

# Analysis of Pupil Performance

# Year 2017 Examination

# ICSE

# SCIENCE



*Research Development and Consultancy Division*

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

**Year 2017**

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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](http://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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	<b>Page No.</b>
<b><i>FOREWORD</i></b>	<b><i>i</i></b>
<b><i>PREFACE</i></b>	<b><i>ii</i></b>
<b>INTRODUCTION</b>	<b>1</b>
<b>QUANTITATIVE ANALYSIS – SCIENCE</b>	<b>3</b>
<b>QUALITATIVE ANALYSIS</b>	
▪ <b>Physics (Science Paper-1)</b>	<b>10</b>
▪ <b>Chemistry (Science Paper-2)</b>	<b>29</b>
▪ <b>Biology (Science Paper-3)</b>	<b>51</b>

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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.

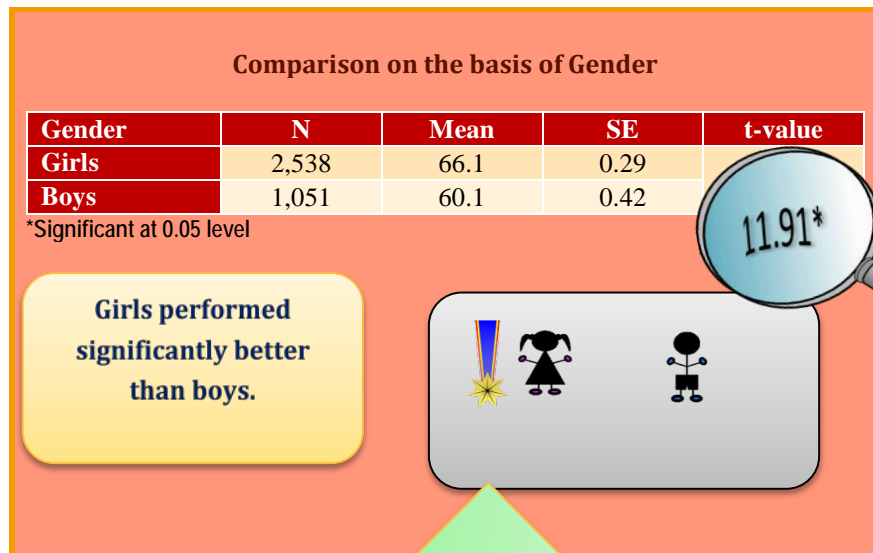
## Understanding the tables

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.



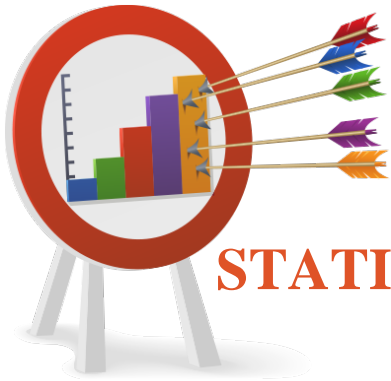
The table shows comparison between the performances of boys and girls in a particular subject. The t-value of 11.91 is significant at 0.05 level (mentioned below the table) with a mean of girls as 66.1 and that of boys as 60.1. It means that there is significant difference between the performance of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

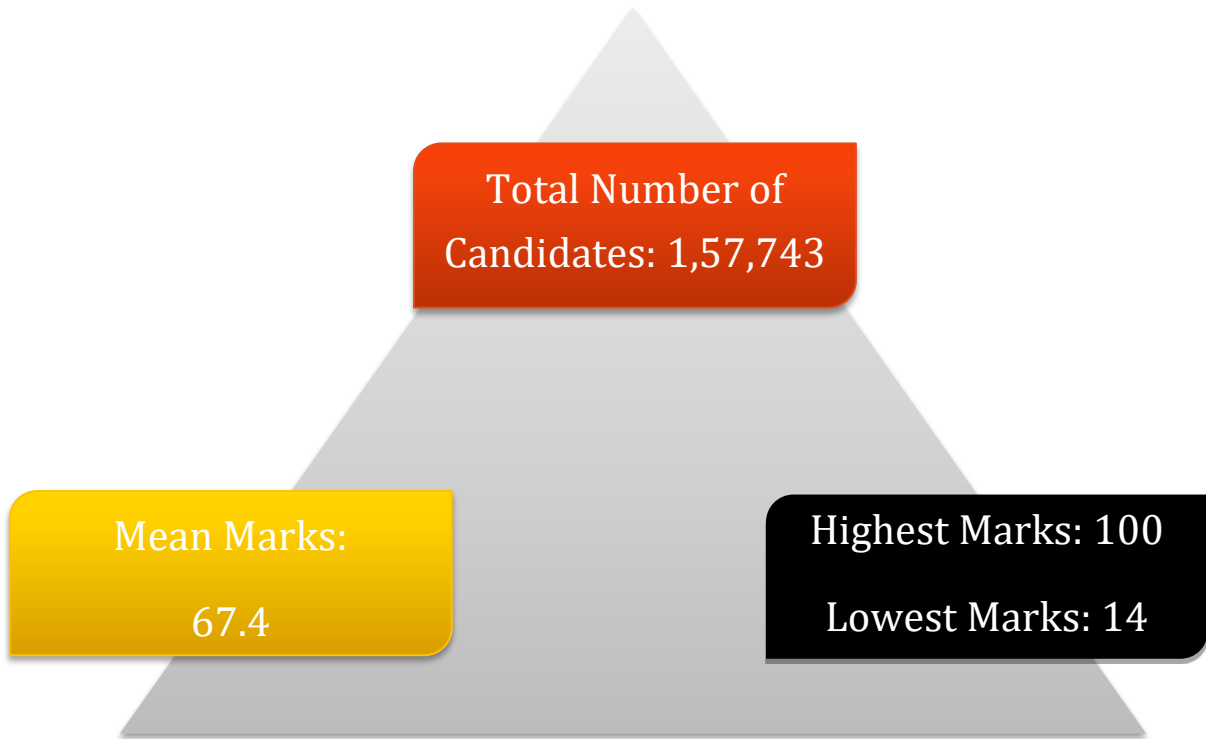
## Qualitative Analysis

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



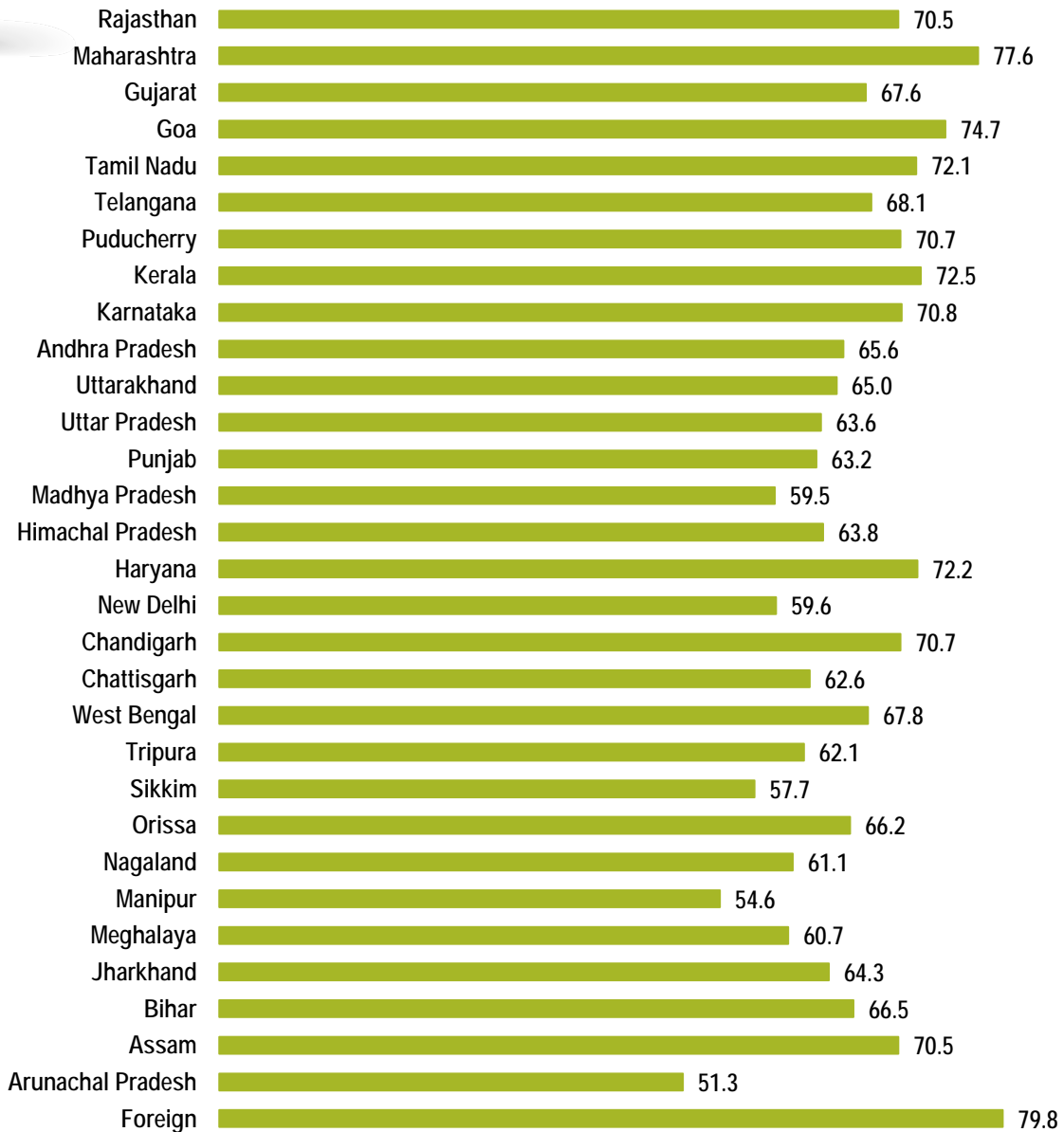
## STATISTICS AT A GLANCE







## 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	

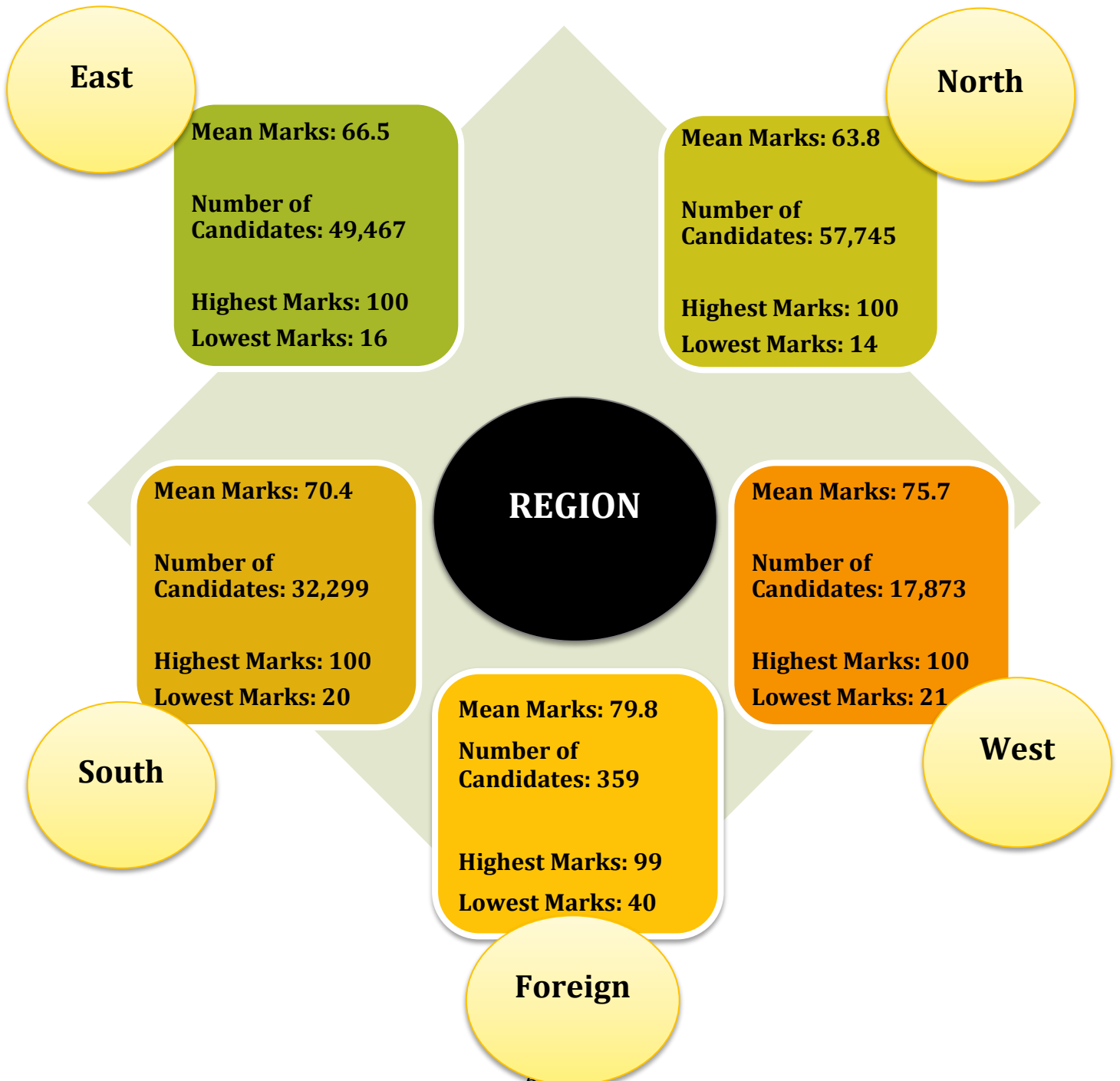
\*Significant at 0.05 level

**Girls performed  
significantly better than  
boys.**

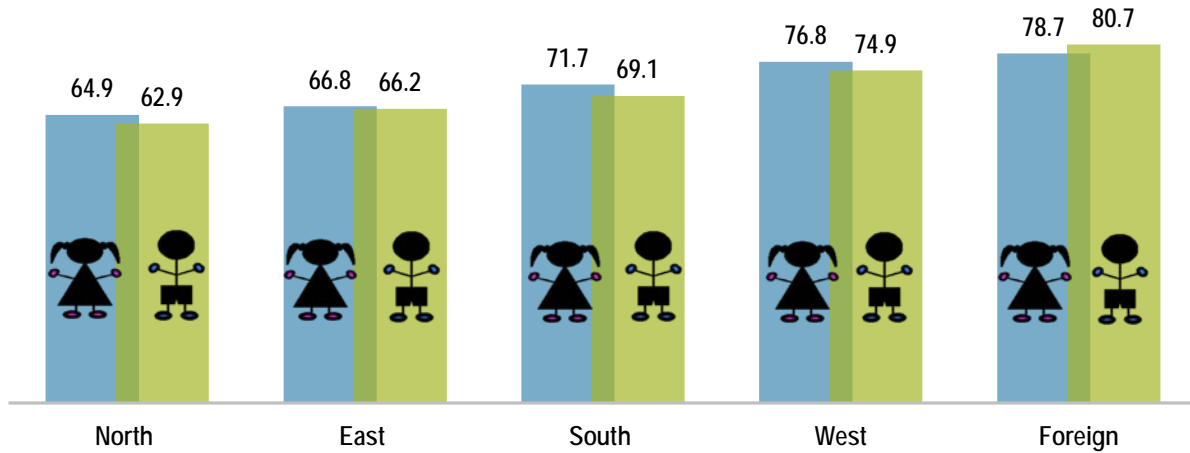




## REGION-WISE COMPARISON



## 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)

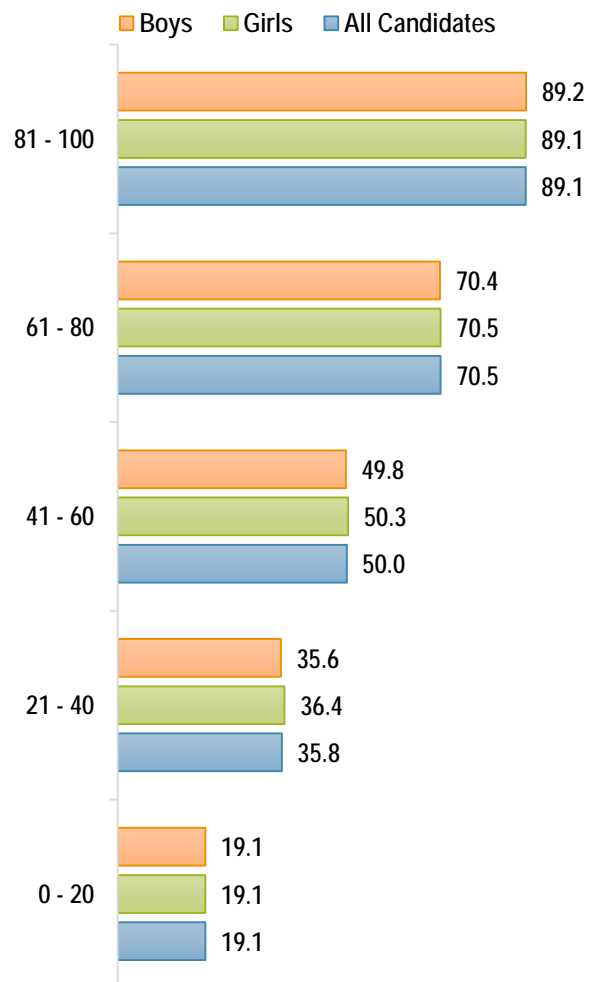
Performance of boys was significantly better than the performance of girls.

#### Marks Range (81-100)



#### Marks Range (0-20)

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



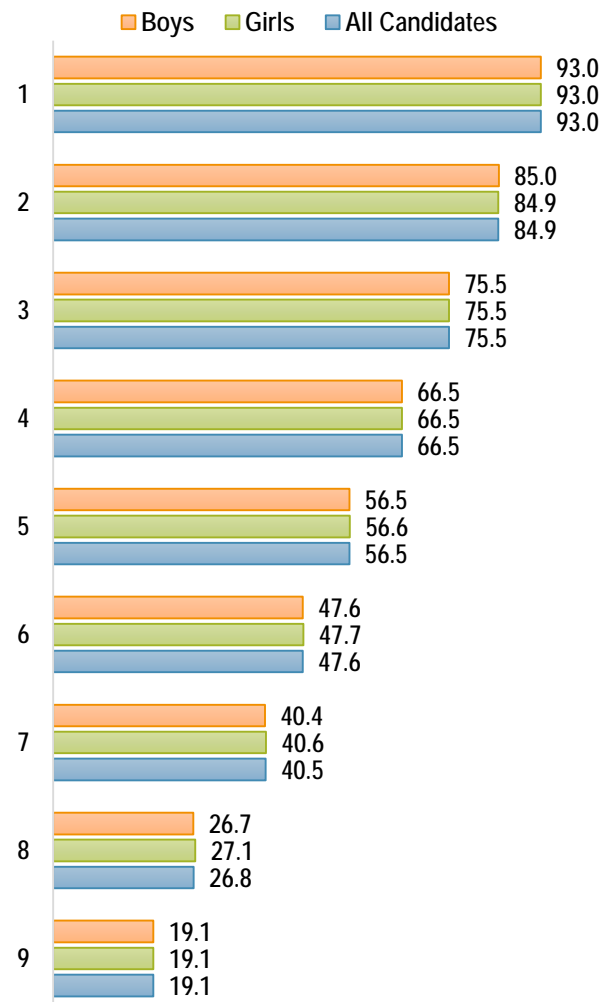


# GRADES AWARDED : COMPARISON GENDER-WISE

## 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

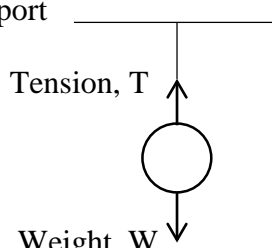
- (a) Most of the candidates drew a ball and the string properly but following errors were observed:
- Labelling was missing.
  - Directions were not drawn.
  - Support was missing.
  - A few candidates drew a spring in place of a string.
- (b) Many candidates identified that “it decreases” but failed 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 <b>always</b> 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 $1^{\circ}\text{C}$ . SI unit of heat capacity is $\text{J/K}$ or $\text{J K}^{-1}$ .
(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  $330 \text{ ms}^{-1}$  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

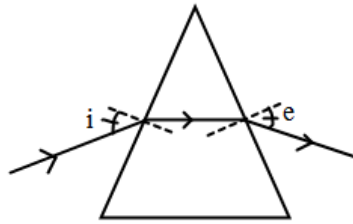
- More practice of drawing diagrams needs to be given to students, with all details included.
- Explain to the students the meaning of specific resistance and its SI unit.

## 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  $500\Omega$ , 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"><li>– Hysteresis</li><li>– Formation of Eddy Currents</li><li>– Resistance of primary or secondary coil,</li></ul> <p style="text-align: right;"><i>(any two)</i></p>
(c)	A good thermionic emitter should have: <ul style="list-style-type: none"><li>– Low work function</li><li>– High melting point</li></ul>
(d)	Rate of emission of thermions depends on: <ul style="list-style-type: none"><li>– the nature of surface (work function),</li><li>– temperature of the surface</li><li>– surface area.</li></ul> <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.

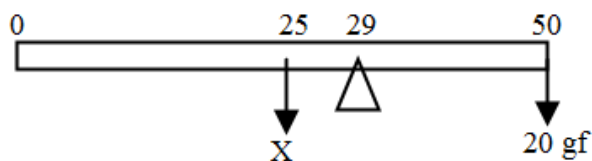
## Suggestions for teachers

- 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.



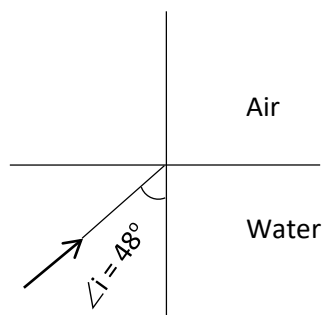
## MARKING SCHEME

### Question 6

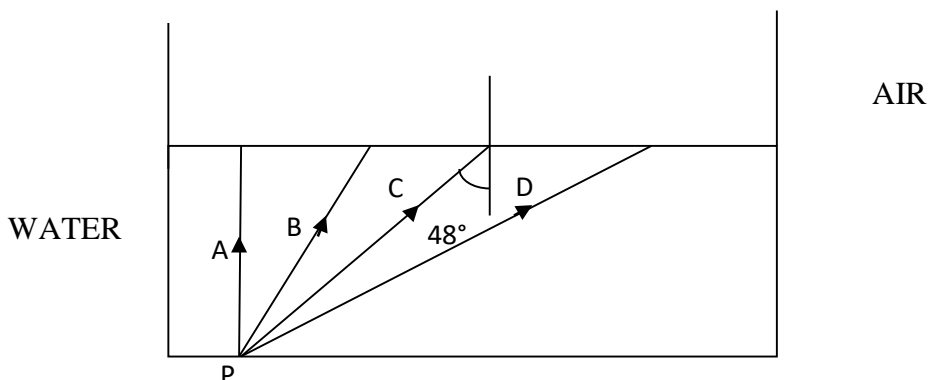
(a)	(i) Both (inner and outer) surfaces of calorimeter are highly polished.  (ii) Metal B is the best option to make a calorimeter.  B has the lowest specific heat capacity; hence it will absorb the least amount of heat.
(b)	Heat gained by ice = $mL + mc\Delta T = m(330 + 4.2 \times 5) = 351m$ J  Heat 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 <span style="float: right;"><i>(Any two correct factors)</i></span>

### 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  $48^\circ$ .
- (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  $48^\circ$ .
- (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.

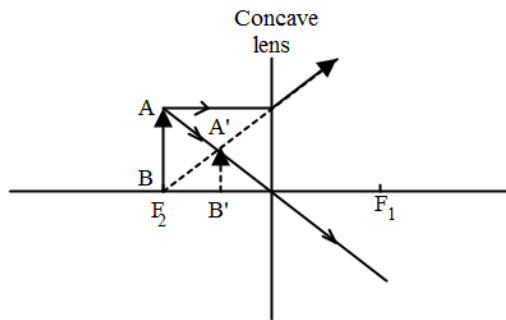
### Suggestions for teachers

- 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.

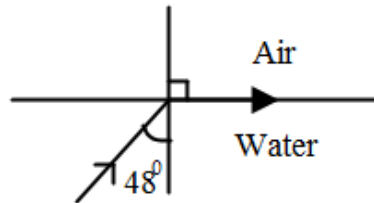
## MARKING SCHEME

### 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.

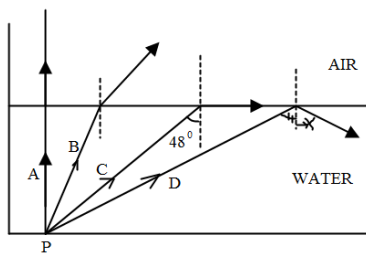


- (b) (i)



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

- (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 <span style="float: right;"><i>(Any one)</i></span></p> <p>(iii) Forced vibration or resonance</p>
(c)	<p>(i) <math>\frac{f_1}{f_2} = \frac{l_2}{l_1}</math></p> $\frac{256}{1024} = \frac{l_2}{80}$ $l_2 = \frac{80 \times 256}{1024}$ $l_2 = 20 \text{ cm}$ <p>(ii) <math>V = 256 \times 1.3 = 332.8 \text{ ms}^{-1}</math></p> $f = \frac{V}{\lambda} = \frac{332.8}{2.6} = 128 \text{ Hz}$ <p>As <math>f</math> in 2<sup>nd</sup> case is less, <math>\therefore</math> sound is shriller in 1<sup>st</sup> 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

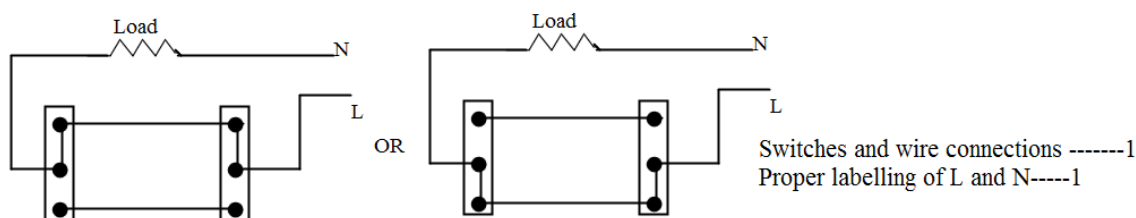
- Train the students to read the question carefully, ascertain the requirement and answer it.
- Explain the working of dual control switches with a diagram and emphasise that the students practice drawing diagrams.
- Explain the concept of earthing clearly to the students with the concept of potential.
- 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  $\alpha, \beta$  and  $\gamma$ .
- (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.