

Analysis of Pupil Performance

Year 2017 Examination

ICSE

SCIENCE



Research Development and Consultancy Division

**Council for the Indian School Certificate Examinations
New Delhi**

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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) and the Research Development and Consultancy Division (RDCD) of the Council 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.

November 2017

**Gerry Arathoon
Chief Executive & Secretary**

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 document includes 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 2017 have a new 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 2017 Examinations, 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 them 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 2017 covers the following subjects: English (English Language, Literature in English), Hindi, History, Civics and Geography (History & Civics, Geography), Mathematics, Science (Physics, Chemistry, Biology), Commercial Studies, Economics, Computer Applications, Economics Applications, Commercial Applications.

Subjects covered in the ISC Analysis of Pupil Performance document for the Year 2017 include English (English Language and Literature in English), Hindi, Elective English, Physics (Theory and Practical), Chemistry (Theory and Practical), Biology (Theory and Practical), 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. Manika Sharma, Dr. M.K. Gandhi, Ms. Mansi Guleria and Mrs. Roshni George, who have done a commendable job in preparing this document. The statistical data pertaining to the ICSE and the ISC Year 2017 Examinations has been provided by the IT section of the Council for which I would like to thank Col. R. Sreejeth (Deputy Secretary - IT), Mr. M.R. Felix, Education Officer (IT) – ICSE and Mr. Samir Kumar, Education Officer (IT) - ISC.

November 2017

Shilpi Gupta
Deputy Head - RDCD

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INTRODUCTION

This document aims to provide a comprehensive picture of the performance of candidates in the subject. It comprises of two sections, which provide Quantitative and Qualitative analysis results in terms of performance of candidates in the subject for the ICSE Year 2017 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.

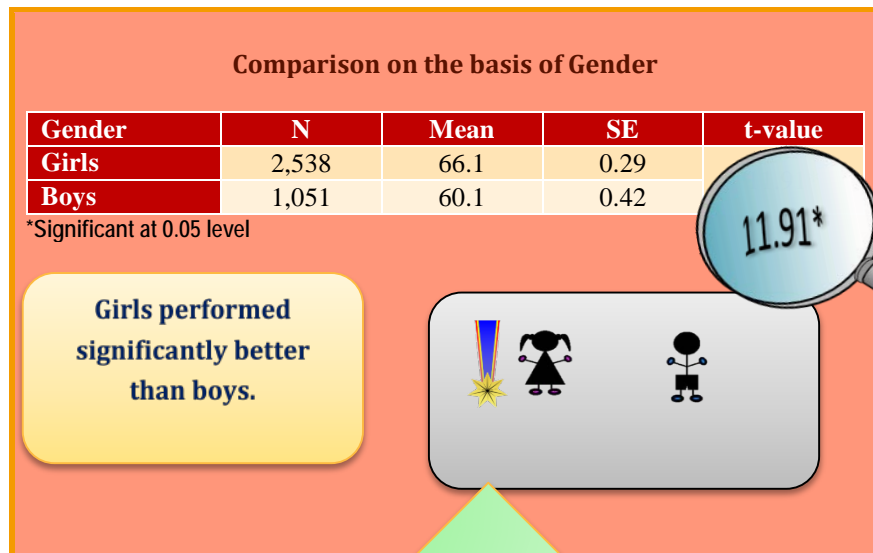
Understanding the tables

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 2017 Examination.

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

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



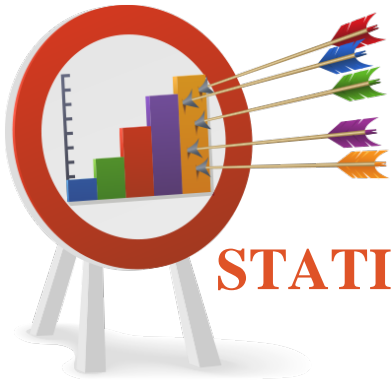
The table shows comparison between the performances of boys and girls in a particular subject. The t-value of 11.91 is significant at 0.05 level (mentioned below the table) with a mean of girls as 66.1 and that of boys as 60.1. It means that there is significant difference between the performance of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

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

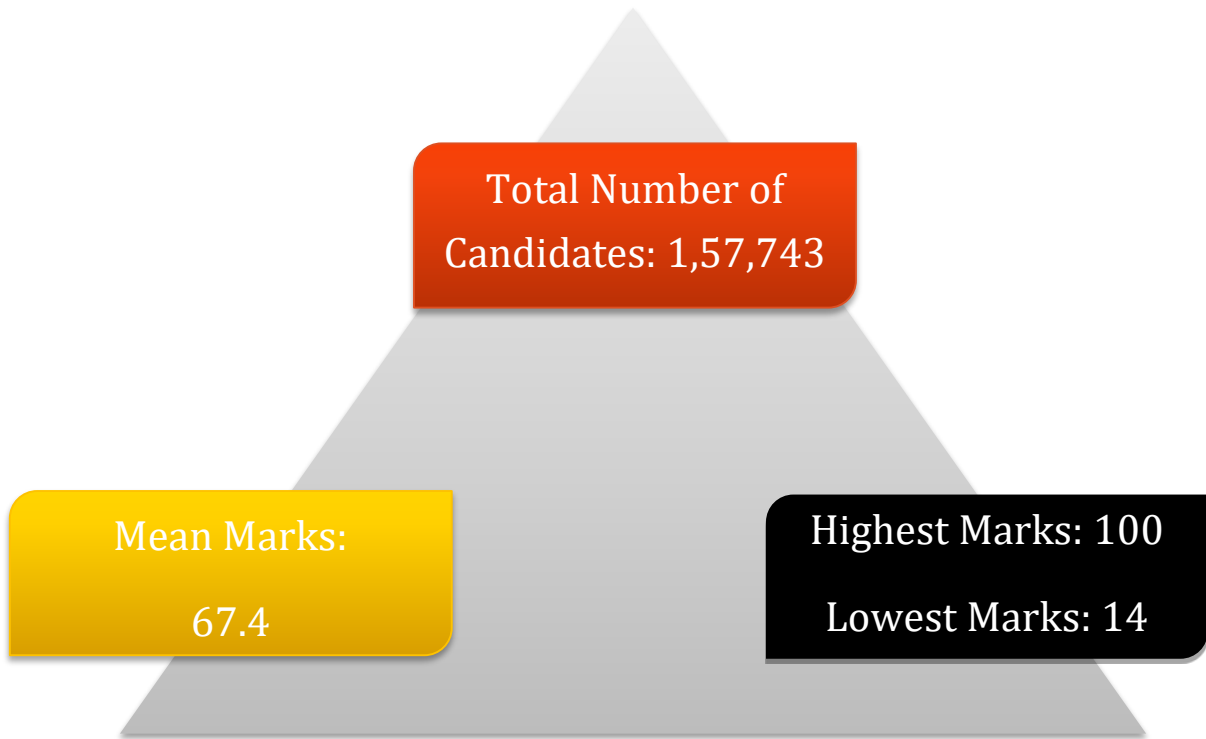
Qualitative Analysis

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

QUANTITATIVE ANALYSIS

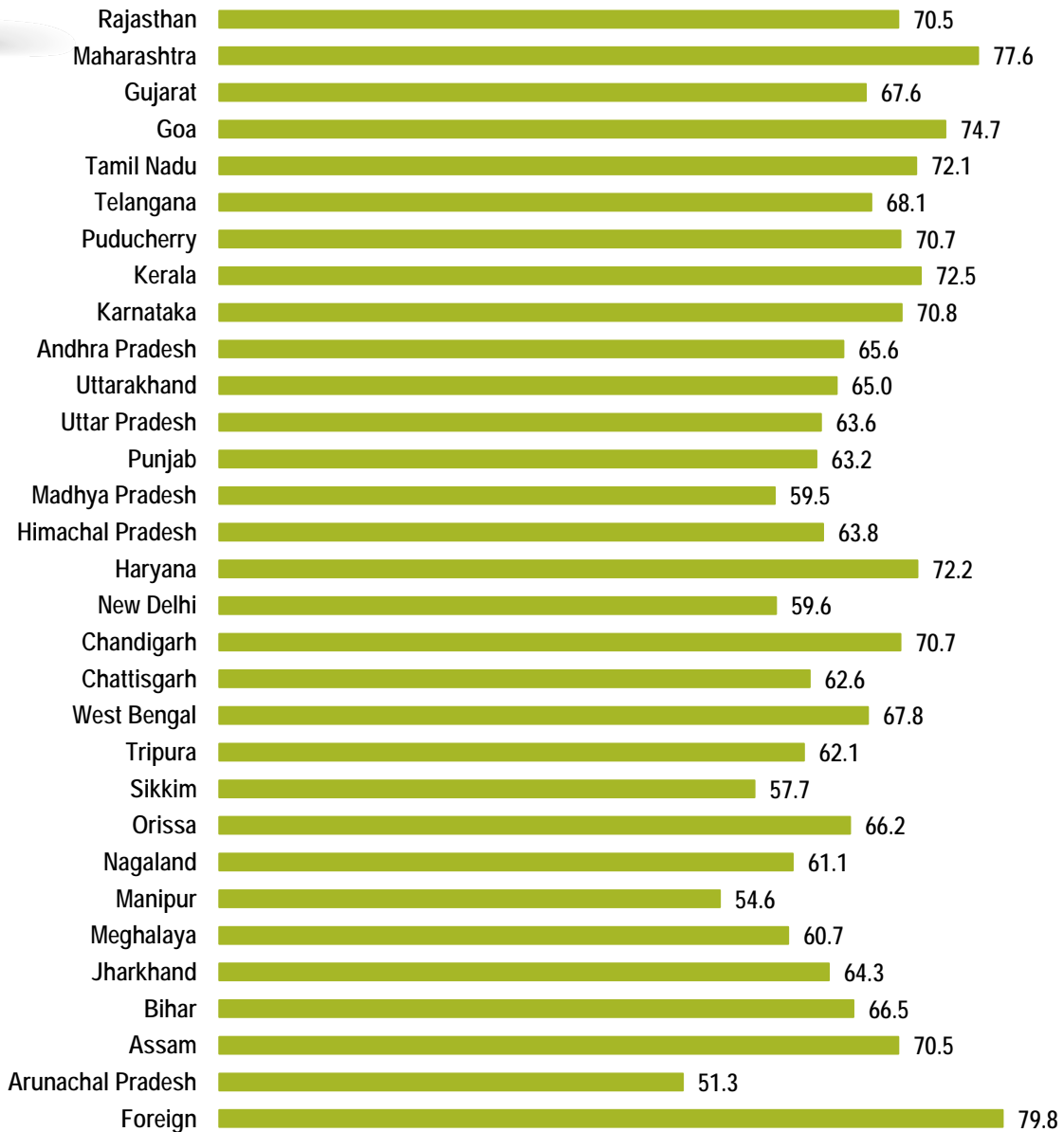


STATISTICS AT A GLANCE

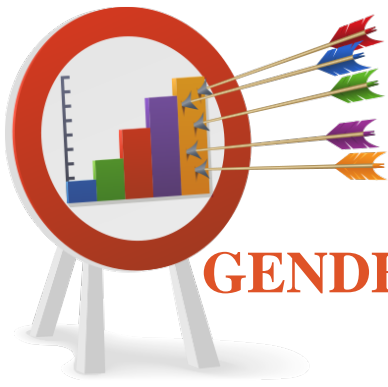




PERFORMANCE (STATE-WISE & FOREIGN)



The States of Maharashtra, Goa and Kerala secured highest mean marks. Mean marks secured by candidates studying in schools abroad were 79.8.



GENDER-WISE COMPARISON



GIRLS

Mean Marks: 68.4

Number of
Candidates: 70,174



BOYS

Mean Marks: 66.6

Number of
Candidates: 87,569

Comparison on the basis of Gender

Gender	N	Mean	SE	t-value
Girls	70,174	68.4	0.07	19.76*
Boys	87,569	66.6	0.06	

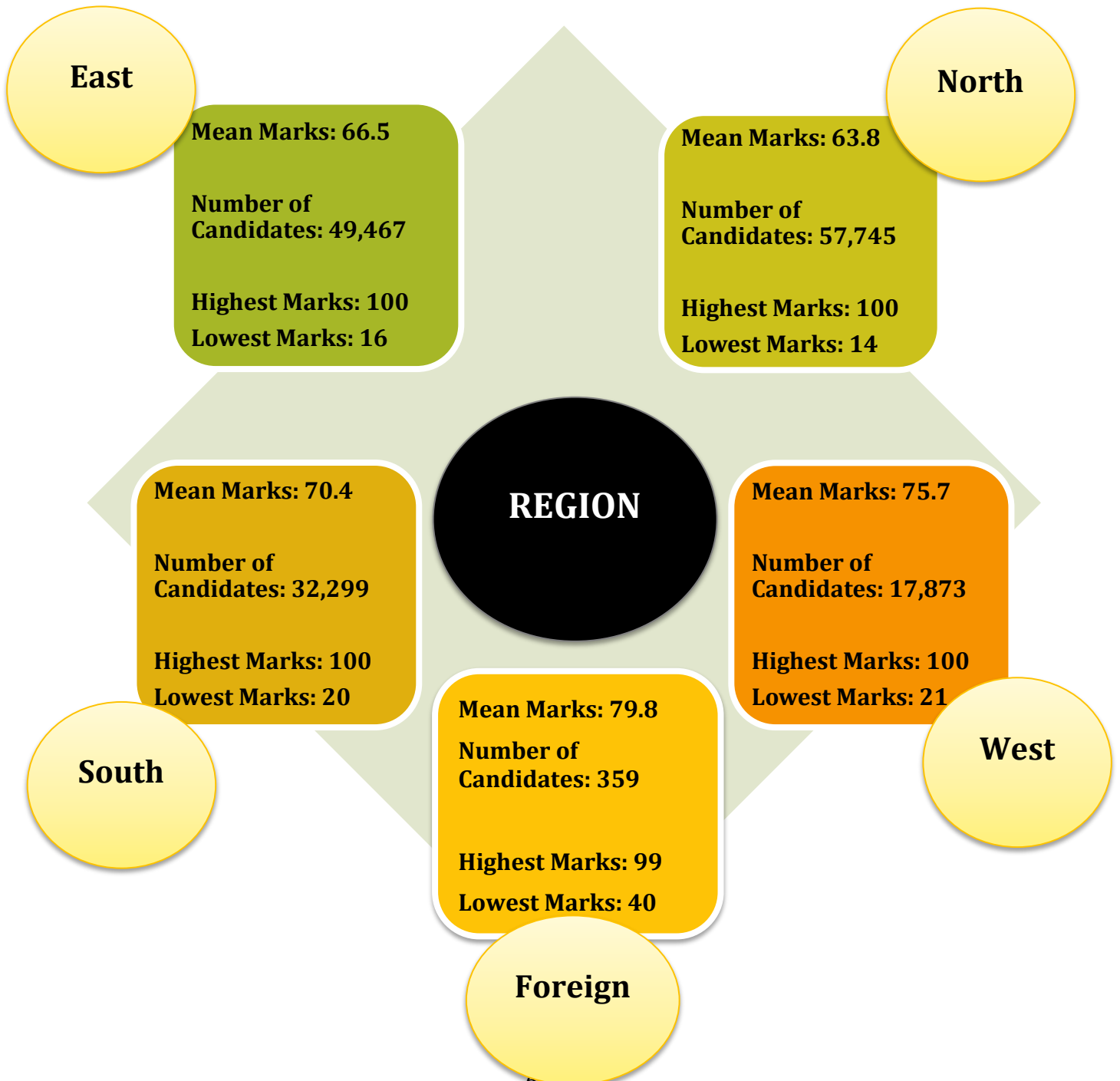
*Significant at 0.05 level

**Girls performed
significantly better than
boys.**

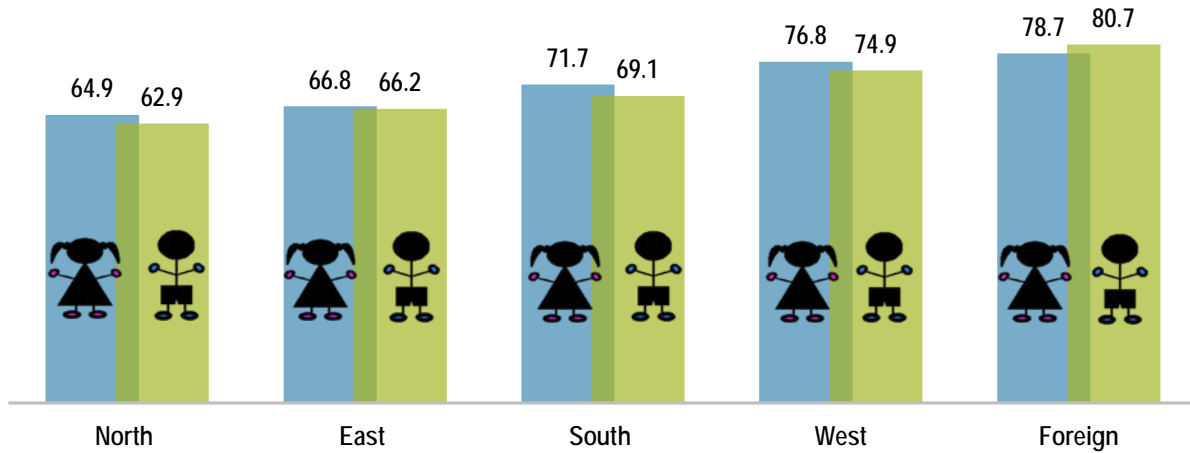




REGION-WISE COMPARISON



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	24,493	64.9	0.11	12.88*
	Boys	33,252	62.9	0.10	
East (E)	Girls	21,820	66.8	0.12	3.43*
	Boys	27,647	66.2	0.11	
South (S)	Girls	15,984	71.7	0.13	14.01*
	Boys	16,315	69.1	0.13	
West (W)	Girls	7,712	76.8	0.18	7.41*
	Boys	10,161	74.9	0.17	
Foreign (F)	Girls	165	78.7	1.16	-1.26
	Boys	194	80.7	1.08	

*Significant at 0.05 level

The performance of girls was significantly better than that of boys in all the regions except foreign region wherein no significant difference was observed between the average performance of girls and boys.

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	22,128	89.1	0.03	-3.10*
	Boys	25,681	89.2	0.03	
Bottom Range (0-20)	Girls	10	19.1	0.46	0.03
	Boys	35	19.1	0.24	

*Significant at 0.05 level

Marks Range (81-100)

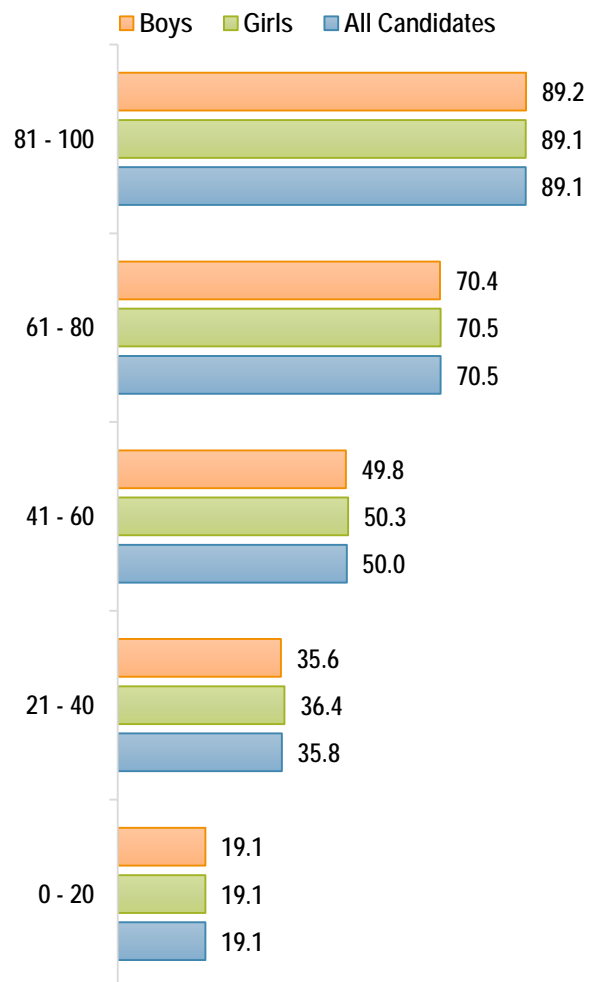
Performance of boys was significantly better than the performance of girls.

Marks Range (81-100)



Marks Range (0-20)

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



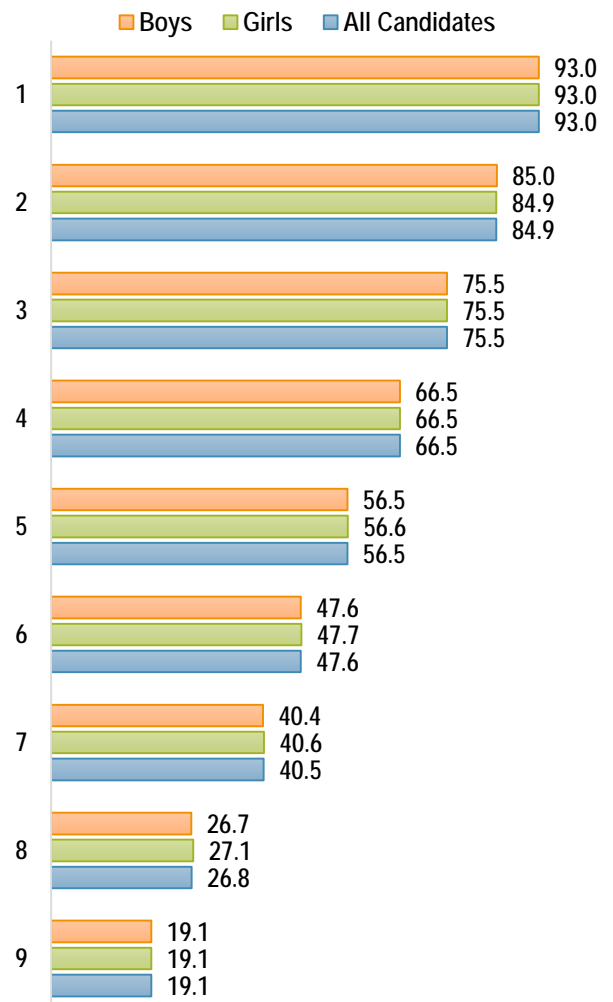


GRADES AWARDED : COMPARISON GENDER-WISE

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

Grades	Gender	N	Mean	SE	t-value
Grade 1	Girls	10,667	93.0	0.03	-1.47
	Boys	12,690	93.0	0.02	
Grade 9	Girls	10	19.1	0.46	0.03
	Boys	35	19.1	0.24	

In Grade 1 and Grade 9 no significant difference was observed between the average performance of girls and boys.



QUALITATIVE ANALYSIS

PHYSICS (SCIENCE PAPER-1)

SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

- (a) A brass ball is hanging from a stiff cotton thread. Draw a neat labelled diagram showing the forces acting on the brass ball and the cotton thread. [2]
- (b) The distance between two bodies is doubled. How is the magnitude of gravitational force between them affected? [2]
- (c) Why is a jack screw provided with a long arm? [2]
- (d) If the power of a motor be 100 kW, at what speed can it raise a load of 50,000 N? [2]
- (e) Which class of lever will always have $MA > 1$ and why? [2]

Comments of Examiners

- (a) Most of the candidates drew a ball and the string properly but following errors were observed:
- Labelling was missing.
 - Directions were not drawn.
 - Support was missing.
 - A few candidates drew a spring in place of a string.
- (b) Many candidates identified that “it decreases” but failed to identify the inverse square relation involved.
- (c) Many candidates just wrote “as force multiplier”. Very few explained with the inverse proportion between force and effort arm.
- (d) Many candidates failed to convert kW to W. Some wrote the unit of speed as ms^{-2} instead of ms^{-1} .
- (e) Some candidates did not understand the meaning of the word ‘always’ and mentioned the class of lever as 1. Most candidates wrote $E.A. > L.A.$ but did not mention that load lies between the fulcrum and the effort.

Suggestions for teachers

- Give more practice in drawing diagrams with labelling. Also, give inputs to students on the mistakes made by them.
- While explaining the relation between various quantities, emphasise the mathematical proportion rather than just saying that one quantity increases then the other decreases or vice versa.
- Advise students to practice conversion of one type of unit into another.
- Train students to understand as to what is exactly asked in the question.
- Make it clear to students that the increase or decrease of effort and load arm does not depend on the class of lever.

MARKING SCHEME

Question 1

(a)	(i)	Support	
(b)	$F \propto \frac{1}{d^2}$ where F: force, d: distance between centres. F becomes $\frac{1}{4}^{th}$ of the initial force.		
(c)	Increase in torque arm, increases the moment of force, so, lesser effort is required for turning.		
(d)	$v = \frac{P}{F} = \frac{100 \times 1000}{50000}$ $v = 2 \text{ m s}^{-1}$		
(e)	Class II As effort arm will always be greater than the load arm.		

Question 2

- (a) Define heat capacity and state its SI unit. [2]
- (b) Why is the base of a cooking pan generally made thick? [2]
- (c) A solid of mass 50 g at 150°C is placed in 100 g of water at 11°C, when the final temperature recorded is 20°C. Find the specific heat capacity of the solid. [2]
 (Specific heat capacity of water = 4.2 J/g°C)
- How is the refractive index of a material related to? [2]
- (d) (i) real and apparent depth?
 (ii) velocity of light in vacuum or air and the velocity of light in a given medium?
- (e) State the conditions required for total internal reflection of light to take place. [2]

Comments of Examiners

- (a) Many candidates wrote the definition of heat capacity correctly but some of them confused it with the definition of specific heat capacity and the same was observed with the unit. It was also observed that some students wrote $^{\circ}\text{K}$ which is the incorrect way of expressing the unit of temperature.
- (b) Most of the candidates answered one point correctly but did not write about the key point, increase in heat capacity.
- (c) Many candidates attempted this numerical correctly but some made mistakes in framing the equation, in substituting the values for temperature and in calculation.
- (d) Most candidates answered this question correctly. Some wrote about direct proportion but failed to write about inverse proportion in both the parts.
- (e) Most of the candidates expressed the conditions required for total internal reflection of light to take place correctly. However, others made the following errors: Only one condition was given.
- Some wrote that light enters from rarer medium to denser medium.
 - Instead of angle of incidence being greater than critical angle, it was written vice versa and some wrote incident “ray greater than critical angle”.

Suggestions for teachers

- Difference between specific heat capacity and heat capacity should be explained clearly. Written practice of definitions needs to be emphasised.
- Stress on kelvin as SI unit of temperature and to be used in derived units also.
- A variety of numericals need to be practised with emphasis on answers being in decimal.
- Train the students to answer as per the question asked and to cover all required points.
- Due to rote learning students, often do not realise that the statement written by them does not convey the correct meaning if they miss a single word or some information. Hence, make the students aware of the probable errors which they make.

MARKING SCHEME

Question 2

(a)	The amount of heat required to raise the temperature of the given mass of the body by 1°C . SI unit of heat capacity is J/K or J K^{-1} .
(b)	To raise its thermal capacity; so that it imparts sufficient heat at low temperature to food. Moreover, it keeps the food warmer for a longer time after cooking.
(c)	Heat given by solid = Heat taken by water $50 \times c \times 130 = 100 \times 4.2 \times 9$ $c = \frac{100 \times 4.2 \times 9}{50 \times 130} = 0.58 \text{ J/g } ^{\circ}\text{C}$
(d)	(i) Refractive Index = $\frac{\text{Real Depth}}{\text{Apparent Depth}}$

	(ii) Refractive Index = $\frac{\text{Velocity of light in air or vacuum}}{\text{Velocity of light in the given medium}}$
(e)	Light ray should travel from a denser to a rarer medium. Angle of incidence($\angle i$) should be greater than the critical angle($\angle i_c$).

Question 3

- (a) Draw a ray diagram to show the refraction of a monochromatic ray through a prism when it suffers minimum deviation. [2]
- (b) The human ear can detect continuous sounds in the frequency range from 20 Hz to 20,000 Hz. Assuming that the speed of sound in air is 330 ms^{-1} for all frequencies, calculate the wavelengths corresponding to the given extreme frequencies of the audible range. [2]
- (c) An enemy plane is at a distance of 300 km from a radar. In how much time the radar will be able to detect the plane? Take velocity of radio waves as $3 \times 10^8 \text{ m s}^{-1}$. [2]
- (d) How is the frequency of a stretched string related to: [2]
- (i) its length?
- (ii) its tension? [2]
- (e) Define specific resistance and state its SI unit. [2]

Comments of Examiners

- (a) Most candidates did not label that the angle of incidence ($\angle i$) is equal to the angle of emergence ($\angle e$) on the ray diagram or did not express the same in words. Some candidates drew the diagram taking a polychromatic ray. Many candidates did not mark the arrows on the diagram.
- (b) Most candidates calculated the wavelengths corresponding to the given extreme frequencies of the audible range correctly.
- (c) While a number of candidates were able to attempt the question correctly, some made mistakes in converting the distance from km to m. Some candidates applied a wrong formula.
- (d) Many candidates could answer this question correctly but some candidates could not write the correct relation.
- (e) This question was answered correctly by most of the candidates. Some candidates could not differentiate between *resistance* and *specific resistance*.

Suggestions for teachers

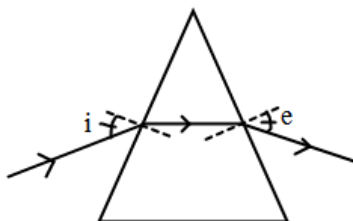
- More practice of drawing diagrams needs to be given to students, with all details included.
- Explain to the students the meaning of specific resistance and its SI unit.

MARKING SCHEME

Question 4

(a)

$$\angle i = \angle e.$$



(b) (i) $\lambda_1 = v/f_1 = 330/20 = 16.5 \text{ m}$

$$(ii) \lambda_2 = v/f_2 = 330/20000 = 1.65 \times 10^{-2} \text{ m}$$

(c) $v = \frac{2d}{t} \Rightarrow t = \frac{2d}{v} = \frac{2 \times 300 \times 1000}{3 \times 10^8}$

$$= 2 \times 10^{-3} \text{ second or } 0.002 \text{ second}$$

(d) $f \propto \frac{1}{l}$, f : frequency, l : length of the string.

$$f \propto \sqrt{T} \quad T: \text{ tension in the string.}$$

(e) It is the resistance of the conductor of unit length and unit cross-sectional area.

SI unit of specific resistance is $\Omega \text{ m}$

Question 4

- (a) An electric bulb of resistance 500Ω , draws a current of $0.4A$. Calculate the power of the bulb and the potential difference at its end. [2]
- (b) State two causes of energy loss in a transformer. [2]
- (c) State two characteristics of a good thermion emitter. [2]
- (d) State two factors upon which the rate of emission of thermions depends. [2]
- (e) When does the nucleus of an atom tend to be radioactive? [2]

Comments of Examiners

- (a) Many candidates attempted this question correctly but quite a number of candidates wrote incorrect formulae/ did wrong substitution and gave incorrect units.
- (b) Most candidates stated the two causes of energy loss in a transformer correctly.
- (c) Most of the candidates wrote the two characteristics of a good thermion emitter correctly.
- (d) Most of the candidates wrote the two factors upon which the rate of emission of thermions depends correctly. Some candidates wrote *melting point* instead of *temperature*; others wrote *area* instead of *surface*.
- (e) Most of the candidates answered correctly but some candidates wrote *neutron electron ratio* instead of *neutron proton ratio*. Common errors made by candidates were as follows:
- Instead of $n:p$, $p:n$ was mentioned greater than 82 and in some cases, instead of neutron, electron was written.
 - Some got confused between *atomic number* and *atomic mass*.
 - Some gave the definition of radioactivity rather than the condition.
 - A few candidates could not give two points.

Suggestions for teachers

- Give ample practice on numericals and formulae.
- Familiarize students with the probable errors that may be made while answering questions which are similar.
- Instruct students to read the questions carefully and write the points as per the requirement of the question.

MARKING SCHEME

Question 4

(a)	$P = i^2 R = \frac{4}{10} \times \frac{4}{10} \times 500 = 80 \text{ W}$ $V = iR = \frac{4}{10} \times 500 = 200 \text{ V}$
(b)	In transformer energy is lost due to: <ul style="list-style-type: none">– Hysteresis– Formation of Eddy Currents– Resistance of primary or secondary coil, <p style="text-align: right;"><i>(any two)</i></p>
(c)	A good thermionic emitter should have: <ul style="list-style-type: none">– Low work function– High melting point
(d)	Rate of emission of thermions depends on: <ul style="list-style-type: none">– the nature of surface (work function),– temperature of the surface– surface area. <p style="text-align: right;"><i>(any two)</i></p>
(e)	Nucleus of an atom tends to be radioactive when the atomic number is greater than 82 and imbalance of proton and neutron as compared to a normal stable atom.

SECTION I (40 Marks)

Attempt any four questions from this Section

Question 5

- (a) A uniform half metre rule balances horizontally on a knife edge at 29 cm mark when a weight of 20 gf is suspended from one end. [3]
- (i) Draw a diagram of the arrangement.
- (ii) What is the weight of the half metre rule?
- (b) (i) A boy uses a single fixed pulley to lift a load of 50 Kgf to some height. Another boy uses a single movable pulley to lift the same load to the same height. Compare the effort applied by them. Give a reason to support your answer. [3]
- (ii) How does uniform circular motion differ from uniform linear motion?
- (iii) Name the process used for producing electricity using nuclear energy.

- (c) A pulley system with $VR = 4$ is used to lift a load of 175 kgf through a vertical height of 15 m. The effort required is 50 kgf in the downward direction. [4]

($g = 10 \text{ N kg}^{-1}$)

Calculate:

- (i) Distance moved by the effort.
- (ii) Work done by the effort.
- (iii) M.A. of the pulley system.
- (iv) Efficiency of the pulley system.

Comments of Examiners

- (a)(i) Some candidates were able to solve this numerical correctly. Common errors made by candidates were as follows:
- Drew 100 cm scale instead of 50 cm.
 - Did not understand what the *knife edge* is?
 - 20 gf weight was suspended at the wrong end.
 - Key labelling such as C.G, weight of the scale was missing.
- (ii) Due to confusion in the diagram, many candidates substituted wrong values of the torque arm and expressed the answer with incorrect unit i.e. only 'g' in place of 'gf'.
- (b)(i) Many candidates could identify that the movable pulley will require less effort but could not explain it with the M.A. ratio of both pulleys.
- (ii) Most of the candidates answered this correctly but some wrote *uniform circular motion is unaccelerated*.
- (iii) Many candidates answered correctly but some wrote both nuclear fission and fusion. A few candidates gave the answer as "thermionic emission".
- (c) Some candidates made conceptual errors by using $L \times L.A. = E \times E.A.$ to calculate the distance moved by the effort. Due to calculation errors in the first part, many candidates got wrong answers in the latter parts. Most candidates answered the third part correctly. In sub-part (iv) some could not express the answer in percentage.

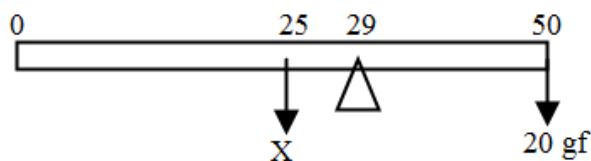
Suggestions for teachers

- The concept of centre of gravity should be made clear to students and clarify to them that the fulcrum may or may not lie at this point.
- Encourage drawing sketches while solving numericals.
- More practice of the numericals needs to be given to students.
- Students should be made aware that due to unavailability of effective control mechanism during nuclear fusion, only nuclear fission is used for the production of electricity.
- Acquaint students with the difference between d_E and E.A. and d_L and L.A. Also, sufficient practice in numericals is required.

MARKING SCHEME

Question 5

(a) (i)



(ii) $X \times 4 = 21 \times 20$

$X = 105 \text{ g f}$ weight of half metre rule = 0.105 kg f

(b) (i) Effort applied will be in the ratio 2:1 as M.A. of single fixed pulley is 1 whereas M.A. of single movable pulley is 2.

(ii) Uniform circular motion is an accelerated motion and Uniform linear motion is an unaccelerated motion.

(iii) Controlled chain reaction of nuclear fission of a radioactive substance.

(c) (i) Velocity ratio = d_E/d_L or $4 = d_E/15 \Rightarrow d_E = 60 \text{ m}$

(ii) $W = 50 \times 10 \times 60 = 30000 \text{ J}$

(iii) $MA = \frac{175 \times 10}{50 \times 10} = 3.5$

(iv) $\eta = \frac{MA}{VR} \times 100 = \frac{3.5}{4} \times 100 = 87.5\%$

Question 6

(a) (i) How is the transference of heat energy by radiation prevented in a calorimeter? [3]

(ii) You have a choice of three metals A, B and C, of specific heat capacities $900 \text{ Jkg}^{-1}\text{ }^{\circ}\text{C}^{-1}$, $380 \text{ Jkg}^{-1}\text{ }^{\circ}\text{C}^{-1}$ and $460 \text{ Jkg}^{-1}\text{ }^{\circ}\text{C}^{-1}$ respectively, to make a calorimeter. Which material will you select? Justify your answer.

- (b) Calculate the mass of ice needed to cool 150g of water contained in a calorimeter of mass 50g at 32°C such that the final temperature is 5°C. [3]

Specific heat capacity of calorimeter = 0.4 J/g°C

Specific heat capacity of water = 4.2 J/g°C

Latent heat capacity of ice = 330 J/g

- (c) (i) Name the radiations which are absorbed by greenhouse gases in the earth's atmosphere. [4]
- (ii) A radiation X is focused by a particular device on the bulb of a thermometer and mercury in the thermometer shows a rapid increase. Name the radiation X.
- (iii) Name two factors on which the heat energy liberated by a body depends.

Comments of Examiners

- (a) (i) Most of the candidates wrote about prevention of conduction instead of prevention of transference of heat energy by radiation.
- (ii) Majority of the candidates answered this part correctly. Some candidates chose the material correctly but were incorrect in justifying the answer.
- (b) Lack of clarity of the concept was observed. For ice, most of the candidates used the formula mL only and used the value of latent heat capacity of ice (336 J/g) instead of the given value 330 J/g. Some candidates did not involve calorimeter in the heat exchange. Calculation errors were also observed.
- (c) (i) Many candidates gave the answer as *UV radiations* or *long wavelength radiations*.
- (ii) Most candidates answered correctly except for a few who got confused as to how two consecutive answers could be the same.
- (iii) Most candidates named one factor on which the heat energy liberated by a body depends correctly. Some candidates failed to write *fall in temperature* and mentioned only *temperature*.

Suggestions for teachers

- Discussion needs to be done on calorimeter and ways of minimising heat losses.
- Explain to students the differentiation between bad conductors and good conductors with reference to the specific heat capacity.
- More practice should be given 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 writing the answers of conceptual questions.

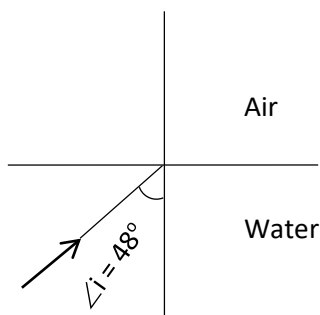
MARKING SCHEME

Question 6

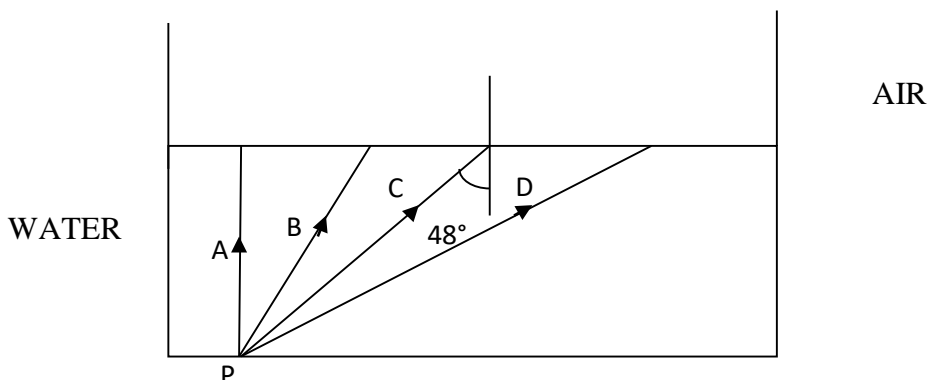
(a)	(i) Both (inner and outer) surfaces of calorimeter are highly polished. (ii) Metal B is the best option to make a calorimeter. B has the lowest specific heat capacity; hence it will absorb the least amount of heat.
(b)	Heat gained by ice = $mL + mc\Delta T = m(330 + 4.2 \times 5) = 351m$ J Heat given out by water and calorimeter = $(150 \times 4.2 + 50 \times 0.4) \times (32 - 5)$ $= 17550$ J Mass of ice = $\frac{17550}{351}$ $= 50$ g
(c)	(i) Infra-red radiations of long wavelength (ii) Infra-red radiations / heat radiations (iii) mass of the body Specific heat capacity of the body Change in temperature of the body <i>(Any two correct factors)</i>

Question 7

- (a) A Lens forms an upright and diminished image of an object when the object is placed [3]
at the focal point of the given lens.
- (i) Name the lens.
- (ii) Draw a ray diagram to show the image formation.
- (b) A ray of light travels from water to air as shown in the diagram given below: [3]



- (i) Copy the diagram and complete the path of the ray. Given the critical angle for water is 48° .
- (ii) State the condition so that total internal reflection occurs in the above diagram.
- (c) The diagram below shows a point source P inside a water container. Four rays A, B, C, D starting from the source P are shown upto the water surface. [4]



- (i) Show in the diagram the path of these rays after striking the water surface. The Critical Angle for water air surface is 48° .
- (ii) Name the phenomenon which the rays B and D exhibit.

Comments of Examiner

- (a) (i) Most of the candidates named the lens correctly but some of them wrote *convex* instead of *concave*.
- (ii) Most of the candidates drew the diagram properly but some candidates made the following errors:
- the object was not drawn at the focus.
 - the image drawn was not dotted.
 - the arrows were missing before and after refraction.
 - the lens was labelled wrongly.
- (b) (i) Most of the candidates drew the diagram correctly. Some completed the diagram assuming $\angle C = 42$ so they showed total internal reflection. Others drew the ray along the normal. Several candidates did not mark the angle of refraction.
- (ii) Many candidates wrote the conditions of total internal reflection correctly. Some were not clear about the concept of critical angle and conditions of total internal reflection.
- (c) (i) Very few candidates got the path of all four rays correct.

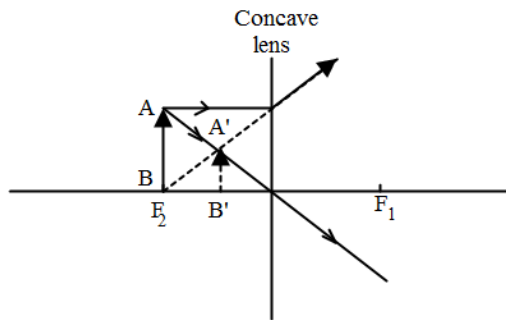
Suggestions for teachers

- Give substantial practice of drawing ray diagrams and to lay stress on
- Drawing arrows on the rays before and after the refraction.
- Drawing dotted line for virtual image.
- Explain the critical angle and TIR clearly with lots of examples.

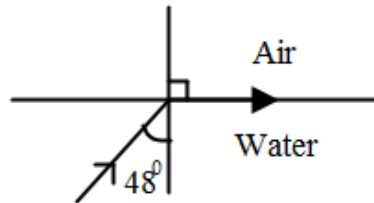
MARKING SCHEME

Question 7

- (a) (i) Concave lens
- (ii) A ray shown parallel to the principal axis and appears to be coming from F_2 .
- A ray shown passing through optical centre and moving un-deviated.
- Image shown correctly with object at the focus.

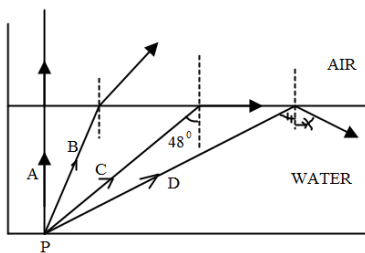


- (b) (i)



- (ii) $\angle i$ should be greater than 48° .

- (c) (i)



- (ii) Ray B undergoes refraction of light

Ray D undergoes total internal reflection of light.

Question 8

- (a) Name the factor that determines: [3]
- (i) Loudness of the sound heard.
 - (ii) Quality of the note.
 - (iii) Pitch of the note.
- (b) (i) What are damped vibrations? [3]
- (ii) Give one example of damped vibrations.
 - (iii) Name the phenomenon that causes a loud sound when the stem of a vibrating tuning fork is kept pressed on the surface of a table.
- (c) (i) A wire of length 80 cm has a frequency of 256 Hz. Calculate the length of a similar wire under similar tension, which will have frequency 1024 Hz. [4]
- (ii) A certain sound has a frequency of 256 hertz and a wavelength of 1.3 m.
 1. Calculate the speed with which this sound travels.
 2. What difference would be felt by a listener between the above sound and another sound travelling at the same speed, but of wavelength 2.6 m?

Comments of Examiners

- (a) (i) This part was answered by most of the candidates except for some who wrote *frequency* or *pitch*.
- (ii) This part was correctly attempted by most of the candidates except for some who wrote 'timbre' or 'wavelength'. Some had also used the terms as *wave note* or *wave pattern*.
- (iii) Most candidates attempted this part correctly except for those who wrote 'wavelength', 'shrillness', 'flatness'.
- (b) (i) Most of the candidates did not write the term 'decreasing amplitude'.
- (ii) Many candidates did not make it clear whether the vibrations were in vacuum or medium. Some wrote only the name of the instrument.
- (iii) Most of the candidates answered this correctly as 'forced vibrations' or 'resonance' but a few candidates wrote the phenomenon as 'echo'.

Suggestions for teachers

- Explain with lots of examples the relation between the characteristics of sound which are subjective in nature and the corresponding measurable quantities on which they depend and which are objective in nature. Also, the difference between wavelength and waveform should be made clear to students. Explain free, forced and damped vibrations clearly.
- It is advisable to do at least basic numerical using $v = f\lambda$. The qualitative understanding and interpretation depends on that and application becomes much clearer.

- (c) (i) Most candidates scored well in this question.
- (ii) 1. This part was attempted well by most of the candidates.
2. Some candidates showed the working of the problem but failed to write the difference felt by the listener. Also, some used the terms *shrillness* and *loudness* interchangeably, without actually knowing the difference.

MARKING SCHEME

Question 8

(a)	<p>(i) Intensity/ amplitude of the sound wave</p> <p>(ii) wave form/ number of overtones present in the waves</p> <p>(iii) Frequency of the wave</p> <p style="text-align: right;"><i>(Any other correct factor)</i></p>
(b)	<p>(i) The periodic vibrations of decreasing amplitude due to the presence of a resistive force are called as damped vibrations.</p> <p>(ii) – A vibrating tuning fork in air</p> <p>– Oscillations of a simple pendulum in air</p> <p>– A slim branch of a tree pulled and released <i>(Any one)</i></p> <p>(iii) Forced vibration or resonance</p>
(c)	<p>(i) $\frac{f_1}{f_2} = \frac{l_2}{l_1}$</p> $\frac{256}{1024} = \frac{l_2}{80}$ $l_2 = \frac{80 \times 256}{1024}$ $l_2 = 20 \text{ cm}$ <p>(ii) $V = 256 \times 1.3 = 332.8 \text{ ms}^{-1}$</p> $f = \frac{V}{\lambda} = \frac{332.8}{2.6} = 128 \text{ Hz}$ <p>As f in 2nd case is less, \therefore sound is shriller in 1st case.</p>

Question 9

- (a) (i) Name the colour code of the wire which is connected to the metallic body of an appliance. [3]
(ii) Draw the diagram of a dual control switch when the appliance is switched 'ON'.
- (b) (i) Which particles are responsible for current in conductors? [3]
(ii) To which wire of a cable in a power circuit should the metal case of a geyser be connected?
(iii) To which wire should the fuse be connected?
- (c) (i) Explain the meaning of the statement 'current rating of a fuse is 5A'. [4]
(ii) In the transmission of power, the voltage of power generated at the generating stations is stepped up from 11kV to 132kV before it is transmitted. Why?

Comments of Examiners

- (a) (i) Most of the candidates attempted this part correctly but in some cases, following errors were observed:
- Candidates wrote the colour code for all the three wires which implies that they did not know which wire is connected to the metallic body of the appliance.
 - Some did not write the colour code but identified the wire as earth wire.
 - Some wrote incorrect colour.
- (ii) Most candidates did not draw the diagram correctly. Vague diagrams were drawn by a few candidates, such as physical appearance of a switch. In some cases, load was connected directly to the live wire. Proper labelling was not done by many candidates.
- (b) (i) While many candidates answered correctly, some wrote protons/ neutrons or positive and negative charges.
(ii) A few candidates gave the answer as 'neutral' or 'live' wire.
(iii) Most candidates attempted this part correctly.
- (c) (i) Most of the candidates wrote about the maximum limit of current through the wire but failed to write about the melting of wire in case the current exceeds.
(ii) Many candidates wrote about minimising the power losses but failed to write about the decrease of current due to increased voltage. Some did not understand the question and wrote vague answers.

Suggestions for teacher

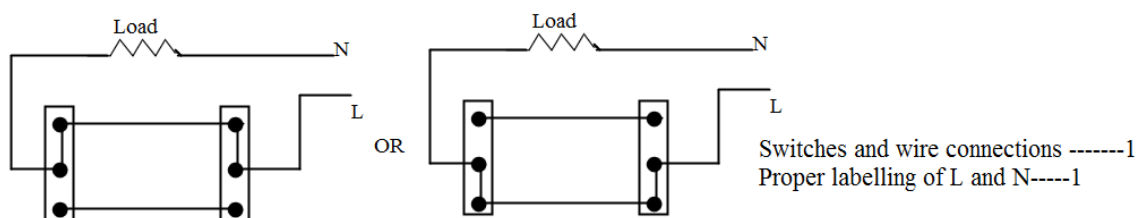
- Train the students to read the question carefully, ascertain the requirement and answer it.
- Explain the working of dual control switches with a diagram and emphasise that the students practice drawing diagrams.
- Explain the concept of earthing clearly to the students with the concept of potential.
- Explain the relation $P = VI$ in relation to the power transmission.

MARKING SCHEME

Question 9

(a) (i) Green / Yellow

(ii)



(b) (i) Electrons

(ii) Earth wire

(iii) Live wire

(c) (i) It can afford a maximum current of 5A. If current in the circuit exceeds beyond 5A, fuse blows.

(ii) For given electric power, the current becomes low at a high voltage and therefore the loss of energy due to heating in the line wire becomes less.

Question 10

(a) Answer the following questions based on a hot cathode ray tube. [3]

(i) Name the charged particles.

(ii) State the approximate voltage used to heat the filament.

(iii) What will happen to the beam when it passes through the electric field?

(b) State three factors on which the rate of emission of electrons from a metal surface depends. [3]

(c) (i) What are free electrons? [4]

(ii) Why do they not leave the metal surface on their own?

(iii) How can they be made to leave the metal surface? (State any two ways)

Comments of Examiners

- (a) (i) Most of the candidates attempted this part correctly but some confused thermionic emission with radioactive phenomenon and gave the answer as α, β and γ .
- (ii) Most of the candidates were confused with household voltage and hence wrote 220V or vague values such as 1000V.
- (iii) Most candidates wrote partial answers to this part, such as:
- deflects towards screen.
 - deflects and forms parabolic path, but direction was missing.
 - deflects towards positive terminal.

(b) Most of the candidates wrote answered correctly. Some candidates wrote *melting point* instead of *temperature*. Many candidates wrote *area* and missed out the word *surface*.

(c) (i) Most of the candidates had a vague idea of free electrons. They wrote that all valence electrons are free electrons.

(ii) Some candidates wrote that free electrons do not possess any energy. In some answers, the word *sufficient* was missing. Lack of clear idea of why they can't leave the metal surface was observed.

(iii) One way, i.e. of heating was given correctly by most candidates. Some wrote 'burning' instead of heating. A few wrote 'nuclear energy'.

Suggestions for teacher

- Concept of free electrons needs to be explained to the students and different ways of emission of electrons also needs to be discussed.
- Explain working of cathode ray tube thoroughly to the students.

MARKING SCHEME

Question 10

(a)	(i) Cathode rays / high speed electrons (ii) 6 V (iii) The beam will get deflected towards the positive plate
(b)	(i) Temperature of the metal surface (ii) Surface area of the metal. (iii) Nature of metal surface.
(c)	(i) Electrons in outer orbits are attracted weakly by the nucleus and so they are loosely bound and are called free electrons. (ii) They do not have sufficient kinetic energy. (iii) By imparting heat energy or light energy or electrical energy to the metal surface.

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

- Conversion of units.
- Numerical on moment of force.
- Advantages of movable and fixed pulley.
- Problems on calorimetry.
- Ray diagrams for lenses and prism.
- Reason for stepping up voltage during power transmission.
- Dual control switch.
- Numerical based on sound
- Specific resistance and its unit.
- Causes of energy losses in the transformer.

Suggestions for candidates

- Focus more on conceptual learning rather than rote learning.
- Make observations and try to relate your learning with it.
- Always participate in class discussion.
- Learn to write answers precisely and to the point.
- Avoid selective study. All topics are covered in Section I which is compulsory.
- Avoid changing the order of sequence of questions and numbering system while attempting the paper.
- Write in a neat and a legible handwriting.
- Learn the principles, laws and definitions accurately.
- While writing the answers it is not only important to cover all the points but also to present them in a proper sequence.
- It is advisable to state the meaning of the symbols if the answer is given in terms of any formula. Do not use any abbreviations which are not standard.
- The answers need to be given in SI units unless it is asked otherwise.
- It is advisable to solve at least last five years question papers.
- It is advisable to learn tables and squares up to 30. This will save a lot of time spent on calculation.
- It is advisable to present the final answer in the decimal form. Answer in fraction is treated as incomplete calculation.
- Units should be written without spelling errors.

QUALITATIVE ANALYSIS

CHEMISTRY (SCIENCE PAPER-2)

SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

(a) Fill in the blanks from the choices given in brackets: [5]

(i) The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called _____.

(electron affinity, ionisation potential, electronegativity)

(ii) The compound that does not have a lone pair of electrons is _____.

(water, ammonia, carbon tetra chloride)

(iii) When a metallic oxide is dissolved in water, the solution formed has a high concentration of _____ ions. (H^+ , H_3O^+ , OH^-)

(iv) Potassium sulphite on reacting with hydrochloric acid releases _____ gas. (Cl_2 , SO_2 , H_2S)

(v) The compound formed when ethene reacts with Hydrogen is _____.
(CH_4 , C_2H_6 , C_3H_8)

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

(i) A **chloride** which forms a precipitate that is soluble in excess of ammonium hydroxide, is:

1. Calcium chloride

2. Ferrous chloride

3. Ferric chloride

4. Copper chloride

(ii) If the molecular formula of an organic compound is $C_{10}H_{18}$ it is:

1. alkene

2. alkane
3. alkyne
4. Not a hydrocarbon

(iii) Which of the following is a common characteristic of a **covalent compound**?

1. high melting point
2. consists of molecules
3. always soluble in water
4. conducts electricity when it is in the molten state

(iv) To increase the **pH** value of a neutral solution, we should add:

1. an acid
2. an acid salt
3. an alkali
4. a salt

(v) **Anhydrous iron(III) chloride** is prepared by:

1. direct combination
2. simple displacement
3. decomposition
4. neutralization

(c) Identify the **substance** underlined, in each of the following cases: [5]

- (i) **Cation** that does not form a precipitate with ammonium hydroxide but forms one with sodium hydroxide.
- (ii) The **electrolyte** used for electroplating an article with silver.
- (iii) The **particles** present in a liquid such as kerosene, that is a non-electrolyte.
- (iv) An **organic compound** containing -- COOH functional group.
- (v) A **solid** formed by reaction of two gases, one of which is acidic and the other basic in nature.

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

- (i) Action of cold and dilute Nitric acid on Copper.

- (ii) Reaction of Ammonia with heated copper oxide.
- (iii) Preparation of methane from iodomethane.
- (iv) Action of concentrated sulphuric acid on Sulphur.
- (v) Laboratory preparation of ammonia from ammonium chloride.
- (e) State **one** relevant observation for each of the following reactions: [5]
- (i) Addition of ethyl alcohol to acetic acid in the presence of concentrated Sulphuric acid.
- (ii) Action of dilute Hydrochloric acid on iron (II) sulphide.
- (iii) Action of Sodium hydroxide solution on ferrous sulphate solution.
- (iv) Burning of ammonia in air.
- (v) Action of concentrated Sulphuric acid on hydrated copper sulphate.
- (f) (i) Draw the *structural formula* for each of the following: [5]
1. 2, 3 – dimethyl butane
 2. diethyl ether
 3. propanoic acid
- (ii) From the list of terms given, choose the most appropriate term to match the given description.
- (*calcination, roasting, pulverisation, smelting*)
1. Crushing of the ore into a fine powder.
 2. Heating of the ore in the absence of air to a high temperature.
- (g) (i) Calculate the number of gram atoms in 4.6 grams of sodium (Na = 23). [5]
- (ii) Calculate the percentage of water of crystallization in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
- (H = 1, O = 16, S = 32, Cu = 64)
- (iii) A compound of X and Y has the empirical formula XY_2 . Its vapour density is equal to its empirical formula weight. Determine its molecular formula.
- (h) Match the atomic number 2, 4, 8, 15, and 19 with each of the following: [5]
- (i) A solid non-metal belonging to the third period.
 - (ii) A metal of valency 1.
 - (iii) A gaseous element with valency 2.
 - (iv) An element belonging to Group 2.
 - (v) A rare gas.

Comments of Examiners

- (a)(i) Some candidates wrote only 'ionization' or selected the incorrect term 'electron affinity' indicating that they were confused between ionization energy and electron affinity.
- (ii) Many candidates selected the incorrect example of water or ammonia for a compound that does not have a lone pair of electrons.
- (iii) Majority of the candidates answered correctly. A few chose H^+ or H_3O^+ .
- (iv) A few candidates made mistakes in selecting the gas released.
- (v) Most of the candidates answered correctly. A few gave answers as CH_4 or C_3H_8 .
- (b)(i) Many candidates wrote *calcium chloride* instead of *copper chloride*.
- (ii) *Alkene* or *alkane* was the occasional incorrect answer written by many candidates.
- (iii) Some candidates gave the option of being *always soluble in water* while others mentioned *conducts electricity when it is in molten state*.
- (iv) Most candidates answered correctly. A few candidates selected *an acid* or *an acid salt* indicating that they did not understand the relation between acidity or alkalinity with the pH of the solution.
- (v) Many candidates made the mistake of choosing *decomposition* instead of *direct combination*.
- (c)(i) Some candidates either wrote the symbol of calcium without the charge or gave Cu^{2+} which was an incorrect answer.
- (ii) Many candidates incorrectly named the substance as *silver argentocyanide* instead of *sodium argentocyanide* or named silver nitrate as the electrolyte.
- (iii) Most candidates answered this part correctly.
- (iv) Some candidates wrote *carbonic acid* or *carboxylic group*.
- (v) Most of the candidates answered correctly.

Suggestions for teachers

- Teach students dot diagrams for several compounds, wherein both shared pairs and lone pairs can be thoroughly explained. Highlighting them with colours will establish clarity between covalent bond and coordinate bond.
- Draw the attention of students to the results of dissolving metallic oxides and non-metallic oxides in H_2O so that the formations of OH^- and H^+ ions can be explained.
- Familiarize students to the ways in which acids react differently with sulphites and sulphides and supplement this information with actual practical work.
- Emphasise to students that when alkenes react with hydrogen the number of carbon atoms do not change and substantiate this with reactions using structural formulae.
- Advise students to stick to the options given and to avoid expressing in the formula form. Make them aware of the inability of calcium salt solutions to form precipitate with NH_4OH and that all other salts included in the practical work form precipitates either soluble or insoluble in excess of NH_4OH .
- Develop an understanding of the students to establish the general formulae of hydrocarbons using a number of structural formulae and then test the application of the general formula with various molecular formulae.
- Teach students Introduction to pH scale to test for acidity, neutrality and alkalinity in detail.

- (d)(i) Equation was written with concentrated HNO_3 instead of dilute HNO_3 . NO_2 was given as a product instead of NO . Balancing was incorrect in many cases and some made errors in writing the formula of copper nitrate.
- (ii) Some candidates wrote NO_2 instead of N_2 as the product while in some cases the equation was not balanced correctly.
- (iii) A few candidates represented iodomethane as CH_4I instead of CH_3I and many candidates used molecular state of hydrogen (H_2) instead of nascent hydrogen (H).
- (iv) In some cases, the products were incorrect. Some wrote the reaction of S with concentrated HNO_3 instead of concentrated H_2SO_4 indicating not having read the question carefully.
- (v) Many candidates chose NaOH as the alkali in the laboratory preparation of ammonia instead of $\text{Ca}(\text{OH})_2$.
- (e)(i) Many candidates wrote the equation or named the products or wrote the term *esterification* instead of writing the relevant *observation* of fruity smell.
- (ii) Most candidates answered this part correctly. A few candidates committed errors such as writing the equation or gave the test for SO_2 .
- (iii) Some of the common errors were: *reddish brown precipitate* instead of *dirty green precipitate*. A few candidates mentioned “dirty green ferrous hydroxide” but failed to mention the word precipitate or insoluble compound.
- (iv) Many candidates could not write the correct colour of the flame on burning ammonia.
- (v) Most of the candidates ignored the colour change or the change from the crystalline state to amorphous state and instead mentioned the phenomenon of dehydration or the formation of anhydrous copper sulphate.
- (f)(i) 1. Some candidates did not complete the structure with adequate number of H atoms.
2. Diethyl ether was confused with acetone or ketone group instead of oxygen linking the 2 ethyl groups. Some candidates erred by substituting the ethyl group with methyl group in ether.
3. Condensed formula of the acid group was given by some candidates; others made errors such as linking the C in the carboxylic group with H.

- Explain the differences between covalent and ionic compounds on the basis of the structure and the kind of forces in these compounds and then relate it to a number of examples.
- Allow the students to observe the effects of adding NaOH and NH_4OH to various salts solutions and noting the observations. Also test to ensure that they retain the observations associated with various cations.
- Explain students why silver nitrate, a soluble salt of silver, is not used for electroplating and instead sodium argentocyanide solution is used.
- Terms electrolytes and non-electrolytes should be thoroughly discussed in the class.
- Explain students why ammonia gas reacts with hydrogen chloride gas and how the resulting solid forms dense white fumes.
- Demonstrate to students the evolution of brown gas with conc. HNO_3 in the laboratory. Also show that no such brown gas is evolved with dil. HNO_3 . This will help students in remembering the products as the conditions change from dil. HNO_3 to conc. HNO_3 .
- Teach students tabulating details of a functional group and the related compounds such as symbols of a functional group, its name and names of variety of compounds containing the functional group.
- Explain to students that the reaction between CuO and NH_3 is a redox reaction.
- Demonstrate to students various types of inorganic and organic reactions in the laboratory repeatedly for a long lasting impact.

- (ii) Most of the candidates answered part 1 correctly. In part 2, a small fraction of candidates got confused between *roasting* and *calcination* as they focused on the high temperature mentioned in the question.
- (g)(i) Many candidates could not calculate the number of gram atoms correctly. Many others got confused between the number of gram atoms and number of atoms and ended up calculating number of atoms as $(4.6/23) \times 6.02 \times 10^{23}$.
- (ii) Some candidates made errors in calculating the relative molecular mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ wherein 5 molecules of water were calculated as $5 \times 2 + 16$ instead of $5(2 + 16)$. Another error made was in the calculation of percentage of water of crystallization wherein some candidates forgot to multiply the mass of water by 5.
- (iii) Many candidates got confused between molecular weight and molecular formula.
- (h)(i) Most candidates answered this part correctly. However, a few chose element with atomic number 19 instead of 15 or wrongly identified the element as K instead of phosphorus.
- (ii) Some candidates opted for hydrogen but a vast majority answered this sub-part of the question correctly.
- (iii) Some of the candidates either chose the atomic number 2 or 4 as the gaseous element with valency 2.
- (iv) Most candidates answered correctly. A few gave the answer as 8, which was incorrect.
- (v) Some candidates wrote atomic number 8 for a rare gas.

- Explain students the logic of balancing chemical equations and give adequate practice in writing balanced chemical equations correctly.
- Teach students that conc. sulphuric acid being an oxidizing agent oxidizes S to SO_2 while it itself gets reduced to SO_2 and hence only 2 products formed SO_2 and H_2O .
- Draw attention of the students to the fact that although an alkali reacts with an ammonium salt to release NH_3 , NaOH is not used in the laboratory preparation as it is deliquescent. $\text{Ca}(\text{OH})_2$ is used instead.
- Advise students to record any noticeable changes (colour changes or smell or formation of precipitate etc.) by giving first-hand experience to them in the laboratory.
- Practical work along with frequent testing or quizzing on the results of mixing solutions will help students learning better.
- Ask students to prepare charts of the observations for various chemical reactions, highlighted with appropriate colours/smell etc, to assist them in remembering these results.
- Ask students to prepare a comparative table that includes the name, molecular formula, condensed formula and structural formula of various organic compounds.
- Advise students to prepare charts for various functional groups specified in the syllabus.
- Frequent testing with varied instructions will assist students in dispelling any doubts and bring in clarity.

MARKING SCHEME

Question 1

(a)	<ul style="list-style-type: none"> (i) Ionisation potential (ii) carbon tetrachloride or CCl_4. (iii) OH^- or hydroxyl ions (iv) SO_2 or Sulphur dioxide (v) C_2H_6 or ethane
(b)	<ul style="list-style-type: none"> (i) 4 or Copper chloride or CuCl_2 (ii) 3 or alkyne (iii) 2 or consists of molecules (iv) 3 or an alkali (v) 1 or direct combination
(c)	<ul style="list-style-type: none"> (i) Ca^{2+} or calcium ion (ii) Sodium argentocyanide solution $\text{Na} [\text{Ag}(\text{CN})_2]$ (iii) Free molecules (iv) Carboxylic acid (v) Ammonium chloride or NH_4Cl
(d)	<ul style="list-style-type: none"> (i) $3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 4\text{H}_2\text{O} + 2\text{NO}$ (ii) $3\text{CuO} + 2\text{NH}_3 \rightarrow 3\text{Cu} + 3\text{H}_2\text{O} + \text{N}_2$ (iii) $\text{CH}_3\text{I} + 2(\text{H}) \xrightarrow[\text{Alcohol}]{\text{Zn/Cu}} \text{CH}_4 + \text{HI}$ (iv) $\text{S} + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{H}_2\text{O} + 3\text{SO}_2$ (v) $\text{Ca}(\text{OH})_2 + 2\text{NH}_4\text{Cl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3$
(e)	<ul style="list-style-type: none"> (i) Fruity smell evolved. (ii) Gas with a rotten egg smell evolved. (iii) Dirty green precipitate formed, insoluble in excess NaOH. (iv) Burns with a green flame. (v) Blue crystals turn into white amorphous powder.
(f)	<ul style="list-style-type: none"> (i) 1. <div style="text-align: center; margin-top: 10px;"> $\begin{array}{ccccccc} & & \text{H} & & & & \\ & & & & & & \\ & \text{H} & - \text{C} & - & \text{H} & & \\ & & & & & & \\ & \text{H} & & & \text{H} & \text{H} & \\ & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{C} - \text{H} \\ & & & & & & \\ & \text{H} & & \text{H} & & \text{H} & \\ & & & & & & \\ & & & & \text{H} & - \text{C} & - \text{H} \\ & & & & & & \\ & & & & & \text{H} & \end{array}$ </div>

	<p>2.</p> $\begin{array}{ccccccc} & \text{H} & \text{H} & & \text{H} & \text{H} & \\ & & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{O} & - \text{C} & - \text{C} & - \text{H} \\ & & & & & & \\ & \text{H} & \text{H} & & \text{H} & \text{H} & \end{array}$ <p>3.</p> $\begin{array}{ccccccc} & \text{H} & \text{H} & \text{O} & & & \\ & & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{OH} \\ & & & & & & \\ & \text{H} & \text{H} & & & & \end{array}$ <p>(ii) 1. Pulverisation 2. Calcination</p>
(g)	<p>(i) Number of g-atoms = $\frac{4.6}{23} = 0.2$</p> <p>(ii) Molecular mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} = 64 + 32 + 64 + 5(18) = 250$ % of water of crystallization = $\frac{5 \times 18}{250} \times 100 = 36\%$</p> <p>(iii) $n = \frac{\text{Molecular formula weight}}{\text{Empirical formula weight}} = \frac{2 \times VD}{EFwt} = 2$ \therefore Molecular formula = $2(\text{XY}_2) = \text{X}_2\text{Y}_4$</p>
(h)	<p>(i) $Z = 15$</p> <p>(ii) $Z = 19$</p> <p>(iii) $Z = 8$</p> <p>(iv) $Z = 4$</p> <p>(v) $Z = 2$</p>

SECTION II (40 Marks)

Attempt any four questions from this Section

Question 2

- (a) Arrange the following as per the instruction given in the brackets: [4]
- (i) He, Ar, Ne (*Increasing order of the number of electron shells*)
 - (ii) Na, Li, K (*Increasing Ionisation Energy*)
 - (iii) F, Cl, Br (*Increasing electronegativity*)
 - (iv) Na, K, Li (*Increasing atomic size*)

- (b) State the *type of Bonding* in the following molecules: [2]
- Water
 - Calcium oxide
- (c) Answer the following questions: [2]
- How will you distinguish between Ammonium hydroxide and Sodium hydroxide using copper sulphate solution?
 - How will you distinguish between dilute hydrochloric acid and dilute sulphuric acid using lead nitrate solution?
- (d) Identify the salts **P** and **Q** from the observations given below: [2]
- On performing the flame test salt **P** produces a lilac coloured flame and its solution gives a white precipitate with silver nitrate solution, which is soluble in Ammonium hydroxide solution.
 - When dilute HCl is added to a salt **Q**, a brisk effervescence is produced and the gas turns lime water milky.

When NH_4OH solution is added to the above mixture (after adding dilute HCl), it produces a white precipitate which is soluble in excess NH_4OH solution.

Comments of Examiners

- Some candidates got confused between the symbols '>' and '<'. Hence, the order of the elements was incorrectly written as $\text{He} > \text{Ne} > \text{Ar}$.
 - Na , Li , K , or Li , Na , K were the common errors made by some candidates.
 - Incorrect order was written by a number of candidates.
 - Incorrect answers were given by some candidates.
- Some of the errors made by candidates were, 'coordinate bond' instead of 'covalent bond' in the case of water, indicating that candidates got confused with hydronium ion.
 - Some candidates associated 'covalent bond' with calcium oxide instead of the 'ionic bond'.
- Many candidates could not use the word *precipitate* in the correct place or failed to record the formation of ink blue solution with NH_4OH and instead recorded the formation of deep blue precipitate with excess NH_4OH , without mentioning the blue precipitate of $\text{Cu}(\text{OH})_2$.
 - Many candidates failed to correctly distinguish between dilute HCl and dilute H_2SO_4 as the solubility of white precipitate formed with HCl on

Suggestions for teachers

- Teach students Periodic Properties and variations of Properties (Physical and Chemical) in detail.
- Regular exercises in the application of the knowledge of trends in periodic properties in the periodic table, must be given for practice.
- Teach chemical bonding in detail to the students and dispel the confusion about the coordinate bond in water by showing a comparison between water and hydronium ion using dot diagram and highlighting the shared pairs and lone pairs with colours.
- Explain the importance of practical work to the students.
- Train students to analyse the data given keeping in mind the basic tests for the cations and anions and to present observations in tabular form.

heating was not included and instead, formation of brown NO_2 gas with H_2SO_4 was mentioned which was not possible.

- (d) (i) Many candidates failed to identify the salt as KCl and instead, resorted to guess work.
(ii) Some candidates identified ZnCO_3 correctly while others listed either $\text{Zn}(\text{HCO}_3)_2$ or ZnSO_4 or ZnSO_3 . Some included Pb^{2+} salts as well.

MARKING SCHEME

Question 2

(a)	(i) He, Ne, Ar (ii) K, Na, Li (iii) Br, Cl, F (iv) Li, Na, K
(b)	(i) Covalent bond (ii) Ionic or electrovalent bond
(c)	(i) On adding copper sulphate solution to both, the one that forms a blue precipitate that is insoluble in excess of the reagent is NaOH . The other solution forms a pale blue precipitate that dissolves in excess reagent to form an ink blue solution and this is NH_4OH . (ii) On adding lead nitrate solution to both, they form white precipitate but the one in which the white precipitate disappears on heating is HCl , while in H_2SO_4 , the white precipitate remains insoluble on heating.
(d)	(i) KCl or potassium chloride (ii) ZnCO_3 or Zinc carbonate

Question 3

- (a) Draw an *electron dot diagram* to show the formation of each of the following [4]
compounds:
- (i) Methane
(ii) Magnesium Chloride
[H = 1, C = 6, Mg = 12, Cl = 17]
- (b) State the **observations** at the anode and at the cathode during the electrolysis of: [4]
(i) fused lead bromide using graphite electrodes.

(ii) copper sulphate solution using copper electrodes.

(c) Select the ion in each case, that would get selectively discharged from the aqueous [2] mixture of the ions listed below:

(i) SO_4^{2-} , NO_3^- and OH^-

(ii) Pb^{2+} , Ag^+ and Cu^{2+}

Comments of Examiners

(a) (i) Mistakes were made by many candidates in the dot diagrams.

(ii) Some candidates showed sharing of electrons instead of transfer of electrons between Mg and Cl atoms. Some others forgot to show the charge on each ion.

(b) (i) Several candidates misinterpreted the question and wrote equations instead of the observations at the electrodes. Some candidates did not give appropriate observations such as reddish-brown fumes of bromine and described them as red or orange while the grey deposit of lead was described as greyish white or greyish black deposit. Some others interchanged the electrodes.

(ii) Some candidates did not associate the correct electrodes with the observations given. Others gave equations instead of observations.

(c) (i) Most of the candidates answered this part correctly. A few candidates randomly selected SO_4^{2-} or NO_3^- ions.

(ii) Many candidates incorrectly picked up Cu^{2+} ions.

Suggestions for teachers

- Draw the attention of students to the fact that sharing of electrons cannot include '+' sign or a straight line. The single bonds may be shown in the next step.
- Insist that students show both the transfer of electrons and subsequent formation of positive magnesium (Mg^{2+}) ion and negative chloride (Cl^-) ions.
- Advise students to read questions carefully and understand and remember the appearance of various products at the electrodes during electrolysis.
- Ensure students know the rules for selective discharge of ions at the electrodes (cations & anions).

MARKING SCHEME

Question 3

(a)	<p>(i) $\cdot \overset{\cdot}{\underset{\cdot}{\text{C}}} \cdot + 4\text{H} \times \rightarrow \text{H} \times \overset{\text{H}}{\underset{\times}{\text{C}}} \cdot \times \text{H}$ i.e. CH₄</p> <p>(ii) $\text{Mg} \cdot + \begin{matrix} \times \times \\ \times \text{Cl} \times \\ \times \times \end{matrix} \rightarrow (\text{Mg})^{2+} + 2 \left[\begin{matrix} \times \times \\ \times \text{Cl} \times \\ \times \times \end{matrix} \right] 1^-$</p> <p style="margin-left: 150px;">$\rightarrow \text{MgCl}_2$</p>
(b)	<p>(i) Reddish brown fumes at the anode Silvery grey deposit at the cathode</p> <p>(ii) Size of the anode decreases or anode gets consumed Reddish brown deposit of copper at the cathode.</p>
(c)	<p>(i) OH⁻ ions</p> <p>(ii) Ag⁺ ions</p>

Question 4

- (a) Certain blank spaces are left in the following table and these are labelled as **A**, **B**, **C**, **D** and **E**. Identify each of them. [5]

	Lab preparation of	Reactants used	Products formed	Drying agent	Method of collection
(i)	HCl gas	NaCl + H ₂ SO ₄	A _____	concentrated H ₂ SO ₄	B _____
(ii)	NH ₃ gas	C _____	Mg(OH) ₂ NH ₃	D _____	E _____

- (b) Write balanced chemical equations to show: [3]
- (i) The oxidizing action of concentrated Sulphuric acid on Carbon.
 - (ii) The behavior of H₂SO₄ as an acid when it reacts with Magnesium.
 - (iii) The dehydrating property of concentrated Sulphuric acid with sugar.

- (c) Write balanced chemical equations to show how SO_3 is converted to Sulphuric acid [2] in the *contact process*.

Comments of Examiners

- (a) (i) In this part of the question, blank space A was correctly answered by most candidates. A few ignored the condition 'laboratory preparation' and wrote the products formed as $\text{Na}_2\text{SO}_4 + \text{HCl}$ instead of $\text{NaHSO}_4 + \text{HCl}$.
For the blank space B pertaining to method of collection of HCl gas, many candidates wrote *downward displacement of air*, which was incorrect.
- (ii) For the blank space C, some candidates wrote, ammonium chloride and alkali or $\text{Mg}(\text{NO}_3)_2$ and water instead of Mg_3N_2 and H_2O .
For the blank space D, many candidates wrote slaked lime /Soda lime / concentrated H_2SO_4 instead of quicklime or CaO .
For the blank space E pertaining to method of collection of NH_3 gas, some candidates wrote downward displacement/ downward displacement of water, which were the incorrect answers.
- (b)(i) Most of the candidates either wrote incorrect products or did not balance the equation.
- (ii) Almost all the candidates wrote this equation correctly. A few candidates wrote H_2O instead of H_2 .
- (iii) Many candidates wrote the formula for sugar as $\text{C}_6\text{H}_{12}\text{O}_6$ (glucose) which is incorrect.
- (c)(i) Many candidates forgot the two-step conversion of SO_3 to H_2SO_4 through the formation of oleum and diluting it in the second step; Instead, they treated SO_3 directly with water to get sulphuric acid.

Suggestions for teachers

- Stress on the conditions of temperature $< 2000^\circ\text{C}$ during laboratory preparation of HCl and point out clearly the products formed i.e. NaHSO_4 and HCl.
- Advise students to correlate the knowledge of density and solubility of gases in deciding the method of collection of the gas.
- Familiarise students with the reaction between metal nitride and H_2O yielding metal hydroxide and ammonia. Also draw attention of students to the variation in formula with similar sounding words, like nitride, nitrite and nitrate.
- Acquaint students about the difference in products formed when a metal/metal oxide reacts with an acid.
- Draw students' attention to the basic nature of ammonia and hence the use of a basic drying agent such as quicklime and not an acidic one like concentrated H_2SO_4 .
- Explain clearly the dehydrating action of sulphuric acid and ensure that students differentiate clearly between cane sugar and glucose.
- Explain oxidising action of sulphuric acid in steps for better understanding and recall. This way both products and balancing is taken care of. Also teach them the outcome of adding water to Sulphur trioxide in the Contact process.

MARKING SCHEME

Question 4

(a)	A – NaHSO ₄ + HCl B – upward displacement of air C – Mg ₃ N ₂ + H ₂ O D – Quicklime or CaO E – downward displacement of air
(b)	(i) $C + 2H_2SO_4 \rightarrow CO_2 + 2H_2O + 2SO_2$ (ii) $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$ (iii) $C_{12}H_{22}O_{11} \xrightarrow[H_2SO_4]{Conc.} 12C + 11H_2O$
(c)	(i) $SO_3 + H_2SO_4 \xrightarrow{Conc.} H_2S_2O_7$ (ii) $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

Question 5

- (a) (i) Propane burns in air according to the following equation: [4]
- $$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O.$$
- What volume of propane is consumed on using 1000 cm³ of air, considering only 20% of air contains oxygen?
- (ii) The mass of 11.2 litres of a certain gas at s.t.p. is 24 g. Find the *gram molecular mass* of the gas.
- (b) A gas cylinder can hold 1 kg of hydrogen at room temperature and pressure: [4]
- (i) Find the number of moles of hydrogen present.
- (ii) What weight of CO₂ can the cylinder hold under similar conditions of temperature and pressure? (H= 1, C = 12, O = 16)
- (iii) If the number of molecules of hydrogen in the cylinder is X, calculate the number of CO₂ molecules in the cylinder under the same conditions of temperature and pressure.
- (iv) State the law that helped you to arrive at the above result.
- (c) Write a *balanced chemical equation* for the preparation of each of the following salts: [2]
- (i) Copper carbonate
- (ii) Ammonium sulphate crystals

Comments of Examiners

- (a)(i) Many considered the volume of Oxygen to be 100 cm^3 ; the volume of propane calculated was incorrect as many candidates ignored the statement *20% of air contains oxygen*.
- (ii) Many candidates answered correctly. Some calculated as $(11.2/24) \times 22.4$ which was incorrect.
- (b)(i) Most of the candidates answered this part of the question correctly. A few candidates considered the molecular mass of hydrogen as 1 g and hence the calculation went wrong.
- (ii) Many candidates wrote that weight of CO_2 held in the cylinder under similar conditions of temperature and pressure was 44 kg.
- (iii) While many candidates answered this part correctly, some gave the answer as 6.02×10^{23} .
- (iv) Many candidates wrote the name of the law instead of stating the law.
- (c)(i) Instead of using soluble carbonates such as Na_2CO_3 or K_2CO_3 many candidates used H_2CO_3 .
- (ii) Some candidates erred by choosing either NH_3 or NH_4Cl as reactant in the preparation of ammonium sulphate. Some candidates did not balance the equation correctly.

Suggestions for teachers

- Drill students to identify the law to be applied if the reactants involved are gases.
- Familiarize students with the equivalent correspondence between number of moles, molar mass and molar volume.
- Drill into the minds of the students that the molecular mass is determined from the molecular formula.
- Advise students to read the questions carefully and check the application of the law to the data given correctly.
- Train students to apply Avogadro's law correctly. Ensure students can state the law using the correct terms and conditions.
- Insist on students having knowledge of solubility of salts. Also familiarize the students with the fact that generally all the salts of sodium, potassium and ammonium are soluble and hence titration is employed as a procedure to carry out neutralization reactions.

MARKING SCHEME

Question 5

(a)	(i) Oxygen consumed = $\frac{20}{100} \times 1000 = 200 \text{ cm}^3$ $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$ $1\text{vol} + 5\text{vol} \rightarrow 3\text{vol}$ $? + 200 \text{ cm}^3$ \therefore Volume of propane consumed = $\frac{200}{5} = 40 \text{ cm}^3$
	(ii) 11.2 L of gas at stp weighs 24 g \therefore 22.4 L of gas at stp weighs = $\frac{24 \times 22.4}{11.2} = 48 \text{ g}$
(b)	(i) Number of moles of hydrogen = $\frac{1000}{2} = 500$
	(ii) Mass of $\text{CO}_2 = 500 \times (12 + 32) = 500 \times 44 = 22000 \text{ g} = 22 \text{ kg}$
	(iii) Number of molecules of $\text{CO}_2 = X$
	(iv) According to Avogadro's law, equal volumes of all gases contain the same number of molecules under the same conditions of temperature and pressure.
(c)	(i) Any soluble salt of copper reacted with sodium, potassium or ammonium carbonate solution $\text{CuCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{CuCO}_3 + 2\text{NaCl}$
	(ii) $2\text{NH}_4\text{OH} + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4 + 2\text{H}_2\text{O}$

Question 6

- (a) Give a *balanced chemical equation* for each of the following: [4]
- Action of concentrated Nitric acid on Sulphur.
 - Catalytic oxidation of Ammonia.
 - Laboratory preparation of Nitric acid.
 - Reaction of Ammonia with Nitric acid.
- (b) Identify the *term* or *substance* based on the descriptions given below: [4]
- Ice like crystals formed on cooling an organic acid sufficiently.
 - Hydrocarbon containing a triple bond used for welding purposes.
 - The property by virtue of which the compound has the same molecular formula but different structural formulae.
 - The compound formed where two alkyl groups are linked by $\begin{array}{c} \text{O} \\ || \\ -\text{C}- \end{array}$ group.

(c) Give a *balanced chemical equation* for each of the following:

[2]

- (i) Preparation of ethane from Sodium propionate
- (ii) Action of alcoholic KOH on bromoethane.

Comments of Examiners

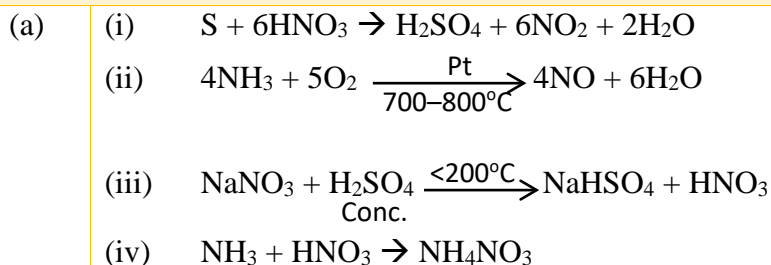
- (a) (i) Some candidates committed common mistakes by writing SO_2 as a product.
- (ii) Many candidates wrote the product as NO_2 instead of NO .
- (iii) Most candidates answered this sub-part correctly. Some candidates recorded the products as NaSO_4 instead of NaHSO_4 .
- (iv) Most of the candidates answered correctly. A few got confused with the formula of ammonia as NH_4 .
- (b) (i) Most of the candidates answered this part correctly. Some candidates failed to associate the word 'glacial' with acetic acid.
- (ii) Many candidates wrote alkyne instead of ethyne or acetylene.
- (iii) Some candidates wrote 'Isotopes' or 'Homologous series' instead of 'Isomerism'.
- (iv) A few candidates referred to the compound as 'Keto group' or 'aldehyde group'.
- (c) (i) Most of the candidates answered this part correctly.
- (ii) In several cases the chemical reaction was written using aqueous KOH instead of with *alcoholic* KOH.

Suggestions for teachers

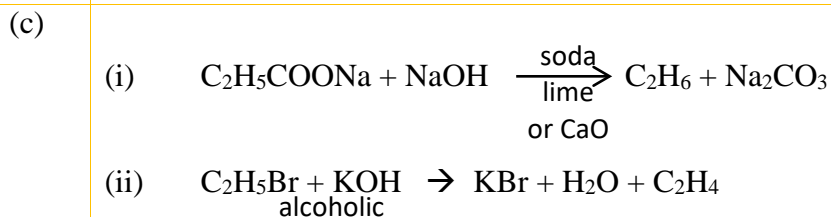
- Explain students that normally Nitrogen is chemically unreactive but it reacts when catalyst such as Pt and a temperature of $700 - 800\text{ }^\circ\text{C}$ is used and gets oxidized to NO .
- Clarify to students the variation in the products of oxidation of ammonia on burning in air and using a catalyst.
- Guide students that NH_3 is basic therefore it reacts with an acid to form neutral salt.
- Familiarise students with the various forms of same organic substances.
- Develop clarity among the various terms in organic chemistry by discussing the meanings of similarly sounding or meaning words.
- Spend adequate time in making the students conversant with various terms and definitions.
- Familiarize students with the various functional groups along with the associated names and reinforce this knowledge with several examples, for practice / drill work.
- Draw the attention of students to the possible errors that they could make while drawing the structural formulae.
- Emphasize the fact that alcoholic KOH is a dehydrohalogenation reaction. Aqueous KOH reaction is a hydrolysis or substitution reaction.

MARKING SCHEME

Question 6



- (b) (i) glacial acetic acid
(ii) acetylene or ethyne
(iii) Isomerism
(iv) Ketone



Question 7

- (a) Name the following: [4]
- The process of coating of iron with zinc.
 - An alloy of lead and tin that is used in electrical circuits.
 - An ore of zinc containing its sulphide.
 - A metal oxide that can be reduced by hydrogen.
- (b) Answer the following questions with respect to the electrolytic process in the extraction of aluminum: [3]
- Identify the components of the electrolyte other than pure alumina and the role played by each.
 - Explain why powdered coke is sprinkled over the electrolytic mixture.
- (c) Complete the following by selecting the correct option from the choices given: [3]
- The metal which does not react with water or dilute H_2SO_4 but reacts with concentrated H_2SO_4 is _____. (Al/Cu/Zn/Fe)

- (ii) The metal whose oxide, which is amphoteric, is reduced to metal by carbon reduction _____. (*Fe/Mg/Pb/Al*)
- (iii) The divalent metal whose oxide is reduced to metal by electrolysis of its fused salt is _____. (*Al/Na/Mg/K*).

Comments of Examiners

- (a) (i) Some candidates answered gave the answer as 'electroplating' which was incorrect.
- (ii) A number of candidates were not able to answer this part correctly.
- (iii) *Zinc sulphide* or *Galena* were written by many candidates instead of *Zinc blende*.
- (iv) Some candidates gave the answer as zinc oxide or oxides of reactive metals such as Aluminum which is incorrect.
- (b) (i) Most of the candidates answered this part correctly.
- (ii) Incomplete answers such as – to prevent burning of electrodes / prevent radiation/ reacts with oxygen, were written by some candidates.
- (c) (i) Many candidates selected an incorrect metal.
- (ii) Several candidates gave the answer as *Al* instead of *Pb*. Candidates seemed to have got confused between Al and Pb as both form amphoteric oxides.
- (iii) Aluminium was incorrectly selected by many candidates, ignoring the instruction of choosing a *divalent metal*.

Suggestions for teachers

- Explain about electrolysis and its applications in detail with examples.
- Tabulate the information about the main composition (main metals) with the important properties and uses of alloys. This would assist students in remembering the details.
- Ask students to commit to memory the names and formulae of important ores of the metals listed in the syllabus.
- Teach activity series thoroughly and give frequent practice.
- Insist on students writing complete answers especially while stating the role played by chemicals.
- Explain to students that although both Al and Pb can form amphoteric oxides, Aluminum being highly electropositive having a strong affinity for oxygen, cannot be reduced by carbon.
- Advise students to refrain from answering in haste and ensure that instructions are read carefully.

MARKING SCHEME

Question 7

- | | |
|-----|--|
| (a) | (i) Galvanizing
(ii) Solder or fuse metal
(iii) Zinc blende
(iv) Copper oxide |
| (b) | (i) Cryolite – lowers the fusion temperature of the electrolyte.
Fluorspar – increases the conductivity of the electrolyte or acts as a solvent.
(ii) to prevent the heat loss from the electrolyte. |
| (c) | (i) Cu or Copper
(ii) Pb or Lead
(iii) Mg or magnesium |

GENERAL COMMENTS

Topics found difficult/ confusing by candidates

- Practical Chemistry and related observations.
- Properties of ionic and covalent compounds.
- Methods of preparation of salts.
- Names of functional groups or their presentation.
- Balancing of chemical equations.
- Drawing of structural formulae.
- Numerical problems based on mole concept and application of Gay Lussac's and Avogadro's Laws.
- Arranging elements of periodic table as per the trends in properties across a period and down a group.
- Identifying substances based on analytical chemistry.
- Selective discharge of ions in electrolysis.

Suggestions for candidates

- Read each question carefully and take note of all the instructions and conditions mentioned in the question.
- When a question demands observations, it is not necessary to identify the substance. Observations could include specific smell or specific colour of precipitate or loss of colour and so on.
- Any distinguishing test must involve only one reagent or test that would give different results with the two substances being distinguished.
- While solving numerical problems, show step by step working.
- While answering questions on periodic table do not try identifying the element unless specified in the question. Writing down the electronic configuration with the atomic numbers known, helps in answering questions on trends in properties across the periodic table.
- Practice drawing dot diagrams and make note of shared pairs and lone pairs.
- Ionic bond formation must include depicting the ions formed with appropriate charges, pattern and with a little understanding, writing chemical equations becomes easy.

- Laws and definitions must be learnt well and reproduced with the correct terms.
- Chemical reactions of compounds must not be learnt in isolation. A comparative study brings forth a pattern and with a little understanding, writing chemical equations becomes easy.
- Practice drawing the structures of organic compounds keeping the tetravalency of carbon in mind and the IUPAC rules for naming.
- Make sure the names of functional groups and the names of compounds in organic chemistry are not confused.
- Reactions without including specific conditions are incomplete and hence these must be included, especially in organic chemistry.
- Knowledge of solubilities of salts is essential especially in deciding the methods of preparation of salts.
- Certain reactions having the same reactants end up having varied products as a result of change in conditions. Such reactions must be noted.
- Solving questions papers of the previous years' examinations will certainly give insights into the kind of questions and help in performing well.
- Avoid selective study and ensure all the topics mentioned in the syllabus are covered, assisted by written work.

QUALITATIVE ANALYSIS

BIOLOGY (SCIENCE PAPER-3)

SECTION I (40 Marks)

Attempt all questions from this Section

Question 1

(a) Name the following: [5]

- (i) The process by which root hairs absorb water from the soil.
- (ii) The organ which produces urea.
- (iii) The kind of lens required to correct Myopia.
- (iv) The pituitary hormone which stimulates contraction of uterus during child birth.
- (v) The international health organization which educates people in accident prevention.

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

- (i) The prime source of chlorofluorocarbons is:
 - A. Vehicular emissions
 - B. Industrial effluents
 - C. Domestic sewage
 - D. Refrigeration equipments
- (ii) Penicillin obtained from a fungus is:
 - A. Antibiotic
 - B. Antiseptic

C. Antibody

D. Antiserum

(iii) Marine fish when placed in tap water bursts because of:

A. Endosmosis

B. Exosmosis

C. Diffusion

D. Plasmolysis

(iv) Surgical method of sterilization in a woman involves cutting and tying of:

A. Ureter

B. Uterus

C. Urethra

D. Oviduct

(v) Synthesis phase in the cell cycle is called so, because of the synthesis of more:

A. RNA

B. RNA and proteins

C. DNA

D. Glucose

(c) The statements given below are *incorrect*. **Rewrite the correct statement** [5]
by changing the underlined words of the statements.

(i) The Graafian follicle, after ovulation turns into a hormone producing tissue called Corpus callosum.

(ii) Deafness is caused due to the rupturing of the Pinna.

(iii) Gyri and Sulci are the folds of Cerebellum.

(iv) Free movement of solutes in and out of the cell takes place across the cell membrane.

(v) The solvent used to dissolve the chlorophyll pigments while testing a leaf for starch is Soda lime.

(d) Given below are sets of five terms each. Rewrite the terms in correct order in a logical sequence. [5]

Example: Large intestine, Stomach, Mouth, Small intestine, Oesophagus.

Answer: Mouth → Oesophagus → Stomach → Small intestine → Large intestine.

(i) Fibrin, Platelets, Thromboplastin, Fibrinogen, Thrombin.

(ii) Cochlea, Malleus, Pinna, Stapes, Incus.

(iii) Receptor, Spinal cord, Effector, Motor neuron, Sensory neuron.

(iv) Uterus, Parturition, Fertilisation, Gestation, Implantation.

(v) Caterpillar, Snake, Owl, Frog, Green leaves.

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

(i) Aqueous humour, Vitreous humour, Iris, Central canal

(ii) Formalin, Iodine, DDT, Lime

(iii) ACTH, TSH, ADH, FSH

(iv) Phosphate, RNA, Sugar, Nitrogenous base

(v) Bile, Urea, Uric acid, Ammonia

(f) Given below are groups of terms. In each group the first pair indicates the relationship between the two terms. Rewrite and complete the second pair on a similar basis. [5]

Example: Oxygen : Inspiration : : Carbondioxide : Expiration

(i) Eye : Optic nerve : : Ear : _____

(ii) Cytoplasm : Cytokinesis : : Nucleus : _____

(iii) TT : Homozygous : : Tt : _____

(iv) Foetus : Amnion : : Heart : _____

(v) Adenine : Thymine : : Cytosine : _____

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

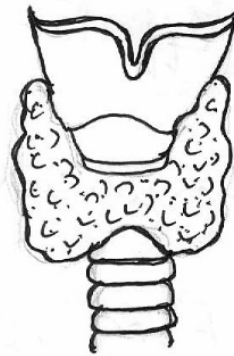
Column A

1. Sacculus
2. Birth rate
3. DNA and histones
4. Euro norms
5. Diabetes mellitus

Column B

- dynamic body balance
- Hyperglycemia
- Hypoglycemia
- Natality
- static body balance
- vehicular standards
- nucleosome

- (h) The diagram given below represents the location and structure of an endocrine gland. Study the same and answer the questions that follow: [5]



- (i) Name the endocrine gland shown in the diagram.
- (ii) Name the secretion of the gland which regulates basal metabolism.
- (iii) Name the mineral element required for the synthesis of the above mentioned hormone.
- (iv) Name the disease caused due to under secretion of the above mentioned hormone in children.
- (v) Name the disease caused due to hypersecretion of the above mentioned hormone.

Comments of Examiners

- (a) (i) Most candidates wrote the correct answer. 'Inhibition' was written as an incorrect answer by some candidates.
- (ii) Most candidates answered correctly. A few wrote 'kidney' instead of 'liver'.
- (iii) The name of the lens was correctly written by most of the candidates.
- (iv) Many candidates answered correctly, but in several scripts spelling errors were noticed.
- (v) Some candidates wrote 'WHO' instead of 'Red Cross'.
- (b) (i) Most candidates wrote the correct answer. A few wrote 'vehicular emissions' instead of 'refrigeration equipments'.
- (ii) Most candidates answered correctly.
- (iii) Some candidates were confused between 'endosmosis' and 'exosmosis'.
- (iv) Most candidates answered correctly the surgical method of sterilization in a woman.
- (v) Most candidates were unsure of the correct option.
- (c) (i) (iii) Most of the candidates wrote the correct answer.
- (iv) A few candidates wrote 'semi permeable membrane' as the incorrect answer.
- (v) Most of candidates wrote 'iodine' instead of 'alcohol'.
- (d) (i) (iv) Many candidates misplaced the terms and hence could not write the correct logical sequence.
- (v) In the given set of terms, most candidates were able to write the correct order.

Suggestions for teachers

- Stress upon learning the correct spellings of biological terms.
- While teaching the lesson on brain, stress on the structure and functions of Cerebrum, Cerebellum and medulla oblongata.
- The concept of endosmosis and exosmosis using hypotonic and hypertonic solution must be taught in laboratory with the help of practical experiments.
- Differentiate clearly between Corpus callosum and corpus luteum, disinfectant and antiseptic.
- Significance of semipermeable membrane in osmosis should be stressed upon.
- Appropriate biological terms should be used to show difference between the permeability of cell wall and cell membrane.
- Teach students the lesson on pollution keeping in mind the various pollutants, their sources, the effect on environment and ways and means to curb them.
- Explain the symptoms of Diabetes mellitus clearly to eliminate confusion regarding hyperglycemia and hypoglycaemia.

- (e) (i) The odd term was identified correctly by most candidates but the category was vague and mentioned as 'eye' in several cases.
(ii) Most candidates were confused whether DDT was an antiseptic or a disinfectant.
(iii) Most of the candidates chose the correct odd term and named the category correctly.
(iv) Some candidates wrote 'nucleosome' instead of 'nucleotide'.
(v) Many candidates identified the odd term as 'Ammonia' instead of 'Bile'.
- (f) (i) (v) Most candidates wrote the correct relationship between the terms. A few were unable to spell Guanine correctly.
- (g) (i) (v) Most candidates wrote the correct matching pairs. Some were confused with the function of Saccules.
- (h) (i) The endocrine gland shown in the diagram was correctly named by most candidates.
(ii) Most of the candidates answered this part correctly.
(iii) A large number of candidates were able to attempt this part correctly. A few wrote 'calcium' instead of 'Iodine'.
(iv) Only a few candidates wrote the correct answer. Majority of them were confused between Cretinism and Myxoedema.
(v) Many candidates wrote an explanation of the disease instead of its name.

MARKING SCHEME

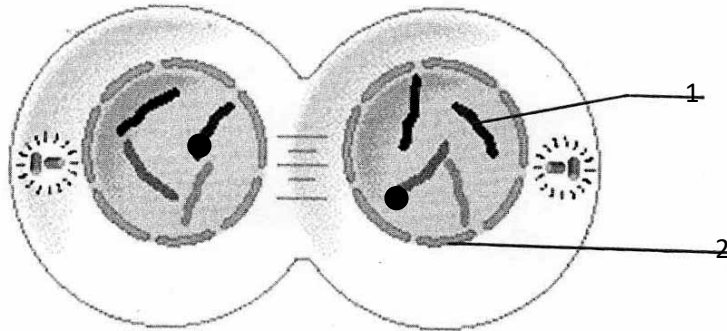
Question 1

(a)	Name the following: (i) Endosmosis (ii) Liver (iii) Concave (iv) Oxytocin (v) Red Cross
(b)	Choose the correct answer: (i) D. Refrigeration equipments (ii) A. Antibiotic (iii) A. Endosmosis (iv) D. Oviduct (v) C. DNA
(c)	Correct Statements: (i) Corpus luteum (ii) Ear drum (iii) Cerebrum (iv) Cell wall (v) Methylated spirit / alcohol

(d)	<p>Terms in logical sequence:</p> <p>(i) Platelets → Thromboplastin → Thrombin → Fibrinogen → Fibrin</p> <p>(ii) Pinna → Malleus → Inus → Stapes → Cochlea</p> <p>(iii) Receptor → Sensory neuron → Spinal cord → Motor neuron → Effector</p> <p>(iv) Fertilisation → Uterus → Implantation → Gestation → Parturition</p> <p>(v) Green leaves → Caterpillar → Frog → Snake → Owl</p>															
(e)	<p>Odd term and category:</p> <p>(i) Odd term – Central Canal Category – Parts of eye</p> <p>(ii) Odd term – Iodine Category – Disinfectants</p> <p>(iii) Odd term – ADH Category – Hormones of Anterior lobe of Pituitary gland</p> <p>(iv) Odd term – RNA Category – Parts of Nucleotide</p> <p>(v) Odd term – Bile Category – Nitrogenous wastes / Excretory substances</p>															
(f)	<p>Words of second pair:</p> <p>(i) Auditory nerve</p> <p>(ii) Karyokinesis</p> <p>(iii) Heterozygous</p> <p>(iv) Pericardium</p> <p>(v) Guanine</p>															
(g)	<p>Matching pairs:</p> <table border="0"> <tbody> <tr> <td>1. Sacculus</td> <td>—</td> <td>Static body balance</td> </tr> <tr> <td>2. Birth rate</td> <td>—</td> <td>Natality</td> </tr> <tr> <td>3. DNA and histones</td> <td>—</td> <td>Nucleosome</td> </tr> <tr> <td>4. Euronorms</td> <td>—</td> <td>Vehicular standards</td> </tr> <tr> <td>5. Diabetes mellitus</td> <td>—</td> <td>Hyperglycemia</td> </tr> </tbody> </table>	1. Sacculus	—	Static body balance	2. Birth rate	—	Natality	3. DNA and histones	—	Nucleosome	4. Euronorms	—	Vehicular standards	5. Diabetes mellitus	—	Hyperglycemia
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(h)	<p>(i) Thyroid</p> <p>(ii) Thyroxine</p> <p>(iii) Iodine / I₂ / I</p> <p>(iv) Cretinism</p> <p>(v) Exophthalmic goitre</p>															

Question 2

- (a) Study the diagram given below which represents a stage during the mitotic cell division and answer the questions that follow: [5]



- (i) Identify the stage giving suitable reasons.
 - (ii) Name the parts numbered 1 and 2.
 - (iii) What is the technical term for the division of nucleus?
 - (iv) Mention the stage that comes before the stage shown in the diagram. Draw a neat labelled diagram of the stage mentioned.
 - (v) Which is the cell division that results in half the number of chromosomes in daughter cells?
- (b) Differentiate between the following pairs on the basis of what is mentioned in brackets: [5]
- (i) Active Transport and Diffusion [*significance in plants*]
 - (ii) Demography and Population density [*Definition*]
 - (iii) Antibiotic and Antibody [*Source*]
 - (iv) Renal cortex and Renal medulla [*Parts of the nephrons present*]
 - (v) NADP and ATP [*Expand the abbreviation*]

Comments of Examiners

- (a)(i) Majority of candidates could identify the stage correctly but could not give valid reasons.
- (ii) Most candidates answered correctly. Some candidates labelled nuclear membrane as cell membrane.
- (iii) Most candidates answered correctly the technical term for the division of nucleus.
- (iv) Most candidates were unsure of the sequence of mitotic stages. They drew metaphase instead of telophase. Many of them did not draw the required number of chromosomes.
- (v) This part of the question was answered correctly by most candidates.
- (b)(i) Most candidates wrote the definitions of active transport and diffusion instead of their significance in plants.
- (ii) Many candidates defined 'demography' correctly but the definition of 'population density' was incomplete.
- (iii) A number of candidates were vague in writing the source of antibody. They wrote 'WBC' instead of 'lymphocytes'.
- (iv) This part of the question was answered correctly by majority of the candidates.
- (v) Most candidates were unable to expand the abbreviation NADP.

Suggestions for teachers

- Emphasise on the definite functions of each type of WBC.
- Give practice to students on the diagram of a vertical section of kidney and the arrangement of nephrons in it.
- Train students to clearly distinguish between Chromosome and Chromatid.
- Draw attention of the students towards the significance of diffusion, osmosis and active transport.
- Written practice must be given for definitions, emphasizing on operative terms.
- Advise students to use simple and short sentences to convey their answers.
- Make a list of all the biological abbreviations related to the syllabus.

MARKING SCHEME

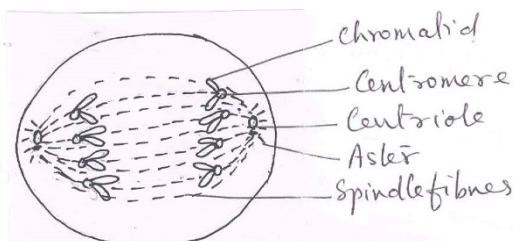
Question 2

(a) (i) Telophase. Nuclear membrane reappears / Spindle fibres disappears / Cytokinesis begins / Chromatids become thin / daughter nuclei are formed. (Any one)

(ii) 1 – Chromosome
2 – Nuclear membrane

(iii) Karyokinesis

(iv) Anaphase



Chromosomes moving towards the poles.

One labelling / Correct No. of Chromosomes.

(v) Meiosis

(b) (i) Active Transport – To absorb mineral ions from soil.

Diffusion – To take in carbon dioxide for photosynthesis and oxygen for respiration /
Removal of Water vapour during transpiration / attract insects for pollination by spreading fragrance of flowers.

(ii) Demography – Statistical study of human population with reference to size, density and distribution.

Population density – Number of individuals per square km at any given time.

(iii) Antibiotic – Micro organisms

Antibody – Lymphocytes

(iv) Renal Cortex – Malpighian capsule, Proximal and distal convoluted tubules

Renal medulla – Loop Henle, Collecting ducts

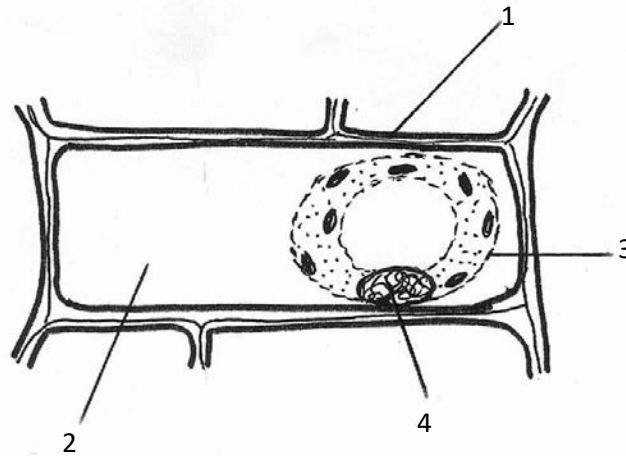
(v) NADP – Nicotinamide Adenine Dinucleotide Phosphate

ATP – Adenosine Tri Phosphate

Question 3

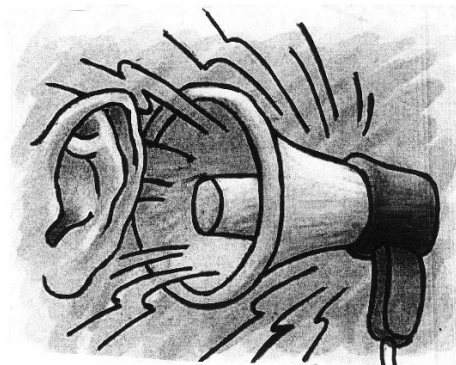
- (a) The diagram given below represents a plant cell after being placed in a strong sugar solution. Study the diagram and answer the questions that follow:

[5]



- (i) What is the state of the cell shown in the diagram?
- (ii) Name the structure that acts as a selectively permeable membrane.
- (iii) Label the parts numbered 1 to 4 in the diagram.
- (iv) How can the above cell be brought back to its original condition? Mention the scientific term for the recovery of the cell.
- (v) State any two features of the above plant cell which is not present in animal cells.
- (b) Given below is a representation of a kind of pollution. Study the same and answer the questions that follow:

[5]



- (i) Name the kind of pollution.

- (ii) List any three common sources of this pollution.
- (iii) Mention three harmful effects of this pollution on human health.
- (iv) Explain the term 'Pollutant'.
- (v) Name two soil pollutants.

Comments of Examiners

- (a) (i) Majority of the candidates mentioned the process instead of the state of cell.
- (ii) Many candidates were unsure of the part of the cell which is selectively permeable.
- (iii) Most of the candidates labelled the diagram correctly. A few wrote 'space' instead of 'strong sugar solution' for the part numbered '2' in the diagram.
- (iv) Some candidates did not mention the term 'deplasmolysis' for the recovery of the cell.
- (v) Most of the candidates answered correctly the two features of the plant cell shown in the diagram.
- (b) Sub-parts (i), (ii), and (iii) were answered correctly by all candidates.
- (iv) Most candidates wrote incomplete explanation for the term 'Pollutant'.
- (v) Most candidates could name two soil pollutants correctly.

Suggestions for teachers

- Teach students physiological processes in plants and the related experiments with a clear understanding of the aim of the experiment.
- In the laboratory, show students the changes observed in the state of the cell when placed in hypertonic and hypotonic solutions.
- Train students to be specific and to give clear and complete answers.
- Draw diagrams on the blackboard to help students assimilate and develop the required skill.
- Stress upon drawing accurate, neat and well labelled diagrams.

MARKING SCHEME

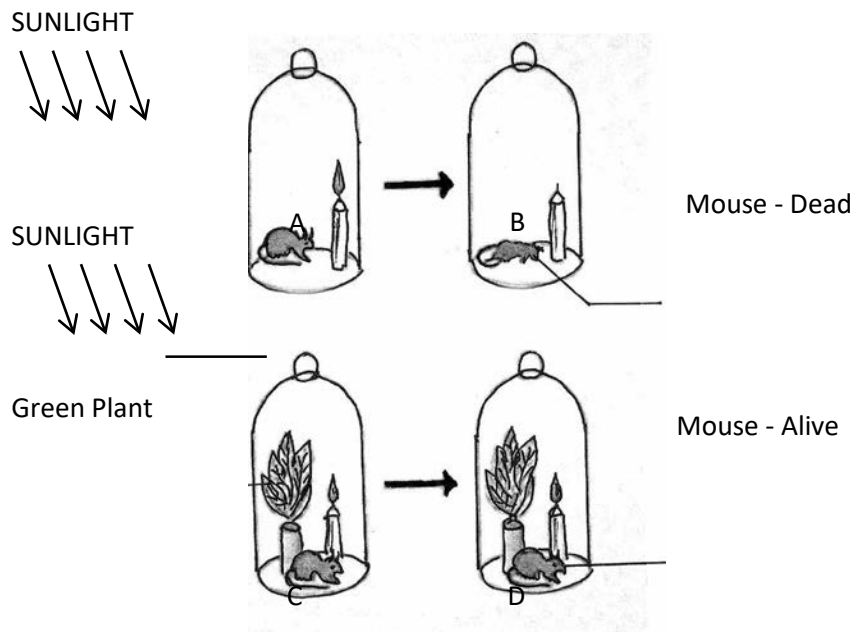
Question 3

- | | |
|-----|---|
| (a) | (i) Flaccid / Plasmolysed |
| | (ii) Plasma membrane |
| | (iii) 1. Cell wall |
| | 2. Strong sugar solution |
| | 3. Cell membrane |
| | 4. Nucleus |
| | (iv) Keeping the cell in tap water / hypotonic solution |

	Deplasmolysis (v) Cell wall, Chloroplasts, large vacuole (Any two)
(b)	(i) Noise pollution (ii) Loudspeaker, Television, Radio, Loud conversation, Musical bands, etc (Any three) (iii) Loss of concentration, disturbs sleep, damage to eardrum, deafness, irritability, etc. (Any three) (iv) Any constituent when added to the environment / air, water or land deteriorates its natural quality. (v) Industrial wastes, Fertilizers, domestic wastes, Plastics, Pesticides, Biomedical wastes, etc. (Any two)

Question 4

- (a) The diagrams given below represent the relationship between a mouse and a physiological process that occurs in green plants. Study the diagrams and answer the questions that follow: [5]



- Name the physiological process occurring in the green plant that has kept the mouse alive.
- Explain the physiological process mentioned above.
- Why did the mouse die in bell jar **B**?
- What is the significance of the process as stated in (i) for life on earth.

(v) Represent the above mentioned physiological process in the form of a chemical equation.

(b) Mention the exact location of the following:

[5]

(i) Prostate gland

(ii) Myelin sheath

(iii) Islets of Langerhans

(iv) Semi-circular canals

(v) Eustachian tube

Comments of Examiners

(a) (i) Most candidates wrote this process to be 'respiration' because of the presence of a mouse.

(ii) Many candidates identified the process and explained it correctly.

(iii) Most candidates did not relate photosynthesis to respiration.

(iv) This sub-part was correctly answered by most candidates.

(v) Majority of the candidates wrote the correct chemical equation, however, a few did not mention the factors.

(b) (i) Most candidates were unable to give the exact location of the prostate gland.

(ii) Many candidates answered correctly. A few mentioned it as 'around the neuron' instead of it surrounds the axon of neuron'. Sub-parts (iii), (iv) and (v) were answered correctly by most candidates.

Suggestions for teachers

- Make use of charts, models and interactive smart boards to explain the parts of eye and ear.
- Acquaint students with the exact location of endocrine glands, the hormones secreted by them and their importance.
- Stress upon prepositions like 'in, on, between, around' while stating the exact location of organs and structures.
- Advise students to read the questions carefully before answering.
- Experiments must be set up to enable students to identify the factors necessary for photosynthesis.
- Explain to the students the location and role of the male accessory glands clearly.

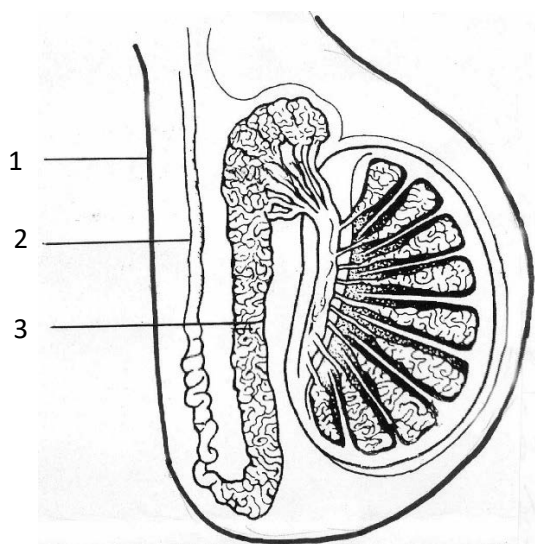
MARKING SCHEME

Question 4

- (a)
- (i) Photosynthesis
 - (ii) It is a process by which plant cells containing chlorophyll prepare food / glucose from CO_2 and water using sunlight.
 - (iii) O_2 was used up by the burning candle. Mouse dies due to lack of oxygen / asphyxiation.
 - (iv) – Provides food for all organisms
– Provides O_2 for respiration.
 - (v) $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$
- (b)
- (i) Surrounds urethra close to its origin from urinary bladder.
 - (ii) Surrounds the axon of neuron.
 - (iii) In Pancreas
 - (iv) Inner ear / Part of the membranous labyrinth
 - (v) Connects middle ear to throat.

Question 5

- (a) The diagram shown below is the longitudinal section of a testis of man. Study it carefully and answer the questions that follow: [5]



- (i) Label the parts numbered 1 to 3 in the diagram.

- (ii) In which part of the testis are the sperms produced?
- (iii) State the functions of the parts labelled 1 and 3 in the diagram.
- (iv) Name the cells that secrete Testosterone.
- (v) Draw a neat, labelled diagram of a sperm.
- (b) Give biological reasons for the following statements: [5]
- (i) Some women have facial hair like beard and moustache.
- (ii) Cutting of trees should be discouraged.
- (iii) In some xerophytes leaves are modified into spines.
- (iv) There is frequent urination in winter than in summer.
- (v) The left ventricle of the heart has a thicker wall than the right ventricle.

Comments of Examiners

- (a) (i) Majority of candidates were able to label the parts asked in the diagram.
- (ii) Most candidates could name the part of the testis in which sperms are produced.
- (iii) Many candidates could not relate temperature regulation, storage and maturation of sperms to the functions of scrotum and epididymis.
- (iv) Most candidates answered this sub-part correctly.
- (v) The diagram of a sperm was largely drawn and labelled correctly.
- (b) (i) Few candidates could attempt this sub-part correctly. 'Overgrowth or over secretion of cortisones' was missing in most answers.
- (ii) A number of candidates were able to explain the biological reason for the statement 'cutting of trees should be discouraged'.
- (iii) Most of the candidates answered correctly.
- (iv) Many candidates did not relate the concept of sweat formation to urine output.
- (v) Most candidates answered this sub-part only partially. The reason for thickening of the right ventricle was missing in many answers.

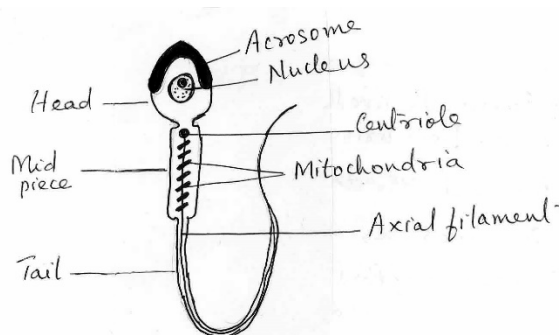
Suggestions for teachers

- Explain the importance of drawing neat, labelled, and accurate diagrams.
- Urine output in different seasons must be taught clearly and the effect of diuretics must also be discussed.
- Students must be familiarised with the location and function of the different parts of testis.
- Construct similar questions in Unit Tests and Term Examinations for practice and clarify the possible errors.
- Teach students to reason out practical examples in daily life related to the environment.

MARKING SCHEME

Question 5

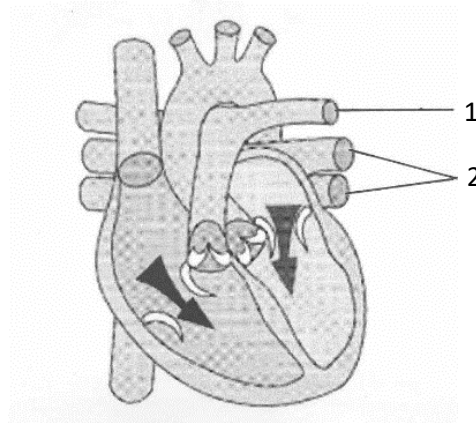
- (a)
- (i) 1. Scrotum / Scrotal sac
2. Sperm duct / Vas deferens
3. Epididymis
 - (ii) Seminiferous tubules
 - (iii) 1. maintains a temperature of 2 to 3° C less than body temperature for the maturation of sperms.
3. Stores the sperms till they become mature.
 - (iv) Ley dig cells / Interstitial cells
 - (v)



- (b)
- (i) Overgrowth of Adrenal Cortex and more secretion of Cortisones stimulates development of certain male characteristics.
 - (ii) – Contribute to bringing rain
– Provide O₂ for breathing
– Natural homes for wild animals
– Can result in soil erosion, droughts, flash floods. (Any two)
 - (iii) – To reduce the surface area exposed to sunlight, number of stomata are reduced.
– To prevent excessive transpiration.
 - (iv) Sweat glands are less active in winter, all the excess water in the body has to be eliminated as urine by the kidneys.
 - (v) Left ventricle has to pump blood till our toes and to the head against gravity. So its walls are thicker. Right ventricle has thinner walls because it pumps blood only upto the lungs.

Question 6

- (a) The diagram given below represents a section of the human heart. Answer the questions that follow: [5]



- (i) Which parts of heart are in the diastolic phase? Give a reason to support your answer.
- (ii) Label the parts numbered 1 and 2 in the diagram. What type of blood flows through them?
- (iii) What causes the heart sounds 'LUBB' and 'DUP'?
- (iv) Name the blood vessels that supply oxygenated blood to the heart muscles.
- (v) Draw neat labelled diagrams of a cross section of an artery and a vein.
- (b) Give appropriate **biological / technical** terms for the following: [5]
- (i) The type of immunity that exists in our body due to our genetic makeup.
- (ii) The suppressed allele of a gene.
- (iii) The accessory gland in human males whose secretion activates the sperms.
- (iv) An apparatus that measures the rate of water uptake in a cut shoot due to transpiration.
- (v) The kind of twins formed from two fertilised eggs.
- (vi) A pair of corresponding chromosomes of the same size and shape, one from each parent.
- (vii) The mild chemical substance which when applied on the body kills germs.

- (viii) The type of waste generated in hospitals and pathological laboratories.
- (ix) The antiseptic substance in tears.
- (x) Cellular components of blood containing haemoglobin.

Comments of Examiners

- (a) (i) Most candidates identified the parts of the heart in diastolic phase but many of them could not give a reason to support the answer.
- (ii) Many candidates were confused in labelling the parts numbered 1 and 2 and the type of blood flowing in them.
- (iii) The causes, the heart sounds 'LUBB' and 'DUB' was answered correctly by most candidates.
- (iv) Majority of the candidates named the blood vessels that supply oxygenated blood to heart muscles correctly.
- (v) Several errors were noticed in drawing the cross section of an artery and a vein, their labelling and the size of lumen.
- (b) (i)-(ii) These sub parts were correctly answered by most candidates.
- (iii) Some candidates wrote 'Prostate gland' instead of 'Seminal Vesicles'.
- (iv)-(viii) Most candidates answered correctly.
- (ix) Most candidates wrote 'lysosome' instead of 'lysozyme'.
- (x) Most candidates could give the correct biological term for the cellular components of blood containing haemoglobin.

Suggestions for teachers

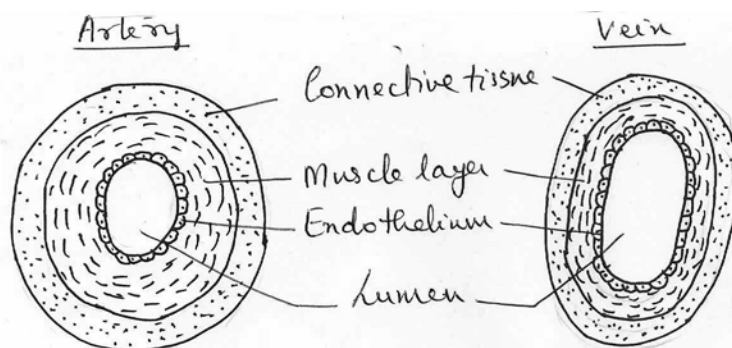
- Give the technical terms for contraction and relaxation of heart and explain their importance.
- Regular practise of diagrams showing cross sections of artery, vein and capillary to be done in class. Structural differences between them to be stressed upon.
- Train students to draw a simple sketch of the heart, to learn the right and left side of the heart, position of valves and the blood vessels entering and leaving the heart.

MARKING SCHEME

Question 6

- (a) (i) Ventricles
Tricuspid and Bicuspid valves are open / semilunar valves are closed.
- (ii) 1. Pulmonary artery, Deoxygenated blood.
2. Pulmonary veins, Oxygenated blood.
- (iii) LUBB – Closure of Tricuspid and bicuspid valves.
DUP – Closure of semilunar valves
- (iv) Coronary arteries

(v)



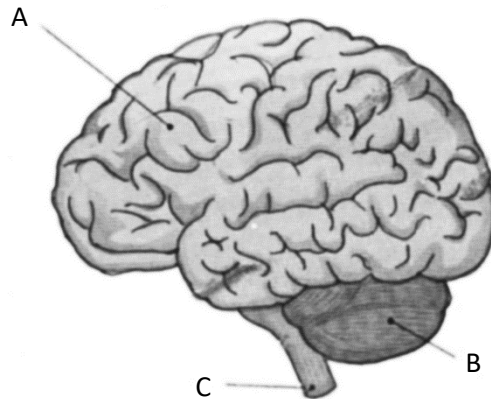
Difference in the size of lumen and thickness of muscle layer

(Any two labelling).

- (b) (i) Innate / Inborn / Natural
(ii) Recessive
(iii) Seminal vesicles
(iv) Potometer
(v) Fraternal
(vi) Homologous chromosomes
(vii) Antiseptic
(viii) Biomedical waste
(ix) Lysozyme
(x) RBCs / Erythrocytes

Question 7

- (a) In a homozygous pea plant, axial flowers (**A**) are dominant over terminal flowers (**a**). [5]
- (i) What is the phenotype and genotype of the **F₁** generation if a plant bearing pure axial flowers is crossed with a plant bearing pure terminal flowers?
 - (ii) Draw a Punnett square board to show the gametes and off springs when both the parent plants are heterozygous for axial flowers.
 - (iii) What is the phenotypic ratio and genotypic ratio of the above cross shown in (ii).
 - (iv) State Mendel's Law of Dominance.
 - (v) Name two genetic disorders commonly seen in human males.
- (b) The diagram given below is an external view of the human brain. Study the same and answer the questions that follow: [5]



- (i) Name the parts labelled A, B and C in the diagram.
- (ii) State the main functions of the parts labelled A and B.
- (iii) What are the structural and functional units of the brain? How are the parts of these units arranged in A and C?
- (iv) Mention the collective term for the membranes covering the brain.
- (v) What is the function of Cerebrospinal fluid?

Comments of Examiners

- (a) (i) Most candidates answered correctly. However, a few mentioned heights of plants instead of the position of flowers.
 (ii) This sub part of the question was correctly answered by most candidates.
 (iii) The phenotypic ratio and genotypic ratio asked in the question was answered correctly by most candidates.
 (iv) Majority of candidates answered correctly but a few wrote the second or third law of Mendel.
 (v) The sub part was answered correctly by most candidates.
- (b) (i) Most candidates labelled cerebrum and cerebellum correctly. A few labelled the 'spinal cord' as 'medulla oblongata'.
 (ii) The main functions of the parts labelled A and B were stated correctly by majority of the candidates.
 (iii) Most candidates were confused with the arrangement of neurons in the cerebrum and the spinal cord.
 (iv) Most candidates could name the collective term for the membranes covering the brain.
 (v) The function of cerebrospinal fluid was answered correctly by most candidates.

Suggestions for teachers

- Give a clear understanding of technical terms like Phenotype, Genotype, Genotypic ratio, Phenotypic ratio, etc.
- Train students to understand and state Mendel's laws in simple words, giving importance to operative words.
- Stress on the difference between monohybrid and dihybrid cross, F₁ and F₂ generations.
- Explain the structure of brain and the immediate emerging part of the brain, the medulla oblongata which continues down as the spinal cord.
- Give a number of examples on monohybrid cross for practise.
- Make the study of genetics simple and clear.

MARKING SCHEME

Question 7

- (a) (i) Phenotype – All bear axial flowers
 Genotype – All are heterozygous dominant for axial flowers.
- (ii)
- | | | |
|---|----|----|
| | A | a |
| A | AA | Aa |
| a | Aa | aa |
- (iii) Phenotypic ratio – 3 : 1
 Genotypic ratio – 1 : 2 : 1

	<p>(iv) Law of Dominance : Out of a pair of contrasting characters, only one is able to express while the other remains suppressed.</p> <p>(vi) Colour blindness, Haemophilia, Pattern baldness. (<i>Any two</i>)</p>
(b)	<p>(i) A – Cerebrum B – Cerebellum C – Spinal Cord</p> <p>(ii) A – Seat of memory, intelligence, consciousness, will power, control voluntary actions, helps us to think, reason, invent, plan (<i>Any one</i>) B – Maintains body balance, posture, equilibrium, co-ordinates muscular activities (<i>Any one</i>)</p> <p>(iii) Neurons / nerve cells A – Outer grey matter has cytons and inner white matter has axons. C – Outer white matter has axons and inner grey matter has cytons.</p> <p>(iv) Meninges</p> <p>(v) Protects the brain / spinal cord from injuries and shocks.</p>

GENERAL COMMENTS

Topics found
difficult /
confusing by
candidates

- Distinction between Myopia and Hyperopia and their correction.
- Medulla Oblongata from spinal cord.
- Monohybrid and Dihybrid cross.
- Activities of WHO and Red Cross.
- Functions of WBCs.
- Male Accessory glands – location and functions.
- Parts of Membranous labyrinth.
- Nuclear changes in Mitosis.
- Brain and Spinal cord with reference to arrangement of neurons.
- Plasmolysed cell – Labelling and causes.
- Arrangement of terms in logical sequence.
- Identifying odd term and mentioning the category of the rest.
- Tonicity of solution and its effect on cells.
- Biological abbreviations and expansions.
- Internal structure of human heart and its working.
- Structural differences between artery and vein.
- Types of immunity.
- Mendel's Laws.



**Suggestions
for
candidates**

- Read the scope and syllabus prescribed for Biology.
- Repeated revision of topics will help in better understanding of concepts.
- Maintain a list of abbreviations related to your syllabus.
- Practise drawing neat, 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 questions as per the rubrics and plan and organise your thoughts.
- Mark the four questions you know best in Section II.
- Follow carefully the instructions given for each question.
- Write the correct question number before answering.
- Be methodical and organised while answering. Do not separate the sub-sections of a question.
- Handwriting must be neat and legible.
- Do not attempt more questions than asked for in the question paper.
- Go through your answers carefully and check for mistakes in terms of spellings or expression.
- Do not be in a hurry to conclude an answer. Never omit any part of a question.
- Practise writing the overall balanced equation for Photosynthesis.
- Revise your answers thoroughly after completion so as to eliminate errors or terms/words missed out.