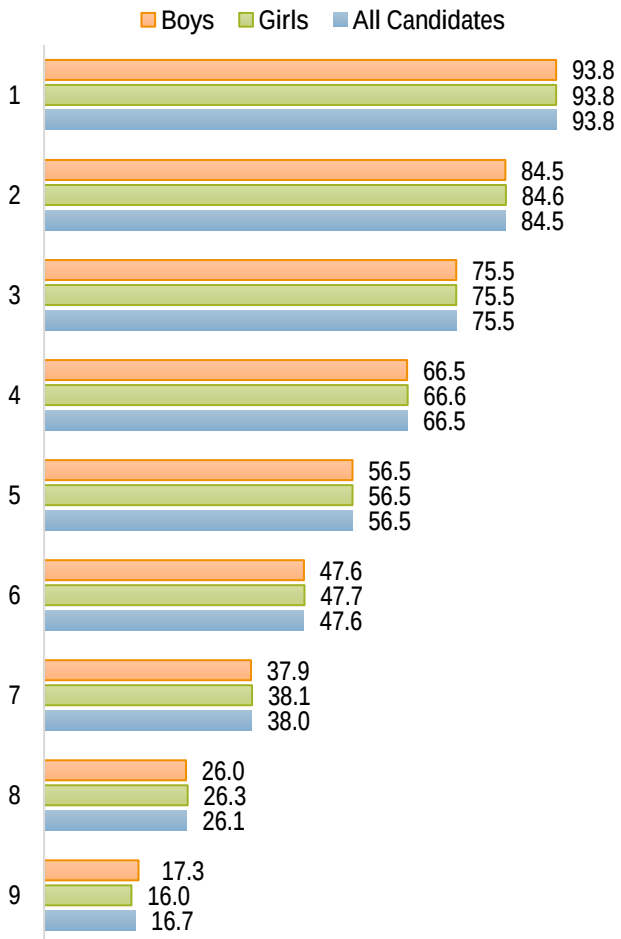


GRADES AWARDED : COMPARISON GENDER-WISE

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

Grades	Gender	N	Mean	SE	t-value
Grade 1	Girls	9,820	93.8	0.03	0.62
	Boys	11,440	93.8	0.02	
Grade 9	Girls	6	16.0	2.18	-0.49
	Boys	7	17.3	1.48	

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



SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

(a) (i) State and define the S.I. unit of power. [2]

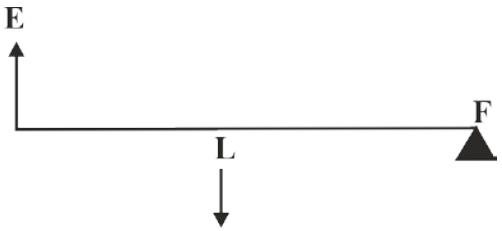
(ii) How is the unit horse power related to the S.I. unit of power?

(b) State the energy changes in the following cases while in use: [2]

(i) An electric iron.

(ii) A ceiling fan.

(c) The diagram below shows a lever in use: [2]



(i) To which class of levers does it belong?

(ii) Without changing the dimensions of the lever, if the load is shifted towards the fulcrum what happens to the mechanical advantage of the lever?

(d) (i) Why is the ratio of the velocities of light of wavelengths 4000Å and 8000Å in vacuum 1:1? [2]

(ii) Which of the above wavelengths has a higher frequency?

(e) (i) Why is the motion of a body moving with a constant speed around a circular path said to be accelerated? [2]

(ii) Name the unit of physical quantity obtained by the formula $\frac{2K}{V^2}$.

Where K: kinetic energy, V: Linear velocity.

Comments of Examiners

(a)(i) Majority of the candidates were able to answer this question. However, some candidates either did not define the unit or defined an incorrect unit. A few candidates made spelling errors while stating and defining the unit *watt*.

(ii) Most candidates answered this sub-part correctly. Some candidates, however, wrote either 1 H.P. = 0.746 watt or 1 watt = 746 H.P. Some candidates were unsure about the exact value of H.P. in watt. A few candidates did not write the unit.

(b)(i) Some candidates stated the energy change in case of an electric iron electrical to mechanical or vice versa. A few candidates gave irrelevant answers.

(ii) Majority of the candidates answered this sub-part correctly. However, some candidates stated the energy change in case of a ceiling fan, *mechanical to wind energy* instead of *electrical to kinetic energy.*

(c)(i) Most of the candidates wrote second class lever but a few candidates did write Class I or Class III lever.

(ii) Majority of the candidates were unable to answer *what happens to the mechanical advantage of the lever if the load is shifted towards the fulcrum without changing the dimensions of the lever!* They just mentioned mechanical advantage is greater than one without realizing that the mechanical advantage of lever is already > 1 which increases further.

(d)(i) Most of the candidates were able to answer this question. A few candidates however, arrived at the correct

answer or an incorrect answer after long calculations.

(ii) Most of the candidates answered it correctly as $4000\overset{0}{A}$ but some candidates wrote $8000\overset{0}{A}$. A few candidates did huge calculations to arrive at the answer.

(e)(i) Several candidates explained the centripetal and centrifugal forces. Some candidates diagrammatically showed that motion is tangential to the curved path but were unable to make it clear that the *motion of a body moving with a constant speed around a circular path, would be accelerated.*

(ii) Most of the candidates could name the unit of physical quantity obtained by the given formula correctly, however, a few candidates were unable to name the unit.

Suggestions for teachers

- Teach units with their definitions and conversions. Emphasise on their correct spellings.
- Explain energy conversion giving common day to day examples to the students. Lay stress on important energy changes that occur, with the proper names of energies.
- Illustrate change in the mechanical advantage of a lever giving daily life examples.
- Clarify to the students the difference between electromagnetic waves and mechanical waves.
- Lay stress on the concept that frequency of a wave is inversely proportional to its wavelength i.e., $f \propto \frac{1}{\lambda}$.
- Interpret the concept of the motion of a body moving with a constant speed around a circular path thoroughly.
- Train the students to read the questions and answer as per their requirements.

MARKING SCHEME	
Question 1	
(a)	(i) watt – If 1joule of work is done in 1 second then the power spent/developed / expended is 1watt. (ii) 1H.P. = 746 W /750 W
(b)	(i) Electrical energy to heat energy (ii) Electrical energy to kinetic/mechanical energy.
(c)	(i) Second order (or class) lever. (ii) Mechanical advantage of the lever increases.
(d)	(i) In vacuum their speed/velocity is the same. (ii) 4000 Å has higher frequency.
(e)	(i) Because on a circular path the direction of motion changes continuously which changes the velocity of the body continuously. (ii) kg or kilogram/g/ any unit of mass can be accepted.

Question 2

(a) The power of a lens is –5D. [2]

(i) Find its focal length.

(ii) Name the type of lens.

(b) State the position of the object in front of a converging lens if: [2]

(i) It produces a real and same size image of the object.

(ii) It is used as a magnifying lens.

(c) (i) State the relation between the critical angle and the absolute refractive index of a medium. [2]

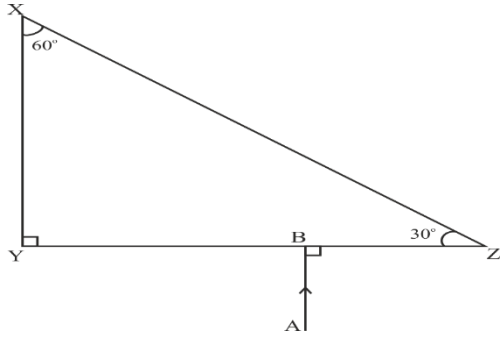
(ii) Which colour of light has a higher critical angle? Red light or Green light.

(d) (i) Define scattering. [2]

(ii) The smoke from a fire looks white.
Which of the following statements is true?

1. Molecules of the smoke are bigger than the wavelength of light.
2. Molecules of the smoke are smaller than the wavelength of light.

(e) The following diagram shows a 60°, 30°, 90° glass prism of critical angle 42°. Copy the diagram and complete the path of incident ray AB emerging out of the prism marking the angle of incidence on each surface. [2]



Comments of Examiners

(a)(i) Most of the candidates answer this sub-part correctly. However, some candidates calculated the focal length of the given lens incorrectly or expressed the focal length in incorrect unit.

(ii) Most candidates named the type of lens correctly. Some candidates, however, were unaware that the focal length of a lens with negative sign is for a concave lens.

(b)(i) Many candidates gave the incorrect position of the object. Some candidates even drew an incorrect diagram. A few candidates got confused due to the labelling seen in question 6 (b).

(ii) Majority of the candidates made the same error as in Q6(b).

(c)(i) Only a few candidates wrote the correct mathematical relation between the critical angle and the absolute refractive index of a medium. Many candidates simply mentioned increases and decreases.

(ii) Most of the candidates wrote correct colour of light which has a higher critical angle. However, some candidates mentioned the colour as green which was incorrect.

(d) (i) Majority of the candidates stated the definition of dispersion which was incorrect. Some candidates did not state absorption and reemission without the change in the wavelength. Some candidates even changed the order and wrote reemission and absorptio

(ii) Almost all candidates identified the correct statement except a few who chose statement 2 as the correct option.

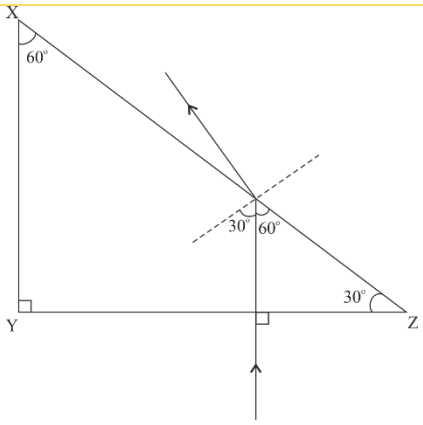
(e) Majority of the candidates showed total internal reflection Some candidates showed the ray bending towards normal. The diagram drawn by a few candidates was ambiguous.

Suggestions for teachers

- Explain clearly the sign convention for the nature of lens, relating it to the spectacle numbers of the students being negative for most of them.
- Emphasise the unit while writing a physical quantity or an answer.
- Teach different cases of image formation by lenses, giving relevant examples from daily life.
- Train students to write mathematically correct statement rather than the generalised mathematical statement in terms of increases and decreases.
- Explain the difference between scattering and dispersion Also give a practical demonstration.
- Train the students to complete the path of the ray of light by calculating the angle of incidence at every new surface when the ray hits the surface.
- Give adequate practice to the students in drawing the ray diagrams.
- Instruct students to focus on the requirement of the question and to draw diagrams only when asked for.

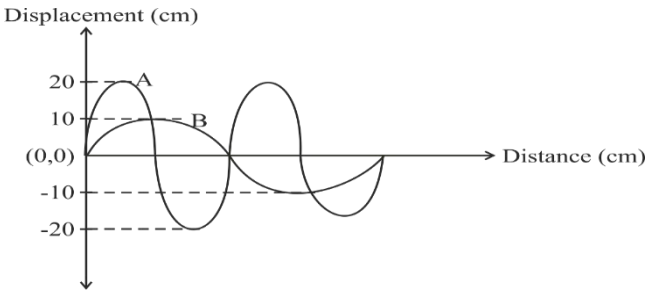
MARKING SCHEME

Question 2

(a)	(i) $f = \frac{1}{P} = \frac{1}{5} = 0.2\ m\ or\ 20cm$(substitution expressed with negative sign is also acceptable) (ii) Concave/diverging lens
(b)	(i) at 2F (ii) Between the optical centre and principal focus.
(c)	(i) $\mu = \frac{1}{\sin c}$ (ii) Red
(d)	Bending away at surface XZ Angle of incidence = 30^o 
(e)	(i) Scattering is the absorption and then reemission of light without the change in the wavelength. (ii) Statement 1

Question 3

(a) Displacement distance graph of two sound waves A and B, travelling in a medium, are as shown in the diagram below. [2]



Study the two sound waves and compare their:

(i) Amplitudes

(ii) Wavelengths

(b) You have three resistors of values 2Ω, 3Ω and 5Ω. How will you join them so that the total resistance is more than 7Ω? [2]

(i) Draw a diagram for the arrangement.

(ii) Calculate the equivalent resistance.

(c) (i) What do you understand by the term nuclear fusion? [2]

(ii) Nuclear power plants use **nuclear fission** reaction to produce electricity. What is the advantage of producing electricity by **fusion** reaction?

(d) (i) What do you understand by free vibrations of a body? [2]

(ii) Why does the amplitude of a vibrating body continuously decrease during damped vibrations?

(e) (i) How is the e.m.f. across primary and secondary coils of a transformer related with the number of turns of coil in them? [2]

(ii) On which type of current do transformers work?

Comments of Examiners

(a) A number of candidates were unable to comprehend the diagram. Many candidates, instead of calculating proper ratios of amplitudes and wave lengths, just compared them by stating more or less. Some candidates left the answer in the fractional form without bringing it to the lowest form. A few candidates stated the values of the quantities for the two waves.

(b) (i) Many candidates showed a straight line instead of a wavy line to depict the resistor in the diagram. Some candidates showed various combinations of series and parallel resistors. A few candidates considered 7Ω as one of the resistors in the circuit

(ii) Many candidates showed series combination but used the formula of parallel combination and *vice versa*. Several candidates tried out different combinations as they overlooked the word *more than* 7 Ω and tried to get it *equal* to 7 Ω. Some candidates did not write the unit in the final answer.

Suggestions for teachers

- Explain to the students that if the numerical figures are given in the question then *compare* means *ratio*.
- Train students to interpret the information of waves from graph.
- rill students for expressing the final answer as per the requirement of the question.
- Encourage students to learn the definitions with proper understanding keeping in mind the importance of keywords like *periodic force, constant frequency and amplitude* in the definition of free vibrations.
- Ensure that the students understand the difference between external force and external resistive force

(c) (i) Many candidates, instead of writing lighter and heavier nuclei, wrote smaller and bigger atoms/nuclei. Some candidates wrote the definition of nuclear fission.

(ii) Majority of the candidates were unable to answer this question correctly. A few candidates expressed that only nuclear fission can be used to produce electricity. Some candidates gave advantages of fission reaction.

(d)(i) Many candidates did not write the key words such as *without influence of external periodic force, constant frequency and constant amplitude* in the definition.

(ii) Most candidates did not write that external force is resistive in nature or that it causes loss of energy. Some candidates wrote the definition of damped vibrations. A few candidates wrote that damped vibrations are due to the removal of external force.

- Point out clearly the distinction
- among free, forced and damped vibrations with a variety of examples.
- Adequate practice should be given to students for comprehension of various terms and related aspects in transformers correctly.
- Give adequate practice to the students in solving numerical problems based on combination(series/parallel/mixed) of resistors.
- Clarify the terms Nuclear *fusion* and *fission* in detail giving relevant examples for comprehension

(e)(i) Several candidates were unable to answer this question. Most of them wrote how voltage or current increases or decreases in step-up and step-down transformer. A large number of candidates wrote $E = \frac{N_s}{N_p}$. Several candidates wrote only primary or only secondary coil without giving clear relation between number of turns and e.m.f.

(ii) Majority of the candidates wrote d.c or induced current or high voltage current or eddy currents.

MARKING SCHEME

Question 3

(a)	(i)	Amplitudes of A and B are in the ratio 2:1.
	(ii)	Wavelengths of A and B are in the ratio 1:2.
(b)	(i)	
	(ii)	$R = 2 + 3 + 5 = 10\ \Omega$ (Only 10 Ω can be accepted if the diagram is shown else substitution is a must.)
(c)	(i)	Nuclear fusion – The process in which two lighter nuclei of lighter atoms combine to form a heavy and more stable nucleus with the liberation of large amount of heat.
	(ii)	The product formed is not radioactive hence less harmful to human/ energy produced per nucleon (for same mass of nuclear material) is more than fission.
(d)	(i)	Vibrations of a body in absence of any external periodic force with constant frequency and amplitude.
	(ii)	The energy is lost to the surrounding due to the friction of the surrounding medium.

(e)	(i)	e.m.f. and the number of turns of the coil are directly proportional.
	(ii)	A.C. or alternating current.

Question 4

(a) (i) How can a temperature in degree Celsius be converted into S.I. unit of temperature? [2]

(ii) A liquid **X** has the maximum specific heat capacity and is used as a coolant in Car radiators. Name the liquid **X**.

(b) A solid metal weighing 150 g melts at its melting point of 800 ^{o}C by providing heat at the rate of 100 W. The time taken for it to completely melt at the same temperature is 4 min. What is the specific latent heat of fusion of the metal? [2]

(c) Identify the following wires used in a household circuit: [2]

(i) The wire is also called as the phase wire.

(ii) The wire is connected to the top terminal of a three-pin socket.

(d) (i) What are isobars? [2]

(ii) Give one example of isobars.

(e) State any two advantages of electromagnets over permanent magnets. [2]

Comments of Examiners

(a)(i) Majority of the candidates could not express a temperature in degree Celsius in S.I. unit of temperature. Several candidates wrote 1^0C = 273 K. Some candidates wrote t^0C-273 or T = 273 – t^0C or t = 273+K, 1^0C=1 K.

(ii) Most of the candidates named the liquid X correctly. However, some candidates wrote hydrogen or kerosene, or petrol or diesel can be used as a coolant in car radiators.

(b) Majority of the candidates used melting point 800 ^{0}C in their calculation. Most candidates substituted $150 \times 800 \times l$ on one side of the equation. Some candidates solved the specific latent heat of fusion of the metal equation using incorrect expressions $Q = mc\Delta t$ only or $Q = ml$ only or using $Q = ml + mc\Delta t$. A few candidates wrote the incorrect unit.

(c)(i) Most of the candidates were unaware of the word *phase*. Some candidates wrote the answer in terms of colours of wire. A few candidates wrote options such as hot wire or live/earth or neutral/earth.

(ii) This question was attempted well by most of the candidates. However, some candidates wrote live wire or live/neutral. Some candidates wrote the answer in terms of colours of wire.

(d) Many candidates answered sub-parts (i) and (ii) correctly. However, some common errors made by a few candidates were as follows:
confused between isotopes and isobars.
wrote examples with incorrect mass number and atomic number.wrote the elements without atomic number and mass numbers. gave examples of isotopes.

(e) Some candidates, instead of writing the advantages of *electromagnets* over *permanent magnets*, wrote the differences between the two. Some candidates wrote only one advantage. Some candidates repeated the points. A few candidates wrote incorrect advantages.

Suggestions for teachers

- Teach the basic physical quantities and their corresponding conversions. While doing calorimetry numerical, ask the students to express the temperature in K or vice versa. Clearly explain the properties of water and the advantages of its high specific heat capacity.
- Tell the students that every piece of information given in the sum need not be used in the calculations involving change of state. Give adequate practice on the heat numerical.
- Make the students aware of the colloquial terms. Practically show the students the connections to the three-pin socket.
- Clearly explain the difference between isotopes and isobars. Ensure that the students are clear that the reactant and product during *beta emission* are always isobars. Teach the topic by giving sufficient examples.
- Encourage the students to think over the statement and check its validity in different situations. Clearly explain the advantages of electromagnets as compared to the permanent magnets.

MARKING SCHEME

Question 4

(a)	(i) $^{o}C + 273 = K$ (ii) Water
(b)	$P \times t = mL \Rightarrow 100 \times 4 \times 60 = 150 \times L$ (both side correct substitutions.) $L = 160$ J g^{-1} (answer is accepted in any unit.)
(c)	(i) Live wire (ii) Earth wire
(d)	(i) Elements of same mass number but different atomic numbers are called isobars. (ii) $^{14}_{6}C, ^{14}_{7}N$, $^{23}_{12}Mg, ^{23}_{11}Na$ *(Any one correct example)*

(e)

Permanent Magnet	Electromagnet
Magnetic Strength cannot be easily altered	Magnetic strength can be easily altered.
Polarity cannot be reversed easily	Polarity can be reversed easily.

SECTION I (40 Marks)

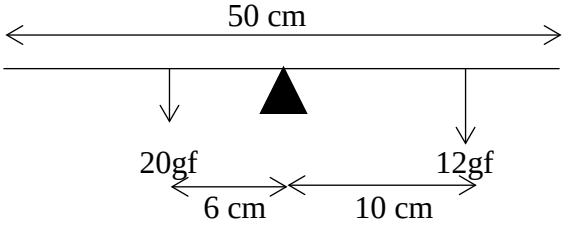
*Attempt any **four** questions from this Section*

Question 5

(a) (i) Derive a relationship between S.I. and C.G.S. unit of work. [3]

(ii) A force acts on a body and displaces it by a distance S in a direction at an angle θ with the direction of force. What should be the value of θ to get the maximum positive work?

(b) A half metre rod is pivoted at the centre with two weights of 20 gf and 12 gf suspended at a perpendicular distance of 6 cm and 10 cm from the pivot respectively as shown below. [3]



(i) Which of the two forces acting on the rigid rod causes clockwise moment?

(ii) Is the rod in equilibrium?

(iii) The direction of 20 kgf force is reversed. What is the magnitude of the resultant moment of the forces on the rod?

(c) (i) Draw a diagram to show a block and tackle pulley system having a velocity ratio of 3 marking the direction of load(L), effort(E) and tension(T). [4]

(ii) The pulley system drawn lifts a load of 150 N when an effort of 60 N is applied. Find its mechanical advantage.

(iii) Is the above pulley system an ideal machine or not?

Comments of Examiners

(a)(i) Some candidates, instead of deriving the relation between S.I. and C.G.S. unit of work wrote the relation. Some candidates showed the derivation between newton and dyne. The derivations done by a few candidates were the substitution on R.H.S of equation making it meaningless.

(ii) Several candidates wrote $\theta = 90^0 \ or 180^0$ or $cos 90^0 = 1$. Some candidates identified the angle correctly but made contradictory statements like $cos 0 = 0$.

(b)(i) Majority of the candidates were able to answer this question. However, some candidates were confused and wrote both 20 gf and 12 gf.

(ii) This part of the question was attempted well by most candidates. However, some candidates arrived at the conclusion after long, elaborate and unnecessary calculations. A few candidates guessed the answer to be either a yes or no.

(iii) This question was performed well by most candidates.

(c)(i) The common anomalies in most of the answer scripts were:

- Direction of load and tension were missing.
- There were no proper number of pulleys in the fixed and movable block.
- No distinction between fixed and movable block.
- No support was shown.
- The strands of the tackle were shown loose.

Suggestions for teachers

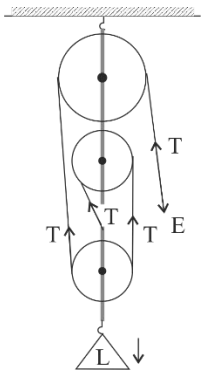
- Lay stress on the derivations for conversions with key steps.
- Clearly explain the work done for $\theta = 0^0, 90^0, 180^0$. Ensure that the basic concept of trigonometry is clear to the students.
- Drill students on the concept of clockwise and anticlockwise moment. Give adequate practice on numerical of moments.
- Train students to answer the questions as per the requirement of the question.
- Ensure that the students are given regular practice of drawing pulley diagrams. Clearly explain the difference between ideal and practical pulley. Tell the students that if the mechanical advantage is less than the number of strands supporting the load, then it is not an ideal pulley system.

(ii) Majority of the candidates were able to get the calculations correct but left the answer in fraction form. Some candidates added the units. The calculations done by a few candidates were vague.

(iii) Majority of the candidates were able to answer this question. Some candidates, however, wrote it is an ideal pulley system.

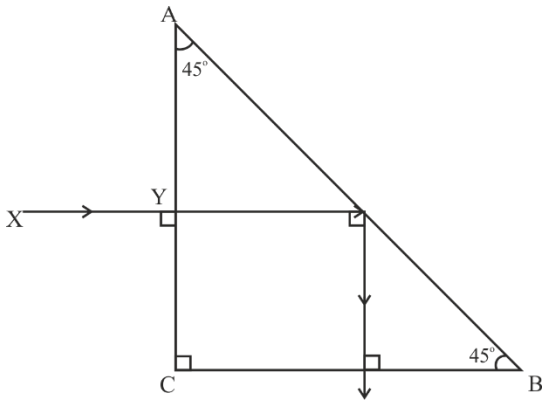
MARKING SCHEME

Question 5

(a)	(i) 1 J = 1 N x 1 m 1 J = 10^5 dyn x 100 cm 1 J = 10^7 ergs (ii) 0°
(b)	(i) 12 kg f (ii) Yes (iii) On reversing the direction of 20 kg f, the magnitude of the resultant forces on the rod = $20 \times 6 + 12 \times 10 = 240$
(c)	(i)  Two pulleys in block and one pulley(movable) in tackle, their proper connection, marking directions of load(L) and effort(E) and at least one tension and the support. Strands should be stretched. (ii) $M.A. = \frac{L}{E} = \frac{150}{60} = 2.5$ (iii) No, it is not an ideal system.

Question 6

(a) A ray of light XY passes through a right angled isosceles prism as shown below. [3]

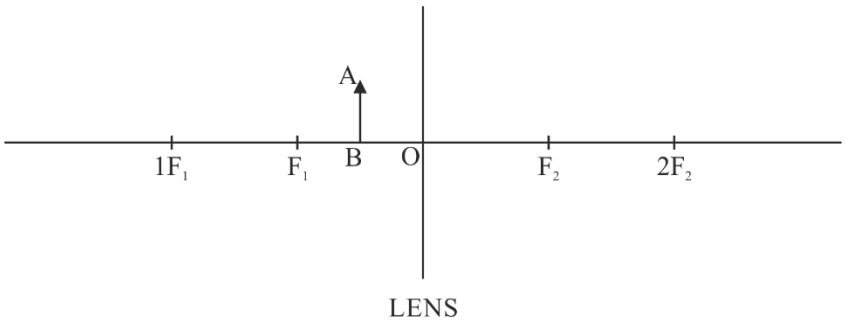


(i) What is the angle through which the incident ray deviates and emerges out of the prism?

(ii) Name the instrument where this action of prism is put into use.

(iii) Which prism surface will behave as a mirror?

(b) An object AB is placed between O and F_1 on the principal axis of a converging lens as shown in the diagram. [3]



Copy the diagram and by using three standard rays starting from point A, obtain an image of the object AB.

(c) An object is placed at a distance of 12 cm from a convex lens of focal length 8 cm. [4]
Find:

(i) the position of the image

(ii) nature of the image

Comments of Examiners

(a) Majority of the candidates answered sub-parts (i),(ii) and (iii) of this question well. However, some common miscues made by candidates were:
- Reported the angle through which the incident ray deviates and emerges out of the prism as 0^0 or 45^0
- named binoculars as the instrument.
- the prism surface BC and AC will behave as a mirror.
- all the three surfaces will behave as a mirror.

(b) Many candidates were unsure of the answer due to the third standard ray which was asked.

The common anomalies in most of the answer scripts were:

- Ray after refraction did not pass through F.
- Virtual intersection or the image was not shown by dotted lines.
- Arrows were missing on either incident or refracted rays.
- Two rays were drawn but the image was not drawn.
- Arrows were drawn on the dotted lines to show the path of the ray.

(c)(i) Majority of the candidates were unable to answer this question. The common flaws observed in most of the answer scripts were:

- use of incorrect lens formula
- incorrect use of sign convention.
- incorrect substitutions.
- incorrect characteristics of the images.
- incorrect answer with correct unit or correct answer with incorrect unit or without unit.

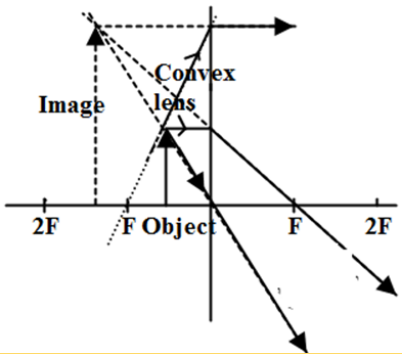
Suggestions for teachers

- Teach the students the angle of deviation with respect to any phenomenon of light and not only with respect to refraction through prism.
- Discuss with the students, the total internal reflection through the right angled isosceles prism in detail.
- Illustrate lenses including characteristics of the images formed, location of images using ray diagrams, sign convention lens formula thoroughly. Ensure that the students understand the sign convention clearly.
- Give sufficient practice to the students to draw ray diagrams using three standard rays even if the object is lying between the optical centre and the focus.
- Insist on the arrows on the rays before and after the refraction. Guide students that apparent intersection and virtual image has to be shown by dotted lines.
- Give sufficient practice to the students to solve the numerical problems.

MARKING SCHEME

Question 6

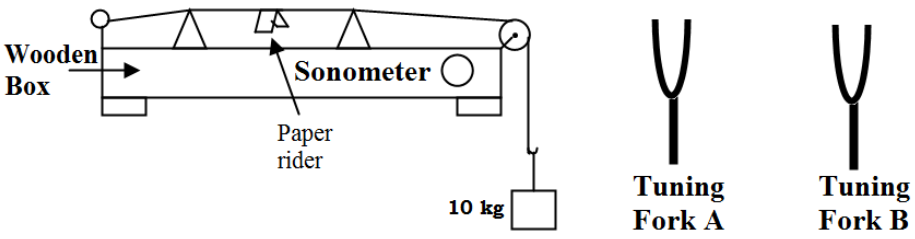
(a)	(i) 90^0 (ii) refracting periscope. (iii) Surface AB

(b)	Image of the object AB, using three standard rays starting from point A 
(c)	(i) $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ $\frac{1}{v} - \frac{1}{-12} = \frac{1}{8}$ $\frac{1}{v} = \frac{1}{8} - \frac{1}{12} = \frac{3-2}{24} = \frac{1}{12}$; image distance v = +24cm (ii) Real or inverted (iii) Image is bigger than object.

Question 7

(a) Draw the diagram of a right angled isosceles prism which is used to make an inverted image erect. [3]

(b) [3]



The diagram above shows a wire stretched over a sonometer. Stems of two vibrating tuning forks A and B are touched to the wooden box of the sonometer. It is observed that the paper rider (a small piece of paper folded at the centre) present on the wire flies off when the stem of vibrating tuning fork B is touched to the wooden box but the paper just vibrates when the stem of vibrating tuning fork A is touched to the wooden box.

(i) Name the phenomenon when the paper rider just vibrates.

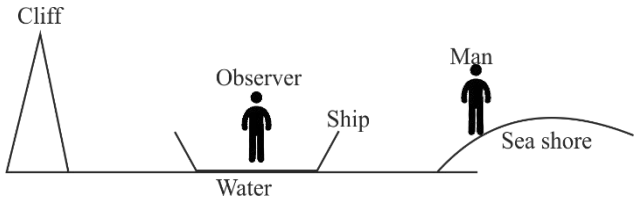
(ii) Name the phenomenon when the paper rider flies off.

(iii) Why does the paper rider fly off when the stem of tuning fork B is touched to the box?

(c) A person is standing at the sea shore. An observer on the ship which is anchored in between a vertical cliff and the person on the shore fires a gun. The person on the shore hears two sounds, 2 seconds and 3 seconds after seeing the smoke of the fired gun. If the speed of sound in the air is 320 ms^{-1} then calculate: [4]

(i) the distance between the observer on the ship and the person on the shore.

(ii) the distance between the cliff and the observer on the ship.



Comments of Examiner

(a) Many candidates performed well barring a few exceptions who could not show:
- 90^0 Deviation
- Inversion of image.
- Arrows on incident, refracted, reflected and emergent rays.

(b) Most candidates answered sub-parts (i), (ii) and (iii) correctly, however a few candidates wrote:

(i) damped and forced or resonant vibrations.

(ii) forced vibrations.

(iii) that the frequency of the tuning fork B becomes more than the natural frequency of the stretched wire and vibrates with greater amplitude or vice versa or the explanation of increased amplitude was missing.

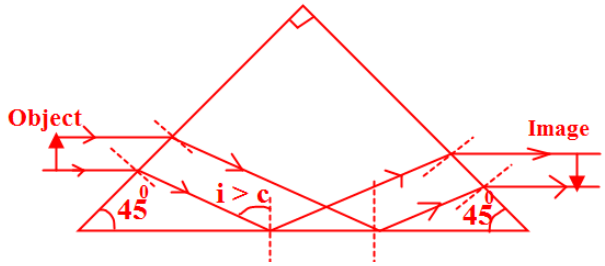
(c) Most of the candidates attempted this part well, however, some candidates made mistakes in calculations.

Suggestions for teachers

- Drill students in drawing correct ray diagrams. Insist on necessary labelling and specifications of the diagrams. Explain to the students, the reason for total internal reflection taking place at the lower surface and not at the side surfaces.
- Illustrate free vibrations, forced vibrations and resonance with relevant examples.
- Train students to read and analyse the question gingerly and then take logical steps towards solving it.
- Instruct students to refrain themselves from simply substituting the data in the formula.

MARKING SCHEME

Question 7

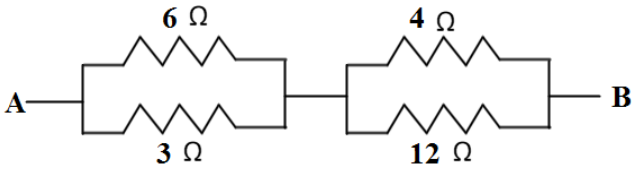
(a)	 *(Any other correct ray diagram)*
(b)	(i) Forced vibrations (ii) Resonance. (iii) Frequency of the tuning fork B matches the natural frequency of the stretched wire and vibrates with greater amplitude.
(c)	(i) $d = v \times t = 320 \times 2$ $d = 640$ m (ii) $d = \frac{v \times t}{2} = \frac{320 \times 1}{2}$ $d = 160$ m

Question 8

(a) (i) A fuse is rated 8A. Can it be used with an electrical appliance rated 5 KW, 200 V? Give a reason. [3]

(ii) Name two safety devices which are connected to the live wire of a household electric circuit.

(b) (i) Find the equivalent resistance between A and B. [3]



(ii) State whether the resistivity of a wire changes with the change in the thickness of the wire.

(c) An electric iron is rated 220V, 2kW. [4]

(i) If the iron is used for 2h daily find the cost of running it for one week if it costs ` 4.25 per kWh.

(ii) Why is the fuse absolutely necessary in a power circuit?

Comments of Examiners

(a) Sub-parts (i) and (ii) were correctly attempted by most of the candidates except for some who:

(i) answered the question without calculating current. calculated the current but made calculation errors. were unable to comprehend the meaning of the term *fuse rating* and hence could not write a proper reason. simply wrote *No* as the answer.

(ii) wrote the names of the appliances. wrote earthing /earth wire without realising that the safety devices connected to the live wire had been asked.

(b) (i) This sub-part was correctly attempted by most candidates. The common anomalies in most of the answer scripts were:

- Series resistor formula was used.
- L.H.S of the parallel resistor formula was written R in place of $\frac{1}{R}$ which resulted in incorrect mathematical step.
- Unit was missing in the answer.

(ii) Majority of the candidates wrote that the resistivity changes as they were unsure about the factors affecting it.

(c) (i) The common lapses observed in some of the answer scripts were:

- calculation errors.
- time (one week) was not taken into consideration.
- kW was converted into watt.

(ii) Many candidates could not write about the absolute necessity of the *fuse* in power circuits correctly.

Suggestions for teachers

- Explain the concepts on electrical power and energy, fuse and its rating and its use in power circuits in detail.
- Ask students to show the calculations in the numerical problems.
- Ensure that the students are clear about the safety devices and their functions.
- Illustrate the concept of resistors in combination (series, parallel and mixed) with adequate number of numerical problems. Guide students about the possible errors also.
- Point out the difference between resistance and resistivity.
- Give regular practice to the students in solving the numerical problems based on different topics in Electricity.

MARKING SCHEME

Question 8

(a)	(i) $I = \frac{P}{V} = \frac{5000}{200} = 25\ A$ No, it cannot be used. Maximum current drawn by the appliance is greater than the fuse rating. (ii) M.C.B. Fuse, switch, ELCB

(b)	(i) $R_1 = \frac{6\times3}{6+3} = 2\ \Omega$ Or $R_2 = \frac{4\times12}{4+12} = 3\ \Omega$ $R = 2 + 3 = 5\ \Omega$ (ii) No, it does not change.
(c)	(i) E = P x t = 2 x 2 =4 kW h [Correct substitution] Cost for running it for a week = 4 x 7 x 4.25 = ` 119/- (ii) Power circuits draw large amount of current/ Electric shock in this circuit is very fatal hence to avoid it fuse is necessary in the power circuit/ to safeguard.

Question 9

(a) (i) Heat supplied to a solid change it into liquid. What is this change in phase called? [3]

(ii) During the phase change does the average kinetic energy of the molecules of the substance increase?

(iii) What is the energy absorbed during the phase change called?

(b) (i) State two differences between "Heat Capacity" and "Specific Heat Capacity". [3]

(ii) Give a mathematical relation between Heat Capacity and Specific Heat Capacity.

(c) The temperature of 170g of water at 50°C is lowered to 5°C by adding certain amount of ice to it. Find the mass of ice added. [4]

Given: Specific heat capacity of water = 4200 J kg^{-1} $^0C^{-1}$ and Specific latent heat of ice = 336000 J kg^{-1}

Comments of Examiners

(a)(i) Majority of the candidates were able to answer this question. However, some candidates wrote melting point, boiling point, boiling, liquification, and vaporization A few candidates explained about specific heat capacity.

(ii) Most of the candidates wrote *yes* for this part, missing out on the word *average* in the question.

(iii) Majority of the candidates wrote specific heat or specific latent heat or heat energy or kinetic energy or potential energy or specific latent heat capacity.

(b)(i) Many candidates made errors in the definitions of Heat Capacity and Specific Heat Capacity. Several candidates stated incorrect units. Some candidates did not write corresponding points of difference.

(ii) Many candidates were confused in the use of symbols such as C, C' and H. Several candidates deviated from the usual symbols but did not explain them.

(c) The common inaccuracies observed in most of the answer scripts were:

- Required conversions were not done.
- Proper equation was not formed.
- Heat absorbed by melted ice was not considered.
- Unit was incorrect or not mentioned in the final answer.

Suggestions for teacher

- Familiarize students with conceptual questions through oral questioning and regular written tests.
- With the help of the heating curve, discuss the various processes of phase change and the difference between them. Explain phase change on the basis of the kinetic theory.
- Explain the differences between Heat Capacity and Specific Heat Capacity. Tell the students that the formula is nothing but the mathematical statement of definition and so is not a point of difference.
- Train students to explain the symbols in an answer given in the form of a formula/mathematical equation.
- Give adequate practice to students in solving a variety of questions based on calorimetry. Also, ask them to use only the values given in the question.
- Give adequate practice in constructing the equation involving change of state and principle of mixtures as well as substitution in the equation.
- Use the Heating curve to construct an equation.

MARKING SCHEME

Question 9

(a)	(i)	Melting
	(ii)	No.
	(iii)	Latent heat of melting/fusion.

(b) (i)

Heat capacity	Specific heat capacity
Heat absorbed by the mass of a body to raise its temperature by 1^{o} C.	Heat absorbed by unit mass of a body to raise its temperature by 1^{o} C.
S.I. Unit is J K^{-1}	S.I. unit is J kg^{-1} K^{-1}
Depends on mass and (specific Heat capacity/material)	Does not depend on mass (but depends on material)

(Any two points)

(ii) Heat capacity(C') = mass of the body(m) x specific heat capacity (c)

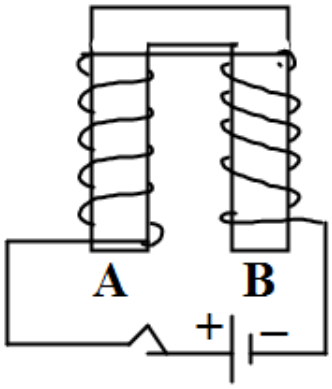
(c) $m_w\ c_w\ \theta_w = m_i\ L + m_i\ c_w\ \theta_w$

$170 \times 4.2 \times 45 = m_i\ [\ 336 + 4.2 \times 5\ ]$

$m_i = 90$ g

Question 10

(a) [3]



The diagram shows a coil wound around a U shape soft iron bar AB.

(i) What is the polarity induced at the ends A and B when the switch is pressed?

(ii) Suggest one way to strengthen the magnetic field in the electromagnet.

(iii) What will be the polarities at A & B if the direction of current is reversed in the circuit?

(b) The ore of Uranium found in nature contains $_{92}U^{238}$ and $_{92}U^{235}$. Although both the isotopes are fissionable, it is found out experimentally that one of the two isotopes is more easily fissionable. [3]

(i) Name the isotope of Uranium which is easily fissionable.

(ii) Give a reason for your answer.

(iii) Write a nuclear reaction when Uranium 238 emits an alpha particle to form a Thorium (Th) nucleus.

Comments of Examiners

(a)(i) Majority of the candidates were unable to write the correct polarity induced at the ends A and B of the coil wound around a U shape soft iron bar AB on pressing the switch. Some candidates wrote that the answer is not possible.

(ii) Most of the candidates answered this sub-part correctly.

(iii) Majority of the candidates who were unable to answer sub-part (i) of this question correctly, could not answer this sub-part correctly.

(b)(i) Many candidates named the easily fissionable isotope of Uranium, ^{238}U. Some candidates wrote ^{238} U or ^{235} U or ^{92} U.

(ii) Majority of the candidates were unable to answer this question.

(iii) Many candidates wrote the nuclear equation but were unable to balance it. Several candidates wrote α above the arrow in the equation.

Suggestions for teacher

- Explain to the students the correct method of determining the polarity induced at any end of a coil wound around a magnetic substance, on passing the current through the coil.
- Discuss the isotopes of Uranium and fission of uranium thoroughly to the students.
- Train students to write balanced nuclear equations.
- Discuss radioactivity and changes in the nucleus, comparative properties of α, β and γ along with the reasons. Explain in detail the important uses of nuclear radiations

(c)(i) Most candidates were able to answer this question. However, some candidates wrote α or β which was incorrect.

(ii) Majority of the candidates, instead of relating it to the negligible mass of β , related it to its speed or negative charge.

(iii) Majority of the candidates wrote either beta or gamma. Candidates seemed to be confused by the word *externally*.

(iv) Majority of the candidates either did not attempt this question or wrote incorrect answer.

MARKING SCHEME

Question 10

(a)	(i)	South and south.
	(ii)	Increasing the strength of current through the coil.
	(iii)	The polarities at the two ends become North.
(b)	(i)	$_{92}U^{235}$
	(ii)	Fission of $_{92}U^{238}$ is possible only by fast neutrons while the fission of $_{92}U^{235}$ can be even possible by the slow neutrons.

	(iii) $^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$
(c)	(i) B (gamma) (ii) C has less mass compared to A (iii) A (iv) C

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

- Change in mechanical advantage when the load is shifted towards fulcrum in class II lever.
- Speed of light for all wavelengths in vacuum is the same.
- Problems on calorimetry.
- Conversion of units.
- Heat capacity and specific heat capacity.
- Ray diagrams of lenses.
- Numerical problem on lens formula.
- Total internal reflection through right angled isosceles prism.
- Specific resistance and its unit.
- Differentiation between resistance and specific resistance.
- Difference between the use of a fuse in a normal circuit and a power circuit.
- Numerical on reflection of sound.
- Confusion between the use of $V = \frac{d}{t}$ and $V = \frac{2d}{t}$.
- Beta emission during carbon dating.
- Nuclear fusion.
- Concept of isobar.
- Identification of magnetic poles in electromagnets.
- Substitution in a numerical which required some conversion.

Suggestions for candidates

- Avoid selective study.
- Learn tables and squares up to 30.
- Read the questions heedfully and write answer in brief and to the point.
- Express the answer only in SI units unless otherwise asked.
- Learn the principles, laws and definitions accurately.
- Focus more on conceptual learning rather than the rote learning.
- Make observations and try to relate your learning with it.
- State the meaning of the symbols if the answer is given in terms of any formula/mathematical equation.
- Use abbreviations/symbols which are standard/acceptable.
- Solve at least the last five years' I.C.S.E. question papers.
- Write in a neat and legible handwriting.
- Avoid changing the order of sequence of questions and numbering system while attempting the paper.
- Express final answer with proper unit as per the requirement of the question.

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) The salt solution which does not react with *ammonium hydroxide* is:

A. Calcium Nitrate

B. Zinc Nitrate

C. Lead Nitrate

D. Copper Nitrate

(ii) The organic compound which undergoes *substitution reaction* is:

A. C_2H_2

B. C_2H_4

C. $C_{10}H_{18}$

D. C_2H_6

(iii) The *electrolysis of acidified water* is an example of:

A. Reduction

B. Oxidation

C. Redox reaction

D. Synthesis

(iv) The *IUPAC* name of dimethyl ether is:

A. Ethoxy methane

B. Methoxy methane

C. Methoxy ethane

D. Ethoxy ethane

(v) The catalyst used in the *Contact Process* is:

A. Copper

B. Iron

C. Vanadium pentoxide

D. Manganese dioxide

(b) Give **one word** or a **phrase** for the following statements: [5]

(i) The energy released when an electron is added to a neutral gaseous isolated atom to form a negatively charged ion.

(ii) Process of formation of ions from molecules which are not in ionic state.

(iii) The tendency of an element to form chains of identical atoms.

(iv) The property by which certain hydrated salts, when left exposed to atmosphere, lose their water of crystallization and crumble into powder.

(v) The process by which sulphide ore is concentrated.

(c) Write a *balanced chemical equation* for each of the following: [5]

(i) Action of concentrated sulphuric acid on carbon.

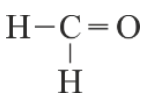
(ii) Reaction of sodium hydroxide solution with iron (III) chloride solution.

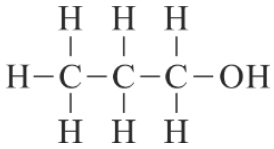
(iii) Action of heat on aluminum hydroxide.

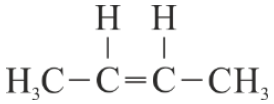
(iv) Reaction of zinc with potassium hydroxide solution.

(v) Action of dilute hydrochloric acid on magnesium sulphite.

(d) (i) Give the IUPAC name for each of the following: [5]

1. 

2. 

3. 

(ii) Write the structural formula of the two isomers of butane.

(e) State one *relevant observation* for each of the following: [5]

(i) Lead nitrate solution is treated with sodium hydroxide solution drop wise till it is in excess.

(ii) At the anode, when molten lead bromide is electrolyzed using graphite electrodes.

(iii) Lead nitrate solution is mixed with dilute hydrochloric acid and heated.

(iv) Anhydrous calcium chloride is exposed to air for some time.

(v) Barium chloride solution is slowly added to sodium sulphate solution.

(f) Give *a reason* for each of the following: [5]

(i) Ionic compounds have a high melting point.

(ii) Inert gases do not form ions.

(iii) Ionisation potential increases across a period, from left to right.

(iv) Alkali metals are good reducing agents.

(v) Conductivity of dilute hydrochloric acid is greater than that of acetic acid.

(g) **Name the gas** that is produced in each of the following cases [5]

(i) Sulphur is oxidized by concentrated nitric acid.

(ii) Action of dilute hydrochloric acid on sodium sulphide.

(iii) Action of cold and dilute nitric acid on copper.

(iv) At the anode during the electrolysis of acidified water.

(v) Reaction of ethanol and sodium.

(h) Fill up the blanks with the correct choice given in brackets. [5]

(i) Ionic or electrovalent compounds do not conduct electricity in their _____ state. (fused / solid)

(ii) Electrolysis of aqueous sodium chloride solution will form _____ at the cathode. (hydrogen gas / sodium metal)

(iii) Dry hydrogen chloride gas can be collected by _____ displacement of air. (downward / upward)

(iv) The most common ore of iron is _____. (calamine / haematite)

(v) The salt prepared by the method of direct combination is _____. (iron (II) chloride / iron (III) chloride

Comments of Examiners

(a) (i) Some candidates chose the salt *copper nitrate* while others selected *lead nitrate* instead of *calcium nitrate*.

(ii) Many candidates made random choices indicating they did not associate the fact that alkanes show substitution reactions or did not apply the general formula to select the correct alkane.

(iii) A few candidates either wrote *oxidation* or *reduction* instead of *redox reaction*.

(iv) Many candidates were unsure of the correct name and gave varied names.

(v) Most candidates selected the correct option of *vanadium pentoxide*. However, a few chose *iron* which was incorrect.

(b) (i) Instead of *electron affinity*, many candidates wrote *electronegativity* or *ionization potential.*

(ii) Many candidates wrote *dissociation* instead of *ionization*.

(iii) Some candidates wrote *self-linking* instead of *Catenation*.

(iv) Majority of the candidates answered correctly. However, a few candidates got confused between *efflorescence* and *deliquescence*. Spelling errors were also noticed in some answers. Some referred to it as *effervescence*.

(v) Many candidates wrote *roasting* or *calcination* instead of *froth floatation*.

(c) (i) Many candidates erred by writing H_2SO_3 or H_2CO_3 among the products. Some left the equation unbalanced. A few wrote Cu instead of C.

(ii) Some candidates wrote the equation with $FeCl_2$ instead of $FeCl_3$.

(iii) Some candidates incorrectly wrote the products as Al and H_2O.

(iv) Some candidates wrote incorrect formula of potassium zincate and many wrote one of the products as $Zn(OH)_2$ or ZnO or K_2O.

(v) Many candidates got confused between magnesium sulphite, sulphide and sulphate. Some others erred by writing one of the products as H_2SO_3 instead of $H_2O + SO_2$.

(d) (i) Some candidates wrote trivial or common names.

(1) *methanone* instead of *methanal*.

Suggestions for teachers

- Encourage students to read the question carefully and state complete answers.
- Familiarize students with the help of practical work that NH_4OH forms precipitate with Pb^{2+}, Zn^{2+}, Cu^{2+} Fe^{2+}, Fe^{3+} but not with Ca^{2+}.
- Ask students to learn hydrocarbons (alkanes, alkenes and alkynes) their general formulae, methods of preparation and main properties thoroughly.
- Stress upon revising the concepts based on oxidation and reduction frequently.
- Train students in naming of compounds, both the trivial names (where possible) and IUPAC names.
- Instruct students to learn industrial processes like Haber's, Ostwald's and Contact with conditions, reactions and precautions (if any) in detail.
- Advise students to learn the differentiation between terms such as: ionization potential and electron affinity; electron affinity and electronegativity; dissociation and ionization; ionic compounds and covalent compounds; self-linking and catenation; efflorescence and deliquescence; efflorescence and effervescence; roasting and calcination; roasting and froth floatation; calcination and froth floatation
- Teach various methods of concentration of ores with the help of diagrams/charts etc, for better retention of the content.
- Test regularly or conduct quizzes on topics that require memorization for better retention.

(2) Name ended by 'al' instead of 'ol' while some incorrectly wrote prop-l-ol.

(3) *1,2-dimethlyethene* instead of *2-butene or but-2-ene*. Some wrote simply *butane or butan-2-ene*.

(ii) Many candidates did not understand the difference between straight and branched chains clearly. Some showed the Carbon skeleton and missed showing the complete structural formula.

(e) (i) Many candidates wrote white $Pb(OH)_2$ instead of *white precipitate soluble*. Thus, the answer was left incomplete. For solubility of the precipitate in excess NaOH some wrote:

- Insoluble in excess instead of soluble in excess.
- White solution instead of colourless solution.

(ii) Colour of bromine was written as orange/red by some candidates; some forgot to add the word *vapour* or *gas* with the colour of bromine; A few candidates wrote that grey metal is deposited at the anode. Several candidates wrote equations instead of observations.

(iii) Instead of *white precipitate* many candidates wrote reddish brown fumes of NO_2. Some wrote the equation without stating the colour of the precipitate. A few candidates expressed the answer by leaving out the effect of heating on the solubility of $PbCl_2$.

(iv) Instead of writing that $CaCl_2$ turns into colourless solution, candidates wrote that it turns hydrated. Some candidates stated that it turns powdery having got confused with efflorescent substances.

(v) Most candidates answered correctly. However, a few candidates identified the product $BaSO_4$ but missed out the word *precipitate* or the colour *white*

(f) (i) *Intermolecular force of attraction* instead of *strong electrostatic force of attraction* between ions was stated to be responsible for the high melting point in ionic compounds.

(ii) Some candidates wrote that inert gases are stable without mentioning *electronic configuration / 8 electrons in the valence shell.*

- Advise students to learn the chemical reactions with necessary conditions and their balanced chemical equations assiduously and practise by writing again and again.
- Draw the attention of students to the difference in the symbols of radicals especially when the names sound similar.
- Ensure students grasp the fact that alcohols end in 'ol' and aldehydes end in 'al' that the 'e' of an alkane is replaced by 'ol' or 'al'
- Instruct students that numbering of chain is essential to assign the number to the functional group.
- Clarify straight and branched chains with sufficient examples and by giving repeated practice.
- Insist upon students recording the observation on their own during practical and then ask them to compare their observations with the observations expected. Discuss the reason for the difference (if any) in their observations.
- Demonstrate the *what happens when* type of possible cases to students to enable them to write relevant observation/s with confidence.
- Give practice in answering reasoning questions in different units. Explain the possible reasoning questions in the class at the time of discussing a topic.
- Train students to write answers to the point. While writing a chemical equation, gas should be highlighted with an upward arrow and precipitation with a downward arrow.
- Instruct students to be specific as per the requirement of the question in writing the correct gas or precipitate instead of giving multiple answers or all products.
- Guide students to learn the chemical names correctly especially the various oxides of nitrogen, etc.

(iii) Many candidates could not explain the reason for increase in ionisation potential across a period, from left to right.

(iv) Many candidates did not write the correct reason to explain *alkali metals are good reducing agents*.

(v) Most candidates wrote about the conductivity of dilute HCl or acetic acid but could not compare the conductivity of both the acids.

- Ask students to first name the electrode and then give the equation or product while answering questions on reaction at electrode.
- Ask students to read the given statements and choices supplied carefully.

(g) (i) Instead of NO_2 some candidates wrote SO_2, H_2S or N_2 while some others wrote NO_2 and SO_2.

(ii) Most of the candidates answered this sub-part correctly.

(iii) While most candidates were able to give correct answer, but a few could not name the gas correctly called it *nitrogen oxide* instead of *nitric oxide* or gave the incorrect answer NO_2.

(iv) While writing the name of the gas produced at the anode during the electrolysis of acidified water many candidates overlooked the term anode and wrote hydrogen and oxygen.

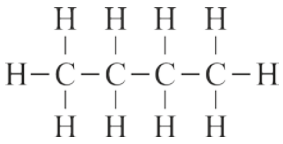
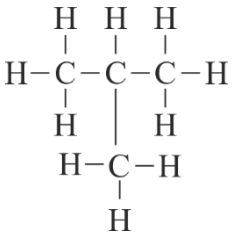
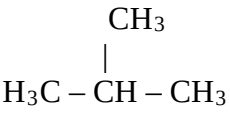
(v) Several candidates wrote ethane/ethene is evolved with the reaction of ethanol and sodium which was an incorrect answer.

(h) This question was attempted well by most candidates, but a few candidates made errors in sub-parts(i), (ii) and (v).

MARKING SCHEME

Question 1

(a)	(i)	A or calcium nitrate
	(ii)	D or C_2H_6
	(iii)	C or redox reaction
	(iv)	B or methoxy methane
	(v)	C or Vanadium pentoxide
(b)	(i)	Electron affinity/electron gain enthalpy
	(ii)	Ionisation
	(iii)	Catenation
	(iv)	Efflorescence/efflorescent
	(v)	Froth floatation method
(c)	(i)	$C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$
	(ii)	$FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$
	(iii)	$2Al(OH)_3 \rightarrow Al_2O_3 + 3H_2O$
	(iv)	$Zn + 2KOH \rightarrow K_2ZnO_2 + H_2$
	(v)	$MgSO_3 + 2HCl \rightarrow MgCl_2 + SO_2 + H_2O$

(d)	(i) 1. Methanal or methan-1-al 2. 1Propanol or Propane – 1 – OL 3. 2Butene or but – 2 – ene
	(ii) 1.  OR CH_3-CH_2-CH_2-CH_3 2.  OR 
(e)	(i) White precipitate soluble in excess of sodium hydroxide solution. (ii) Reddish brown vapour at the anode. (iii) A white precipitate is formed which dissolves on heating or initially white precipitate is formed but on heating colourless solution is observed. (iv) Colourless solution or solid $CaCl_2$ turns into solution. (v) A white precipitate is formed. *(correct relevant observations accepted)*
(f)	(i) Oppositely charged ions are held by strong force of attraction or energy is required to separate the ions/ particles held by strong electrostatic force of attraction (ii) Inert gases have stable electronic configuration or have 8 electrons in the valence shell (last shell) / do not lose or gain electrons to form ions/complete outermost or valence shell. (iii) Nuclear charge increases / nucleus exerts greater force of attraction on the valence electrons of same shell or atomic size decreases / the force of attraction on the valence electrons are more i.e., increases. (iv) Alkali metals have low ionization potential / have one electron in their valence shell /and hence they easily lose or donate electron. (v) Dilute hydrochloric acid undergoes complete ionization/ dissociation whereas acetic acid undergoes incomplete or partial ionization or dilute HCl has higher concentration of ions than acetic acid./Dilute hydrochloric acid is a stronger acid than acetic acid/ Dilute hydrochloric acid is a strong electrolyte and acetic acid is a weak electrolyte/ Dilute hydrochloric -only ions, acetic acid- ions and molecules/ Dilute hydrochloric acid has higher degree of dissociation than acetic acid.

(g)	(i) Nitrogen dioxide or NO_2 (ii) Hydrogen sulphide or H_2S (iii) Nitric oxide / nitrogen monoxide or NO (iv) Oxygen or O_2 (v) Hydrogen or H_2
(h)	(i) solid (ii) hydrogen (gas) (iii) upward (iv) Haematite (v) iron III chloride

SECTION II (40 Marks)

*Attempt **any four** questions from this Section*

Question 2

(a) (i) What do you understand by a lone pair of electrons? [3]

(ii) Draw the electron dot diagram of Hydronium ion. (H=1; O=8)

(b) *In Period 3 of the Periodic Table, element **B** is placed to the left of element **A**.* [3]

On the basis of this information, choose the correct word from the brackets to complete the following statements:

(i) The element **B** would have *(lower / higher)* metallic character than **A**.

(ii) The element **A** would probably have *(lesser / higher)* electron affinity than **B**.

(iii) The element **A** would have *(greater / smaller)* atomic size than **B**.

(c) Copy and complete the following table which refers to the conversion of ions to neutral particles. [4]

Conversion	Ionic Equation	Oxidation / Reduction
Chloride ion to chlorine molecule	(i) _____	(ii) _____
Lead (II) ion to lead	(iii)_____	(iv) _____

Comments of Examiners

(a)(i) Many candidates could not define *a lone pair of electrons* completely. They missed out the key words in the definition like *pair of electrons* or *not shared/unshared* or *covalent molecule.*

(ii) Observations in the electron dot diagram of hydronium ion drawn by some candidates were as follows:

- the lone pair or the charge was missing.
- same kind of dots were used for electrons of both O and H
- the coordinate bond was not indicated by an arrow.

(b) Majority of the candidates attempted sub-parts (i), (ii) and (iii) of this question well barring a few exceptions who could not choose the correct word from the brackets to complete the given statements.

(c) Common errors observed in this question were:

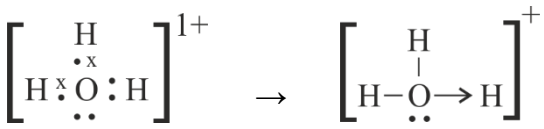
- in ionic equations such as of Cl_2 formation,
  equation $Cl^- + e^- \rightarrow$ Cl was given and the next equation was missed out.
- $Pb^{2+} - 2e \rightarrow Pb$.
  the term oxidation/reduction was incorrectly associated with the ionic equations.

Suggestions for teachers

- Stress upon using the necessary key words and insist on underlining them at the time of regular practice in class.
- Train students to draw both dot structure and bond structure separately.
- Instruct students about the periodic properties of elements in the Periodic table and variations of properties in detail. Use charts displayed with pictorial representation of the trends to enhance understanding and retention.
- Give regular exercises in application of the knowledge of trends of the following periodic properties in groups and periods: atomic size, metallic character, electron affinity, etc.
- Illustrate the concept of oxidation and reduction based on loss and gain of electrons in detail.

MARKING SCHEME

Question 2

(a)	(i) The pair of electrons which is not yet shared with other atoms in a covalent molecule is known as lone pair of electrons. (ii) 
(b)	(i) higher (ii) higher (iii) smaller
(c)	(i) $2Cl^{1-} - 2e \rightarrow Cl_2$ or $Cl^- - e \rightarrow Cl$ (or $Cl^- \rightarrow Cl + e^-$) and $Cl + Cl \rightarrow Cl_2$ or $2Cl \rightarrow Cl_2$ (ii) Oxidation (iii) $Pb^{2+} + 2e \rightarrow Pb$ (iv) Reduction

Question 3

(a) (i) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. [3]

(ii) State why concentrated sulphuric acid is not used for drying ammonia gas.

(iii) Why is ammonia gas not collected over water?

(b) (i) Name the acid used for the preparation of hydrogen chloride gas in the laboratory. Why is this particular acid preferred to other acids? [3]

(ii) Write the balanced chemical equation for the laboratory preparation of hydrogen chloride gas.

(c) For the preparation of hydrochloric acid in the laboratory: [2]

(i) Why is direct absorption of hydrogen chloride gas in water not feasible?

(ii) What arrangement is done to dissolve hydrogen chloride gas in water?

(d) For the electro-refining of copper: [2]

(i) What is the cathode made up of?

(ii) Write the reaction that takes place at the anode.

Comments of Examiners

(a) (i) Many candidates wrote the required balanced chemical equation to prepare ammonia gas in the laboratory using an alkali correctly but some wrote methods of preparation of NH_3 gas using NaOH or using $(NH_4)_2SO_4$ instead of NH_4Cl. Some showed the formation of NH_4OH instead of NH_3. Most candidates answered sub parts (ii) and (iii) of this question correctly.

(b) (i) Many candidates did not specify whether sulphuric acid used for the preparation of hydrogen chloride gas in the laboratory should be concentrated or dilute. In response to the preference of this acid over other acids, some wrote that it does not react with HCl gas.

(ii) Some candidates did not mention the necessary condition of temperature i.e., below 200 ^oC to ensure Na_2SO_4 is not formed which has a tendency to get fused with the glass and ended up writing the equation which was not required as per the question asked :

$2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

(c)(i) Many candidates gave inadequate explanation without mentioning the effect *back suction*.

(ii) Most candidates answered correctly. However, a few candidates wrote *thistle funnel* instead of *inverted funnel* arrangement.

(d) (i) Majority of the candidates wrote that the cathode is made up of copper. A few candidates missed out associating the word *pure* with it or wrote *impure copper*.

(ii) Some candidates wrote incorrect reactions such as:

$Cu + 2e^- \rightarrow Cu^{2+}$ Or $Cu^{2+} - 2e^- \rightarrow Cu$

Suggestions for teachers

- Insist upon students sticking to the choice of appropriate reactants for laboratory preparations.
- Explain thoroughly the study of compounds with laboratory preparation of hydrogen chloride gas, ammonia, etc., and their physical and chemical properties. Besides this, also discuss all possible reasoning questions related to their physical and chemical properties at length.
- Instruct students to read the question carefully and answer to the point as per the requirement of the question.
- Clarify the technical terms used in the question.
- Train students to write *dilute* or *concentrated* whenever reference is made to any acid.
- Habituate students to write chemical equations with necessary conditions
- Show a presentation on back suction will give clarity to students.
- Discuss electrorefining and also give practice in writing reactions taking place at cathode and anode.

MARKING SCHEME

Question 3

(a)	(i)	$2NH_4Cl + Ca(OH)_2 \xrightarrow[\Delta]{} CaCl_2 + 2H_2O + 2NH_3$
	(ii)	Concentrated sulphuric acid reacts with ammonia / form ammonium sulphate or NH_3 being basic combines with concentrated H_2SO_4 /correct chemical equation.
	(iii)	NH_3 is highly soluble in water or dissolves in water.
(b)	(i)	Concentrate sulphuric acid. It is nonvolatile / has high boiling point / displaces the volatile hydrogen chloride from the salt sodium chloride.
	(ii)	$NaCl + H_2SO_4 \xrightarrow{\angle 200^\circ C} NaHSO_4 + HCl$ (conc.)
(c)	(i)	Back suction occurs (or the description of back suction) / HCl gas dissolves in water at a faster rate than it is produced.

	(ii)	Inverted funnel arrangement/ the rim of the funnel just touches the surface of water taken in the trough or correct diagram.
(d)	(i)	Pure copper
	(ii)	$Cu - 2e \rightarrow Cu^{2+}$ / $Cu \rightarrow Cu^{2+} + 2e^-$

Question 4

(a) The percentage composition of a gas is: [2]

Nitrogen 82.35%, Hydrogen 17.64%.

Find the empirical formula of the gas. [N = 14, H = 1]

(b) Aluminum carbide reacts with water according to the following equation: [4]

$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$

(i) What mass of aluminum hydroxide is formed from 12 g of aluminum carbide?

(ii) What volume of methane at s.t.p. is obtained from 12 g of aluminum carbide?

[Relative molecular weight of Al_4C_3 = 144; $Al(OH)_3$ = 78]

(c) (i) If 150 cc of gas A contains X molecules, how many molecules of gas B will be present in 75 cc of B? [2]

The gases A and B are under the same conditions of temperature and pressure.

(ii) Name the law on which the above problem is based.

(d) Name the main component of the following alloys: [2]

(i) Brass

(ii) Duralumin

Comments of Examiners

(a) Some candidates calculated the number of atoms by dividing atomic weight by the individual percentage. Therefore, empirical formula went incorrect. In the last step, some candidates stated the empirical formula as N_3H instead of NH_3.

(b) (i) Many candidates ignored the stoichiometric coefficients and did not consider 4 moles of $Al(OH)_3$.

Suggestions for teachers

- Train students to work out numericals step by step and give enough practice in solving them. *Explain Mole concept and Stoichiometry in detail*

(ii) A few candidates ignored the fact that 3 moles of CH_4 were released with every mole of Al_4C_3.

(c) (i) Most candidates answered correctly. However, a few candidates wrote number of molecules of gas B as 2x instead of x/2.

(ii) Many candidates named the law as Gay Lussac's law which was incorrect.

(d) In sub-parts (i) and (ii), most candidates listed all the components of the alloys *Brass* and *Duralumin* instead of giving the *main components* as asked in the question.

- Familiarize students with the equivalent correspondence between number of moles, molar mass and molar volume.
- Give adequate practice to students in solving numerical problems based on Mole and Stoichiometry.
- Ensure that students understand Gay Lussac's law of combining volumes, Avogadro's law, their statements, explanation and numerical problems based on them.
- Train students to read the question carefully and answer only whatever is asked in the question.

MARKING SCHEME

Question 4

(a)

	% Composition	Atomic Mass	No. of atoms	Simplest formula
N	82.35	14	82.35/14=5.88	5.88/5.88=1
H	17.64	1	17.64/1=17.64	17.64/5.88=3

Empirical Formula N_1H_3

(b)

$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$

144 4 x 78 = 312

1. 144 g $Al_4C_3 \rightarrow$ 312 g of $Al(OH)_3$

Mass of $Al(OH)_2 = \frac{312}{144} \times 12 = 26$ g

2. 144 g $Al_4C_3 \rightarrow$ 3 x 22.4l of CH_4

Volume of $CH_4 = \frac{3 \times 22.4}{144} \times 12 = 5.6$l CH_4

(c) (i) No. of molecules of B = $\frac{75 \times x}{150} = \frac{x}{2}$

(ii) Avogadro's law

(d) (i) Copper

(ii) Aluminum

Question 5

(a) Complete the following table which relates to the homologous series of hydrocarbons. [6]

General formula	IUPAC name of the homologous series	Characteristic bond type	IUPAC name of the first member of the series
$\mathbf{C_nH_{2n-2}}$	(A) _____	(B)_____	(C)_____
$\mathbf{C_nH_{2n+2}}$	(D)_____	(E)_____	(F)_____

(b) (i) Name the most common ore of the metal aluminum from which the metal is extracted. Write the chemical formula of the ore. [4]

(ii) Name the process by which impure ore of aluminum gets purified by using concentrated solution of an alkali.

(iii) Write the equation for the formation of aluminum at the cathode during the electrolysis of alumina.

Comments of Examiners

(a) Some candidates made the following mistakes in completing the table which relates to the homologous series of hydrocarbons:
- Name of compound was written in place of homologous series;
- The characteristic bond was referred to as unstaturated/saturated instead of triple covalent bond and single covalent bond respectively;
- The IUPAC name of the first member of the alkynes was given as methyne.

(b) Most candidates wrote the name of the common ore of aluminum from which the metal is extracted as *alumina* or *cryolite* instead of *Bauxite*. Some candidates gave chemical formula of Bauxite as $Al_2O_3.5H_2O$ wherein the number of water molecules was incorrect.

(i) A few candidates named the process by which impure ore of aluminum gets purified by using concentrated solution of an alkali as *Hall's process* or *Hoope's Process* in place of *Baeyer's process*.

Suggestions for teachers

- Develop an understanding of the general formula of hydrocarbons. Train students to apply general formula to various component and point out the formation of a homologues series with its special features like successive members differing by CH_2 and so on.
- Write the name or formula of any organic compound using the IUPAC system of nomenclature.
- Give enough practice to students in writing the name of compounds and their structures.
- Clarify electrolysis and its applications in detail with examples. Instruct students to commit to memory the names and formulae of important ores of metals (listed in the syllabus) and the processes for extraction of metals from ores

(ii) Most candidates wrote the correct equation for the formation of aluminum at the cathode during the electrolysis of alumina. However, a few got confused and wrote equations like:

$Al - 3e^- \longrightarrow Al^{3+}$

Or $Al + 3e^- \longrightarrow Al^{3+}$

Or $2Al^{3+} + 6e^- \longrightarrow Al$

- Advise students to ensure that instructions are read carefully.

MARKING SCHEME

Question 5

(a)	(A) Alkyne (B) Triple covalent bond/ triple/≡ / C ≡ C/ CH ≡ CH (C) Ethyne (D) Alkane (E) Single covalent bond/ single / – / C – C (F) Methane
(b)	(i) Bauxite $Al_2O_3.2H_2O$ (ii) Baeyer's Process (iii) $Al^{3+} + 3e \rightarrow Al$

Question 6

(a) A compound **X** (having vinegar like smell) when treated with ethanol in the presence of the acid **Z**, gives a compound **Y** which has a fruity smell. [4]

The reaction is:

$$C_2H_5OH + X \xrightarrow{Z} Y + H_2O$$

(i) Identify **Y** and **Z**.

(ii) Write the structural formula of **X**.

(iii) Name the above reaction.

(b) Ethane burns in oxygen to form CO_2 and H_2O according to the equation: [4]

$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$.

If 1250 cc of oxygen is burnt with 300 cc of ethane.

Calculate:

(i) the volume of CO_2 formed.

(ii) the volume of unused O_2.

(c) Three solutions P, Q and R have pH value of 3.5, 5.2 and 12.2 respectively. Which one of these is a: [2]

(i) Weak acid?

(ii) Strong alkali?

Comments of Examiners

(a)(i) Many candidates identified compound Y as $C_2H_5COOCH_3$ while some identified it as ester.A few candidates did not mention the strength of the acid.

(ii) Some candidates drew an incorrect structure of compound X.

(iii) Majority of candidates named the reaction correctly. However, a few called it *catalysis* which was not correct.

(b) (i) While majority of candidates answered correctly, a few candidates incorrectly used volume of O_2 to calculate the volume of CO_2. Some copied the volume of ethane incorrectly.

(ii) Many candidates did not calculate the volume of unused O_2.

(c) (i) Some candidates wrote solution P having value of pH 3.5 as that of a weak acid.

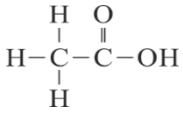
(ii) Most candidates answered correctly.

Suggestions for teachers

- Clarify that the H of acid is replaced by the alkyl group of alcohol and to prevent the backward reaction conc.H_2SO_4 (a strong dehydrating agent) is used to remove the moisture content.
- Train students in naming as well as drawing various kinds of structural formulae.
- Ensure that students know the reaction is called esterification.
- Provide adequate practice to students in numerical problems. Insist on stepwise working.
- Guide students about pH scale to test for acidity, neutrality and alkalinity.

MARKING SCHEME

Question 6

(a)	(i)	Y: Ethyl acetate / Ethyl ethanoate / $CH_3COOC_2H_5$ Z: Concentrated H_2SO_4
	(ii)	
	(iii)	Esterification
(b)	(i)	Volume of CO_2 formed = $\frac{4}{2}$ x 300 = 600 cc
	(ii)	Volume of O_2 used = $\frac{7}{2}$ x 300 = 1050 cc Volume of unused oxygen = 1250 – 1050 = 200 cc

(c)	(i)	Solution Q
	(ii)	Solution R

Question 7

(a) Give a chemical test to distinguish between the following pairs of chemicals: [4]

(i) Lead nitrate solution and Zinc nitrate solution

(ii) Sodium chloride solution and Sodium nitrate solution

(b) Write a balanced equation for the preparation of each of the following salts: [2]

(i) Copper sulphate from Copper carbonate.

(ii) Zinc carbonate from Zinc sulphate.

(c) (i) What is the type of salt formed when the reactants are heated at a suitable temperature for the preparation of Nitric acid? [2]

(ii) State why for the preparation of Nitric acid, the complete apparatus is made up of glass.

(d) Which property of sulphuric acid is shown by the reaction of concentrated sulphuric acid with: [2]

(i) Ethanol?

(ii) Carbon?

Comments of Examiners

(a) (i) Many candidates ignored the solution state of both $Pb(NO_3)_2$ and $Zn(NO_3)_2$ and gave dry heating test for each, which was contrary to the requirement of the question. Some candidates used, the reagent solution NaOH in place of NH_4OH for distinguishing one from the other.

(ii) A few candidates used concentrated H_2SO_4 to distinguish between NaCl and $NaNO_3$ overlooking the fact that both were in solution form and not in solid state.

(b)(i) Instead of reaction with H_2SO_4, a few candidates used Na_2SO_4 solution. Some candidates wrote two equations first using HCl and then using H_2SO_4.

Suggestions for teachers

- Demonstrate chemical tests to distinguish between the pairs of chemicals for better understanding and recall. Simultaneously, explain other technicalities related to use of those chemicals/reagents, etc.
- Guide students to learn the typical reactions of acid in word form also such as

  Carbonate +Acid $\longrightarrow$ Salt +H_2O +CO_2

(ii) Instead of Na_2CO_3 solution or another soluble carbonate solution, a few candidates used H_2CO_3 solution.
Some used two steps to obtain $ZnCO_3$:
- first reaction of $ZnSO_4$ with HCl and
- second reaction of $ZnCl_2$ with Na_2CO_3.

(c)(i) Instead of acid salt, some candidates wrote normal salt.

(ii) Most candidates answered correctly but a few stated that rubber will melt due to heat or cork will break.

(d)(i) Many candidates wrote *drying* instead of *dehydration*.

(ii) Several candidates stated *acidic* property instead of *oxidising* property.

- Discuss most of the reasoning questions (wherever it is possible), with demonstration in the laboratory or in the class through actual observation to develop students' inquisitiveness.
- Explain thoroughly the preparation of nitric acid, equations with conditions, setting up of apparatus, precautions, material suitable for its storage, etc.
- Stress on the essential difference between *drying* and *dehydration* i.e. in the former process only physically combined water/moisture is removed but in dehydration chemically combined H_2O is removed.
- Explain about the behavior of sulphuric acid in its dilute and concentrated forms, and its volatile nature with illustrations.

MARKING SCHEME

Question 7

(a)	(i) By adding ammonium hydroxide in excess. Lead nitrate solution gives a white precipitate while Zinc Nitrate solution gives a colourless solution. (ii) By adding silver nitrate / lead nitrate solution. Sodium chloride gives a white precipitate while sodium nitrate gives no precipitate / colourless solution / remains unchanged. *(alternate correct chemical test)*
(b)	(i) $CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2$ (ii) $ZnSO_4 + Na_2CO_3 \rightarrow ZnCO_3 + Na_2SO_4$ Or $ZnSO_4 + (NH_4)_2CO_3 \rightarrow (NH_4)_2SO_4 + ZnCO_3$
(c)	(i) Acid Salt/ bisulphate/ hydrogen sulphate/ $NaHSO_4$/ $KHSO_4$ (ii) The vapour of nitric acid being highly corrosive/ HNO_3 vapours attack rubber, cork etc./ HNO_3 vapours do not react with glass.
(d)	(i) Dehydrating agent/dehydration (ii) Oxidizing agent/oxidation

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

- Specific tests to identify/distinguish between substances.
- IUPAC names of organic compounds.
- Scientific terms for process/properties.
- Observations of different reactions based on practical chemistry.
- Reasons behind trends in properties across or down the periodic table.
- Ionic equations, especially involving the discharge of ions/formation of ions.
- Selective discharge of ions during electrolysis.
- Definition if lone pair of electrons.
- Scientific reasons for certain observations.

Concepts in which candidates got confused

- Electron affinity and Ionization potential.
- Froth floatation and roasting.
- Method of preparations of salts in the lab.
- Dissociation and Ionization.
- Gases involved in reactions.
- Structural formulae of organic compounds.
- Difference between precipitate and solution.

Suggestions for Candidates

- Read the questions carefully and then answer accordingly what has been asked.
- Avoid selective study.
- Prepare charts to study topics at a glance, such as Industrial processes, comparative study of Homologous series of hydrocarbons, etc.
- Practice numerical problems regularly, solve the numericals stepwise with correct formula and write the answer with correct unit.
- Learn definitions verbatim and highlight key words.
- Learn symbols of elements and their valencies. Practice writing balanced chemical equations with necessary conditions.
- In a chemical equation, write an acid with its strength(dilute/concentration)
- Name organic chemical compounds only using IUPAC nomenclature.
- In laboratory listen to the teacher's instructions carefully, read the experiment thoroughly and then perform it.
- Select only one reagent when distinguishing between substances and state the result with each substance.
- Study the typical reactions of acids as word equations such as
  Metal + Acid ---> Salt + H_2
  OR
  Carbonate + Acid ---> Salt + H_2O + CO_2
- Practice structural formulae of hydrocarbons.
- Solve past years' papers to understand the pattern of the paper.

QUALITATIVE ANALYSIS

BIOLOGY (PAPER-3)

SECTION I (40 Marks)

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

Question 1

(a) Name the following: [5]

(i) The organization which procures and supplies blood during an emergency.

(ii) The blood vessel which supplies blood to the liver.

(iii) The number of chromosomes present in a nerve cell of a human being.

(iv) The layer of the eyeball that forms the transparent Cornea.

(v) The wax-like layer on the epidermis of leaves which reduces transpiration.

(b) Choose the correct answer from each of the four options given below: [5]

(i) The number of Spinal nerves in a human being are:

A. 31 pairs

B. 10 pairs

C. 21 pairs

D. 30 pairs

(ii) Which one of the following is non-biodegradable?

A. DDT

B. Vegetable peel

C. Cardboard

D. Bark of trees

(iii) Aqueous humour is present between the:

A. Lens and Retina

B. Iris and Lens

C. Cornea and Iris

D. Cornea and Lens

(iv) A strong chemical substance which is used on objects and surfaces in our surroundings to kill germs:

A. Cresol

B. Carbolic acid

C. Iodine

D. Mercurochrome

(v) Which one of the following is a Greenhouse gas?

A. Oxygen

B. Methane

C. Sulphur dioxide

D. Nitrogen

(c) Complete the following paragraph by filling in the blanks (i) to (v) with appropriate words: [5]

To test a leaf for starch, the leaf is boiled in water to (i)_____. It is then boiled in Methylated spirit to (ii)_____. The leaf is dipped in warm water to soften it. It is placed in a petri dish, and (iii)_____ solution is added. The region of the leaf which contains starch, turns (iv)_____ and the region which does not contain starch, turns (v)_____.

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

Column A	**Column B**
(i) Cretinism	(a) Hypersecretion of adrenal cortex
(ii) Diabetes insipidus	(b) Hyposecretion of Thyroxine

(iii) Exophthalmic Goitre

(iv) Adrenal virilism

(v) Dwarfism

(c) Hyposecretion of growth hormone

(d) Hyposecretion of Vasopressin

(e) Hyposecretion of adrenal cortex

(f) Hypersecretion of Growth hormone

(g) Hypersecretion of Thyroxine

(e) Correct the following statements by changing the underlined words: [5]

(i) Normal pale yellow colour of the urine is due to the presence of the pigment <u>*Melanin*</u>.

(ii) The outermost layer of Meninges is <u>*Pia mater*</u>.

(iii) The cell sap of root hair is <u>*Hypotonic.*</u>

(iv) <u>*Xylem*</u> transports starch from the leaves to all parts of the plant body.

(v) <u>*Nitrogen*</u> bonds are present between the complementary nitrogenous bases of DNA.

(f) Choose between the two options to answer the question specified in the brackets for the following: [5]

An example is illustrated below.

Example: Corolla or Calyx (Which is the outer whorl?) *Answer: Calyx*

(i) Blood in the renal artery or renal vein (Which one has more urea?)

(ii) Perilymph or endolymph (Which one surrounds the organ of Corti?)

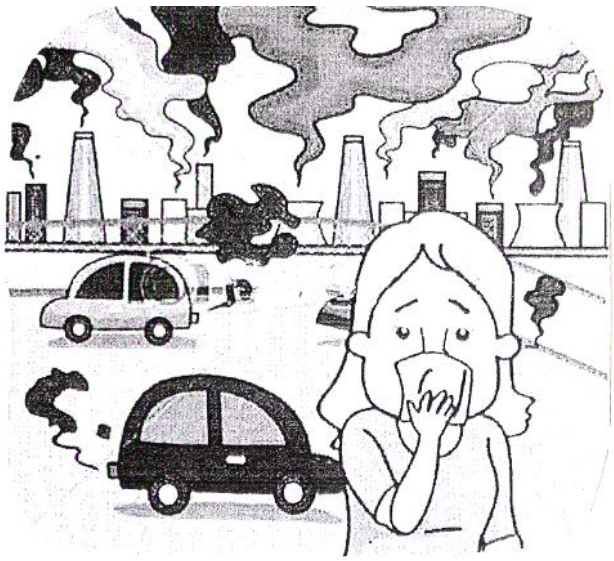
(iii) Lenticels or stomata (Which one remains open always?)

(iv) Sclerotic layer or choroid layer (Which one forms the Iris?)

(v) Blood in the pulmonary artery or pulmonary vein (Which one contains less oxyhaemoglobin?)

(g) Given below is a representation of a type of pollution. [5]

Study the picture and answer the questions:



(i) Name the type of pollution shown in the picture.

(ii) Name one source of this pollution.

(iii) How does this pollution affect human health?

(iv) Write one measure to reduce this pollution.

(v) State one gaseous compound that leads to the depletion of the ozone layer and creates 'Ozone holes'.

(h) Choose the **ODD** one out from the following terms given and name the **CATEGORY** to which the others belong: [5]

Example: *Nose, Tongue, Arm, Eye*

Answer: *Odd Term – Arm, Category – Sense organs*

(i) Detergents, X-rays, sewage, oil spills

(ii) Lumen, muscular tissue, connective tissue, pericardium

(iii) Dendrites, Medullary Sheath, Axon, Spinal cord

(iv) Centrosome, Cell wall, Cell membrane, Large vacuoles

(v) Prostate gland, Cowper's gland, seminal vesicle, seminiferous tubules.

Comments of Examiners

(a) (i) Most candidates wrote the correct answer. *WHO* was written as an incorrect answer by some candidates.

(ii) Majority of candidates wrote the correct answer. However, some candidates were confused between *Hepatic artery* and *Hepatic vein*.

(iii) Most candidates answered correctly. Some candidates, however, wrote the *chromosome number of gametes* instead of *number of chromosomes present in a nerve cell*.

(iv) Many candidates wrote *choroid* instead of *sclera*. Some candidates could not spell the term correctly.

(v) Most candidates wrote the correct answer.

(b) (i) Most candidates wrote the number of Spinal nerves in a human being correctly.

(ii) Most candidates chose the correct non-biodegradable from the options given.

(iii) Many candidates were unsure of the location of aqueous humour.

(iv) Most candidates wrote the correct answer.

(v) Most candidates wrote the correct option from the given four alternatives for a Greenhouse gas.

(c) In the given paragraph, most candidates filled in the appropriate words in the blanks (i), (iii)-(v). However, a few candidates could not fill in the appropriate word in the blank (ii), which shows that some candidates did not know the usage of methylated spirit in the starch test.

(d) Most candidates wrote the most appropriate matching pairs for the items given in column A and column B.

(e) (i) Majority of the candidates, instead of writing *Urochrome*, wrote *Bilirubin*.

(ii) Many candidates were confused with the location of the three meninges. In sub-parts (iii)-(v), most candidates corrected the statements by changing the underlined words correctly. However, a few candidates changed the underlined word in statement (v) to *Covalent* instead of *Hydrogen*.

(f) (i) Majority of the candidates chose the correct option to answer the question specified in the bracket. However, a few candidates were confused between renal artery and renal vein.

Suggestions for teachers

- Give importance to each step of the 'Starch Test' which is done at the end of an experiment on photosynthesis along with its significance.
- Give a number of examples of plants having variegated leaves and tell the students which parts of such leaves give a positive test for the presence of Starch.
- Advise students to read the instructions given for each question very carefully.
- Explain the parts and functions of the eye and ear using charts, models and interactive boards.
- Emphasise on the differences between Plant and Animal Cells.
- Train students to know the location and function of stomata and lenticels.
- Familiarise students with the location and function of the different parts of testis and accessory glands.
- Acquaint students with the hormones secreted by the endocrine glands and the disorders caused due to their Hypo and Hyper secretions.
- Explain the differences between Biodegradable and Non-Biodegradable substances, Antiseptics and Disinfectants and the kind of blood flowing in Pulmonary artery and Pulmonary vein.
- Draw the attention of the students towards the activities of WHO and Red Cross and guide them to express these correctly.

(ii) Most candidates wrote the incorrect option to answer the question specified in the bracket which clearly implies that the candidates were unaware of the fluid surrounding the organ of Corti.

(iii) Most candidates answered correctly.

(iv) Many candidates were unsure of the layer of eyeball which forms the Iris.

(v) Majority of the candidates wrote an incorrect answer as they were confused with the oxygen content in pulmonary artery and pulmonary vein.

(g) In sub-parts (i-iv), most of the candidates answered the questions based on the study of a picture on type of pollution, correctly.

For sub-part (v), only a few candidates wrote the correct answer. Most of them were unsure of the gases causing ozone holes.

(h) In sub-parts (i) – (iii) & (v), most of the candidates chose the ODD one out from the given terms correctly and named the category to which the others belong appropriately. However, in sub-part(iv), majority of the candidates were unsure of the difference between plant and animal cell.

MARKING SCHEME

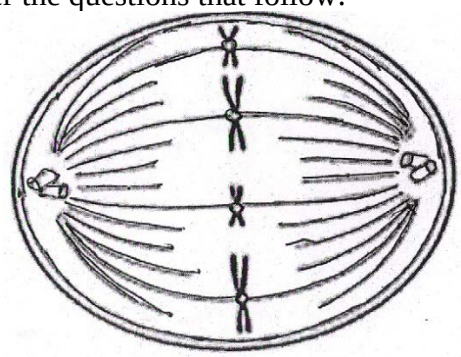
Question 1

(a)	(i)	Red Cross / Red Cross Society			
	(ii)	Hepatic artery/Hepatic Portal Vein			
	(iii)	46 or 23 pairs			
	(iv)	Sclera/Sclerotic layer			
	(v)	Cuticle/cutin			
(b)	(i)	A.31 pairs			
	(ii)	A. DDT			
	(iii)	D. Cornea and Lens			
	(iv)	A. Cresol			
	(v)	B. Methane/CH_4			
(c)	(i)	kill the cells			
	(ii)	remove chlorophyll/decolourise the leaf			
	(iii)	Iodine/Potassium iodide/K1/I_2			
	(iv)	blue black/blackish blue/dark blue/Indigo			
	(v)	yellowish brown/reddish brown/yellow /golden brown			
(d)	(i)	Cretinism	-	(b)	Hyposecretion of thyroxine
	(ii)	Diabetes insipidus	-	(d)	Hyposecretion of Vasopressin
	(iii)	Exophthalmic Goitre	-	(g)	Hypersecretion of thyroxine

	(iv)	Adrenal virilims	-	(a)	Hypersecretion of adrenal cortex
	(v)	Dwarfism	-	(c)	Hyposecretion of growth hormones
(e)	(i) Urochrome/Urobilin (ii) Duramater (iii) Hypertonic/Concentrated (iv) Phloem (v) Hydrogen/ H				
(f)	(i) Renal artery (ii) Endolymph (iii) Lenticels (iv) Choroid (v) Pulmonary artery				
(g)	(i) Air/Gaseous Pollution (ii) Factories / industries / motor vehicles / cars / buses/ burning of garbage / brick kilns/trucks/lorries/Power Plant/oil refineries/burning crop residues/bursting crackers. (iii) Respiratory problems / difficulty in breathing / Asthma / poor visibility / damages lungs / bronchitis/Respiratory inflammation/cough/sneezing/wheezing/eye irritation/allergies/toxic chemical enters food chain/disorders of liver,kidney,lung,hormonal (iv) Use of unleaded petrol / CNG / Chimneys with filters or precipitators / switching off engines when not in use/use of carpool, public transport,planting more trees/regular check up of vehicles (v) Styrofoam / CFCs / Refrigerants / Freons / Ccl_4 / HFCs / HCFCs./halons/methyl bromide			
(h)	(i)	X-rays	-	water pollutants	
	(ii)	Pericardium	-	parts of artery and vein / blood vessels	
		Lumen	-	Parts of heart/tissues of heart	
	(iii)	Spinal Cord	-	parts of neuron / nerve cell	
	(iv)	Centrosome	-	parts of plant cell	
	(v)	Seminiferous tubules	-	accessory **or** reproductive glands of male	

Question 2

(a) The diagram given below represents a stage during cell division. [5]
Study the same and answer the questions that follow:



(i) Identify whether it is a plant cell or an animal cell.
Give a reason in support of your answer.

(ii) Name the stage depicted in the diagram.
What is the unique feature observed in this stage?

(iii) Name the type of cell division that occurs during:
1. Replacement of old leaves by new ones.
2. Formation of gametes.

(iv) What is the stage that comes before the stage shown in the diagram?

(v) Draw a neat, labelled diagram of the stage mentioned in (iv) above keeping the chromosome number constant.

(b) Mention the exact location of the following: [5]

(i) Epididymis

(ii) Lacrimal gland

(iii) Malleus

(iv) Hydathodes

(v) Pulmonary semilunar valve

Comments of Examiners

(a) (i) Most candidates identified the diagram as that of animal cell and were able to support it with a suitable reason.

(ii) Majority of the candidates wrote the correct stage of Mitosis. A few candidates were unable to give the pattern of arrangement of Chromosomes.

(iii) Most candidates named *the type of cell division*…… correctly.

(iv) Most candidates wrote the stage that comes before the stage shown in the diagram, correctly.

(v) Most candidates drew the correct diagram. A few candidates, however, drew Anaphase and did not keep the chromosome number constant.

(b) (i) Majority of the candidates were unable to specify the exact location of Epididymis.

(ii) Majority of the candidates, instead of writing upper outer corner of the eye, wrote above the eye.

(iii) Most candidates wrote the exact location of Malleus correctly.

(iv) The exact location of Hydathodes was written correctly by most candidates.

(v) Many candidates wrote the location of the pulmonary semilunar valve in between right and left ventricle.

Suggestions for teachers

- Simplify the textual explanation so that the students are able to write the answers in simple and short sentences.
- Train students to draw labelled diagrams of the phases of mitosis with the required number of Chromosomes. Emphasis must be laid on the nuclear changes during mitosis.
- Clearly explain the location of various structure and organs in a plant and human body.
- Construct similar questions in Unit Tests and Term Examinations for practice and clarify the possible errors.

MARKING SCHEME

Question 2

(a) (i) Plant cell/cell wall present, Aster absent, Aster present Animal cell,Centrioles / Centrosome present

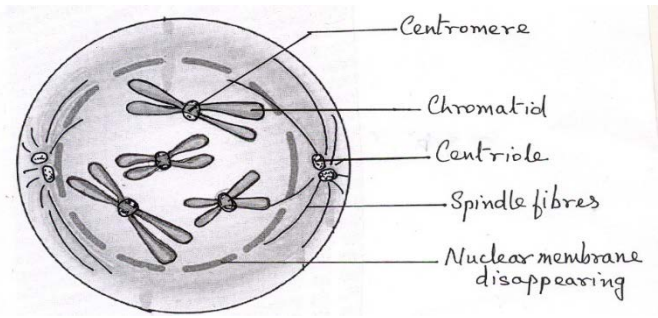
(ii) Metaphase, Chromosomes are in the equatorial plane.

(iii) 1. Mitosis

2. Meosis

(iv) Prophase

(v)

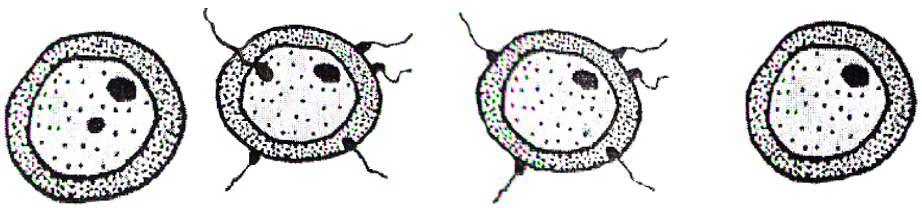


(b)	(i) on top of the testis/head, dorsal ride, back, rear of testis (ii) upper sideward portion of orbit/upper outer part of eye/upper lateral region of eye (iii) middle ear / between eardrum and incus. /inner surface of eardrum (iv) Tips / margins of leaves / in leaves. /ends or apex of veins/apex of leaves/Epidermis of leaves (v) In the right ventricle at the base of pulmonary artery. /at the opening of Pulmonary Artery

Question 3

(a) Given below are diagrams showing the different stages in the process of fertilisation of an egg in the human female reproductive tract. [5]

Study the diagrams and answer the questions:



A B C D

(i) Arrange the letters given below each diagram in a logical sequence to show the correct order in the process of fertilisation.

(ii) Where does fertilisation normally take place?

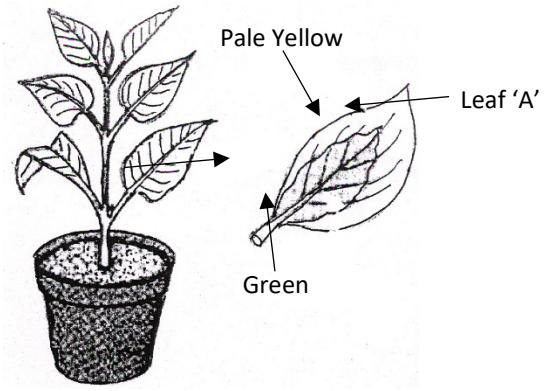
What is 'Implantation' that follows fertilisation?

(iii) Mention the chromosome number of the egg and zygote in humans.

(iv) Explain the term 'Gestation'. How long does Gestation last in humans?

(v) Draw a neat, labelled diagram of a mature human sperm.

(b) A potted plant with variegated leaves was taken in order to prove a factor necessary for photosynthesis. The potted plant was kept in the dark for 24 hours and then placed in bright sunlight for a few hours. Observe the diagrams and answer the questions. [5]



(i) What aspect of photosynthesis is being tested in the above diagram?

(ii) Represent the process of photosynthesis in the form of a balanced equation.

(iii) Why was the plant kept in the dark before beginning the experiment?

(iv) What will be the result of the starch test performed on leaf 'A' shown in the diagram? Give an example of a plant with variegated leaves.

(v) Draw a neat labelled diagram of a chloroplast.

Comments of Examiners

(a) (i) Most candidates arranged the letters given below each diagram in a logical sequence to show the correct order in the process of fertilisation. However, a few candidates were unsure of the sequence of fertilisation.

(ii) Majority of the candidate wrote the correct place of fertilisation but, some were unable to explain implantation.

(iii) Most candidates mentioned the chromosome number of the egg and zygote in humans correctly.

(iv) Explanation of the term Gestation and how long does it last in humans was written correctly by most of the candidates.

(v) Most of the candidates drew the correct diagram of a mature human sperm. Some candidates, however, were unable to show a clear differentiation of the three parts.

(b) (i) Most candidates answered the aspect of photosynthesis being tested through the diagram, correctly.

(ii) Most candidates wrote the balanced equation representing the process of photosynthesis correctly.

(iii) Majority of the candidates did not mention that de-starching takes place in leaves and not in the plant.

(iv) Majority of the candidates did not mention the parts of leaf which give positive and negative test for starch.

(v) Most candidates drew a correct diagram. A few candidates, however, did not draw a double membrane for chloroplast.

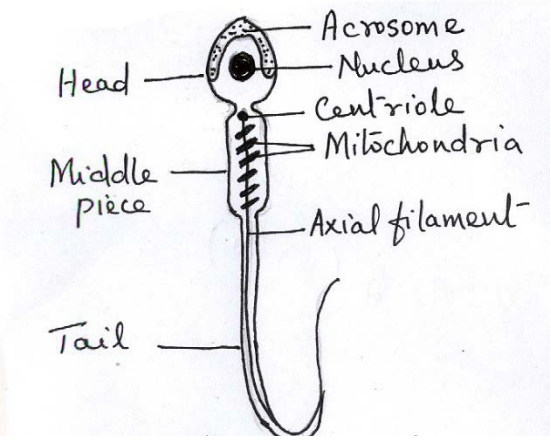
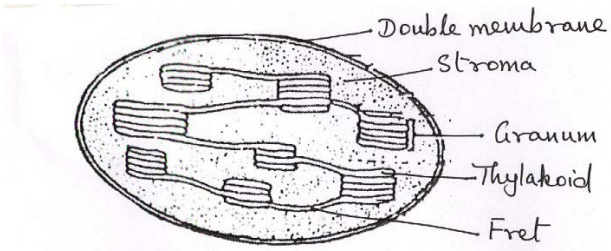
Suggestions for teachers

- While teaching the concept of fertilisation, lay stress on the number of Chromosomes in gametes and Zygote.
- Setup experiments to enable students to identify the factors necessary for Photosynthesis.
- Make students practise writing a balanced overall chemical equation for Photosynthesis.
- Give adequate practise to the students in drawing the diagram of chloroplast with a double membrane
- Emphasise the significance of de-starching the leaves before beginning any experiment on Photosynthesis.
- Guide students to collect a number of samples of plants having variegated leaves.
- Clearly explain Implantation and Gestation.
- Advise students to read the questions carefully so that they do not miss out on answering certain parts

MARKING SCHEME

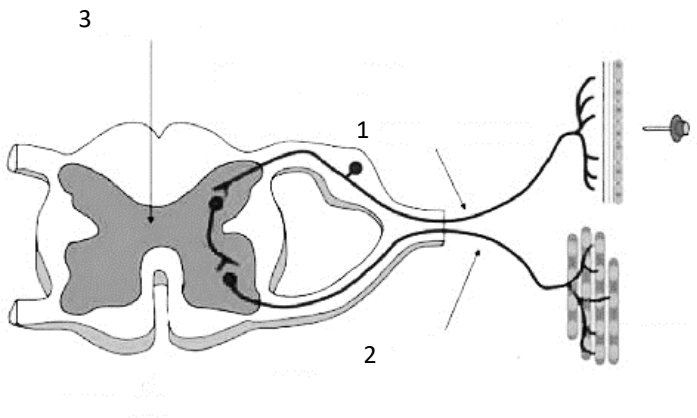
Question 3

(a)	(i)	D C B A/ C B A D
	(ii)	Oviduct, fixing of the embryo in the wall of uterus or Fallopian tube blastocyst in the wall of uterus

	(iii) Egg – 23, Zygote – 46 / 23 pairs (iv) Full term development of the embryo in the uterus, 280 days / 40 weeks/9 months. It is the period between implantation and birth of baby (v) 
(b)	(i) Chlorophyll is necessary for photosynthesis. (ii) $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2$ (iii) to destarch the leaves. (iv) Green part – blue black/blackish/dark blue/indigo (v) Yellow part – brown/yellowish brown/golden yellow 

Question 4

(a) The diagram given below shows the internal structure of a spinal cord depicting a phenomenon. Study the diagram and answer the questions: [5]



(i) Name the phenomenon that is depicted in the diagram. Define the phenomenon.

(ii) Give the technical term for the point of contact between the two nerve cells.

(iii) Name the parts numbered 1, 2 and 3.

(iv) How does the arrangement of neurons in the spinal cord differ from that of the brain?

(v) Mention two ways by which the spinal cord is protected in our body.

(b) Give appropriate *biological or technical terms* for the following: [5]

(i) Process of maintaining water and salt balance in the blood.

(ii) Hormones which regulate the secretion of other endocrine glands.

(iii) Movement of molecules of a substance from their higher concentration to lower concentration when they are in direct contact.

(iv) The condition in which a pair of chromosomes carry similar alleles of a particular character.

(v) The complex consisting of a DNA strand and a core of histones.

(vi) The onset of menstruation in a young girl.

(vii) Squeezing out of white blood cells from the capillaries into the surrounding tissues.

(viii) The fluid which surrounds the foetus.

(ix) The relaxation phase of the heart.

(x) The difference between the birth rate and the death rate.

Comments of Examiners

(a) (i) Most candidates named the phenomenon depicted in the diagram and wrote its definition correctly. A few candidates, however, were unsure of the meaning of the word phenomenon and therefore, were unable to give the correct answer.

(ii) Majority of the candidates did not know the difference between synapse and synaptic cleft, nerve and neuron.

(iii) Most of the candidates answered correctly. Some candidates, however, labelled neuron as nerve.

(iv) Many candidates wrote the location of grey and white matter instead of Cytons and Axons.

(v) Most candidates wrote two ways by which the spinal cord is protected in our body, correctly.

(b) In sub-parts(i)-(x), most of the candidates wrote the appropriate *biological or technical terms* for the given statements. However, in sub-parts (i), (viii) and (x), some candidates wrote *Homeostasis* instead of *Osmoregulation, Amnion fluid* instead of *Amniotic fluid* and *Birth rate/ Death* rate instead of *Growth Rate of population* respectively.

Suggestions for teachers

- Give sufficient practice to the students in drawing the nervous path way of Reflex action and to label all the parts.
- Ensure that the students are able to identify the neuron involved in a Reflex action and the location of Synapse.
- Emphasise the arrangement of Cytons and Axons in the Brain and in the Spinal cord.
- Insist upon learning the correct spellings of the biological terms with their correct meaning.
- Encourage students to use biological/technical terms.

MARKING SCHEME

Question 4

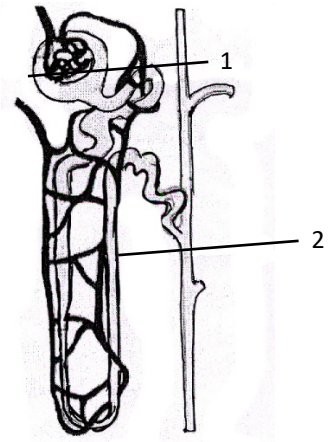
(a)	(i)	Reflex action, /Simple reflex/Reflex act It is an automatic, [spontaneous, quick] involuntary response to a stimulus.
	(ii)	Synapse
	(iii)	1. Sensory neuron / afferent fibre/Axon of sensory neuron

	2. Motor neuron / efferent fibre/Axon of motor neuron 3. Grey matter/central canal (iv) Spinal Cord – Cytons in the inner grey matter and axons in the outer white matter. /Cytons are inside & Axons are outside Brain – Cytons in the outer grey matter and axons in the inner white matter. /Cytons inside, Axons outside (v) Meninges, Cerebrospinal fluid, Vertebral column / backbone.
(b)	(i) Osmoregulation/Osmotic regulation (ii) Tropic hormones (iii) Diffusion (iv) Homozygous (v) Nucleosome (vi) Menarche (vii) Diapedesis (viii) Amniotic fluid (ix) Diastole (x) Growth rate of population

Question 5

(a) The diagram given below is that of a structure present in a human kidney. [5]

Study the same and answer the questions that follow:



(i) Name the structure represented in the diagram.

(ii) What is the liquid entering part '1' called?

Name two substances present in this liquid that are reabsorbed in the tubule.

(iii) What is the fluid that comes to part '2' called?

Name the main nitrogenous waste in it.

(iv) Mention the three main steps involved in the formation of the fluid mentioned in (iii) above.

(vi) Name the substance which may be present in the fluid in part '2' if a person suffers from Diabetes mellitus.

(b) Differentiate between the following pairs on the basis of what is indicated in the brackets. [5]

(i) Leaf and Liver [form in which glucose is stored]

(ii) ATP and AIDS [expand the abbreviations]

(iii) Testosterone and Oestrogen [organ which secretes]

(iv) Ureter and Urethra [function]

(v) Hypotonic solution and Hypertonic solution [condition of a plant cell when placed in them]

Comments of Examiners

(a) In sub-parts(i)-(v), most of the candidates wrote correct answers to the questions based on the given diagram of a structure present in a human kidney. However, in sub-part (v), a few candidates wrote *insulin* instead of *glucose*.

(b) In sub-parts(i)-(v), most of the candidates wrote the correct differentiation between the given pairs based on what is indicated in the brackets. However, in sub-part (iii), some candidates wrote the names of the *structure* instead of writing the names of the *organs* and in sub-part (v), many candidates wrote common words like *Swells* and *Shrinks* instead of *Turgid* and *Flaccid* respectively.

Suggestions for teachers

- By drawing a simple and clear diagram of Nephron, explain the significance of each part in Urine formation.
- Explain the role of insulin in regulating blood sugar level.
- Give to the students, a list of the substances which are present in the urine of normal person and in the urine of a person suffering from Diabetes mellitus.
- With the help of experiments, teach the concept of endosmosis and exosmosis using hypotonic and hypertonic solution.
- Advise the students to use biological terms –*Turgid* and *Flaccid* when explaining the condition of the cell.
- Give to the students, a list of the biological abbreviations mentioned in the scope of the syllabus.
- Advise students to use words *from* and *to* when structures are involved in transport of certain substances.
- Clearly explain to the students the difference between an organ and a structure.
- Stress upon the form in which glucose is stored in Plants and Animals.

MARKING SCHEME

Question 5

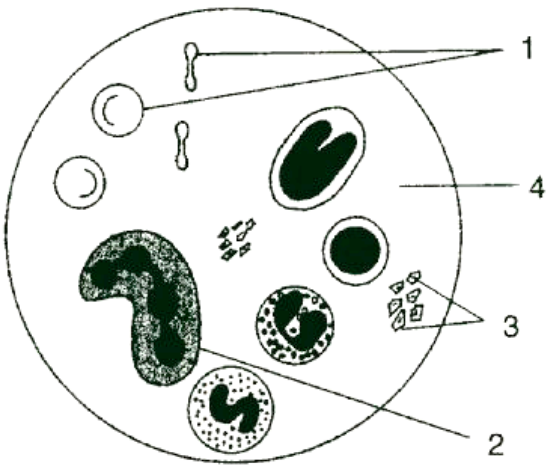
(a)	(i)	Nephron / Uriniferous tubule / Renal tubule / Kidney tubule
	(ii)	Glomerular filtrate, water / glucose / Sodium Chloride/Na ions/chloride ions/amino acids/ultrafiltrate/Nephric filtrate
	(iii)	Urine, Urea
	(iv)	Ultrafiltration, selective reabsorption, tubular secretion, Glomerular filtration.
	(v)	Glucose / Sugar / Ketones

(b)	(i)	Leaf – Starch, Liver – Glycogen
	(ii)	ATP – Adeosine triphosphate, AIDS – Acquired immune deficiency syndrome.
	(iii)	Testosterone – testis, Oestrogen – Ovary
	(iv)	Ureter – conducts urine from the kidney to the urinary bladder/transports urine from Renal pelvis to bladder Urethra – expulsion of urine from the urinary bladder/eliminates urine from body/expels urine and semen.
	(v)	Hypotonic – Turgid / Turgidity Hypertonic – Flaccid / Plasmolysed/Flaccidity

Question 6

(a) Given below is a diagram of a human blood smear. [5]

Study the diagram and answer the questions that follow:



(i) Name the components numbered '1' to '4'.

(ii) Mention two structural differences between the parts '1' and '2'.

(iii) Name the soluble protein found in part '4' which forms insoluble threads during clotting of blood.

(iv) What is the average lifespan of the component numbered '1'?

(v) Component numbered '1' do not have certain organelles but are very efficient in their function. Explain.

(b) Give biological explanations for the following: [5]

(i) Education is very important for population control.

(ii) The placenta is an important structure for the development of a foetus.

(iii) All the food chains begin with green plants.

(iv) Plants growing in fertilized soil are often found to wilt if the soil is not adequately watered.

(v) We should not put sharp objects into our ears.

Comments of Examiners

(a) In sub-parts(i)-(v), most of the candidates wrote correct answers to the questions based on the given diagram of a *human blood smear*. However, in sub-part (iii), a few candidates named the soluble protein found in part '4' which forms insoluble threads during clotting of blood as *Fibrin* instead of *Fibrinogen.*

(b) In sub-parts(i)-(v), most of the candidates wrote correct explanations for the given statements. However, in sub-part (iii), a few candidates wrote incorrect explanation for the statement: *All the food chains begin with green plants.* Similarly, in sub-part (iv), many candidates wrote the explanation in terms of *transpiration* instead of *hypertonic medium and ex-osmosis* in response to the statement: *Plants growing in fertilized soil are often found to wilt if the soil is not adequately watered.*

Suggestions for teachers

- Instruct students practice the diagram of blood cells. Teach the significance of RBCs not having certain organelles.
- Clearly explain the structural differences between RBCs and WBCs.
- Ensure that the students have a general awareness regarding population control.
- Explain the factors causing wilting of plants.
- Advise students to read and understand the statements before answering.
- Related to the statements, give biological explanations to the students.

MARKING SCHEME

Question 6

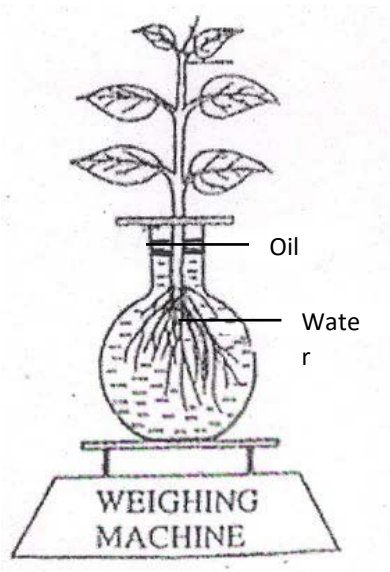
(a)	(i) 1. RBCs / Erythrocytes 2. WBC / Leucocytes/named WBC 3. Platelets / Thrombocytes 4. Plasma (ii) 1. RBC

	- Biconcave disc like - Nucleus absent - Haemoglobin present 2. WBC - Irregular, amoeboid - Nucleus present - Haemoglobin absent (iii) Fibrinogen (iv) 120 days (v) Absence of nucleus increases the surface area for absorbing more oxygen / more RBCs can be accommodated. Absence of mitochondria means they do not use oxygen for respiration, hence all the transported to tissues. Absence of endoplasmic reticulum increases the flexibility to move through narrow capillaries.
(b)	(i) Desire for a male child, ignorance regarding the functioning of reproductive system, gender inequality, etc can be eliminated with education and population increase can be checked. /to create awareness for birth control measures/vital for growth of nation/Food, water, environmental pollution, lack of job opportunities can be eliminated /to improve quality of life. (ii) - Transport of oxygen / digested foods / hormones / antibodies from maternal blood to foetal blood/nutrients /glucose etc. - Elimination of nitrogenous wastes / carbon dioxide from foetal blood to maternal blood./urea, uric acid, creatinine - Secretes oestrogen and progesterone - Acts as a barrier to germs. (iii) All animals / organisms depend on green plant for oxygen and directly or indirectly depend for food. (iv) Soil medium becomes hypertonic. Roots lose water by exosmosis/ plasmolysis and the plants wilt. (v) Can damage eardrum / tympanum leading to deafness.

Question 7

(a) The diagram below represents a process in plants. [5]

The setup was placed in bright sunlight. Answer the following questions:



(i) Name the physiological process depicted in the diagram.

Why was oil added to the water?

(ii) When placed in bright sunlight for four hours, what do you observe with regard to the initial and final weight of the plant?

Give a suitable reason for your answer.

(iii) What happens to the level of water when this setup is placed in:

1. Humid conditions?
2. Windy conditions?

(iv) Mention any three adaptations found in plants to overcome the process mentioned in (i).

(v) Explain the term ‘Guttation’.

(b) A pea plant which is homozygous for Green pods which are inflated [GGII] is crossed with a homozygous plant for yellow pods which are constricted [ggii]. Answer the following questions: [5]

(i) Give the phenotype and genotype of the F_1 generation.
Which type of pollination has occurred to produce F_1 generation?

(ii) Write the phenotypic ratio of the F_2 generation.

(iii) Write the possible combinations of the gametes that can be obtained if two F_1 hybrid plants are crossed.

(iv) State Mendel's law of 'Segregation of Gametes'.

(v) What is the scientific name of the plant which Mendel used for his experiments on inheritance?

Comments of Examiners

(a) (i) Most candidates wrote the correct answer. Some candidates, however, wrote *Absorption* instead of *Transpiration.*

(ii) Majority of the candidates were unable to answer this question as they could not relate bright sunlight to loss in weight of the plant due to increased transpiration.

(iii) Most candidates answered correctly about the change in the level of water on placing experimental setup (a process in plants) in Humid conditions and Windy conditions.

(iv) Most of the candidates mentioned three adaptations found in plants to overcome the process mentioned in (i) correctly.

(v) The term *Guttation* was explained by most of the candidates correctly.

(b) (i) Many candidates wrote the phenotype and genotype ratios of Monohybrid cross. Some candidates overlooked the second part of this question.

(ii) Most candidates, instead of writing the phenotypic ratio of F_2 generation, drew the Punnett square and worked out the genotypic ratio.

Suggestions for teachers

- Advise students to observe the diagrams carefully before answering the questions.
- Ensure that the students have understood the rate of transpiration under various climatic conditions.
- Teach the various adaptations in plants to overcome excessive transpiration.
- Give adequate practice of monohybrid and dihybrid cross and the phenotype and genotype ratios related to F_1 and F_2 generation.
- For better retention, instruct students to write the three laws of inheritance put forth by Mendel.

(iii) Majority of the candidates could not write the possible combinations of the gametes that can be obtained if two F_1 hybrid plants are crossed.

(iv) Most candidates stated Mendel's law of 'Segregation of Gametes' correctly.

(iv) Most of the candidates wrote the correct scientific name of the plant which Mendel used for his experiments on inheritance. However, a few candidates wrote only the generic name.

MARKING SCHEME

Question 7

(a)	(i) Absorption of water by roots, Transpiration by leaves. To prevent evaporation of water. (ii) Weight of the plant reduces. Rate of transpiration is more than the rate of absorption of water. /Final weight is less than initial weight because leaves transpire (iii) 1. Remains same 2. Reduces (iv) Sunken stomata, fewer stomata, narrow leaves, Rolled or folded leaves, loss of leaves, leaves modified to spines, thick cuticle on leaves. /small leaves/needle like leaves/hair on leaves/multiple epidermis. (v) Loss of water (as droplets) from the margins / hydathodes of leaves. /apex, tips of leaves.
(b)	(i) Phenotype: All have green, inflated pods. Genotype: GgIi, Cross pollination (vii) 9 : 3 : 3 : 1 (viii) GI, Gi, gI, gi (iv) Two members of a pair of factors separate during gamete formation./The two alleles of a trait separate during gamate formation. (v) Pisum Sativum

GENERAL COMMENTS

Topics found difficult / confusing by candidates

- Number of Chromosomes in somatic cells and gametes.
- Layers of eyeball and their associated structures.
- Biodegradable and Non-biodegradable substances.
- Antiseptics and Disinfectants.
- Greenhouse gases and gases causing depletion of ozone layer.
- Significance of each step in Starch test of leaf.
- Blood vessels supplying the organs and the kind of blood they carry.
- Difference between Plant cell and Animal cell.
- Internal structure of testis.
- Structures of the male reproductive system.
- Exact location of structures and organs.
- Implantation and Gestation.
- Factors affecting Photosynthesis.
- Placement of Cytons and Axons in brain and spinal cord.
- Nucleosome and Nucleotide.
- Birth rate, Death rate, Growth rate.
- Significance of each part of Nephron in Urine formation.
- Biological abbreviations.
- Efficiency of RBCs in transporting Oxygen to tissues.
- Factors affecting Transpiration
- Monohybrid and Dihybrid Cross.
- Mendel's Laws of Inheritance.

Suggestions for candidates

- Read the scope and syllabus prescribed for ICSE Biology.
- Revise the topics repeatedly for better understanding of concepts.
- Maintain a list of abbreviations related to the syllabus.
- Learn the keywords/biological terms/ definitions with conceptual clarity.
- Practise drawing neat and labelled diagrams.
- Give importance to biological and technical terms.
- Make the best use of the 15 minutes reading time to understand and assimilate the questions.
- Make your choice of question as per the rubrics and plan and organize your thoughts.
- Select the four questions you know the best in Section II.
- Follow carefully the instructions given for each question.
- Write the correct question number before answering.
- Be methodical and organized while answering.
- Do not separate the subsections of the question.
- Handwriting must be neat and legible.
- Do not attempt more questions than asked for in the question paper.