BIOLOGY PAPER 2 (PRACTICAL)

Question 1 **[5]**

(a) Carefully examine the two flower specimens **D-41** and **D-42** provided. Describe the floral characteristics of each in semi-technical terms. (Details of individual whorls are not required.)

(b) Cut a longitudinal section of the specimen **D-41** with a sharp razor blade. Arrange one of the cut surfaces on a moist filter paper so that all the parts are clearly visible.

Draw a neat and labelled diagram of the cut surface.

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

(d) With the hand lens provided, carefully observe the cut surfaces of **D-41** and **D-42**. Record your observation as per the table given below:

Androecium:		**D-41**	**D-42**
(i)	Relation of stamens to each other		
(ii)	Nature of anthers		
(iii)	Relation of stamens to petals		
Gynoecium			
(i)	Nature of stigma		
(ii)	Type of placentation		

(e) Take a fresh specimen **D-41** and with the help of forceps, remove the calyx. Now, detach each petal carefully and arrange the whorl on a moist filter paper. Draw a labelled diagram of the arrangement of petals.

(f) Remove the stamens from this specimen **D-41** and expose the gynoecium. Cut a longitudinal section of the gynoecium. Draw a neat labelled diagram of this longitudinal section.

(g) Draw the floral diagram of specimen **D-42**.

(h) Name the families to which each specimen, **D-41** and **D-42** belong respectively.

(i) Write two characteristics of each family mentioned in (h) above.

(j) Write the floral formula of each specimen, **D-41** and **D-42**.

(k) Mention one economically important plant of each family you have mentioned in (h) above. (write the **botanical name** only)

Comments of Examiners

(a)Spelling errors were made by candidates in describing the semi-technical terms. Many candidates described all floral whorls. Some used contrasting terms such as, zygomorphic / actinomorphic for the same flower.

(b) Some candidates did not understand the term 'L.S.'. In some cases, ovules were not attached to upper margin of ovary wall. Spelling errors were observed in labelling – words like keel/carina were misspelt. In some cases, very thick ovary was drawn.

(c) Some mistakes made by candidates in drawing the diagram were as follows: epicalyx missing in the diagram; polypetalous/ gamopetalous condition wrongly represented; reniform anthers not shown; style passing through staminal tube not drawn; locules and ovules not well represented.

(d) A number of candidates made mistakes in spelling the terms. In some cases, tabular form was not used by candidates.

(e) Many candidates did not understand the concept of arranging the whorl. In some cases, standard, wing and keel were not drawn with reference to each other. In a few cases, the broad standard was not drawn or keel not joined.

(f) Many candidates drew a T.S of the ovary instead of the L.S. Many drew the entire gynoecium and not the L.S. In several cases, feathery stigma was not drawn/ swollen ovary was drawn instead of a narrow ovary.

(g) In the floral diagrams drawn by many candidates, the mother axis was missing or wrongly placed. In some cases, orientation of whorls was incorrect. In a few diagrams, petals were attached to the gynoecium instead of the androecium or locules, ovules and placentation was shown incorrectly.

(h) Spelling errors were made by many candidates while naming the family. Some candidates used a small letter for family name.

Suggestions for teachers

- Explain semi-technical terms by showing examples.
- Ask students to follow the instructions given in the Question Paper.
- Explain concepts of T.S, L.S. C.S. etc.
- Ask students to refrain from using text book diagrams. Students must be encouraged to draw from the actual sample.
- Explain all relevant terms. Students must be made aware that spellings errors of technical terms lead to loss of, marks.
- Dissection of flower and arrangement of whorls on a fitter paper must be practised during practical classes.
- Relevance of the mother axis in a floral diagram must be highlighted. Orientation of whorls with respect to the M.A. must be explained.
- Make students aware of scientific names.
- Specific characteristics must be taught by demonstrating relevant live specimens of the family.
- More practice must be given in writing the floral formula.
- Students must be made aware of the rules of binomial nomenclature.

(i) In several cases, characteristics solely pertinent to the family were not written by candidates.

(j) Several candidates were confused regarding br/ebr with reference to the supplied specimen. Epik was not used by many. Epipetalous condition not shown in a few cases.

(k) In several cases, the Genus and species name were both capitalised. Spelling mistakes were also observed. Underling was not done correctly in many cases.

MARKING SCHEME

Question 1.

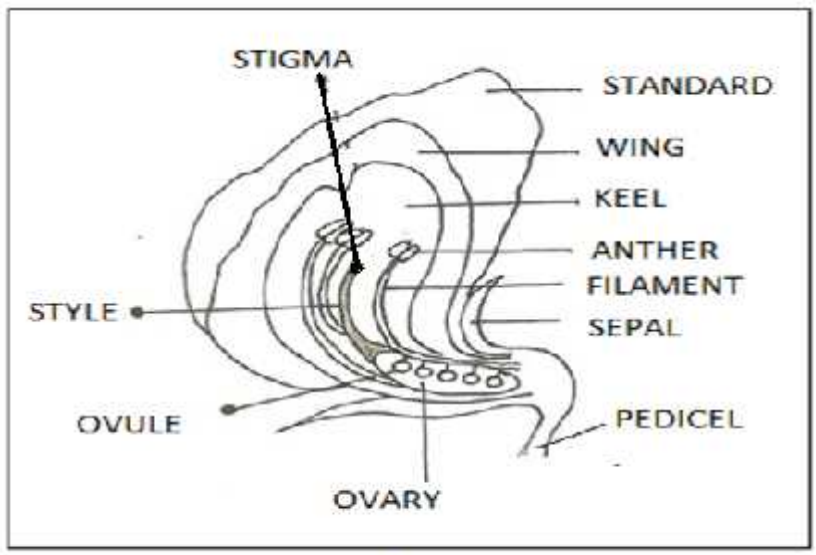
(a) Description of flower D 41 in semi-technical terms: Ebracteate, ebracteolate, complete, pedicillate, hermaphrodite (bisexual), zygomorphic (irregular), pentamerous, hypogynous (sometimes perigynous), papilionaceous, acyclic.

(Bracteate if Clitoria is given)

Description of flower D 42 in semi-technical terms:

Bracteolate (bracteoles form epicalyx), ebracteate, complete, pedicillate, hermaphrodite (bisexual), actinomorphic (regular), pentamerous, hypogynous, cyclic.

(b)



L.S. of D 41

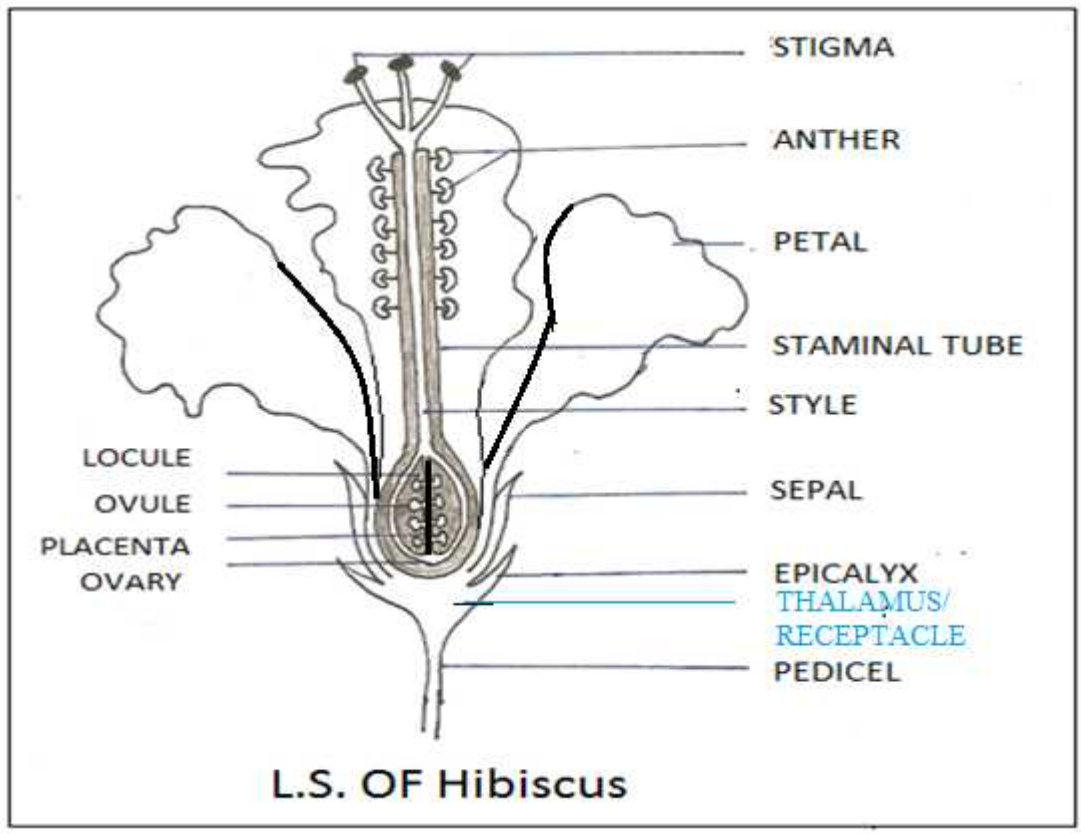
Drawing:

1. 2 sepals shown
2. Broad Standard shown
3. Smaller wing is shown on the standard
4. Much smaller keel on wing
5. More than 2 stamens shown
6. Elongated ovary shown
7. Bent style
8. One chambered ovary
9. 2-3 ovules attached to the
10. Upper margin of the ovary

Labelling:

1. Sepal
2. Standard/ Vexillum
3. Wing/ Ala
4. Keel/ Carina
5. Anther/ Stamen
6. Filament
7. Stigma
8. Style
9. Ovary
10. Ovule
11. Pedicel/ Stalk
12. Locule

(c)



L.S. OF Hibiscus

Drawing:

1. 2 epicalyx shown
2. 2 sepals shown
3. 2 – 3 free petals shown
4. Staminal tube shown
5. Thin long style passing through staminal tube
6. 2-many reniform anthers shown
7. 2 – 3 capitate stigma shown
8. 2 locules visible in the ovary
9. 2 rows of ovules attached to the placenta

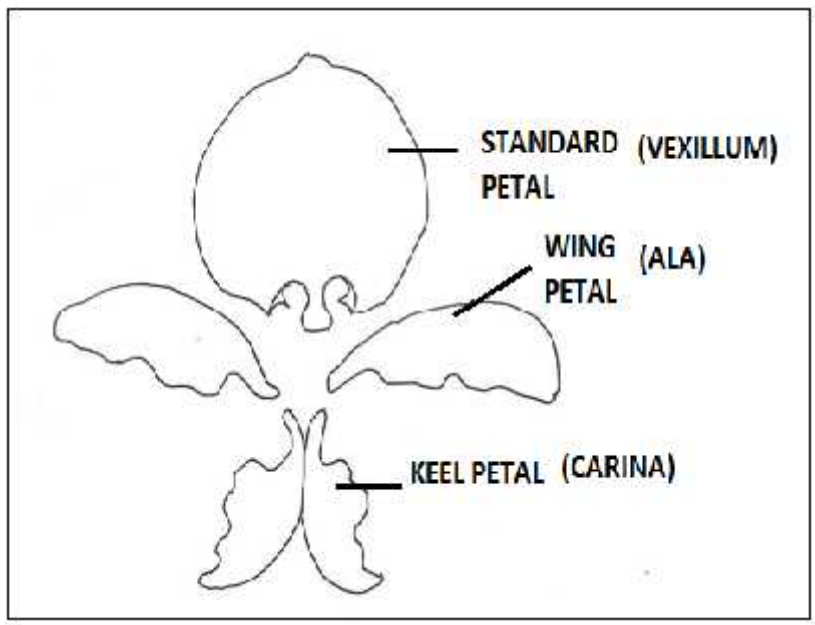
Labelling:

1. Stigmatic lobe/Stigma
2. Style
3. Staminal tube
4. Anther/ Stamen
5. Petal
6. Sepal
7. Ovary
8. Ovule
9. Epicalyx/ Episepal
10. Pedicel/ Stalk
11. Thalamus / Receptacle
12. Placenta
13. Locule

(d)

Floral Whorls	D – 41 Sesbania	D – 42 Hibiscus
Androecium		
Relation of stamens to each other	Diadelphous(9+1) or explained	Monadelphous or explained
Nature of anther	Dithecous/ introrse,	Monothecous/ extrorse
Relation of stamen to petals	Free from petals/ Not adnate with petals	Epipetalous /Petals adnate to the base of the staminal tube
Gynoecium		
Nature of stigma	Hairy/ indistinct/ feathery/plain	Pentafid/ capitate / Discoid
Type of placentation	Marginal	Axile

(e)



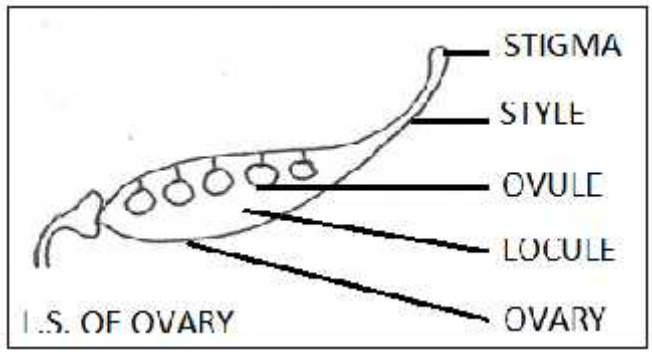
Drawing:

1. Broad standard petal shown
2. Two wing petals drawn perpendicular to standard
3. Two small keel petal drawn (fused)

Labelling:

1. Standard / Vexillum
2. Wing / Ala
3. Keel / Carina

(f)



Drawing: *(any five)*

1. Narrow elongated ovary
2. One locule
3. 3-6 ovules attached to the upper Margin of the ovary
4. Bent style
5. Small / feathery/plain stigma
6. Pedicel shown

Labelling: *(any five)*

1. Stigma
2. Style
3. Ovary
4. Locule
5. Ovule
6. Pedicel/ stalk

(g)

Floral diagram of D42

Drawing:

- Mother axis shown
- Epicalyx shown
- Five joined sepals in correct orientation
- Five separate petals in correct orientation

- Epipetalous stamens
- Monadelphous androecium
- Pentalocular ovary
- Two ovules in each locule
- Axile placentation *(any eight)*

(h) **Family of Specimen D - 41**

Family: Leguminosae/ Fabaceae

Family of Specimen D – 42

Family: Malvaceae

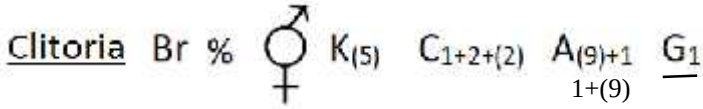
(i) **Family characters of Specimen D – 41** *(Any two)*

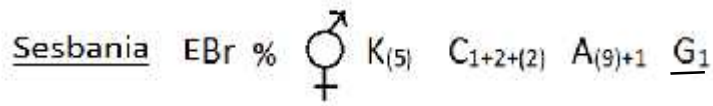
1. Papilionaceous corolla
2. Vexillary aestivation
3. Diadelphous stamen Or stamen in two bundles
4. Marginal placentation
5. Feathery stigma / hairy Stigma
6. Bent style
7. Zygomorphic flower

Family characters of Specimen D – 42 *(Any two)*

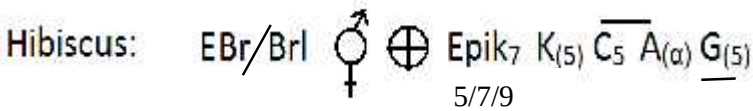
1. Monadelphous stamen
2. Reniform or kidney shaped anther
3. Mucilaginous flower
4. Style passes through staminal tube
5. Epicalyx present

(j) **Floral Formula of Specimen D - 41**





Floral diagram of Specimen D – 42



(k) **Scientific name of economically important plant belonging to the same family as Specimen D - 41**

Lens esculenta

Vigna radiata

Clitoria ternatea

- *Abrus,* *Acacia* *Arachis*
- *Bauhinia* *Butea* *Cajanus*
- *Calliandra* *Calliandropsis* *Cassia*
- *Cicer* *Clitoria* *Dalbergia*
- *Desmodium* *Glycine* *Halimodendron*
- *Indigofera* *Inga* *Jacksonia*
- *Lablab* *Lathyrus* *Lens*
- *Leucaena* *Parkinsonia* *Patagonium*
- *Peltiera* *Phaca* *Phaseolus*
- *Pisum* *Sesbania* *Vicia*
- *Vigna* *Zornia*

Scientific name of economically important plant belonging to the same family as Specimen D - 42

Gossypium herbaceum

Abelmoschus esculentus

- *Abelmoschus* *Abroma* *Abutilon*
- *Acropogon* *Adansonia* *Alcea*
- *Althaea* *Bombax* *Bombycidendron*
- *Ceiba* *Cenocentrum* *Corchorus*
- *Gossypium* *Lavatera* *Lecanophora*
- *Octolobus* *Peltaea* *Phymosia*
- *Sida*

Question 2 **[5]**

You are provided with glassware and twigs of plant **D-43** to set up an experiment to demonstrate photosynthesis. Set up the experiment using one or two twigs of **D-43** and tap water. Keep the apparatus near a light source.

(a) Draw a labelled diagram of the experimental set-up.

(b) When gas bubbles start emerging from the cut ends of the twig(s), **show the set-up to the Visiting Examiner**.

(c) Count the number of bubbles evolved in one minute and record it. Repeat your observation for two more readings. Tabulate the three readings and calculate the average number of bubbles (x) evolved in one minute.

(d) Prepare 10% solution of $NaHCO_3$ (Sodium bicarbonate). Add 10 ml of this solution to the experimental set-up. Stir the water with the glass rod. Wait for three minutes. Count the number of bubbles evolved in one minute. Repeat your observation for two more readings. Tabulate the three consecutive readings and calculate the average number of bubbles evolved in one minute (y).

(e) Add another 10 ml of freshly prepared $NaHCO_3$ solution to the set-up and stir the water with the glass rod. Wait for three minutes. Count the number of bubbles evolved in one minute. Take two more readings and calculate the average number of bubbles evolved in one minute (z).

Tabulate your observations as follows:

Experimental set-up	Number of bubbles evolved per minute		Average Value
Initial set-up: tap water.	(i)		x :
	(ii)		
	(iii)		
After adding 10 ml of 10% $NaHCO_3$ solution	(i)		y :
	(ii)		
	(iii)		
After adding another 10 ml of 10% $NaHCO_3$ solution	(i)		z :
	(ii)		
	(iii)		

(f) Name the plant specimen **D-43**.

(g) Comment briefly on the observations made by you regarding the recorded average values (x, y and z) of the bubbles evolved per minute.

(h) What do you conclude from this experiment?

(i) Mention *any two* precautions you have taken while performing this experiment.

Comments of Examiners

(a) Some common mistakes made by candidates while drawing the diagram were:
- the stem of the aquatic plant was not directed towards the neck of the funnel;
- the funnel not placed at the base of the beaker; the stem of the funnel was above the level of water in the beaker;
- the test tube was not resting on the funnel;
- the light source was missing.

(c) & (d) Some candidates calculated the bubbles in decimals.

(e) The observation table was not filled up properly by a number of candidates.

(f) The name of the aquatic plant specimen was spelt incorrectly by many candidates.

(g) In a number of cases, the explanation of 'x', 'y' and 'z' was not given individually but in a general manner. The fact that $NaHCO_3$ increases CO_2 concentration was not mentioned by some candidates. The rate of photosynthesis was not mentioned. Initial condition of tap water (with low CO_2) was ignored in a few cases.

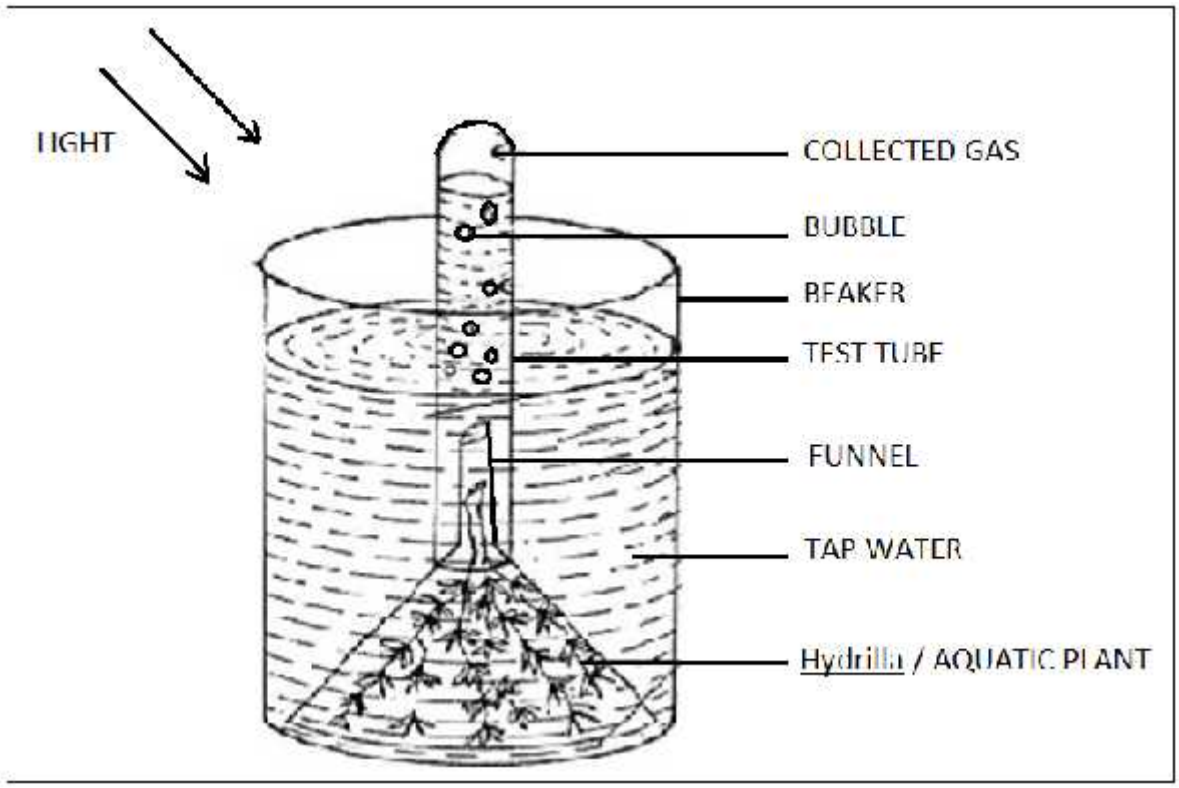
(h) Several candidates did not correlate the CO_2 concentration with the rate of photosynthesis. They failed to mention that the other factors should remain constant. Unnecessary explanation of Blackman's Law of Limiting factors was given by some candidates.

Suggestions for teachers
- Tell students that the number of bubbles cannot be represented in decimals.
- Stress upon the importance of spelling scientific names correctly.
- Explain the importance of dealing with each observation separately with relevant conditions.
- Theoretical and practical work on 'photosynthesis' should be correlated. Factors influencing rate of photosynthesis should be explained.

MARKING SCHEME

Question 2.

(a)



Drawing points:

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 points:

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

(e)

Experimental Set Up	Number of Bubbles evolved per minute	Average / Mean
Initial set-up: Tap water	(i) 7 (ii) 11 (iii) 12	x = 10
After adding 10ml of 10% $NaHCO_3$ solution	(i) 67 (ii) 70 (iii) 79	y = 72
After adding another 10ml of 10% $NaHCO_3$ solution	(i) 106 (ii) 114 (iii) 125	z = 115

x, y, z in increasing order

(f) Hydrilla / Elodea / Ceratophyllum demersum

(g) X

Initially in tap water (or in low / normal carbon dioxide concentration, number of bubbles is minimum or low (or value stated) because (rate) of photosynthesis is low or minimum (accept photosynthesis is low or slow).

Y

(On addition of 10ml of 10% solution of sodium hydrogen carbonate) the carbon dioxide concentration increases. So (rate) of photosynthesis increases and hence (rate) of bubble evolution increases / number of bubbles increases (or value given).

Z

(On addition of another 10ml of 10% solution of sodium hydrogen carbonate) the carbon dioxide concentration increases further. So (rate) of photosynthesis increases (further) and hence (rate) of bubble evolution increases further (or more that y)/ number of bubbles further increases (or value given).

(h) All other factors (light, temperature, water) remaining constant, the rate of photosynthesis increases (rate of evolution of bubbles increases) with the increase in concentration of carbon dioxide.

(i) **Precautions: (Any two)**

- Hydrilla should be fresh
- Hydrilla twig should be obliquely cut
- Cut end of the twig should face towards the stem of the funnel
- Test tube should be filled with water/ there should be no air bubbles.
- Adequate light source
- Stem of funnel should be under the water level of beaker.
- Sodium bicarbonate should be freshly prepared
- Distilled water should not be used

Question 3 **[5]**

(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 the stained section in glycerine. **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) (i) Identify the specimen.

(ii) Give *two* reasons to support your answer in (c)(i) above.

Comments of Examiners

(b) Most candidates drew diagrams with cellular details. In many cases, trichrome/stem hair were missing. Differentiation of epidermis, hypodermis and cortex was not clear in several cases. A thick hypodermis was drawn by some candidates. Vascular bundles were not clear with relevant endarch xylem. Labelling lines intersected each other.

(c) (i) A few candidates wrote 'sunflower stem' instead of 'T.S. of dicot stem'.

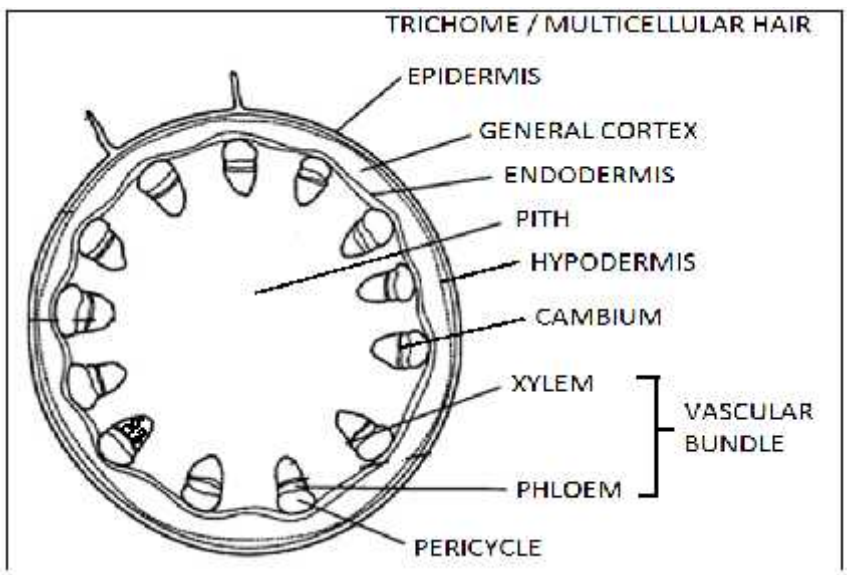
(ii) Reasons were given incorrectly by several candidates, e.g. vascular bundles are conjoint and open (incorrect); vascular bundles are endarch (incorrect) – it is xylem which is endarch.

Suggestions for teachers

- More practice must be given in cutting T.S. of specimen with emphasis on the characteristic features of each layer.
- Students should be made aware of the fact that labelling lines should not intersect each other.
- The concept of open/closed vascular bundle must be clarified.
- Conceptual errors should be clarified while teaching theoretical concepts in class.

MARKING SCHEME

Question 3.



Drawing Points	Labelling Points
1. Trichome/ multicellular hair	1.Trichome/ multicellular hair/stem hair
2. Single layered epidermis	2. Epidermis
3. Hypodermis	3. Hypodermis
4. General Cortex (thick)	4. Cortex
5. Endodermis	5.Endodermis/ Starch Sheath
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. Phloem
10. Distinct pith	10. Vascular bundle (instead of Xylem and phloem)

(i) The given specimen is Dicot Stem.

(ii) **Reasons of identification***: (Any two)*
Vascular bundles are conjoint, collateral and open (operative).

- Vascular bundles arranged in a ring.
- Xylem endarch - (Protoxylem towards the centre and metaxylem towards the periphery).
- Cortex differentiated into hypodermis general cortex, endodermis.
- Pericycle consists of (semi-lunar) patches (of sclerenchyma and intervening masses of parenchyma).
- Distinct pith

Question 4 **[5]**

Identify the given specimens A to E. For specimen D, identify the type of inflorescence. Give *two* reasons to support your answer in each case. 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 booklet to the Supervising Examiner after you finish answering this question.*

Comments of Examiners

(a) In the identification, the term 'T.S of mammalian' was missing in many cases. Some common mistakes made by candidates in the diagrams drawn were as follows: follicles of different sizes were not shown in the cortex; Graafian follicle did not contain an ovum; germinal epithelium was not labelled; labelling of cortex/medulla was interchanged; corpus luteum and empty follicle were indistinguishable; incomplete labelling was done.

(b) In many cases, identification mentioned 'T.S.' instead of whole mount of specimen. The scientific name was spelt incorrectly. In the diagrams, ectoplasm/ endoplasm was labelled as ectoderm/ endoderm; many pseudopodia drawn instead of one; single food vacuole was drawn instead of many.

(c) Identification did not mention the term 'T.S/mammalian'. Some candidates mentioned 'frog blastula'. In some of the diagrams, inner cell mass was not attached to trophoblast.

Suggestions for teachers

- Theoretical concepts must be clarified.
- Practice must be given in drawing non-cellular diagrams in the stipulated time.
- The different stages in embryonic development must be explained clearly.
- Theoretical concepts of inflorescence must be made clear with specimens.
- It must be clarified that the need for CO_2 in photosynthesis is demonstrated by the KOH experiment not by the hydrilla set up.

(d) The specimen was wrongly identified as 'gladiolus/capitulum/cymose inflorescence'. In some of the diagrams drawn by candidates, bracts were not shown; there was no difference in size between younger and older flowers; sessile flowers were not drawn.

(e) Many candidates identified this spot as Moll's half-leaf experiment. Some centres drew the evolution of O_2 by Hydrilla. In the diagrams drawn by a few candidates, sunlight was not drawn and labelled. No support was drawn for the conical flask containing KOH.

MARKING SCHEME

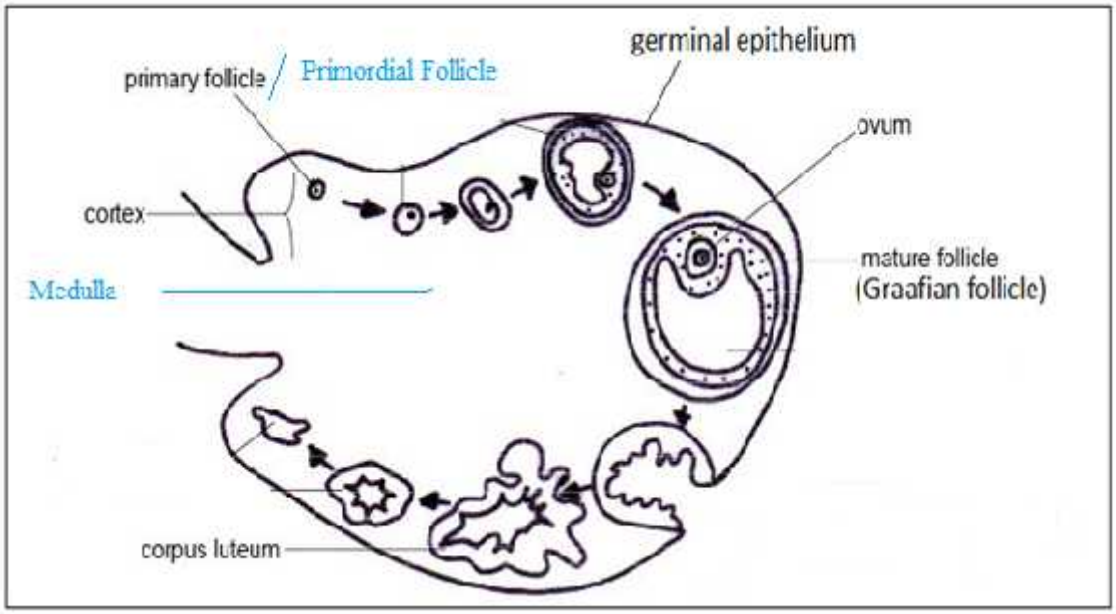
Question 4.

SPOT A

Identification: (Slide showing) T.S. of Mammalian Ovary

Reasons for Identification: (Any two)

- (The outer surface is covered by) germinal epithelium is visible/present (composed of single layer of cubical cells).
- The cortex contains numerous ovarian follicles of different sizes at different stages of maturation and (Graafian follicles).
- The matured Graafian follicles (containing centrally placed) with ovum surrounded by several layers of granular cells, visible.
- Corpus luteum present
- Primordial/ primary follicle are seen near the germinal epithelium



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:

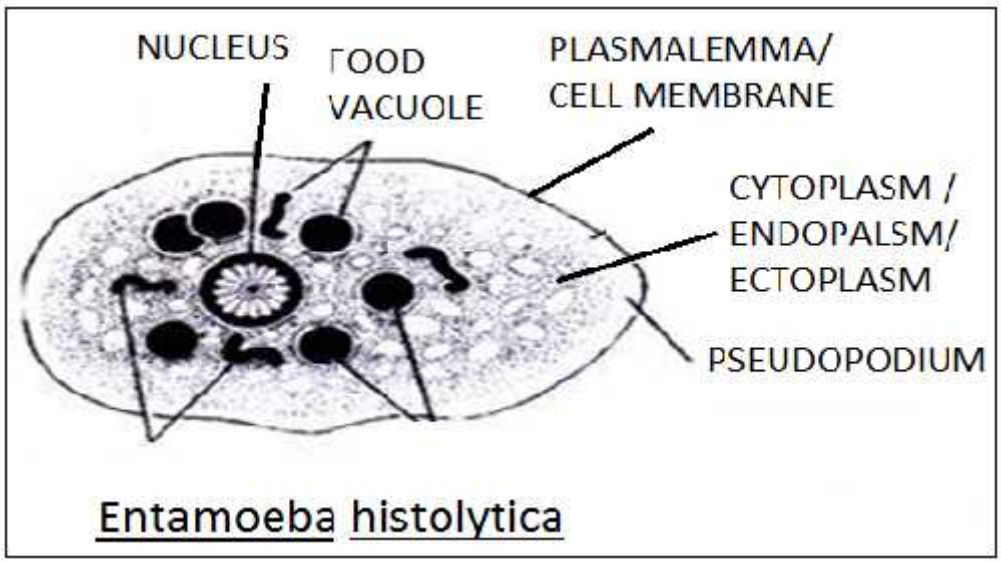
1. Germinal epithelium
2. Maturing follicle/Graffian follicle
3. Primordial follicle
4. Ovum
5. Medulla
6. Cortex
7. Corpus Luteum

SPOT B

Identification: (Slide showing) Entamoeba histolytica

Reasons for Identification: (Any two)

- Unicellular microorganism
- Pseudopodium visible
- Cytoplasm/ Endoplasm is granular and contains a spherical nucleus, Red Blood Cells, Leucocytes and tissue debris.
- Many (dark) food vacuoles present.
- Cytoplasm is differentiated into ecto and endoplasm



Drawing:

1. Unicellular organism
2. Ectoplasm/ Endoplasm/ cytoplasm
3. Nucleus
4. Food vacuole
5. Ingested Red Blood Cells

Labelling:

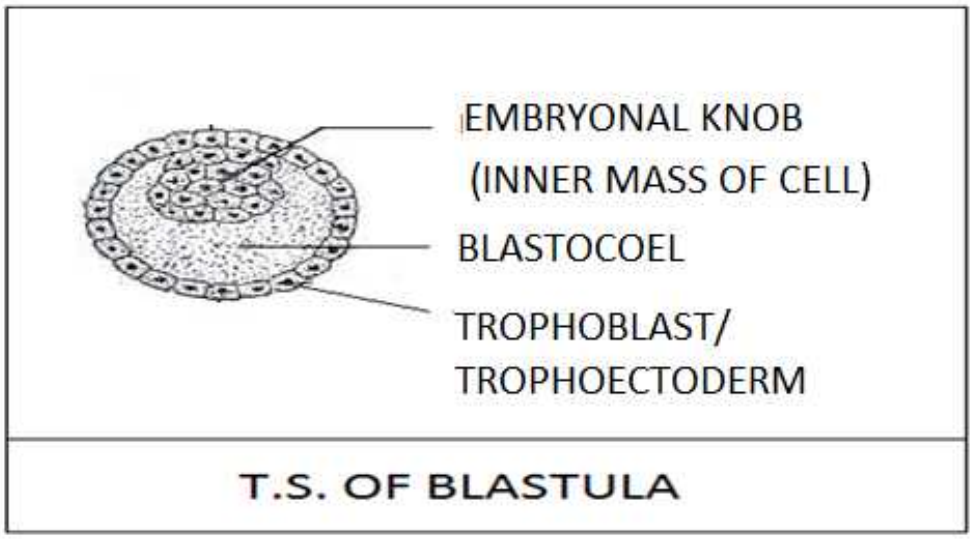
1. Ectoplasm/ Cytoplasm
2. Plasma membrane /Cell Membrane
3. Nucleus
4. Food vacuole
5. Ingested Red Blood Cells
6. Endoplasm
7. Cytoplasm (instead of ecto and endoplasm
8. Pseudopodium

SPOT C

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.



T.S. OF BLASTULA

Drawing:

1. Trophoblast
2. Blastocoel
3. Embryonal knob / or spherical mass of cell on one side / inner cell mass

Labelling:

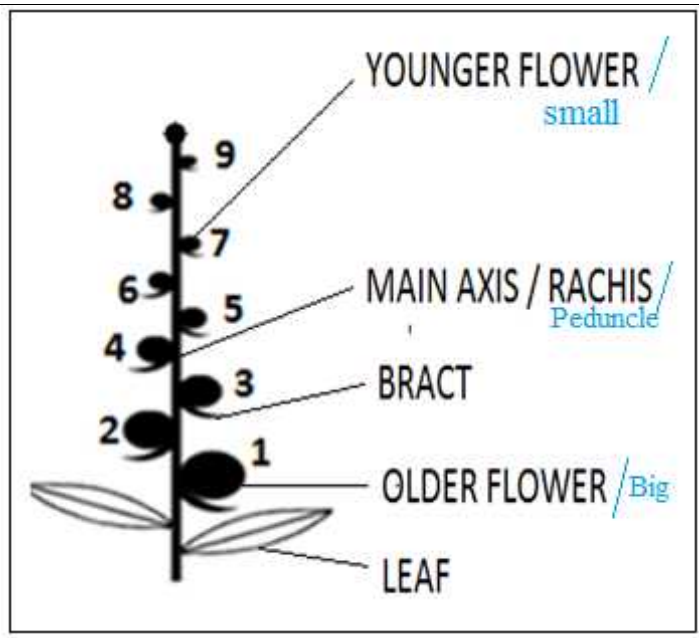
1. Trophoblast
2. Blastocoel
3. Embryonal knob/ inner mass of cell

SPOT D

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

Reasons for Identification: (Any two)

- Main axis or rachis or /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:

1. Main axis
2. Younger flower at the top
3. Older flower at the bottom
4. Sessile flower
5. Bracteate flowers/ bract

Labelling:

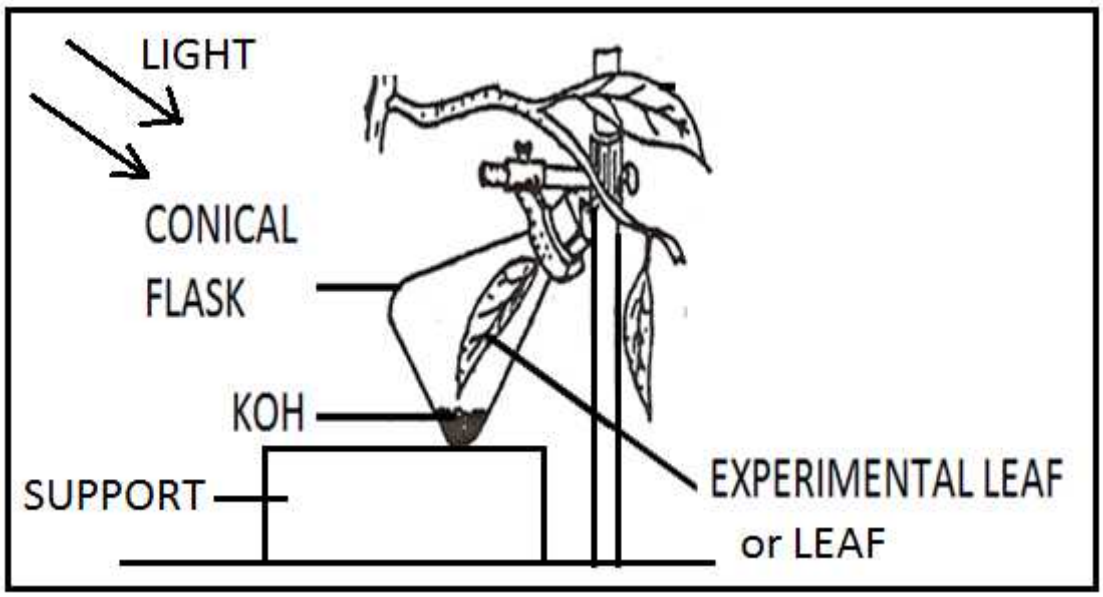
1. Main axis/ rachis/ penduncle
2. Older flower/Big
3. Younger flower/Small
4. Bract

SPOT E

Identification: (Experimental set up to show that) CO_2 is necessary for photosynthesis.

Reasons for Identification: (Any two)

- Experimental leaf is kept in a conical flask
- KOH (pellets) in the bottle/flask (for absorbing carbon dioxide).
- On performing starch test control leaf turns blue black due to presence of starch and experimental leaf does not turn blue black due to absence of starch as photosynthesis did not occur in the experimental leaf due to absence of CO_2 which was absorbed by KOH pellets/ Experimental leaf gives – ive result for starch test.



Drawing:	**Labelling:**
1. Leaf connected to potted plant	1. Leaf
2. One whole leaf inside the bottle	2. KOH
3. KOH present in the bottle	3. Conical flask/ bottle/ jar
4. Bottle is balanced by support	4. Light
5. Light source	

GENERAL COMMENTS:

(a) Topics found difficult by candidates in the Question Paper:

- The L.S. of gynoecium- Q.1 (f)
- Floral diagram- Q.1 (g)
- A comprehensive explanation of the observation of Q.2 (g)
- Spot E with relevant reasons. (Q.no. 4)

(b) Suggestions for candidates:

- Learn semi-technical terms with correct spellings
- Practice drawing all diagrams through observation. Draw neat well labelled diagrams.
- Correlate theoretical concepts with the practicals.
- Conceptual understanding is important.