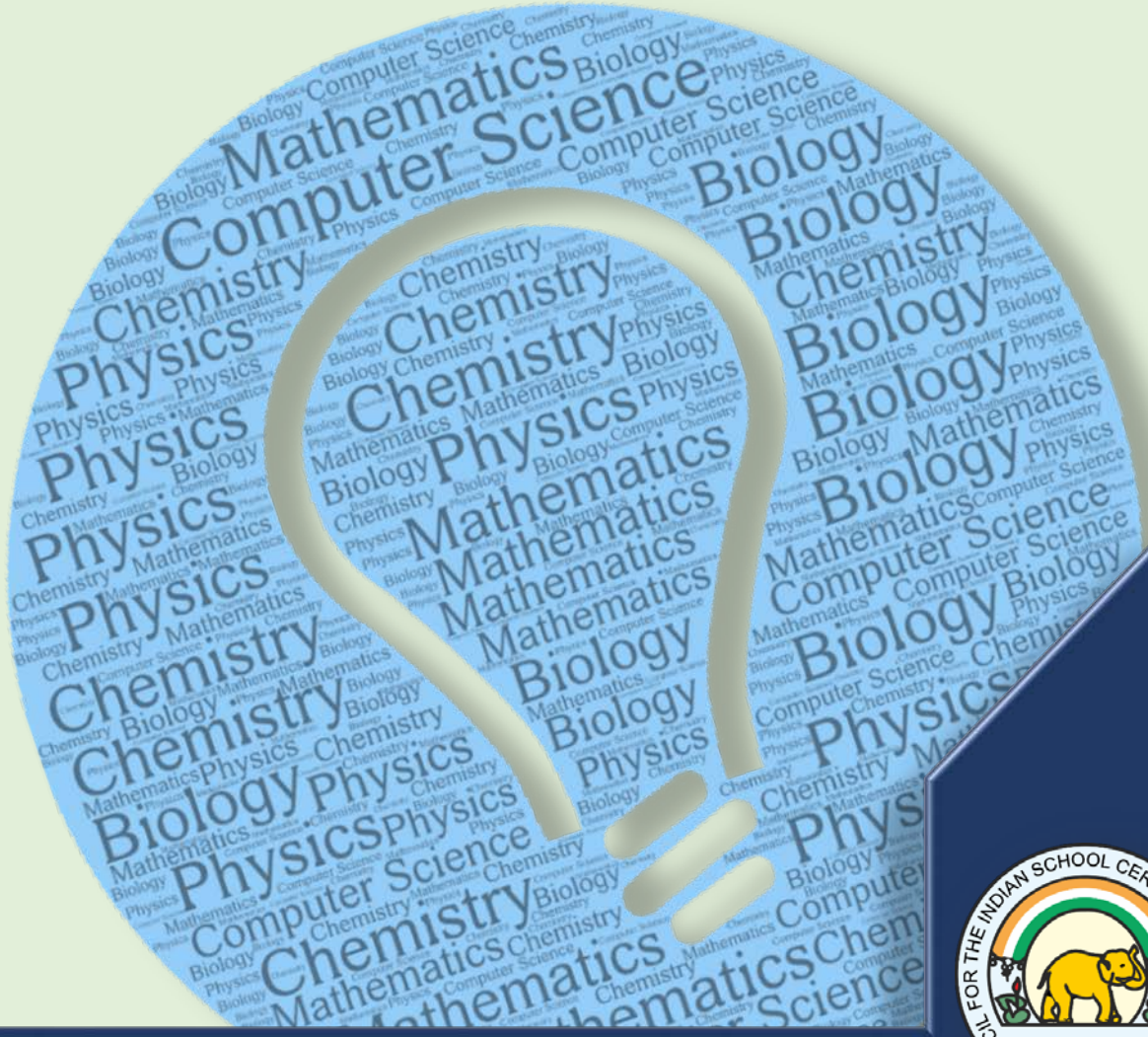
Analysis of Pupil Performance

ISC Year 2017 Examination

Sciences & Mathematics

BIOLOGY



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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.

Gerry Arathoon
Chief Executive & Secretary

November 2017

PREFACE

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

The 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.

Shilpi Gupta

November 2017 ***Deputy Head - RDCD***

CONTENTS

INTRODUCTION

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

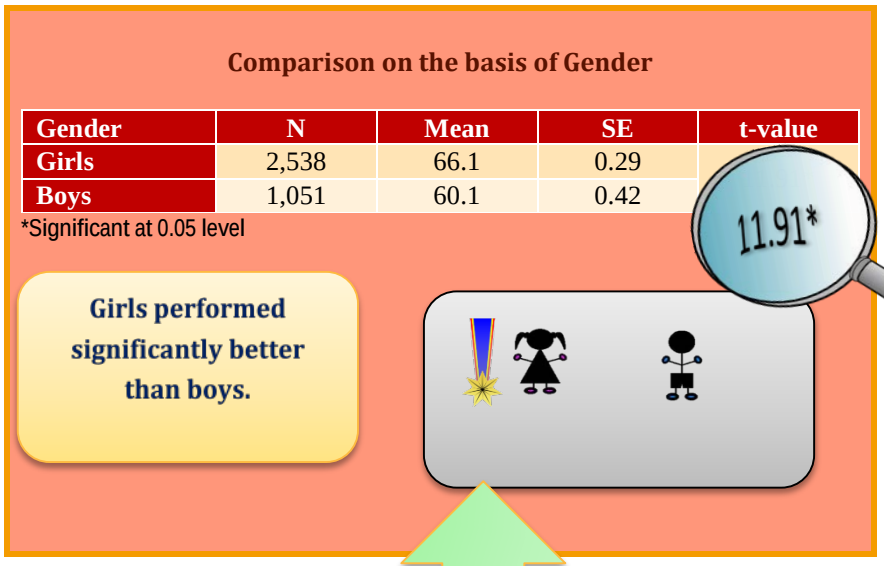
Understanding the tables

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 ISC 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.



Comparison on the basis of Gender

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

*Significant at 0.05 level

Girls performed significantly better than boys.

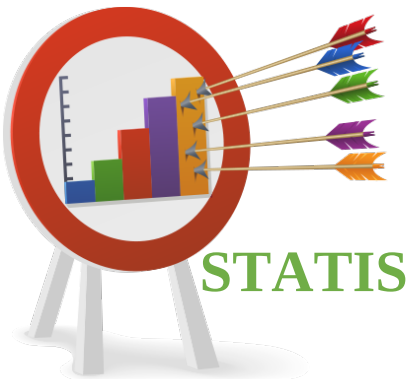
The table shows comparison between the performances of boys and girls in a particular subject. The t-value of 11.91 is significant at 0.05 level (mentioned below the table) with a mean of girls as 66.1 and that of boys as 60.1. It means that there is significant difference between the performance of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

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

Qualitative Analysis

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

QUANTITATIVE ANALYSIS



STATISTICS AT A GLANCE

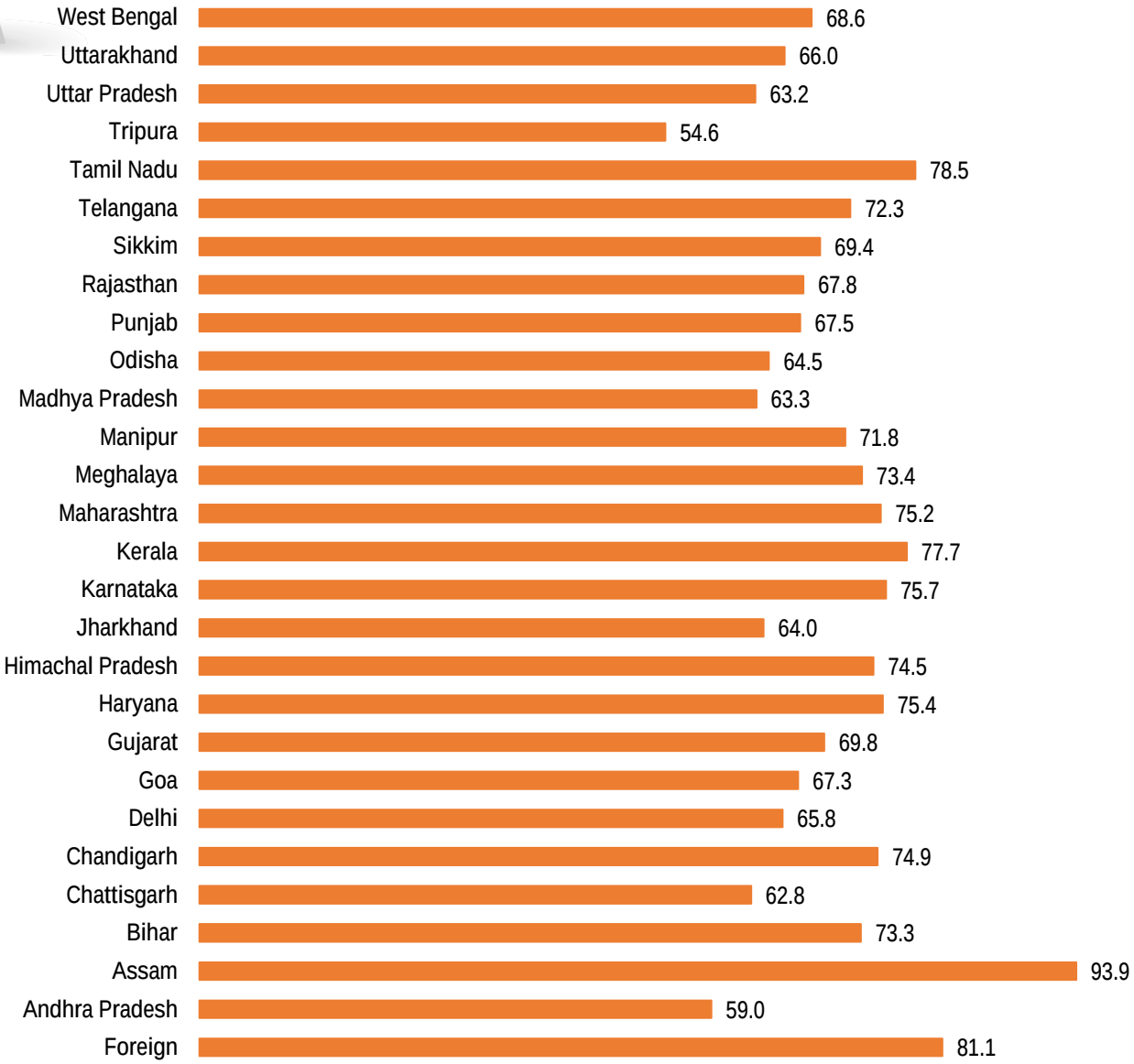
Total Number of Candidates: 14,539

Mean Marks: 68.0

Highest Marks: 100

Lowest Marks: 03

PERFORMANCE (STATE-WISE & FOREIGN)



The State of Assam secured highest mean marks. Mean marks secured by candidates studying in schools abroad were 81.1.

GENDER-WISE COMPARISON

GIRLS

Mean Marks: 70.0

Number of Candidates: 8,624

BOYS

Mean Marks: 65.2

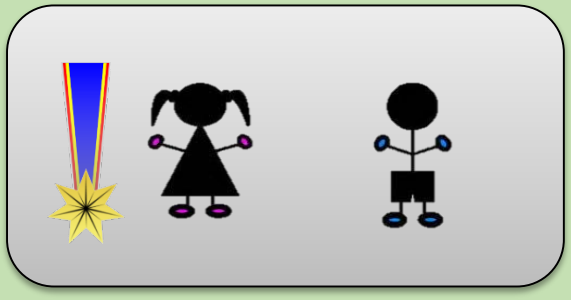
Number of Candidates: 5,915

Comparison on the basis of Gender

Gender	N	Mean	SE	t-value
Girls	8,624	70.0	0.19	15.71*
Boys	5,915	65.2	0.24	

*Significant at 0.05 level

Girls performed significantly better than boys.



REGION-WISE COMPARISON

REGION

East

Mean Marks: 67.7

Number of Candidates: 6,188

Highest Marks: 100
Lowest Marks: 03

North

Mean Marks: 65.1

Number of Candidates: 5,781

Highest Marks: 100
Lowest Marks: 15

South

Mean Marks: 76.1

Number of Candidates: 1,837

Highest Marks: 100
Lowest Marks: 22

West

Mean Marks: 72.7

Number of Candidates: 660

Highest Marks: 100
Lowest Marks: 19

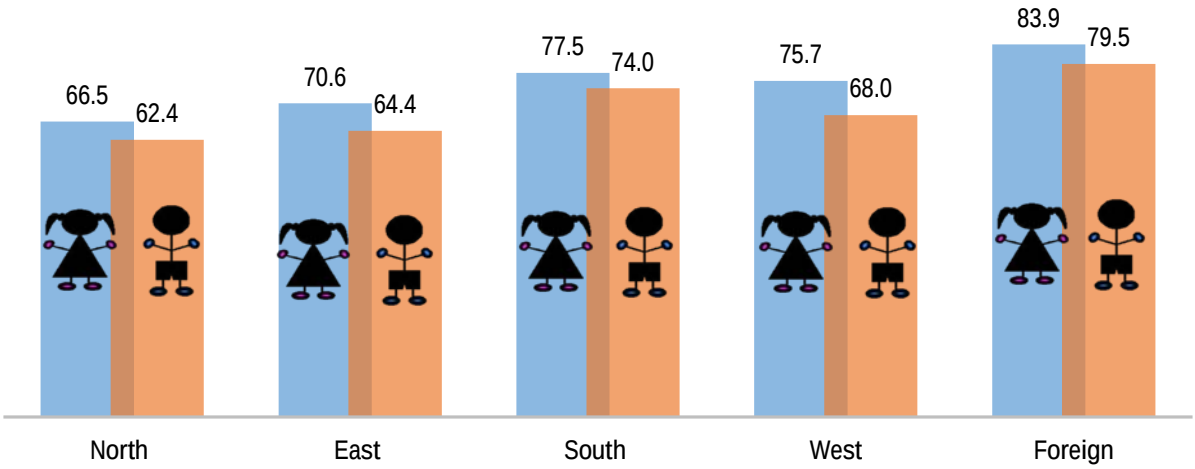
Foreign

Mean Marks: 82.4

Number of Candidates: 73

Highest Marks: 100
Lowest Marks: 43

Mean Marks obtained by Boys and Girls-Region wise

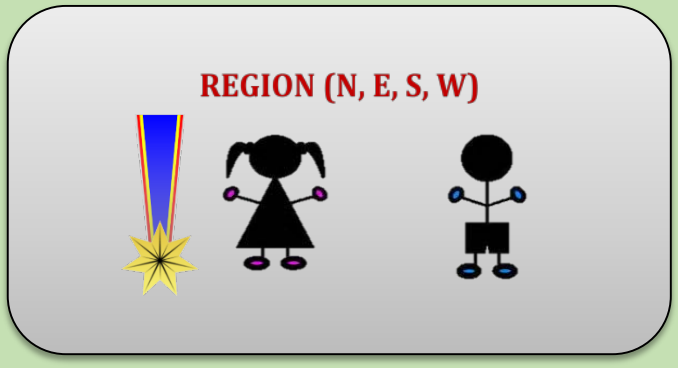


Comparison on the basis of Gender within Region

Region	Gender	N	Mean	SE	t-value
North (N)	Girls	3,840	66.5	0.28	8.18*
	Boys	1,941	62.4	0.42	
East (E)	Girls	3,238	70.6	0.29	14.18*
	Boys	2,950	64.4	0.33	
South (S)	Girls	1,095	77.5	0.48	4.57*
	Boys	742	74.0	0.61	
West (W)	Girls	404	75.7	0.85	5.36*
	Boys	256	68.0	1.15	
Foreign (F)	Girls	47	83.9	1.58	1.19
	Boys	26	79.5	3.39	

*Significant at 0.05 level

The performance of girls was significantly better than that of boys in the northern, eastern, southern and western region. In foreign region no significant difference was observed.

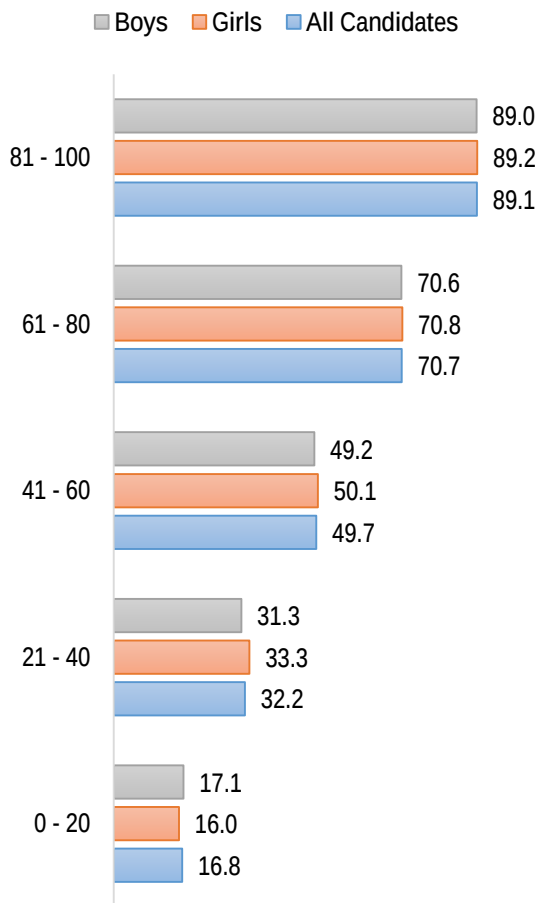


MARK RANGES : COMPARISON GENDER-WISE

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	2,786	89.2	0.10	1.05
	Boys	1,416	89.0	0.14	
Bottom Range (0-20)	Girls	9	16.0	1.44	-0.67
	Boys	31	17.1	0.64	

No significant difference was found in the performance of girls and boys in the top and bottom marks range.

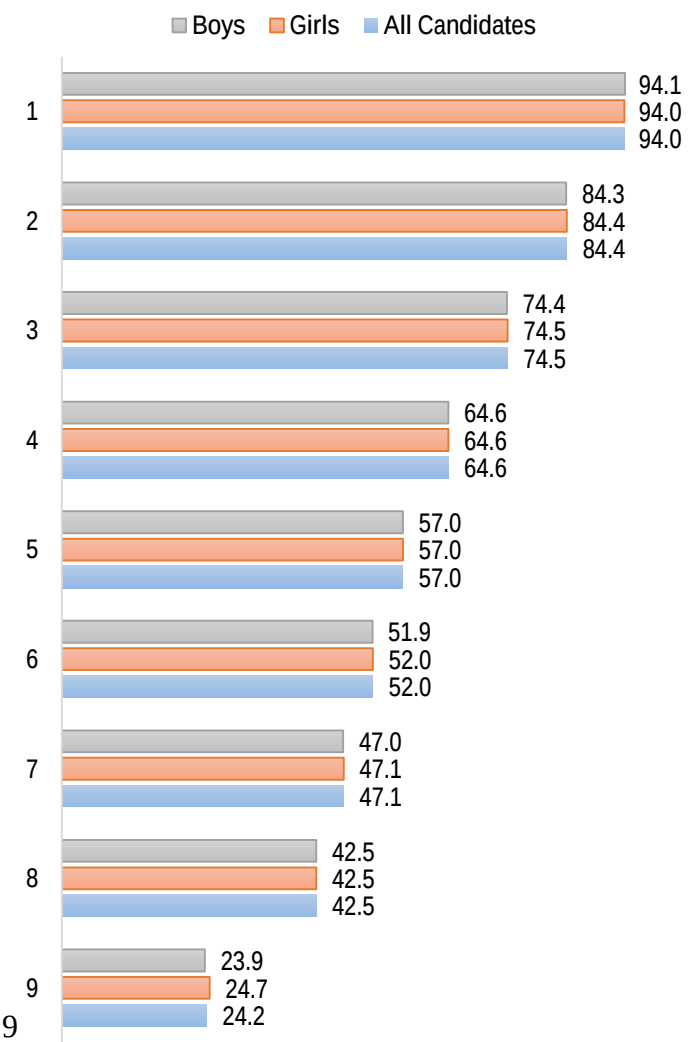


GRADES AWARDED : COMPARISON GENDER-WISE

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

Grades	Gender	N	Mean	SE	t-value
Grade 1	Girls	1,287	94.0	2.62	-0.01
	Boys	632	94.1	3.74	
Grade 9	Girls	96	24.7	2.52	0.24
	Boys	174	23.9	1.83	

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



QUALITATIVE ANALYSIS

THEORY (PAPER-1)

Part I (20 marks)

Answer all questions

Question 1

(a) Give a brief answer for each of the following: **[4]**

(i) Why do Green plants start evolving CO_2 instead of O_2, at high temperatures?

(ii) Define *Apomixis*.

(iii) What is a *Recon?*

(iv) Why are the spores of *Bacillus thuringiensis* used as bio insecticide?

(b) Each of the following question(s)/statement(s) has four suggested answers. Choose the correct option in each case. **[4]**

1. Initiation codon of protein synthesis in Eukaryotes:

   (i) GUA

   (ii) GGA

   (iii) CCA

   (iv) AUG

2. Type of Interaction where an individual sacrifices its own welfare (life) for the benefit of another animal of its own species:

   (i) Altruism

   (ii) Scavenging

   (iii) Protocooperation

   (iv) Commensalism

3. Wings of Insect and Birds are examples of:

   (i) Analogous

   (ii) Homologous

   (iii) Vestigial

   (iv) Atavism

4. The pressure of the cell contents on the cell wall is known as:

(i) Wall pressure

(ii) Osmotic pressure

(iii) Turgor pressure

(iv) Diffusion pressure

(c) Give a scientific term for each of the following: **[4]**

(i) An act of expelling the full-term foetus from mother's uterus at the end of gestation.

(ii) Entry of pollen tube into an ovule through integuments.

(iii) An alternative form of the single gene which influences the same character and produces different expressions in different individuals of a species.

(iv) The study of human population covering all aspects and parameters.

(d) Expand the following abbreviations: **[4]**

(i) MTP

(ii) IVF

(iii) HIV

(iv) DPD

(e) Name the scientists who have contributed to the following: **[4]**

(i) Discovered the fossil of Cro-Magnon man.

(ii) Classified active and passive absorption of water by roots.

(iii) Reported Haemophilia.

(iv) Discovered double fertilization.

Comments of Examiners

(a) (i) Some candidates wrote 'photo-oxidation' of chlorophyll instead of 'photorespiration' and some wrote 'Law of limiting factors'.

(ii) Most candidates wrote the definition of *parthenogenesis* and *parthenocarpy*. Some wrote 'type of asexual reproduction' without mentioning 'substitution of sexual reproduction'.

(iii) The concept of a *Recon* being the smallest unit capable of undergoing recombination was not clear to many candidates. Instead of 'recombination', which was the key word, candidates wrote 'replication'.

(iv) Answers such as, "used to kill insects, spore is toxic, spore kills, chokes the gut", were given.

(b) 1. Most of the candidates answered correctly.

2. A few candidates opted for the correct choice but many wrote incorrect answers as proto-co-operation and commensalism.

3. Some candidates were confused between *homologous* and *analogous*.

4. Most of the candidates answered correctly. A few wrote *wall pressure* instead of *turgor pressure*.

(c) (i) Instead of the scientific term many candidates used general term 'delivery'.

(ii) A few candidates wrote 'Porogamy' instead of 'Mesogamy'.

(iii) Many candidates wrote only 'alleles' instead of 'Multiple Alleles'. Some wrote 'polygenic inheritance'.

(iv) Answer to the study of human population covering all aspects and parameters was written correctly by most candidates.

(d) (i) A few candidates answered correctly. Some wrote incorrect answers like, 'Multiple testing program' and 'Model test paper'.

(ii) Most of the candidates attempted correctly. Some wrote *intra vitro* instead of *in vitro*.

(iii) Some candidates omitted the word 'deficiency' and wrote *Immuno virus*.

(e) (i) to (iv) Names of scientists were spelt incorrectly by a number of candidates. Some candidates did not write the full name correctly.

Suggestions for teachers

- Key words should be emphasized. The term RUBISCO must be expanded as carboxylase oxygenase. The condition under which Rubisco starts behaving as oxygenase must be explained while teaching photorespiration.
- Ensure that the students understand the terms apomixis, recon etc. comprehensively.
- The mechanism of action of Bt-toxin must be explained with reference to "Cry protein". The reason for calling it "cry protein" should also be explained.
- Advise students to learn initiation and termination codons. To make it interesting students should be given mnemonics for e.g. UAA – You Are Away, UAG – You Are Gone, UGA – You Go Away.
- Homologous and Analogous organs should be discussed with respect to their origin and functions. Merely giving a list of these organs does not help in proper learning.
- All three modes of pollen tube entry should be explained by correlating with the structures e.g. chalazogamy signifies chalaza, porogamy refers to micropyle and misogamy implies middle (meso) i.e. between chalaza & micropyle.
- Multiple allelism should be explained with the example of blood group inheritance. Explain that the term multiple implies three alleles.
- Encourage students to learn the names of scientists prescribed in the syllabus (with their correct spellings) alongwith their major contributions.

MARKING SCHEME

Question 1

(a)	(i)	Green plants start evolving CO_2 instead of O_2, at high temperatures due to photorespiration, where RubisCO functions as RuBPoxygenase. More photosynthetically fixed carbon is lost by photorespiration.
	(ii)	The development of an embryo without the occurrence of fertilization, especially in plants. /Substitution of sexual reproduction by asexual reproduction/Agamospermy/Formation of seed without fertilization/reproduction without formation of zygote/without fertilization.
	(iii)	Recon is the smallest unit of DNA capable of undergoing crossing over and recombinations.
	(iv)	Spores of *Bacillus thuringiensis* used as bio insecticide: The spores produce insecticidal cryoprotein / endotoxins which kills larvae of certain insects/crystalline protein/toxic protein/insecticidal protein/BT toxin
(b)	1.	(iv) AUG
	2.	(i) Altruism
	3.	(i) Analogous
	4.	(iii) Turgor pressure
(c)	(i)	Parturition
	(ii)	Mesogamy
	(iii)	Multiple alleles.
	(iv)	Demography
(d)	(i)	MTP – Medical Termination of Pregnancy
	(ii)	IVF – In Vitro Fertilization
	(iii)	HIV – Human Immuno Deficiency Virus
	(iv)	DPD – Diffusion Pressure Deficit
(e)	(i)	Mac Gregor
	(ii)	Kramer
	(iii)	John Otto
	(iv)	G. Nawaschin

Part II (50 marks)

SECTION A

*Answer any **two** questions.*

Question 2

(a) Differentiate between *Apes* and *Man* with respect to the following characteristics: **[3]**

(i) Posture

(ii) Brow ridges

(iii) Cranial capacity

(b) Define *protobionts*. **[1]**

(c) What is *cognogeny?* **[1]**

Comments of Examiners

(a) Most candidates wrote the first two parts correctly but *cranial capacity* was written as "large" and "small", without giving the exact values.

(b) Many candidates wrote "First cell" instead of precursor/protocell/cell like. Some were confused between *eobionts* and *protobionts*.

(c) Some candidates wrote *biogeny* for *cognogeny*. Some wrote only "evolution", which was incomplete.

Suggestions for teachers

- Differences when asked should be compatible. Answers should be specific and precise. Answers like present and not present are not acceptable.
- Protobionts, eobionts and protocells should be clearly discussed for proper understanding. Coacervates and microsphere should be taken as examples of photobionts.
- Chemogeny, biogeny and cognogeny must be taught under three separate headings.

MARKING SCHEME

Question 2

(a)	Characteristics		Apes	Man
	(i)	Posture	Semi-erect/stooping/bent	Erect/upright/straight
	(ii)	Brow ridges	Prominent/ heavy/protruded /conspicuous/broad thick/dense/projecting	Are reduced/inconspicuous
	(iii)	Cranial capacity	390 – 650 cc	1350 – 1600 cc
(b)	*Protobionts*: aggregate of Biomolecules A protobiont is an aggregate of abiotically produced organic molecules surrounded by a membrane-like structure and are considered to have possibly been the precursors to first cells.\Pre-cell like structures/Protocells/Precursor of cell/cell like			
(c)	Cognogeny: Diversification and evolution of the prokaryotic and eukaryotic cells /Development of complexities/The process of evolution of complex life forms/ development of senses of perception/ communication/modification. /Cognition/expression/evolution.			

Question 3

(a) Explain *any three* molecular (genetic) evidences in favour of organic evolution. **[3]**

(b) Define *biogenesis*. **[1]**

(c) Define *fossils*. **[1]**

Comments of Examiners

General points for evidences were given without specifying the headings.

(a) Many candidates treated *biogeny* and *biogenesis* as synonyms.

(b) Some candidates only wrote "remains of dead organisms" without any reference to prehistoric plants and animals.

Suggestions for teachers

- The evidences should be taught under different headings such as cytology, molecular biology, metabolic process and serological tests.
- Familiarise students with words like 'biogenesis', fossils, etc.
- The definition of fossils must have reference to prehistoric plants and animals.

MARKING SCHEME

Question 3

(a) Evidences from molecular biology: *(Any three points)*

1. Cytology:
   - Basic structure of cell is same in all organism
   - Mitochondria are same in plants and animals
   - Photosynthetic machinery/plastids/chloroplasts same. /chlorophyll/ribosomes same
2. Molecular biology:
   - Genetic code is universal … Anything related to codon
   - DNA/Nucleotide sequence is almost similar.
   - Similar chromosome bands.
   - Similarity in chromosome number.
   - Structure of actin and tubulin proteins is also same.
   - Homology occurs in amino acid sequence of cytochrome C/Haemoglobin.

     Enzymes, hormones
3. Metabolic process:
   - Same biochemical reactions are found from bacteria to humans. /Glycolytic pathway/ Krebs cycle/ET**S**
   - Co_2 is released by oxidation of glucose/oxygen consumed
   - Energy released is stored in ATP molecules.
   - Nitrogenous wastes in all living organism is produced in the form of ammonia.
4. Serological test:
   - Shows similarities in blood groups.
   - Similar antigen-antibody profile (Precipitin test) in man and apes.

(b) *Biogenesis*: Formation of first living form/Eob**i**onts/Biological evolution

The production of living organisms from other living organisms / Origin of life.

(c) *Fossils*: The remains / impression of a prehistoric plant or animal embedded in a rock / preserved in petrified form.

Question 4

(a) List *any three* drawbacks of Darwinism. **[3]**

(b) State Hardy Weinberg's principle. **[1]**

(c) Differentiate between *Directional natural selection* and *Disruptive natural selection*. **[1]**

Comments of Examiners

(a) Drawbacks of *Darwinism* were mixed up those of with *Lamarckism*. Some candidates explained the long neck of giraffe.

(b) Hardy Weinberg principle was not explained by many candidates. Only the equation was given. In some cases, "=1" was not written. The term *population* was not mentioned by some candidates. A few candidates wrote the definition of gene pool/genetic erosion.

(c) Some candidates wrote, "frequency of one phenotype is high" for directional instead of one extreme phenotype. Some candidates explained the differences through examples but gave similar examples for both.

Suggestions for teachers

- Lamarckism and Darwinism should be compared to give a central idea of the theories. The objections raised against these theories should also be discussed with appropriate examples.
- Teach students Hardy Weinberg principle in detail. Also make them understand the factors which disturb the Hardy Weinberg equation.
- Directional, disruptive and stabilizing selection must be explained with comparison.

MARKING SCHEME

Question 4

(a)	1. Could not explain – characters are transmitted from generation to generation 2. Theory of pangenesis 3. Inheritance of small variations / laid too much stress on large variation 4. Ignored mutation 5. Existence of vestigial organs 6. Overspecialization 7. Arrival of the fittest. 8. Could not explain causes and sources of variations 9. No role of genes/Theory of germplasm 10. Considered individual (not population) as unit of evolution 11. Could not explain connecting link.
(b)	The relationship of gene frequencies / genotype frequencies of alleles in the gene pool of a population.

gene (allele) frequencies remain constant in a large, randomly breeding population/ genetic equilibrium in population

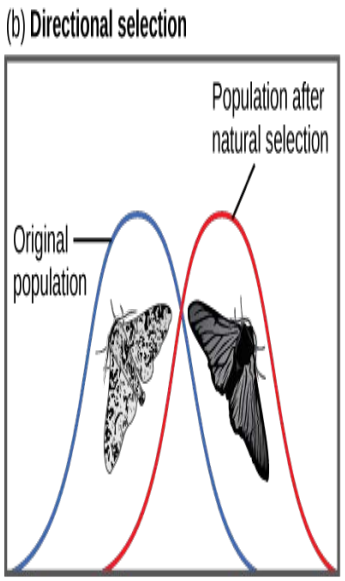
OR

$(p+q)^2 = 1$ OR $p^2 + 2pq + q^2 = 1$

(c)

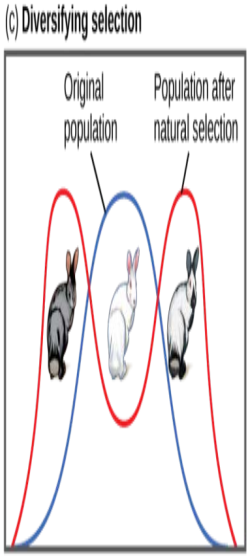
Directional Natural Selection Relatively frequent	**Disruptive Natural Selection** Rare in nature
A mode of natural selection in which a single phenotype is favoured, causing the allele frequency to continuously shift in one direction	A mode of natural selection in which extreme values for a trait are favoured over intermediate values
Results in relatively uniform phenotype	Polymorphism/more than one distinct forms
Frequency of any one extreme phenotype is very high One side of mean of average frequency	Frequencies of both extreme phenotypes are high (that of the average phenotype is very low)
Example- With explanation	Example Both sides of mean

Directional Selection



Light-colored peppered moths are better camouflaged against a pristine environment; likewise, dark-colored peppered moths are better camouflaged against a sooty environment. Thus, as the Industrial Revolution progressed in nineteenth-century England, the color of the moth population shifted from light to dark, an example of directional selection.

Diversifying Selection



In a hyphothetical population, gray and Himalayan (gray and white) rabbits are better able to blend with a rocky environment than white rabbits, resulting in diversifying selection.

SECTION B

*Answer any **two** questions.*

Question 5

(a) Give *four* anatomical differences between a *dicot leaf* and *monocot leaf*. **[4]**

(b) Briefly describe the secretory phase of the menstrual cycle. **[4]**

(c) Define: **[2]**

(i) Menarche

(ii) Actinomorphic symmetry

Comments of Examiners

(a) Some candidates wrote morphological differences instead of anatomical differences. Some got confused between *isobilateral* and *dorsiventral* and wrote opposite statements.

(b) Some candidates explained the entire menstrual cycle with phases and events.

(c) (i) Most of the candidates defined *menarche* correctly. Some confused it with menopause.
(ii) The definition of *actinomorphic* was not written correctly by a number of candidates.
Most of the candidates only wrote "Flower cut into two equal halves along any plane", but made no mention of "passing through the centre".

Suggestions for teachers

- Morphological and anatomical differences should be taught separately. Use labelled diagrams/charts in the class to show the structures to students.
- The question should be read carefully and answers should be crisp and precise. The sequence of events should be discussed for every phase. Keywords should be highlighted in definitions.

MARKING SCHEME

Question 5

(a)

Monocot Leaf	Dicot Leaf
Mesophyll compact/small intercellular spaces	Large intercellular spaces
At both surfaces (abaxial and adaxial) sclerenchymatous bundle sheath is present	At abaxial surface sclerenchymatous bundle sheath is present.
Stomata present on the upper and lower epidermis /isobilateral/ equifacial / amphistomatic	Stomata mainly present on the lower epidermis/dorsiventral/bifacial/hypostomatic
Some epidermal cells are modified into bulliform cells	Epidermis does not have bulliform cells.
Mesophyll is undifferentiated/only spongy	Mesophyll is differentiated into palisade and spongy parenchyma
Bundle sheaths double layered	Bundle sheath single layered
Guard cells dumbbell shaped	Kidney /bean shape
Equally thick cuticle on both sides	Thicker on upper (ventral) side.
All veins of equal size/ parallel venation	One main vein/Prominent vein/reticulate or net venation

(b)

Luteal or secretory phase:

- Glycogen content of endometrium increases.
- Graafian follicle ruptures to release the ovum (ovulation) due to LH surge.
-Uterine movement/contraction decreases
-cervical mucus becomes thick
-formation of yellow colour body called corpus luteum.
- The corpus luteum secretes large amounts of progesterone.
– Thickness/ Vascularization of the endometrium increases.
- Uterine glands secrete “uterine milk”/corkscrew shaped/active/tortuous/coiled
- In case ovum is not fertilized corpus luteum degenerates into corpus albicans
- Longest phase of the cycle /14 days duration/extends from days 14 to 25
- Decline of progesterone level starts menstrual phase.

(c)	(i)	Menarche: Beginning / Onset of the menstrual cycle in young females.
	(ii)	Actinomorphic symmetry: Radial symmetry / flower can be divided into two equal halves in any plane passing through the centre.

Question 6

(a) Give a graphic representation of the Hatch Slack or C4 cycle. **[4]**

(b) Give *two* significant differences between: **[4]**

(i) *Transpiration* and *Guttation*

(ii) (i) *Chlorophyll 'a'* and *Chlorophyll 'b'*

(c) Define the following: **[2]**

(i) Amniocentesis

(ii) Polyembryony

Comments of Examiners

(a) Some candidates did not represent the cycle graphically. Others wrote in paragraphs but did not give the correct sequence. Many candidates did not make any mention of mesophyll and bundles heath chloroplasts.

(b)(i) Some candidates mentioned only loss of water in transpiration but made no mention of water vapour. Several candidates were confused between *guttation* and *bleeding*.

(ii)Molecular weights of chlorophyll a & b were not given correctly by many candidates.

Suggestions for teachers

- Tell students the importance of writing in correct sequence.
- In amniocentesis, give importance to the reason for removal of amniotic fluid i.e. to detect genetic abnormalities.

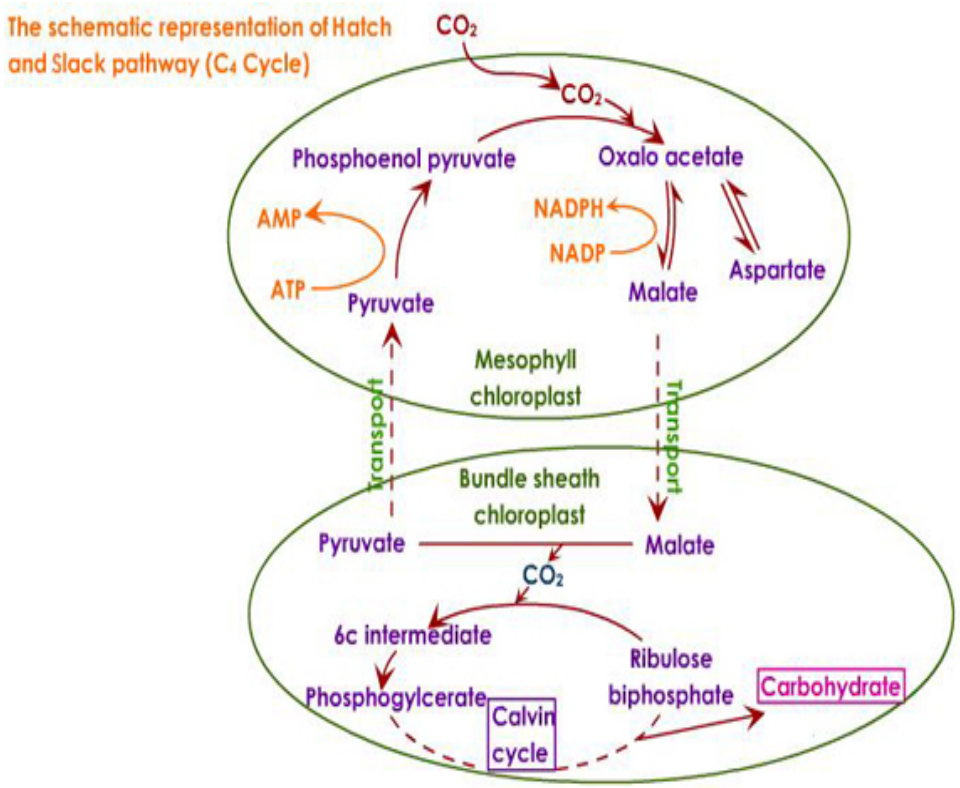
(c)(i) Most candidates did not mention the purpose of amniocentesis. Some wrote "sex determination", which is actually misuse point.

(ii) For *polyembryony*, several candidates wrote "formation of many embryos" without mentioning plant, animal, ovule or seed, which made the definition vague and incomplete.

MARKING SCHEME

Question 6

(a) Graphic representation of the Hatch Slack or C4 cycle:



(b) Difference between:

(i)

Transpiration	*Guttation*
During the day	Night and early morning
Water loss in the form of water vapour	Water loss in the form of liquid droplets.
Through stomata, lenticels, cuticle/ Leaf surface	Through hydathodes/ leaf margin
Under dry conditions	Under humid conditions
Only water is lost	Both water and minerals are lost
Due to evaporation Cooling effect	Due to root pressure Helps to get rid of excess water.

	(ii)	*Chlorophyll 'a'*	*Chlorophyll 'b'*
		The empirical formula of *Chlorophyll 'a'* is $C_{55}H_{72}O_5N_4Mg$	The empirical formula of *Chlorophyll 'b'* is $C_{55}H_{70}O_6N_4Mg$
		Blue green in colour	Yellow green in colour/olive green
		Primary pigment	Accessory pigment
		It has a methyl group attached to third carbon	It has a aldehyde group attached to third carbon
		Soluble in petroleum ether	Soluble in methyl alcohol
		Molecular weight is 893	Molecular weight is 907
		Maximum absorption of violet-blue/red and orange-red light (430 and 662 nm)/Red 430-450 & 660-690	Maximum absorption of blue light (453 and 642 nm) 450-480 **&**640-650
		More abundant/All green plants 2 parts/ more	Less abundant/ Not found in diatoms etc 1 part *[any 2 points]*
(c)	(i)	Amniocentesis: Prenatal diagnostic technique: A procedure in which a small sample of amniotic fluid is drawn out of the uterus through a needle inserted in the abdomen. The fluid is then analysed to detect genetic abnormalities in the foetus.	
	(ii)	Polyembryony: The phenomenon of development of more than one embryo in a seed.	

Question 7

(a) Describe K+ transport stomatal mechanism. **[4]**

(b) Draw a neat-labelled diagram of L.S. of anatropous ovule. **[4]**

(c) Differentiate between the following: **[2]**

(i) *Spermatogenesis* and *oogenesis*

(ii) *Apocarpous ovary* and *syncarpous ovary*.

Comments of Examiners

(a) Many candidates failed to specify guard cells as the region of influx or efflux of K^+ ions. Some mentioned only details of opening of stomata and wrote reverse process for closing without giving the relevant points.

(b) *Orthotropous* ovule was drawn instead of *anatropous* ovule by some candidates. In several cases, the diagrams were not drawn / labelled correctly.

(c) (i) This part of the question was well attempted by most of the candidates.

(ii) Many candidates wrote opposite answers for *apocarpous* and *syncarpous*. Some candidates wrote the differences between *superior* and *inferior* ovary.

Suggestions for teachers

- Guide students to follow the sequence starting from photosynthesis. Opening and closing of stomata must be written separately.
- Stress upon the importance of neat well labelled diagrams and give sufficient practice to the students.
- While discussing plant families, show students sections of each type of ovary (T.S) for comparison. L.S of the flower may be cut to show superior and inferior ovaries.

MARKING SCHEME

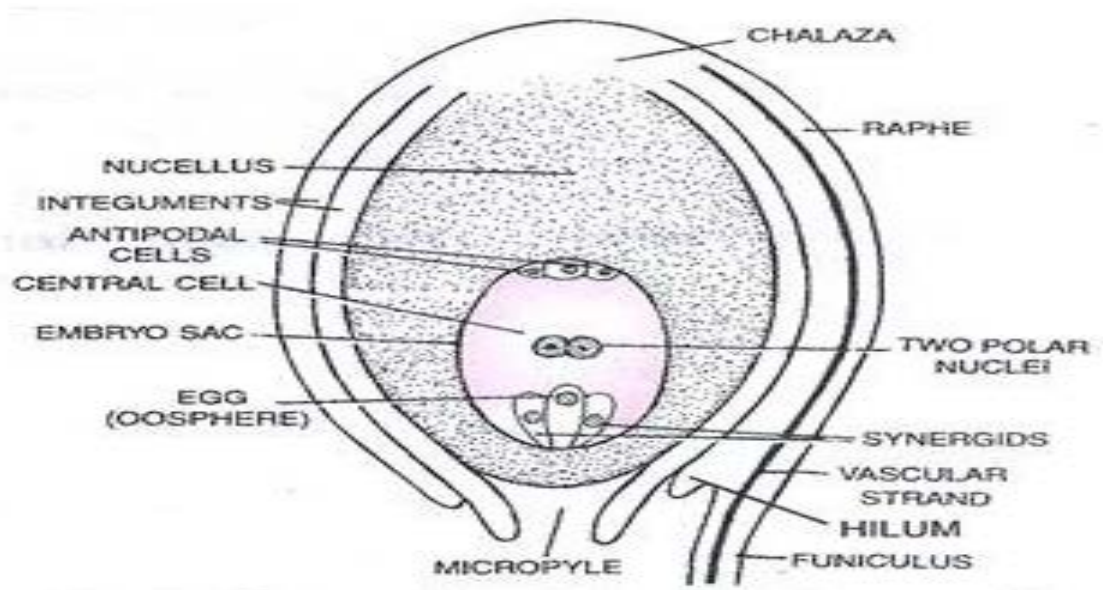
Question 7

(a) K+ transport stomatal mechanism:

In light	In dark
Starch converted to malic acid.	Photosynthesis stops, respiration continues, increase CO_2 conc.
Malic acid– malate & H+ ions	High CO_2, K ion transport stops.
H+ ions move to epidermal cells, K+ ions enter guard cells (ion exchange)	Abscisic acid is formed, reverses H – K pump.
K+ ions balanced by organic ions (malate)	Malate ions produces malic acid with H ions lowering its synthesis by PEP carboxylase.
Cl- ions are also taken in to balance K ions	These changes induce reversal of K ions.
H – K ion exchange requires energy supplied by photosynthesis, respiration	Thus, decreases the OP of guard cells
Increased K ions & malate ions increase the OP thus water enters the guard cells and stomata open	Guard cells – flaccid – stomata close

[4 points in sequence]

(b) Diagram of L.S. of anatropous ovule.



Structure of a typical ovule (anatropous ovule) prior to fertilization.

(c) (i) *Spermatogenesis* and *oogenesis:*

Spermatogenesis	**Oogenesis**
Starts at puberty	Before birth
Process of formation of haploid spermatids from diploid germinal cells	Process of formation of ovum.
Four spermatids are produced from a single spermatogonium	One functional ovum and three non-functional polar bodies.
No formation of polar body	(Two/three) polar bodies formed
Spermiogenesis (transformation/tail formation)	Direct formation
Continuous process	Meiotic arrest during formation of oocytes
Regulated by androgens/ testosterone	Regulated by oestrogens
Growth phase not significant No synthesis of yolk/no vitellogenesis	Significant increase in the size of Pr. Oocyte Synthesis of yolk/ vitellogenesis
In testes	In ovary

(ii)

Apocarpous Ovary	Syncarpous Ovary
Aggregate inflorescence	Multiple inflorescence
Have carpels that are free from one another	Consist of united carpels
Used of a single flower with two or more separate pistils,	Flowers bear single pistil
Ovary is unilocular	Ovary can be unilocular or multilocular.

Question 8

(a) Explain Pleiotropy with reference to phenylketonuria. **[4]**

(b) Explain the mechanism of transcription in a prokaryotic cell. **[4]**

(c) Explain Rh factor incompatibility during pregnancy. **[2]**

Comments of Examiners

(a) Most of the candidates defined Pleiotropy correctly with reference to phenylketonuria. Some wrote symptoms of alkaptonuria e.g. black urine.

(b) Many candidates wrote *replication* instead of *transcription*. They were confused between *sense strand* and *anti-sense* strand. Very few mentioned 3'- 5' or 5'- 3'.

(c) Many candidates wrote on blood transfusion incompatibilities.

Suggestions for teachers

- Explain Pleiotropy and symptoms in detail.
- The three components of central dogma should be discussed i.e. Initiation, Elongation and Termination.
- Clarify to students all possible combinations of father, mother and foetus's Rh groups. Sequences of Rh incompatibility should also be discussed separately (i) during blood transfusion (ii) during pregnancy.

MARKING SCHEME

Question 8

(a) Pleiotropy: One gene with many effects.

Phenylketonuria:
- Associated with chromosome 12
- Caused by deficiency of phenylalanine hydroxylase
- Affected individuals fail to convert phenyl pyruvic acid into P-hydroxy phenyl pyruvic acid.
- Autosomal recessive/genetic disorder
- Accumulation in blood.
- Can cause mental retardation
- Skin pigmentation
- loss of hair

(b) The mechanism of transcription in prokaryotic cell:

Transcription proceeds in the following general steps:

1. Initiation: RNA polymerase, together with one or more general transcription factor (rho factor), binds to promoter DNA.
2. RNA polymerase creates a transcription bubble, which separates the two strands of the DNA helix. This is done by breaking the hydrogen bonds between complementary DNA nucleotides.
3. Elongation: RNA polymerase adds matching RNA nucleotides to the complementary nucleotides of one DNA strand.
4. Various ribonucleotide triphosphate is converted to ribonucleo monophosphate on binding to DNA template chain.
5. RNA polymerase can cause polymerization only in 5' – 3'direction. using energy
6. Termination: when polymerase reaches the termination signal it leaves the DNA
7. Hydrogen bonds of the RNA–DNA helix break, freeing the newly synthesized RNA strand.
8. **Bacteria** use two different strategies for transcription termination - *Rho-independent termination* and *Rho-dependent termination*. /Poly A- tail.

OR

(i) Initiation

(a) Transcription starts at a specific sequence called promoter sequence

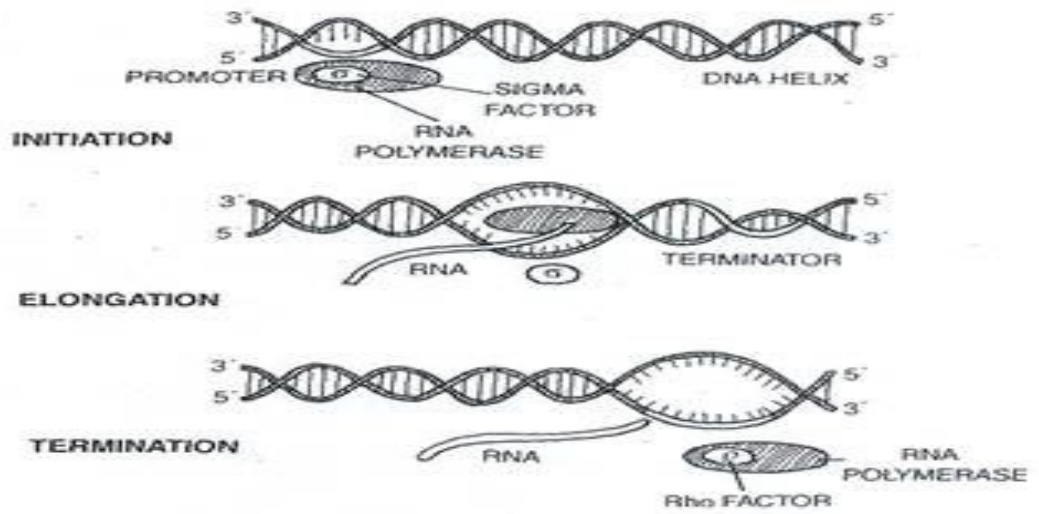
(b) RNA polymerase binds at promoter sequence

(c) Sigma factor helps in recognising promoter sequence

(d) RNA polymerase creates a transcription bubble, by breaking the hydrogen bonds between complementary DNA nucleotides.

Elongation

(a) 3' – 5' strand of DNA acts as template.

	(b) RNA polymerase adds complementary nucleotides in 5' – 3' direction. Termination (a) Rho-dependent (b) Rho-independent (c) Newly synthesised RNA dissociates from DNA – RNA helix. 
(c)	Rh factor incompatibility during pregnancy: • Father Rh positive and mother Rh negative • Rh –ve woman bears Rh +ve child • Rh antibody formation in mother due to exposure to Rh antigen • Antibodies less during first conception so first child normal • Second child – Erythoblastosis foetalis.

Question 9

(a) Discuss the various In-situ and Ex-situ strategies for conservation of biodiversity. **[4]**

(b) List *any four* applications of tissue culture. **[4]**

(c) Mention the causative agent and the preventive measures for each of the following: **[2]**

(i) Gonorrhoea

(ii) Pneumonia

Comments of Examiners

(a) In situ and Ex situ modes of conservation were mixed up. Some candidates wrote general points. Several candidates discussed the importance of biodiversity and the consequences of loss of biodiversity.

(b) Very generalised answers were given. Many candidates repeated the same points in different terms e.g. improving insect resistance, pest resistance, fungal attack resistance and so on.

(c) Many candidates wrote the causative agents without following Binomial Nomenclature. Spellings were incorrect in several cases. Preventive measures were either missed or written incorrectly.

Suggestions for teachers

- Introduce topics *In situ* and *Ex situ* in the class separately with relevant examples.
- Discuss importance of biodiversity, consequences of loss of biodiversity and strategies for conservation of biodiversity in detail with students.
- Different areas in which tissue culture is involved should be discussed under separate headings.
- Stress upon the importance of writing scientific names correctly according to Binomial Nomenclature. Preventive measures should also be discussed.

MARKING SCHEME

Question 9

(a) In-situ and Ex-situ strategies for conservation of biodiversity:

In-situ conservation is also known as "***on-site* conservation**". This technique is more applicable for conserving wild species in its natural habitats. It includes protected areas like: Hotspots, wetland/ Ramsar sites, sacred groves

National Parks: is an area strictly reserved for betterment of wildlife where no human activities are permitted and no private ownership right is allowed.

Wildlife sanctuaries: is an area where protection is given to fauna and certain operations like harvesting of timber and collection of forest products is permitted and also private ownership rights are allowed.

Biosphere reserves: is divided into three zones. Its aim is to conserve gene pool of flora and fauna and traditional life style of tribals.it provides area for ecological research and training.

Ex-situ conservation "is also known as "***Off-site* conservation**. In this technique, the conservation of biodiversity components is done outside of their natural habitats**.**

Home gardens: useful plants grown at home

Botanical gardens: is a garden dedicated to the collection, cultivation and display of a wide range of plants labelled with their botanical names.

	Zoo: Is a facility in which animals are confined within enclosures, displayed to the public, and in which they may also be bred. Aquarium is a clear-sided container in which water-dwelling plants and animals are kept. Cryopreservation The storage of seeds, pollen, tissue, or embryos in liquid nitrogen at -196 °C. Arboreta seed bank/gene bank/ germplasm bank/ pollen bank Safari parks			
(b)	• Propagation of a large number of plants in a short duration / micropropagation. • Plants formed are genetically identical to the original plant / somaclonal propagation. • Variations appearing during tissue culture / somaclonal variations. • Production of disease free plants • Anther culture and formation of androgenic haploids • Embryo culture of successful hybridization • Induction and selection of mutants. • Production of transgenic plants • Production of weedicide resist plants • Production of abiotic stress resist plants • Production of high yielding varieties • Production of secondary metabolites • Conservation of germplasm/biodiversity • Production of pest or insect resistant plants • Protoplast culture			
(c)	Disease		Causative agent	Preventive measure
	(i)	Gonorrhoea	Nisseria gonorrhoeae	Avoid sexual contact with infected person. Avoid Homosexuality
	(ii)	Pneumonia	Streptococcus phenumoniae / Haemophilus influenzae	Maintain personal and public hygiene Avoid sharing glasses, utensils, food or water with infected persons.

Question 10

(a) Name the components of lac operon and discuss their role. **[4]**

(b) Give the significance of transgenic animals. **[4]**

(c) Give *one* significant difference between: **[2]**

(i) *Electroporation* and *Gene Gun*.

(ii) *ECG* and *EEG*

Comments of Examiners

(a) A few candidates wrote *Oparin's theory* instead of *Operon concept*. Some wrote components of Lac operon only without mentioning their functions.

(b) Many candidates wrote the same points in different terms and enumerated the same significance with different examples. Others wrote only the definition. A few candidates discussed recombinant DNA technology.

(c) Many candidates were confused between *electroporation* and *electrophoresis*. Some candidates did not write the role of electric current (high voltage) for insertion of DNA into the host cells.

Suggestions for teachers

- While teaching Lac- operon, discuss its each component individually with the function. Also discuss the working of Lac-operon in the presence of lactose and in its absence.
- Explain definitions, importance, significance and applications of transgenics in detail.
- Different methods of transformation should be discussed under two headings - direct and indirect methods.
- Terms like electroporation should be explained by breaking it into two segments "electro" for use of (high voltage) and "poration" implying introduction of transient pores in the cell membrane of the host for facilitating the entry of foreign DNA (rDNA) into the cell.

MARKING SCHEME

Question 10

(a)	• Lac operon consists of three structural genes, promoter, termination and an operator. • Lac Z encodes B-Galactosidase – hydrolyses lactose into glucose and galactose • Lac Y codes for enzyme permease • Pumps B-galactosides into the cell • Lac A – codes for transacetylase

	Only lac Z and lac Y are necessary for lactose catabolism.
	• Lac I/R/Rep/Reg codes for repressor protein
	• Promoter gene/Lac P - binding of RNA polymerase/Initiation of transcription
	• Operator gene/Lac O - Place for binding of repressor protein/switch
	• Structural genes - codes for enzymes required for metabolising lactose.
(b)	**Any four points** Genetically modified animals currently being developed can be placed into six different broad classes based on the intended purpose of the genetic modification: 1. To research human diseases (for example, to develop animal models for these diseases); 2. To produce industrial or consumer products (fibres for multiple uses); 3. To produce products intended for human therapeutic use (pharmaceutical products or tissue for implantation); 4. To enrich or enhance the animals' interactions with humans (hypo-allergenic pets); 5. Enhance production or food quality traits (faster growing fish, pigs that digest food more efficiently); fishes are used for scientific research and as pets, and are being considered for use as food and as aquatic pollution sensors. 6. Improve animal health: genetically modified viruses to deliver genes that can cure disease in humans. It has been used to treat genetic disorders (disease resistance) 7. Improvement of quality of human race/eugenics 8. To study normal physiological process 9. Testing safety of vaccine 10. To study chemical toxicity/ teratogenesity.
(c)	(i)

Electroporation	Gene Gun
Electroporation is a method that uses short pulses of high voltage to carry DNA across the cell membrane. This shock is thought to cause temporary formation of pores in the cell membrane, allowing DNA molecules to pass through. Can be used only for naked protoplast	In this technique, DNA is coated onto gold particles/platinum/tungsten and loaded into a device which generates a force to achieve penetration of the DNA into the cells. Can be used for cells with cell wall as well

(ii)

ECG	EEG
Used for recording rate and rhythm of atria and ventricles.	For examination of Brain

GENERAL COMMENTS

Topics found difficult by candidates

- Photorespiration and photooxidation
- Apomixis,
- Pleiotropy
- Transcription in prokaryotic cell,
- Tissue culture,
- Lac - operon,
- Transgenic animals
- Electroporation

Concepts in which candidates got confused

- Multiple allelism and polygenic inheritance
- Protobionts and Eobionts
- Transgenic and transcription
- In situ and Ex situ strategies for conservation of biodiversity
- Electroporation and electrophoresis

Suggestions for candidates

- Study all topics thoroughly.
- Lay stress on understanding the concept instead of rote learning.
- Learn main laws, principles and key-words.
- Learn names of scientists, organisms, diseases with correct spelling.
- Always read the question carefully and write answer to the point.
- Utilise the additional 15 minutes allowed in the examination hall judiciously.
- Express main concepts pointwise wherever it is possible.
- Use Key words in definitions.
- Graphic representations should be in the proper sequence.
- Differences must be written in tabular form and the points should be compatible.
- All parts and sub parts of a question should be attempted together in the same sequence.

QUALITATIVE ANALYSIS

PRACTICAL (PAPER-2)

Question 1

(a) Examine carefully the flower specimens D-41 and D-42 provided. Describe the floral characteristics in semi-technical terms. (Details of individual whorls are not required.) **[5]**

(b) Cut a longitudinal section of one flower of specimen D-41 with a sharp razor blade. Place one of the cut surfaces on a moist filter paper so that all the parts are clearly visible. Draw a neat labelled diagram of the cut surface.

(c) Similarly, cut a longitudinal section of specimen D-42 with a sharp razor blade. Place one of the cut surfaces on a moist filter paper. Draw a neat labelled diagram of this cut surface.

(d) With the hand lens provided, carefully observe the cut surface of D-41 and D-42 and reco observations in the table below:

Androecium		**D-41**	**D-42**
(i)	Relation of stamens to each other	--	--
(ii)	Attachment of anther to filament	--	--
(iii)	Relation of stamen to petals	--	--
Gynoecium			
(i)	Number of locules in the ovary	--	--
(ii)	Type of placentation	--	--

(e) Take a fresh specimen of D-42. Isolate its pistil. Cut a transverse section of its ovary. Draw a neat labelled diagram of the transverse section of ovary.

(f) Name the families to which each specimen D-41 and D-42 belong.

(g) Draw a floral diagram of D-41.

(h) Write the floral formulae of D-41 and D-42.

(i) Write two characteristic features of each family you have mentioned in (f) above.

(j) Mention the botanical name of one economically important plant belonging to each family that you have named in (f) above.

Comments of Examiners

(a) Candidates made mistakes in the spellings of the semitechnical terms. Use of similar words twice, e.g. zygomorphic/irregular was also observed. Details of all the floral whorls were discussed by many candidates.

(b) In the L.S of the flower – epicalyx was not drawn or drawn at the wrong place. Some mistakes made in the diagram were as follows: the sepals appeared to be free, the petals were in gamopetalous condition, reniform anthers were not shown, ovules were not attached to the placenta, five stigma drawn.

(c) Many stamens drawn by some candidates; in some other cases, the ovules were not attached to the upper margin of the ovary/bent style not shown.

(d) (i) Several candidates used the term monothecous / dithecous instead of Monadelphous / diadelphous.
(ii) Instead of writing 'axile placentation' some candidates wrote 'axial' placentation.

(e) The concept of marginal placentation was not clear to many candidates. In many cases, elongated locule was not drawn, the ovary wall was labelled as 'ovary', placenta was not drawn correctly/not labelled.

(f) Many candidates made spelling mistakes while writing the name of the family. Subfamily written by many in D42.

(g) Some common mistakes made by candidates were as follows: Mother axis was either not drawn or drawn in wrong place by several candidates, the orientation of sepals and petals was incorrect, epipetalous stamens was not shown correctly, monothecous anther was not drawn correctly, T.S of ovary in floral diagram was indistinct.

Suggestions for teachers

- Candidates must be encouraged to make a list of all semitechnical terms required. Students must be cautioned against spelling errors.
- Encourage students to draw from the actual specimen (L.S.) by observing and not from a book. Technical diagram is important.
- Fixation of anther to the filament must be illustrated and explained by the teacher.
- Students should be encouraged to prepare slides with T.S and L.S of ovary which must be observed under microscope to understand the attachment.
- Family names must be taught with correct spellings. Teacher may prepare a chart with family names for the laboratory.
- Teachers must encourage students to draw and practice repeatedly.
- Students should be taught unique identifiable features of the family. General features usually overlap amongst few families.
- Rules of binomial nomenclature should be taught thoroughly.

(h) Range (5-7) was written by many candidates for epicalyx. Epipetalous and hypogynous signs were not shown in several cases. Many candidates wrote both Br/Ebr.

(i) Many candidates mentioned general characteristics instead of unique features of the family.

(j) Binomial nomenclature was not followed by a number of candidates. The generic and species name were either not underlined or not underlined separately. Spelling errors were also observed.

MARKING SCHEME

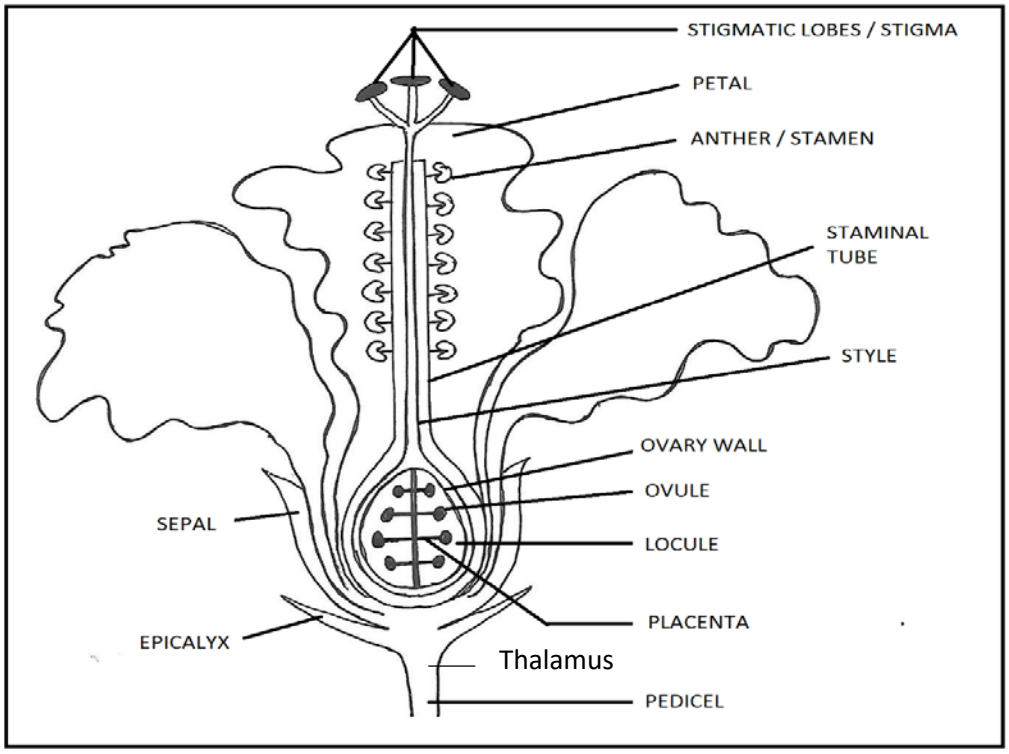
Question 1

1(a)

Floral characters of flower specimen D-41 in semi technical terms.
Bracteolate/bracteoles form epicalyx, complete, ebracteate, pedicillate, hermaphrodite (bisexual), actinomorphic (regular), pentamerous, hypogynous, cyclic.

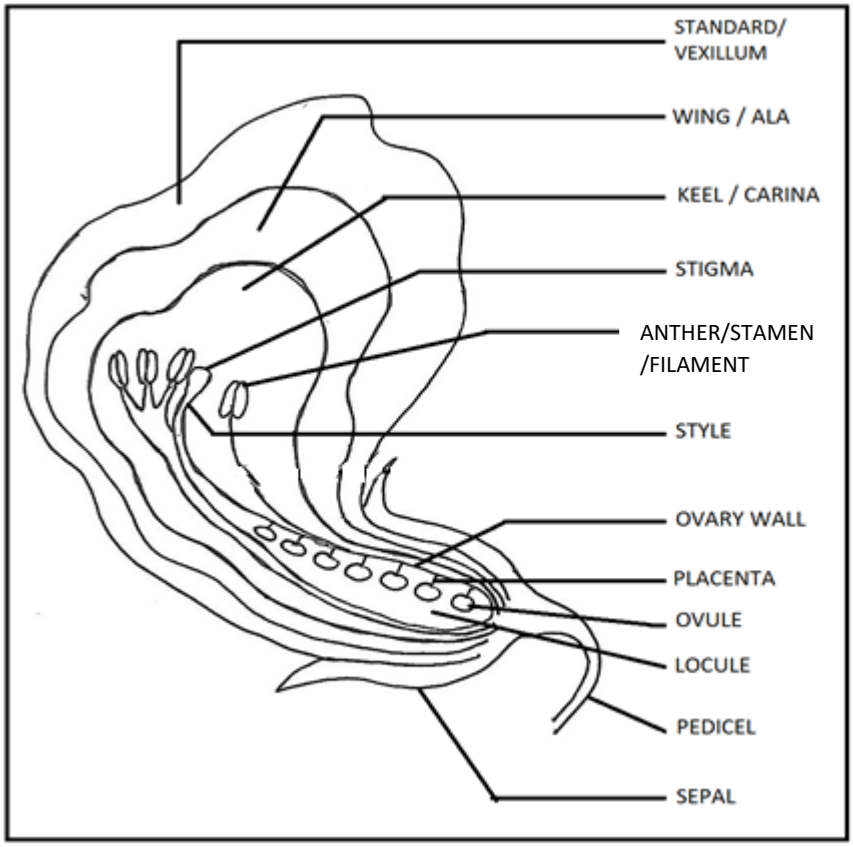
Floral characters of flower specimen D-42 in semi technical terms.
Ebracteate, complete, pedicillate, hermaphrodite (bisexual), zygomorphic (irregular), pentamerous, hypogynous/ perigynous), papilionaceous, acyclic
Bracteate in case of Clitoria

1(b)



Drawing:		**Labelling:**	
1	2 epicalyx shown	1	Stigmatic lobe/Stigma
2	2 sepals shown	2	Style
3	2 – 3 free petals shown	3	Staminal tube
4	Staminal tube shown	4	Anther/ Stamen/Filament
5	Thin long style passing through staminal tube	5	Petal
6	2-many reniform anthers shown	6	Sepal
7	2 – 3 capitate stigma shown	7	Ovary
8	2 locules visible in the ovary	8	Ovule
9	2 rows of ovules attached to the placenta	9	Epicalyx/Episepal
		10	Pedicel/Stalk
		11	Thalamus / Receptacle
		12	Locule

1(c)		13 Placenta



Drawing:		**Labelling:**	
1	2 sepals shown	1	Sepal
2	Broad Standard shown	2	Standard/ Vexillum
3	Smaller wing is shown on the standard	3	Wing/ Ala
4	Much smaller keel on wing	4	Keel/ Carina
5	More than 2 stamens shown	5	Anther/ Stamen/Filament
6	Elongated ovary shown	6	Placenta
7	Bent style	7	Stigma
8	One chambered ovary	8	Style
9	2-3 ovules attached to the upper margin of the ovary	9	Ovary
10	One free stamen shown	10	Ovule
		11	Pedicel/ Stalk
		12	Locule

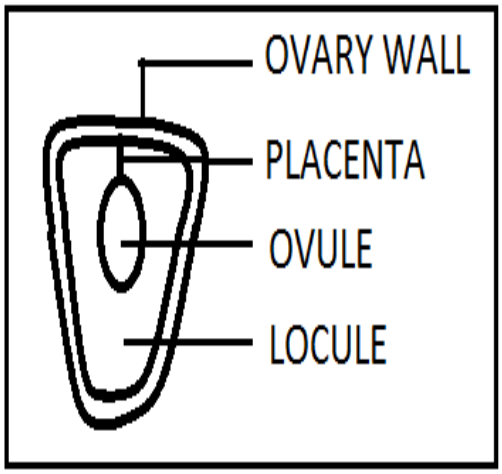
Kindly note androecium of Crotalaria juncea is different.

1(d)

	D - 41	D - 42
Androecium		
1. Relation of stamens to each other	Monadelphous or explained	Diadelphous [(9)+1] or explained
2. Attachment of filament	Basifixed	Basifixed
3. Relation of stamen to petals	Epipetalous /Petals adnate to the base of petals	Free (from petals)

	D - 41	D - 42
Gynoecium		
(i) Locules	Five/ Pentalocular	One/ Unilocular
(ii) Type of placentation	Axile	Marginal

1(e)



1(f)

Drawing:	**Labelling:**
1 Narrow elongated locule	1 Ovary wall
2 One locule	2 Locule
3 Marginal placentation	3 Ovule
4 One ovule attached to the placenta	4 Placenta

Family to which D-41 flowers belong - Malvaceae

Family to which D-42 flowers belong - Leguminosae/ Fabaceae

1(g)

1. Mother axis shown
2. Epicalyx shown
3. Five joined sepals in correct orientation
4. Five separate petals in correct orientation
5. Epipetalous stamen
6. Monothecous anther
7. Monadelphous Androecium
8. Pentalocular ovary
9. Two ovules in each locule
10. Axile placentation

Write the <u>floral formula</u> of D-41.

1(h)

Hibiscus EBr (Brl) ♂ ⊕ Epik $_7$ $K_{(5)}$ $\overline{C_5}$ $\overline{A}_{(\alpha)}$ $\underline{G_{(5)}}$

Write the <u>floral formula</u> of D-42.

<u>Clitoria</u> Br % ♂ $K_{(5)}$ $C_{1+2+(2)}$ $A_{(9)+1}$ $\underline{G_1}$ / G_{1-} (1 + (9))

<u>Sesbania</u> EBr % ♂ $K_{(5)}$ $C_{1+2+(2)}$ $A_{(9)+1}$ $\underline{G_1}$ / G_{1-} (1 + (9))

1(i)

Family characters of Specimen D – 41 (any two)

- Monadelphous stamen
- Reniform or kidney shaped anther
- Mucilaginous flower
- Style passes through staminal tube
- Epicalyx present

Family characters of Specimen D – 42 (any two)

- Papilionaceous corolla
- Vexillary aestivation
- Diadelphous stamen Or stamen in two bundles (or explained)
- Marginal placentation
- Feathery stigma / Hairy stigma
- Zygomorphic flower

	• Bent style
1(j)	Give the scientific names of two economically important plants belonging to family of D-41. • Gossypium herbaceum • Malvastrum tricuspidatum • Sida cordifolia • Urena lobata • Malva rotundifolia • Malva verticillata • Thespesia populnea • Abelmoschus esculentus • Althaea rosea • Gossypium hirsutum • Hibiscus radiates • Malva sylvestris • Abutilon • Sida rhombifolia Give the scientific names of two economically important plants belonging to family of D-42. • Lens esculenta • Vigna radiata • Glycine max • Dalbergia sisso • Phaseolus radiata • Vicia faba • Cajanas cajan • Casia sp • Bauhinia sp • Acacia sp • Crotalaria juncea • Dolichos lablab • Lathyrus odoratus • Phaseolus mungo • Phaseolus vulgaris • Trifolium sp. • Pisum sativum • Caesalpinia sp • Delonix sp

Question 2

(a) Label three petri dishes as A, B and C respectively. Measure and pour 20 ml of solution S_1 in petri dish A, 20 ml of solution S_2 in petri dish B and 20 ml of solution S_3 in petri dish C. Cover the three petri dishes. **[3]**

(b) You are provided with a potato, specimen **D-43**. Peel the potato with a peeler. With the help of a knife, cut three rectangular pieces, each measuring approximately 4cms in length, 0·5cm in width and 0·5cm in height.

(c) Place the potato pieces on a moist filter paper to prevent drying. Measure and record the length of each piece.

Fully immerse one piece in solution S_1, in petri dish A. Similarly, immerse the second piece in solution S_2, in petri dish B and the third piece in solution S_3, in petri dish C. (More solution may be added, if need be, so that the potato pieces are fully immersed.)

(d) Cover the petri dishes and leave them as such for 30 minutes.

S**how the set up to the Visiting Examiner**.

(e) After 30 minutes, remove the potato piece from petri dish A. Dry it on a filter paper and measure it. Record its length. Transfer it back to petri dish A.

Similarly, repeat the procedure with the potato pieces from petri dishes B and C. Measure and record the length of each and transfer each potato piece to the respective petri dishes.

(f) Record the length of each piece in a tabulated form as shown below:

Length of rectangular potato piece		At the beginning	After 30 minutes
(i)	In S_1 solution - petri dish A	--	--
(ii)	In S_2 solution - petri dish B	--	--
(iii)	In S_3 solution - petri dish C	--	--

(g) Explain the observation of each potato piece in petri dishes A, B and C as recorded by you in (f) above.

(h) With the help of forceps pick up the potato piece from petri dish A. Place it on a dry filter paper. Touch it and feel it. Write your observation regarding any change you have noticed.

Repeat the process with potato pieces from petri dishes B and C.

(i) Explain the changes (if any) observed by you in (h) above.

(j) Name and define the process that led to the changes (if any) observed in (h) above.

(k) Comment on the tonicity of the solutions S_1, S_2, and S_3.

(l) What do you think would happen if a red blood corpuscle is placed in solution S_1?

Comments of Examiners

(f) Many candidates did not use the table. In some cases, the initial length of the potato tuber was not taken according to the given direction.

(g) While explaining, many candidates failed to use keywords – e.g. exosmosis, endosmosis, turgid, hyper or hypotonic.

(h) Many candidates could not write about the exact feel of the potato pieces under three different concentrations. Instead, they mentioned the process that took place (Flaccidity and turgidity)

(i) Keywords were not used to describe the changes. Many repeated the answers as in 'g'.

(j) Due to lack of conceptual clarity, many candidates named the processes in the wrong sequence. Keywords were missing in the definition.

(k) Many answered this correctly. However, some candidates may not have identified and labelled the solutions properly, as a result, their tonicity of the solution were interchanged.

(l) Many failed to use the term 'crenation'. Some used the term 'Plasmolysis' which is not applicable to R.B.C.

Suggestions for teachers

- Students should be encouraged to read the instruction and questions repeatedly before answering.
- Teachers must instruct students to use keywords.
- The concept of Osmosis must be clearly explained.
- Students should be taught to observe the changes in the potato pieces with respect to size, texture and processes involved with those changes.
- It must be emphasized that precise answer using correct keywords is important.
- Teachers must provide clear understanding of the keywords in the definition.
- Correct uses of the terms must be taught with examples.

MARKING SCHEME

Question 2

2(f)

	Length of rectangular potato piece	At the begining	After 30 minutes
(i)	In S_1 solution – Petridish A	4 cm	Decreased
(ii)	In S_2 solution – Petridish A	4 cm	No change
(iii)	In S_3 solution – Petridish A	4 cm	Increased

2(g)

⇒ Tuber in solution S_1 is kept in <u>hypertonic solution</u> / <u>more concentrated than cell sap</u>.
⇒ <u>Exosmosis</u> / <u>Plasmolysis</u> occurs
⇒ Length of the tuber in Petridish A <u>decreases</u>
⇒ The <u>cells/ tuber become flaccid</u>
⇒ Thus the <u>strip becomes less firm / limp / soft</u>
⇒ Tuber in solution S_2 is kept in <u>isotonic solution</u> / <u>same concentration than cell sap</u>.
⇒ No gain or loss of water
⇒ The <u>length</u> of the tuber <u>remains same</u> / <u>no change</u>
⇒ <u>Firmness/stiffness</u> of the tuber <u>remains the same</u>
⇒ Tuber in solution S_3 is kept in <u>hypotonic solution</u> / <u>less concentrated than cell sap</u>.
⇒ <u>Endosmosis</u> occurs
⇒ The length of the tuber increases.
⇒ The <u>cells / tuber become turgid</u>.
⇒ Thus the <u>strip becomes firm / hard</u>.

2(h)

Petridish A - In S_1 - The <u>strip becomes less firm / soft / limp</u>

Petridish B - In S_2 - Firmness of the tuber <u>remains the same/ No change</u>
Petridish C - In S_3 - The <u>strip becomes firmer / hard / stiff</u>.

2(i)

Petridish A - As potato pieces were kept in hypertonic solution (S_1) they <u>lost water through exosmosis</u> / <u>piece becomes flaccid</u>.

Petridish B - As potato pieces were kept in isotonic solution (S_2) there was <u>no loss / exit or gain/ entry of water</u> / <u>piece undergoes no change</u>.

Petridish C - As potato pieces were kept in hypotonic solution (S_2) they <u>gained water by endosmosis</u> / <u>piece becomes turgid</u>.

2(j)

Petridish A
⇒ Plasmolysis
⇒ This <u>shrinkage of protoplasm</u> from the <u>cell wall</u>, by <u>exosmosis</u>, when the cell is placed in a <u>hypertonic solution</u>, is called plasmolysis.

or

Petridish A
⇒ Exosmosis

2(k)	⇒ Exosmosis is the process in which, water from the solution leaves the cell from inside, through the semi-permeable cell membrane, when a cell is placed in a hypertonic solution (solution whose concentration is less than that of the cell sap solution). Petridish C ⇒ Endosmosis ⇒ Endosmosis is the process in which, water from the solution enters the cell from outside, through the semi-permeable cell membrane, when a cell is placed in a hypotonic solution (solution whose concentration is less than that of the cell sap solution).
2(l)	S_1 → Hypertonic S_2 → Isotonic S_3 → Hypotonic S_1 - RBC shrinks due to exosmosis and undergoes crenation

Question 3

(a) With a sharp razor blade, cut several transverse sections of the specimen **D-44** provided. Select a good section and stain with safranin. Mount it in glycerine. **[2]**

Show your slide to the Visiting Examiner under low power of Microscope.

(b) Draw a neat labelled diagram of the mount as seen under the microscope. (Microscopic details are not required.)

(c) Identify the given specimen.

(d) Write *two* characteristic features of this specimen.

Comments of Examiners

(b) In the diagrams drawn by many candidates: the hypodermis and cortex were not differentiated; thick cortex was not shown; vascular bundle conjoint, collateral and open was not clearly drawn. In some cases, cellular diagram was drawn which was not required.

(c) Most of the candidates identified the given specimen correctly.

(d) Many candidates wrote – *Vascular Bundles 'Endarch'*, instead of *'Xylem Endarch'*. Many candidates wrote general features instead of specific ones.

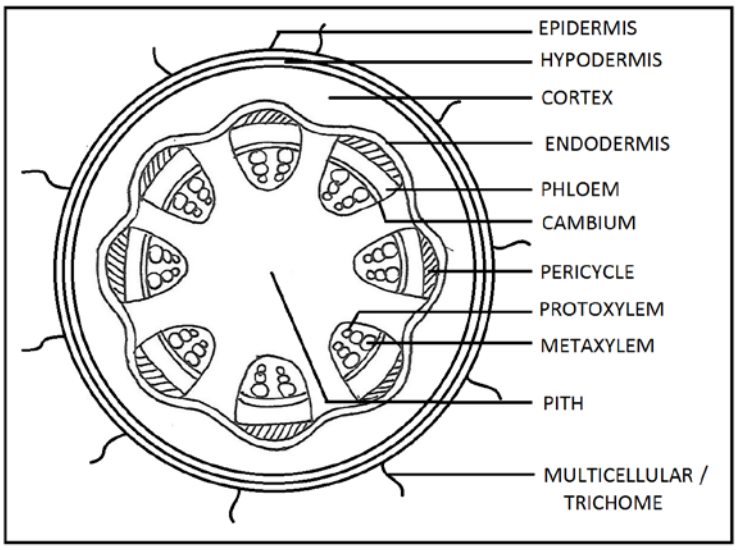
Suggestions for teachers

- Diagrammatic representation with correct and complete labeling must be practiced.
- Emphasize the difference between the internal structure of Dicot and Monocot Stem.
- During practical classes, types of vascular bundles must be taught with diagrams. Emphasis must be laid on the distinctive features.

MARKING SCHEME

Question 3

3(b)



Drawing points		Labelling points	
1	Trichome/ multicellular hair	1	Trichome/ multicellular hair
2	Single layered epidermis	2	Epidermis
3	Hypodermis	3	Hypodermis
4	General cortex (thick)	4	Cortex
5	Endodermis	5	Endodermis / starch
6	Pericycle (in patches)	6	Pericycle
7	Vascular bundles arranged in a ring	7	Xylem
8	Conjoint, collateral, open vascular bundles	8	Pith
9	Endarch xylem	9	Pholem
10	Distinct pith	10	Cambium
		11	Vascular Bundle

3(c) The given specimen is Dicot Stem

3(d)

- Pericycle consists of semi-lunar patches of sclerenchyma and intervening masses of parenchyma.
- Vascular bundles arranged in a ring.
- Vascular bundles are conjoint, collateral and open (Cambium present) [operative]
- Xylem endarch - (Protoxylem towards the centre and metaxylem towards the periphery).

Question 4

Identify the given specimens A to E. Give *two* reasons to support your answer in each case. **[5]**
Draw a neat labelled diagram of each specimen. You are not allowed to spend more than three minutes for each spot.

Note: *Hand over your continuation sheets to the Supervising Examiner after you finish answering this question.*

Comments of Examiners

(a) Incomplete identification was done by many candidates – they did not write "T.S". In some other cases, "epiblema" was labeled as "epidermis". In the identifying features, several candidates failed to mention *radial vascular* bundle and vascular bundles are more than '6'. Labelling of the diagram was incomplete/ incorrect in many cases.

(b) Many candidates did not mention *T.S./Mammalian* in the identification of T.S. of Mammalian Blastula. In the diagram, embryonal knob was wrongly placed/ "blastocoel" was labelled as "blastocyst" and "trophoectoderm" was wrongly labeled as "trophoderm".

(c) In the identification, several candidates omitted to mention "T.S." or "Mammalian Ovary". In many cases, follicular stages were not shown in the cortex. The drawing of ruptured follicle/ Graafian follicle was missing in many diagrams.

(d) Many candidates wrote "Raceme" instead of "Racemose" in the identification of spot D. In some diagrams, acropetal arrangement not drawn properly/ sessile flower was not drawn/ bracts not shown. In several cases, the identification points and the drawings were contradictory. Labelling of the diagrams was incomplete.

Suggestions for teachers

- Stress upon distinctive features and complete identification.
- Insist on a simplified diagram with complete labeling required for identification. Labeling lines should not cut each other.
- Explain the difference between T.S., L.S. and V.S. of any specimen in a permanent slide.
- A diagrammatic sketch of Racemose and Cymose inflorescence must be drawn while teaching. Also, show actual specimens while teaching, to explain the difference.
- The experimental set up should be observed by the students for drawing. Encourage students to label all the parts seen. Conclusion must be drawn from the observation.

(e) Some errors observed in the diagrams drawn by candidates are as follows: light source was not shown; air bubbles were drawn in empty test tube; the test tube was not resting on the funnel but floating in water; the stem of the funnel was drawn above the water level. Some candidates labelled gas bubbles as 'oxygen bubbles'. A few candidates spelt "Hydrilla" as "Hydra".

MARKING SCHEME

Question 4

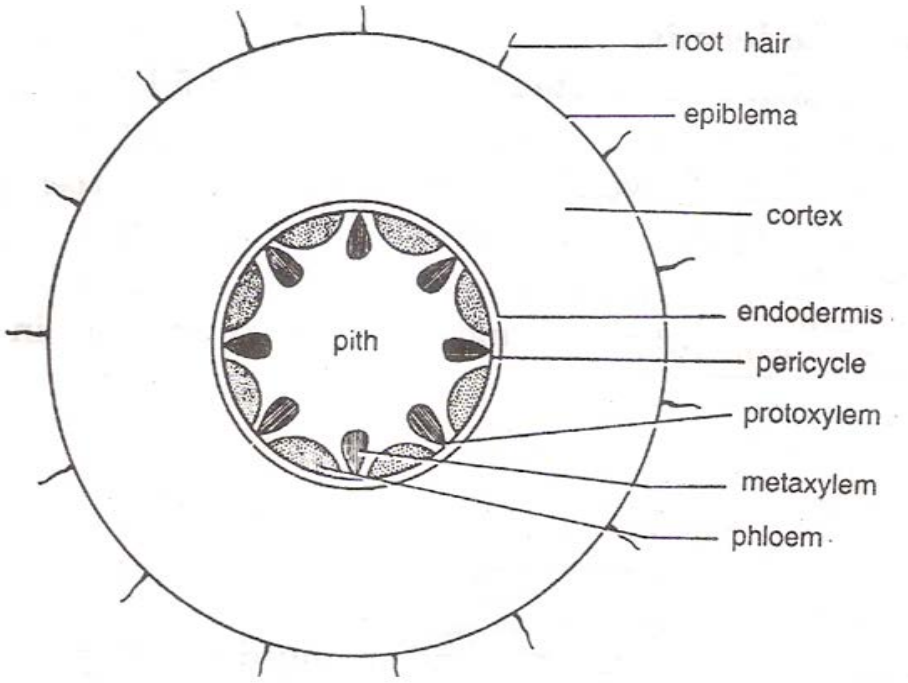
4

SPOT A

Identification: Slide showing T.S. of Monocot root

Reasons: **(Any two)**

- Vascular bundles are radial. (Xylem and phloem present on separate radii) and more than 6. **(operative)**
- Xylem exarch (Protoxylem towards the periphery and metaxylem towards the centre).
- Pith is well developed.



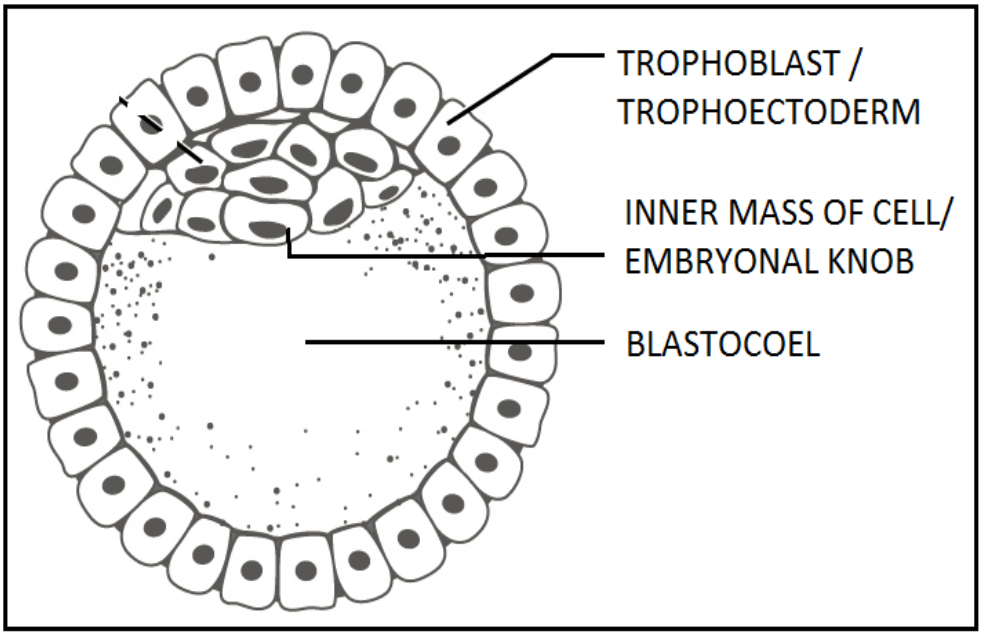
	Drawing		Labelling
1	1. Unicellular root hair	1	Root hair
2	2. Single layered epiblema	2	Epiblema
3	3. General cortex (thick)	3	Cortex
4	Endodermis	4	Endodermis
5	Pericycle	5	Pericycle
6	Xylem and phloem alternate	6	Xylem
7	Exarch xylem	7	Phloem
8	Distinct pith	8	Pith
9	Vascular bundle more than 6 and less than 14		

4 SPOT B

Identification: Slide showing T.S. of mammalian Blastula

Reasons for Identification: **(Any two)**

- The trophoblast or trophoectoderm visible.
- Embryonal knob/ inner mass of cell is visible.
- Fluid filled cavity called blastocoel present.



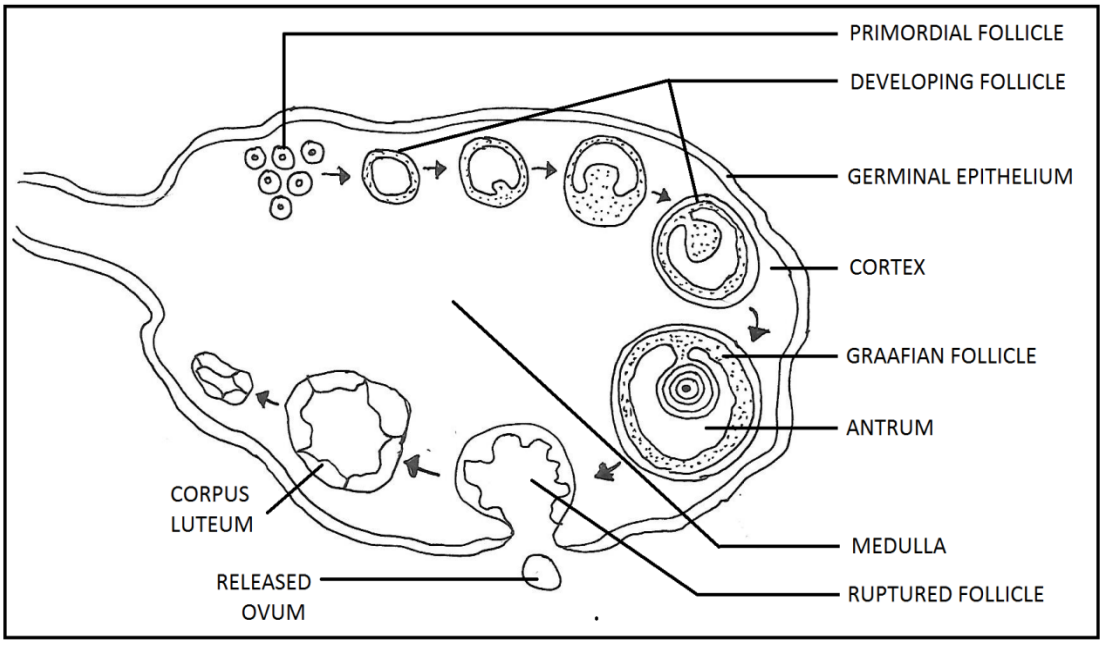
	Drawing		**Labelling**
1	Trophoblast	1	Trophoblast
2	Blastocoel	2	Blastocoel
3	Embryonal knob / or spherical Mass of cell on one side	3	Embryonal knob/ inner mass of cell

4 SPOT C

Identification: Slide showing T.S. of Mammalian Ovary

Reasons for Identification:

- The outer surface is covered by germinal epithelium
- The cortex contains numerous ovarian follicles of different sizes /different stages of maturation.
- Primordial/ Primary follicle visible
- The (matured) Graafian follicles (containing centrally placed ovum surrounded by several layers of granular cells), visible.
- Corpus Luteum visible



Drawing

1. Follicles of different sizes shown
2. Germinal epithelium present
3. Ovum seen in mature follicle
4. Empty follicle visible
5. Corpus luteum

Labelling

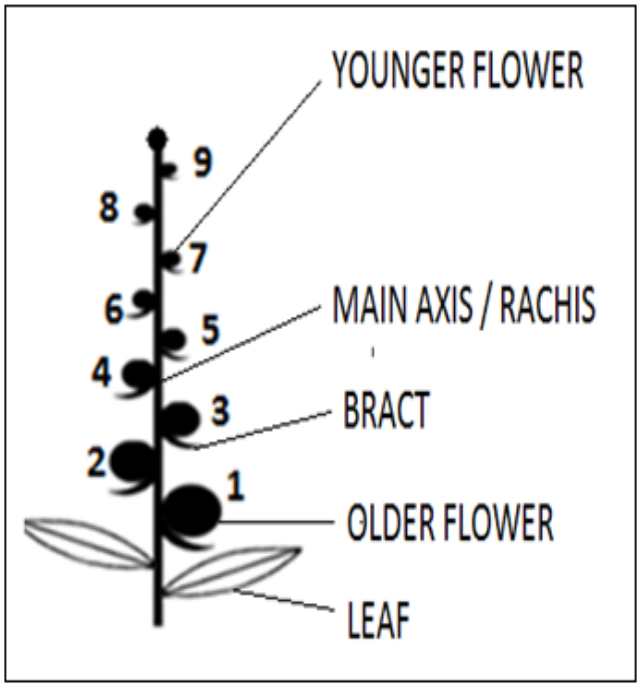
1. Germinal epithelium
2. Maturing follicle/Graafian Follicle
3. Primordial follicle
4. Ovum
5. Medulla
6. Cortex
7. Corpus Luteum
8. Ruptured follicle

SPOT D

4 **Identification:** (Twig of Gladioli showing) Racemose inflorescence / Spike

Reasons for Identification:

- Main axis or rachis or penduncle or floral axis is elongated/ unbranched/ grows indefinitely
- Flowers are arranged in acropetal manner / older flowers are borne at the base and younger flowers towards the apex.
- Flowers are sessile



	Drawing		Labelling
1	Main axis	1	Main axis/ rachis/ penduncle
2	Younger flower at the top	2	Older flower
3	Older flower at the bottom	3	Younger flower
4	Sessile flower	4	Bract
5	Bracteate flowers/ bract		

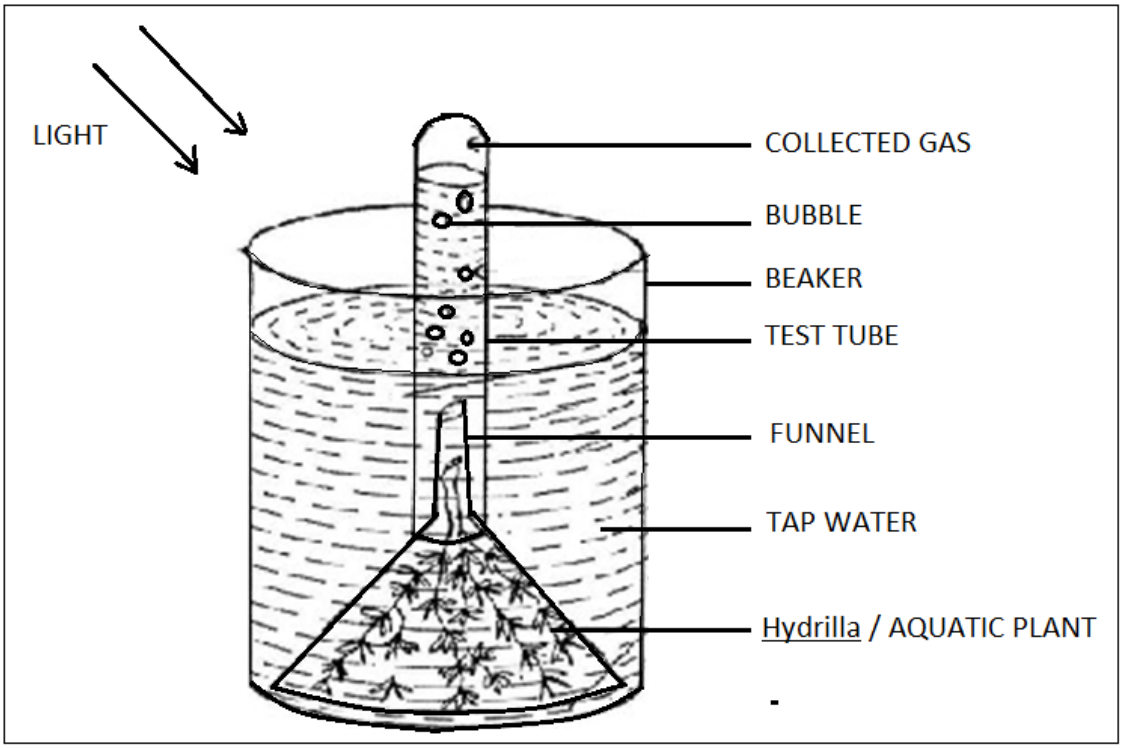
4 **SPOT E**

Identification: Experimental set up on demonstration of photosynthesis showing liberation of oxygen / liberation of gas bubble

Reason for Identification:

- One or two twigs of Hydrilla is placed in the water
- Beaker 2/3 filled with water
- A funnel is kept upside down inside the beaker in a way that it covers the Hydrilla/ aquatic plant.

- A test tube is filled with water and carefully inverted on the stem of the funnel in a way that no air bubble enters the test tube.
- Bubbles of gas are seen evolving that collects by downward displacement of water.



Drawing

1. Stem of the twig pointed towards the neck of the funnel
2. Test tube rests on the funnel
3. Stem of the funnel in beaker under water
4. Light source
5. Bubbles shown in the test tube under water

Labelling

1. Light
2. Air bubble/ Gas bubble
3. Test tube
4. Water
5. Beaker
6. Funnel
7. Hydrilla
8. Collected gas

GENERAL COMMENTS

Topics found difficult by candidates

- Q. No.1.: Floral formula, floral diagram, botanical names and spelling of family names; identifying features of the family; usage of correct semitechnical terms.
- Q. No.2. Explanation of (h) 'Touch and feel' and (j) Definition of exosmosis and endosmosis.
- Q. No.3. Diagram (thickness of hypodermis and cortex, endarch Xylem). Specific identifying points.
- Q. No.4. Spot E – The experimental set up.

Concepts in which candidates got confused

- Exarch and Endarch
- Epidermis and Epiblema
- Open and closed vascular bundle
- Cymose and Racemose inflorescence
- Blastula and Blastocyst
- Plasmolysis, Exosmosis and Endosmosis

Suggestions for candidates

- Learn the semi technical terms with correct spellings.
- Follow binomial nomenclature.
- Use actual specimen for the diagram and not the book.
- Learn the keywords in any definition with conceptual clarity.
- Keep the laboratory manual up to date.
- Practice all the diagrams.
- Practice floral diagram. Understand the importance of mother axis.
- Understand the difference between T.S./L.S./V.S.
- Read the question carefully, understand and then proceed. Follow the instructions provided.
- Draw neat labelled diagrams. Do not cut guide lines.
- Follow the table whenever asked.