BIOLOGY (PAPER-1)

SECTION A – 20 MARKS

Question 1

Answer the following questions briefly.

(i) In human plasma, five different types of immunoglobulins are found. Which type of immunoglobulin is responsible for allergic reactions? **[1]**

(ii) Some orchids live on the branches of mango trees. Name the type of interaction that exists between mango tree and the orchid. **[1]**

(iii) Four triplet codons code for the amino acid valine. Three of them are given below. **[1]**

GUU GUC GUA

Write the fourth codon.

(iv) A haemophilic man marries a carrier woman, and they have a daughter. What is the probability of their daughter being haemophilic? **[1]**

(v) Home-made fruit juices are turbid, while the bottled fruit juices purchased from the market are clear. Give a reason for this difference. **[1]**

(vi) The number of lily plants in a pond was found to be 50. After one year, the number increased to 65. Calculate the natality of lily plants. **[1]**

(vii) Based on the table given below, identify the type of natural selection taking place. **[1]**

Size of the seeds	% of germination
Small	75%
Medium	15%
Large	75%

(viii) Give the name of the target pest of gene *cry* IAc. **[1]**

(ix) If a person shows the production of interferons in his body, then he is suffering from: **[1]**

(a) Malaria

(b) Ring worm

(c) Dengue

(d) Typhoid

(x) Match the columns I and II with reference to weeks of pregnancy and development of human embryo. Select the correct option from the choices given below: **[1]**

Column I		Column II	
I.	8 weeks	(P)	Limbs and external genital organs become well developed.
II.	12 weeks	(Q)	Limbs and digits develop.
III.	20 weeks	(R)	Body hair develops.
IV.	24 weeks	(S)	Eyelids separate.

(a) I - (P), II – (Q), III – (R), IV - (S)

(b) I - (Q), II – (P), III – (R), IV - (S)

(c) I - (R), II – (S), III – (P), IV - (Q)

(d) I - (S), II – (R), III – (Q), IV - (P)

(xi) **Assertion:** In a bioreactor, it is not necessary to maintain sterile ambience. **[1]**

Reason: Sterile conditions promote the growth of unwanted microbes in the culture medium.

(a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion.

(b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion.

(c) Assertion is true and Reason is false.

(d) Both Assertion and Reason are false.

(xii) **Assertion:** Lymphocytes originate and proliferate in primary lymphoid organs. **[1]**

Reason: Spleen is a secondary lymphoid organ.

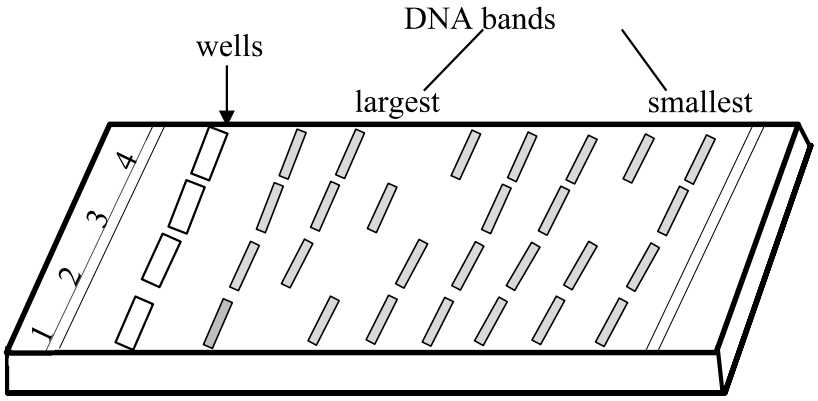
(a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion.

(b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion.

(c) Assertion is true and Reason is false.

(d) Both Assertion and Reason are false.

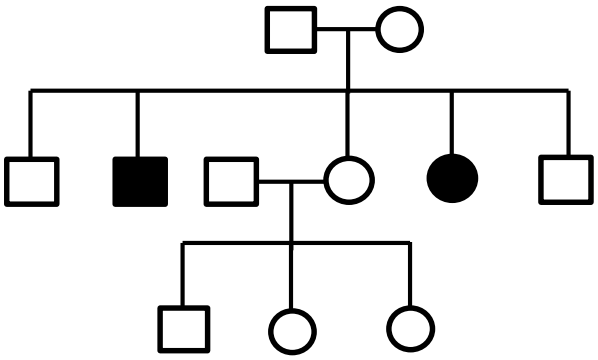
(xiii) The equipment shown below is used for the separation of DNA fragments. **[1]**



Name the chemical used to visualise the movement of DNA fragments in the gel.

(xiv) In humans, somatic gene therapy was carried out to correct an immunodeficiency disease. Name this disease. **[1]**

(xv) The pedigree chart given below represents the pattern of inheritance of thalassaemia in a family **[1]**



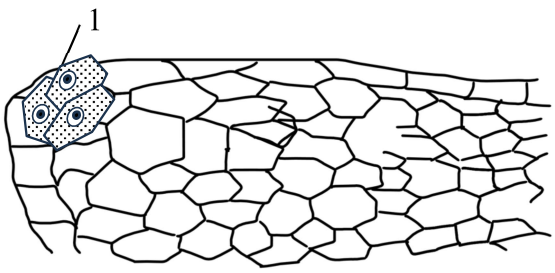
What could be the genotype of the affected male?

(xvi) Answer the following questions: **[2]**

(a) In a karyotype analysis, X and Y chromosomes represent sex chromosomes. Name the scientist who discovered the X Chromosome.

(b) Expand the abbreviation NACO.

(xvii) The figure given below shows the early stage of development of microsporangium. **[1]**



Name the hypodermal cell labelled '1' which divides periclinally.

(xviii) Give a reason for each of the following: **[2]**

(a) The second half of the menstrual cycle is called luteal phase as well as secretory phase.

(b) Streptokinase is administered to the patients having myocardial infarction.

Comments of Examiners

(i) Some of the candidates mentioned the names of all five types of immunoglobulins instead of IgE.

(ii) Several candidates mentioned **'communalism'** instead of **'commensalism**.' Ambiguous answers were received such as positive interaction, symbiosis and mutualism.

(iii) A number of candidates mentioned **'GUT'** instead of '**GUG**.'

(iv) Some candidates wrote '**25%'** instead of '**50%.'**

(v) Instead of referring to '**enzymes**, some candidates mentioned **chemicals and preservatives**. Some confused these with the fermentation process. However, some candidates wrote **'enzymes'** in general instead of providing the correct name, '**pectinase.'**

(vi) Most of the candidates subtracted the original population from the increased population. They did not extrapolate the values in terms of the annual rate per individual.

(vii) Several candidates mentioned **'dispersive'** instead of **'disruptive.'**

(viii) Some candidates answered **'cotton worm'** or **'cotton borer'** instead of **'cotton bollworm.'** Others mentioned only **'bollworm'** or **'corn bollworm.'**

(ix) Several candidates chose the distractors instead of the correct answer.

(x) Some candidates were found to choose the incorrect option.

(xi) The majority of the candidates answered correctly. However, some candidates were confused between options (b) and (d).

(xii) Majority of the candidates were confused about **primary and secondary lymphoid organs,** which led them to select the wrong option.

(xiii) Some candidates mentioned UV rays instead of the chemical. Ethidium bromide was misspelled as **'Ethiad bromide,' 'ethylene bromide,'** etc.

(xiv) Many candidates mentioned haemophilia, sickle cells anaemia, AIDS etc. instead of **SCID**.

Suggestions for teachers

- Discuss all different types of immunoglobulins, including their structures and functions, separately.
- Share examples of ecological relationships and mention the roles of individual partners.
- Develop a clear understanding by explaining the differences between ammensalism and commensalism simultaneously.
- Stress upon the terms codons and anti-codons as they relate to RNA, and not of DNA.
- Emphasise by demonstrating the process using a Punnett square, including the correct genotypes and phenotypes.
- Discuss industrial application of enzymes.
- Provide regular and rigorous practice on calculations.
- Write the formula, followed by substitution of values.
- Use diagrams to provide explanations to build clear understanding among students.
- Stress on high specificity of the gene products with respect to host and the target pest.
- Discuss with proper examples role of microbes as biocontrol agents.
- Provide clarity on Cry *IAC* & Cry *IAB*.
- Discuss the name of the disease and causative agent.
- Highlight the role of interferons while teaching human health, diseases and mechanism of action.
- Teach the landmarks of embryonic development, specific periods in terms of months, weeks and days.
- Explain the function of bioreactor along with the conditions necessary. Explain terms like sterile, and aseptic.
- Elucidate in detail sources, examples, functions & differences between primary and secondary lymphoid organs.

(xv) Instead of the genotype of the autosomal disease like thalassemia, most of the candidates mentioned **haemophilia using XY**, which implied a sex-linked disease.

(xvi) (a) Spelling errors such as 'Hankin'and Hunting were noted in some of the answers. Many candidates mentioned 'Morgan.'

(b) Instead of providing the correct answer, several candidates mentioned the National Agriculture Control Office, Natural Accident Control Organisation, Narcotic Abuse Control Organisation.

(xvii) Several candidates wrote '**archegonial initial'** instead of '**archesporial initial**.' Some candidates mentioned Leydig cells, microspore, tapetum and endothecium. Additionally, some candidates referred to the megaspore mother cell.

(xviii) (a) Few candidates were found to be confused between LH & FSH functions.

(b) A number of candidates mentioned **'to prevent heart attack'** in general, without mentioning the term **'clot buster.'**

Suggestions for teachers

- Mention the UA rays as physical agent and Ethidium bromide as the chemical agent.
- Establish contrast between Ethidium & ethylene.
- Discuss the role of gene therapy in genetic disorders like SCID.
- Teach to build clarity on distinction between autosomal and sex-linked disorders.
- Help students to interpret the pedigree chart correctly with discussion on rules.
- Teach development of male and female gametophyte in descriptive lecture format as well as graphic and diagrammatic format.
- Explain the functions of hormones during the different phases of the menstrual cycle.
- Emphasise the difference between blood thinner & clot buster. Explain the use of bioactive molecules with their mechanism of action.

MARKING SCHEME

Question 1

(i)	IgE/Immunoglobin E
(ii)	Commensalism/Ecto-commensalism
(iii)	GUG
(iv)	50%, ½ *(accept Punnett square with correct phenotype)*
(v)	Due to industrial use of pectinase/ cellulase/protease/amylase which dissolves the cell wall.
(vi)	30% / 0.3
(vii)	Disruptive
(viii)	Cotton bollworm
(ix)	(c) or Dengue
(x)	(b) or I – (Q), II – (P), III – (R), IV – (S)

(xi)	(d) or Both Assertion and Reason are false.	
(xii)	(b) or Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion.	
(xiii)	Ethidium bromide/EtBr	
(xiv)	Severe Combined Immunodeficiency Disease/ SCID/ ADA deficiency	
(xv)	Homozygous Recessive (tt)/ Hb^AHb^A, Hb^5Hb^5/autosomal recessive.	
(xvi)	(a)	Henking
	(b)	National AIDS Control Organisation
(xvii)	Archesporial initial cell/Archesporial cell/Sporogenous cell/Primary Parietal cell	
(xviii)	(a)	Uterine glands secrete uterine milk. / Corpus luteum is formed due to release of Luteinising Hormone. / Corpus luteum secretes progesterone.
	(b)	Streptokinase acts as clot buster. / Removes intravascular clot.

SECTION B – 14 MARKS

Question 2

[2]

Name *any two* Cu-ions releasing IUDs. Explain *any two* ways by which these devices act as contraceptives.

Comments of Examiners

Some candidates **named only one device.** However, others **multiload 365** for **375.** Instead of Copper releasing IUDs, the candidates mentioned the functions of mechanical/barrier methods.

Suggestions for teachers

Teach all the contraceptive devices with their specific mechanism of action.

MARKING SCHEME

Question 2

- CuT, Cu7, multiload 375. *(Any two)*

- Increase phagocytosis of the sperm.
- Suppress mobility of sperm. / Prevent fertilisation.
- Prevent implantation. *(Any two)*

Question 3

[2]

A population of 200 fruit flies is in Hardy Weinberg equilibrium. The frequency of the allele (a) is 0·4.

Calculate the following:

(i) Frequency of allele (A).

(ii) The number of homozygous dominant fruit flies.

(iii) The number of homozygous recessive fruit flies.

(iv) The number of carrier fruit flies.

Comments of Examiners

(i) In many instances, calculation errors were found. Candidates **mentioned 0.4** instead of **0.6**. The question asked was on the number of flies and answers were provided in percentage.

(ii) When the first step to find the frequency of A allele went wrong, the candidates were unable to find the number of homozygous dominant fruit flies. Instead of the number, some candidates mentioned percentage frequency.

(iii) Several candidates calculated using a different way. They did subtraction of the numbers like 40/60 out of 200.

(iv) Random answers were provided without proper calculation.

Suggestions for teachers

- Provide rigorous practice for numerical-based questions, including different types of questions to evaluate various parameters, such as number and frequency.
- Offer additional practice related to calculations based on Hardy-Weinberg Law in class.

MARKING SCHEME

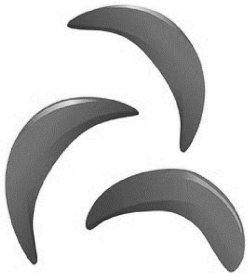
Question 3

(i)	0.6
(ii)	72
(iii)	32
(iv)	96

Question 4

[2]

Jacob is genetically a carrier of the disorder that affects the shape of the RBCs, as shown in the diagram below. His son James suffers from the same disorder.



(i) Give the biochemical reason for the disorder that changes the shape of the RBCs, as shown above.

(ii) Draw a Punnett square to show the genotype of the mother of James.

(iii) Name and define the type of '*point mutation*' responsible for this disorder.

Comments of Examiners

(i) In some cases, the substitution of valine with glutamic acid was noted, but there was no reference to the β-chain. While many candidates discussed the structural differences between normal red blood cells and sickle cells, they overlooked the term **'biochemical reason.'** Several candidates attributed the cause to a mutation.

(ii) The Punnett square was drawn correctly by most of the candidates; however, some candidates did not specify the mother's genotype.

(iii) Some candidates repeated the word '**point mutation**' without mentioning substitution or transversion.

Suggestions for teachers

- Focus on explaining the importance of amino acids in the shape of red blood cells.
- Elucidate the meaning of 'biochemical reason.'
- Clarify diagrammatically how glutamic acid is replaced by valine.
- Explain autosomal recessive inheritance to the students.
- Elucidate the types of mutations with examples, such as sickle cell anemia versus thalassemia.

MARKING SCHEME

Question 4

(i)	Substitution of glutamic acid by valine (GAG→ GUG) at sixth position of β-Chain (Beta-Chain) of haemoglobin.
(ii)	Heterozygous (Hb^AHb^S or Ss) or homozygous recessive (Hb^SHb^S or ss)

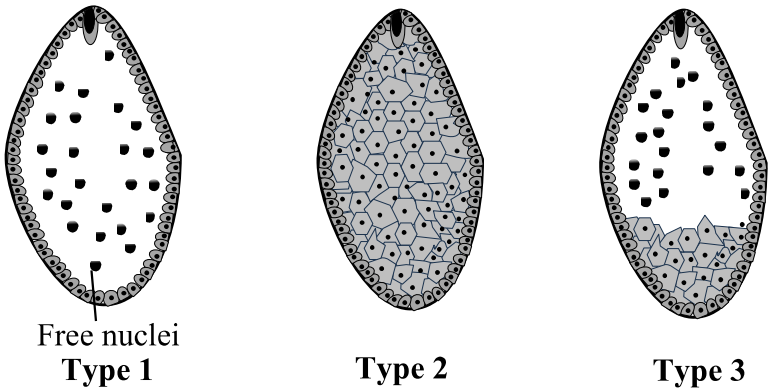
	Father of James Hb^AHb^S OR Ss	**Mother of Jacob Hb^SHb^S OR Ss /ss**
	S	**s**
S	Ss	Ss
s	ss	ss

(iii)	Substitution – replacement of a nucleotide by another one. **OR** Transversion – Purine replaced by Pyrimidine or vice versa.

Question 5

[2]

(i) The diagram given below shows the three types of endosperms in angiosperms.

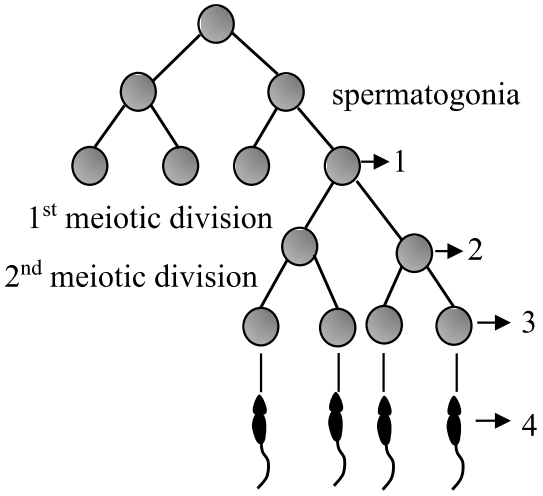


(a) Identify the *three* types of endosperms shown above.

(b) Name the type of endosperm which commonly occurs in polypetalous dicots.

OR

(ii) The diagram given below shows the various steps in *spermatogenesis*.



(a) Name the parts labelled '1', '2' and '3'.

(b) Name the process by which part '3' changes to part '4'.

Comments of Examiners

(i) (a) Several candidates made spelling errors like **'hellobial'** and **'nucellar**.' Some candidates failed to identify correctly the three types of endosperms.

(b) A number of candidates mentioned **'cellular type'** instead of **'nuclear type.'**

(ii) (a) In some cases, candidates mentioned **'spermatogonia'** instead of **'spermatocyte.'**

(b) Several candidates wrote **'spermatogenesis'** instead of **'spermiogenesis.'**

Suggestions for teachers

- Use stepwise diagrams to explain the distinction between multicellular and multinucleate structures.
- Explicitly explain the sequence of terms: spermatogonia, spermatocyte, spermatid, and spermatozoa, along with their chromosome numbers and the steps of spermatogenesis.
- Explain the phases and sub-stages of spermatogenesis.
- Develop an understanding of the differences between spermatogenesis and spermiogenesis.

MARKING SCHEME

Question 5

(i)	(a)	A – Nuclear endosperm B – Cellular endosperm C – Helobial endosperm
	(b)	Nuclear endosperm
		OR
(ii)	(a)	1 – primary spermatocyte 2 – secondary spermatocyte 3 – spermatid
	(b)	Spermiogenesis

Question 6

[2]

Write the scientific name of the causative agent and the mode of transmission of each of the following diseases.

(i) Filariasis

(ii) Typhoid

Comments of Examiners

(i) Most candidates made spelling errors **(e.g. Wucheria/ Vaucheria**). Although the biological name was not written according to the rules of binomial nomenclature, the mode of transmission 'contaminated food and water for both diseases' were mentioned. Many candidates had written **'Anopheles/Aedes mosquito'** or simply **'mosquito'** instead of **'female culex mosquito.'**

(ii) Majority of the candidates used general terms like 'bacteria' and 'virus,' In some cases, the binomial nomenclature was not followed by candidates.

Suggestions for teachers

- Encourage students to follow the rules of binomial nomenclature starting from class XI.
- Teach the causative agents of diseases and their modes of transmission in a tabular format to avoid intermixing of facts.

MARKING SCHEME

Question 6

(i)	*Wuchereria bancrofti* - female *Culex* mosquito *W. malayi* *Brugi malayi*
(ii)	*Salmonella typhi* – contaminated food and water

Question 7

[2]

A male plant, bearing red flowers, was crossed with a female plant bearing yellow flowers. In the F_1 generation, all the flowers were orange in colour.

(i) Give a reason to explain the change of colours in F_1 generation.

(ii) Mention the ratio of red flowers, yellow flowers and orange flowers in the F_2 generation.

Comments of Examiners

(i) Instead of 'incomplete dominance,' some candidates mentioned 'co-dominance.' Additionally, some candidates referred to 'masking of colours' instead of 'blending.'
(ii) The ratio was quoted as 1:2:1 according to the text by several candidates, without specifying the phenotypes. As a result, this phenotypic ratio did not match the question's requirement of 1:1:2 (red: yellow: orange).

Suggestions for teachers

- Teach incomplete dominance and co-dominance together with parallel examples from daily life (such as black and white = blue, and black and white = black and white spots) to avoid confusion.
- Provide practice in representing the F2 generation using a Punnett square.
- Encourage students to read the question carefully before writing down the correct phenotypic ratio.

MARKING SCHEME

Question 7

(i)	Incomplete dominance/Intermediate/blending or explained (Punett square drawn).
(ii)	¼ or 25% red, ½ or 50% orange, ¼ or 25% yellow/1:1:2.

Question 8

[2]

Microbes are useful to human beings in diverse ways. Give the biological names of each of the following microbes:

(i) Lactic acid producing bacterium.

(ii) Microbe known as Baker's yeast.

(iii) Fungus which helps in the production of cyclosporin-A.

(iv) Microbe used in the production of statins.

Comments of Examiners

(i) The biological name was not written according to binomial nomenclature by some of the candidates.
(ii) Many candidates did not mention the biological name according to binomial nomenclature. Moreover, spelling errors were found **(Sarcomyces/ Sacromyces).**
(iii) Several candidates did not mention the biological name according to binomial nomenclature.
(iv) Some candidates mentioned incorrect spelling for '**Monascus.'**

Suggestions for teachers

- Adhere strictly to the rules of binomial nomenclature.
- Clearly mention that yeasts live on sugar/saccharin, which is why their name Saccharomyces, to help students remember it.

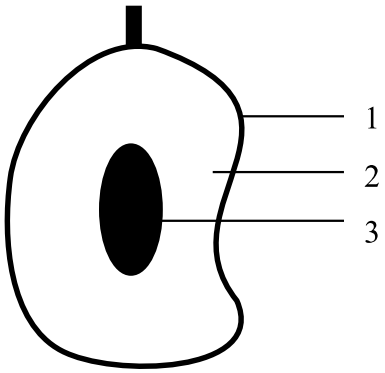
MARKING SCHEME Question 8	
(i)	Lactic acid bacteria / LAB / *Lactobacillus/ Streptococus lactis*
(ii)	*Saccharomyces cerevisiae*
(iii)	*Trichoderma polysporum*
(iv)	*Monascus purpureus*

SECTION C – 21 MARKS

Question 9

[3]

The diagram given below is L.S. of a typical fruit.



(i) Identify the parts labelled '1', '2' and '3'.

(ii) State the difference between a *true fruit* and a *false fruit*.

(iii) What is the significance of formation of fruit in angiosperms?

Comments of Examiners

(i) Some candidates used common names, such as 1 = skin, 2 = flesh and 3 = hard cover.

(ii) The distinction between true fruits (fruits with seeds) and false fruits (fruits without seeds) was not understood by many candidates, particularly in relation to fertilisation.

(iii) While some candidates noted that humans eat fruit for nourishment, others struggled to grasp the meaning of the word 'significance.' They explained the entire process of fruit formation without addressing its significance.

Suggestions for teachers

- Teach fruits and seeds as biological entities, not just as common products.
- Clearly explain the role of the ovary in the formation of fruit and the role of ovules in the formation of seeds using the diagram.
- Encourage students to clearly contrast true and false fruits.
- Explain the role of fruit in seed dispersal and nutrition for seeds, using examples from their surroundings.

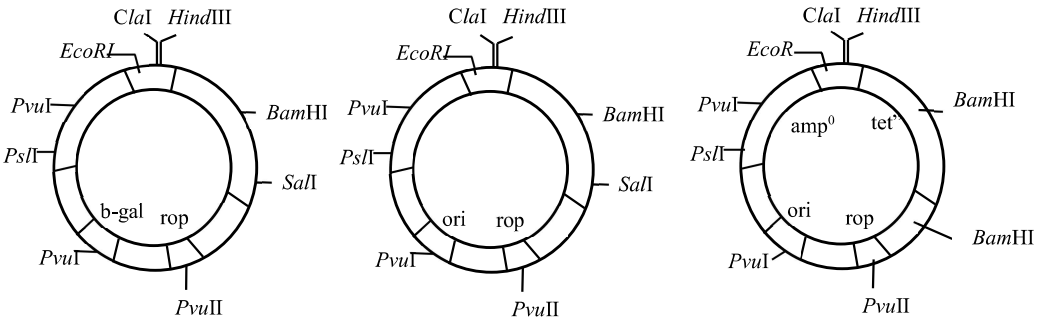
MARKING SCHEME Question 9	
(i)	'1'- Epicarp/ Exocarp/ Fruit wall '2'- Mesocarp/ Pulp '3'- Endocarp / seed/ Ovule
(ii)	<table><tr><th>True fruits</th><th>False fruits</th></tr><tr><td>Develops from ovary alone.</td><td>Other parts along with ovary.</td></tr></table>
(iii)	Dispersal of seed/ provides protection/ provides nutrition.

Question 10

[3]

Suneeta is planning an experiment to clone a gene in a vector. So, she has to choose a good cloning vector.

Which one of the vectors shown below should she choose? Justify your answer by giving *two* reasons.



Comments of Examiners

In some cases, the name of the selected vector did not match the correct reason. Most candidates could not distinguish between Vector B and Vector C. They were unable to understand the significance of the 'Ori site' 'selectable marker', and 'restriction site', and thus could not provide justifications with appropriate reasons.

Suggestions for teachers

Explain the features of an ideal cloning vector by detailing the exact role of each feature.

MARKING SCHEME

Question 10

She should choose vector C.

1. Ori site
2. Selectable marker/antibiotic resistant gene.
3. Restriction site/ multiple cloning sites.

(Any two)

OR

She should choose none.

- Vector-A lacks Ori site.
- Vector-B lacks Selectable marker.
- Vector-C has multiple cloning site for the same RE.

(Any two)

Question 11

[3]

Study the two figures shown below that represent two growth models.

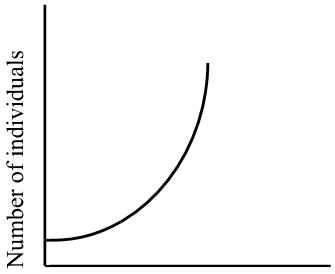


Figure A

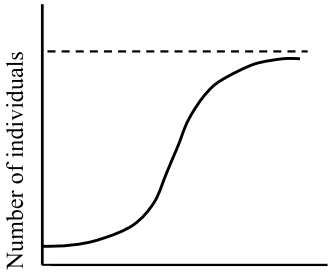


Figure B

(i) Which one of the two figures represents an unlimited supply of nutrients? Give a reason.

(ii) Which figure depicts a challenge to population growth?

(iii) Explain the term *reproductive fitness*.

(iv) Give the mathematical expressions for Figure A and Figure B.

Comments of Examiners

(i) The majority of candidates mentioned figure A instead of B, and vice versa. However, many candidates repeated the phrase from the question itself ('**unlimited supply of nutrients'**) as their reason.

(ii) Most candidates attempted this question well, but some indicated the **incorrect graph**.

(iii) A number of candidates explained reproductive health instead of reproductive fitness. The answer should reference population rather than the reproductive system.

(iv) Majority of the candidates mentioned the equation for Curve B as dN/dt = **r [(K-N) K]**, **omitting rN.**

Suggestions for teachers

- Correlate the interpretation of the nature of growth curves with the data on the X-axis and Y-axis.
- Emphasise that exponential growth produces a J-shaped curve, while logistic growth produces an S-shaped curve.
- Highlight that the Sigmoid graph indicates limiting resources.
- Explain the role of reproductive fitness in terms of evolution, referencing Darwinian fitness.
- Clearly define all terms in the formulas, such as N =? and K =?.
- Explain the equations for both curves in detail.

MARKING SCHEME

Question 11

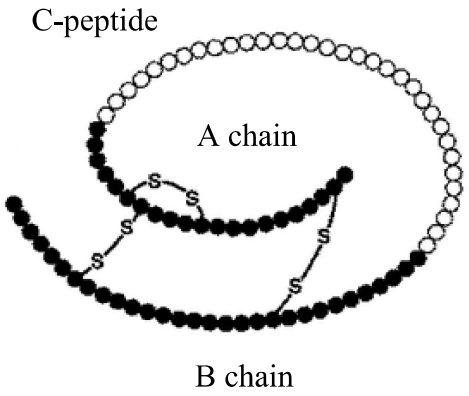
(i)	Figure A (J-shaped curve). Reason-Exponential growth, no environmental resistance, maximum biotic potential.
(ii)	Figure B (S-shaped curve)
(iii)	Individual showing maximum reproductive ability in the population.
(iv)	Curve A Equation: $\frac{dN}{dt}$ = rN OR dN/dt=(b-d)xN/ Nt=No ert Curve B Equation: $\frac{dN}{dt}$ = rN $\left(\frac{K-N}{K}\right)$ OR dN/ dt=rN(K-N/K)/ C Nt=N o e^n

Question 12

[3]

The diagram given below represents the schematic structure of proinsulin which undergoes certain modifications before it becomes a fully functional insulin.

Study the diagram carefully and answer the questions that follow:



(i) State the change the proinsulin undergoes to become fully functional.

(ii) Name the modern scientific technique used for the production of human insulin.

(iii) How are the two polypeptide chains of the fully functional insulin held together?

Comments of Examiners

(i) Many candidates did not mention the removal of the C peptide.
(ii) This question was well answered by most of the candidates. However, some candidates wrote **'PCR technique'** instead of **'rDT,'** as the modern scientific method for insulin preparation.
(iii) Several candidates mentioned '**sulphur bonds, sulphide bonds, and hydrogen bonds'** instead of **'disulphide bonds.'**

Suggestions for teachers

- Explain that the maturation process of proinsulin to insulin involves the loss of the C peptide.
- Share a pictorial presentation or video on the development of insulin through recombinant DNA technology for better understanding.
- Clearly indicate the disulphide bridges when teaching this topic, using a diagram for illustration.
- Highlight that the S – S notation represents disulphide bridges/bonds as post of the post-translational processing of proinsulin.

MARKING SCHEME Question 12	
(i)	Removal/splicing of C-peptide and joining of peptide-A and peptide-B by disulphide bridges.
(ii)	rDT – recombinant DNA technology/ genetic engineering.
(iii)	Disulphide bonds / bridges

Question 13

[3]

A patient was given an anti-retroviral drug by the doctor.

(i) Which disease was the patient diagnosed with? Mention *any one* symptom of this disease.

(ii) Give the scientific name of the causative agent of this disease.

(iii) Which method was used to diagnose this disease?

(iv) What is the role of *Reverse Transcriptase* and *Integrase* in the life cycle of a retrovirus?

Comments of Examiners

(i) Several candidates mentioned names other than AIDS, such as dengue, chikungunya, and common cough & cold. However, some candidates confused the symptoms of **STDs** with those of **AIDS** and provided incorrect responses.

(ii) The name of the virus mentioned by some candidates did not match the diseases.

(iii) Instead of **ELISA test,** many candidates mentioned **Widal Test** or simply a **blood test.**

(iv) The role of reverse transcriptase was correctly described by most candidates. However, some candidates did not address the role of integrase, some of them mentioned that integrase, and a few incorrectly stated that integrase helps in the integration of proteins instead of the viral genome.

Suggestions for teachers

- Teach the contrast between viral and retroviral diseases to highlight the differences clearly.
- Present the names of diseases and their causative agents in a tabular format.
- Encourage students to learn about the diseases, their causes, testing methods, etc. in a connected manner.
- Teach the roles of reverse transcriptase and integrase together, so that students can understand the fate of the viral genome in the life cycle of retrovirus.

MARKING SCHEME

Question 13

(i)	• AIDS • Immunodeficiency / Any other correct symptom.
(ii)	HIV – Human Immunodeficiency Virus/ retrovirus
(iii)	ELISA/ PCR/ Western blotting /Rt PCR/ Molecular diagnostic technique.
(iv)	• Reverse transcriptase – RNA to DNA. • Integrase – Integration of viral DNA with host genome.

Question 14

[3]

(i) Draw a neat and well labelled diagram of T.S. of anther.

OR

(ii) Draw a neat and well labelled diagram of T.S. of mammalian ovary.

Comments of Examiners

(i) Some candidates drew a longitudinal section (L.S.) of the anther instead of a transverse section (T.S.). However, some candidates correctly drew the testis and labelled the seminiferous tubules and Leydig cells.

OR

(ii) Some candidates drew the longitudinal section (L.S.) of the ovule, while a few candidates drew only the Graafian follicle instead of the ovary.

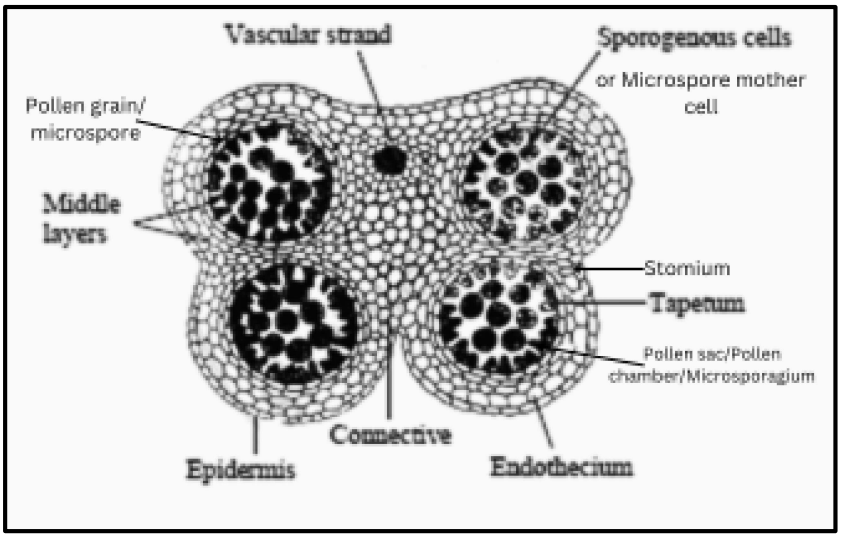
Suggestions for teachers

- Provide repeated practice of diagram-based questions with correct labels.
- Stress upon on the role of all labelled parts in the diagram.
- Elucidate in detail the ovary and the position of the Graafian follicle inside the ovary, along with correct labelling.
- Ensure that the arrows for the labels do not intersect with each other.

MARKING SCHEME

Question 14

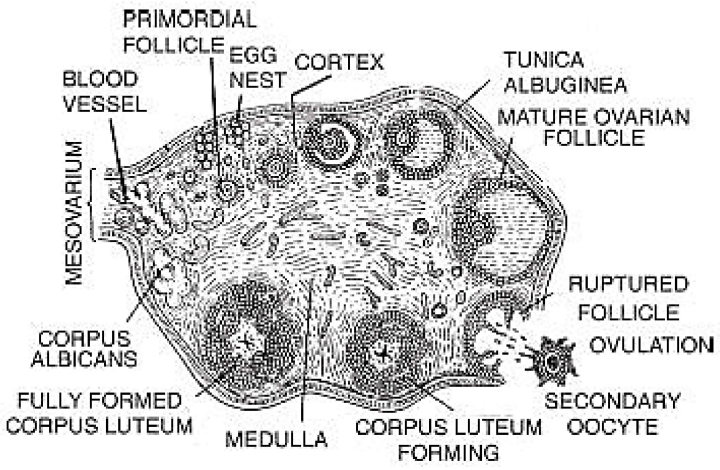
(i) Diagram of T.S. of anther.



(Correct diagram, any five labels)

OR

(ii) Diagram of T.S of mammalian ovary.



(Correct diagram, any five labels)

Question 15

[3]

The table given below shows the Area, Y-intercept and the regression coefficient of the continents namely, Africa and Europe. Study the table carefully and answer the questions that follow:

	Africa	Europe
Area (A)	62,000 km sq.	65,000 km sq.
Y-intercept (C)	10	20
Regression coefficient (Z)	1	1

(i) Calculate the species richness (S) of each continent.

(ii) Which of these continents shows a higher biodiversity?

(iii) State *any two* factors that cause an increase in biodiversity.

Comments of Examiners

(i) Several candidates applied incorrect formula (**Instead of multiplication, the formula was used to divide the values).** Some candidates mentioned the formula but did not perform the calculation.

(ii) A number of candidates mentioned '**Africa'** instead of **'Europe.'**

(iii) Instead of writing the factors that increase biodiversity, many candidates explained methods of conservation. Some candidates explained the species-area relationship because the first part of the question was based on it.

Suggestions for teachers

- For numerical-based questions, practice different types of questions by changing the parameters and the values of the given parameters.
- Familiarise students with the concept of the species-area relationship.
- Correlate the interpretation of the value of 'S' in the formula with the degree of biodiversity.
- Provide important points to students while teaching biodiversity; otherwise, they may confuse it with other topics.
- While teaching the causes of biodiversity loss, explain that reversing these factors could lead to an increase in biodiversity.

MARKING SCHEME

Question 15

(i)	620000 – Africa 1300000 – Europe
(ii)	Europe
(iii)	Factors that cause increase in biodiversity: • Tropical areas remain relatively **undisturbed**/Less seasonal variations.

	• There is **more solar energy available** in the tropics. • Higher productivity can support a larger number of species. *(Any two correct factors)*

SECTION D – 15 MARKS

Question 16

[5]

(i) Meena had grown Rose and China-rose plants in her garden. She collected pollen grains from China-rose plants and sprinkled them on stigma of the Rose flowers, as she wanted to grow a hybrid variety of Rose.

(a) Will this pollination give the desired results? Give a reason for your answer.

(b) What is *geitonogamy*? Why is it considered equivalent to cross-pollination in ecological context and self-pollination in genetic context?

OR

(ii) Fertilisation is the key process in sexually reproducing organisms and it acts as a vital link between two generations. Flowering plants adopt a unique pattern of sexual reproduction as compared to other organisms.

(a) Explain the process of fertilisation in angiosperms.

(b) What is the precise location and function of filiform apparatus in the embryo sac of angiosperms?

(c) Fruits and seeds are generally formed due to fertilisation. Name the processes involved in the production of the following without fertilisation:

(1) Fruits

(2) Seeds

Comments of Examiners

(i) (a) Many candidates mentioned 'Yes' instead of 'No' and explained it as hybridization, while incorrectly explaining pollen-pistil interaction. The term 'incompatible' was missing in some of the answers. Several candidates could not differentiate China rose and rose as different species.

(b) Some candidates did not mention that flowers can be present on the same plant to explain geitonogamy. No agents of pollination were mentioned as part of the ecological context to consider geitonogamy as equivalent to cross-pollination.

OR

(ii) (a) Most of the candidates answered this question correctly. However, a few candidates did not follow the correct sequence of the fertilisation process. Some candidates mentioned only double fertilisation.

(b) Vague answers, such as **'female part of the plant'** and **'ovary,'** were provided by a few candidates regarding the location of the filiform apparatus.

(c) Some candidates provided the answer **'parthenocarpy'** for both fruits and seeds**.**

Suggestions for teachers

- Select and share similar examples (such as potato and sweet potato) to explain compatibility and incompatibility.
- Elucidate the definition and concept of geitonogamy as a combination of self and cross-pollination.
- While teaching pollination, use a diagram to geitonogamy, showing insects as the pollination agent. Then, draw two additional plants to demonstrate cross-pollination with the help of insects.
- Emphasise that both geitonogamy and cross-pollination involve external agents for pollination.
- Explain in detail the events involved in fertilisation.
- Clarify the correct location of the micropylar end of the embryo sac in an ovule.
- Clearly differentiate between parthenocarpy and apomixes in class.

MARKING SCHEME

Question 16

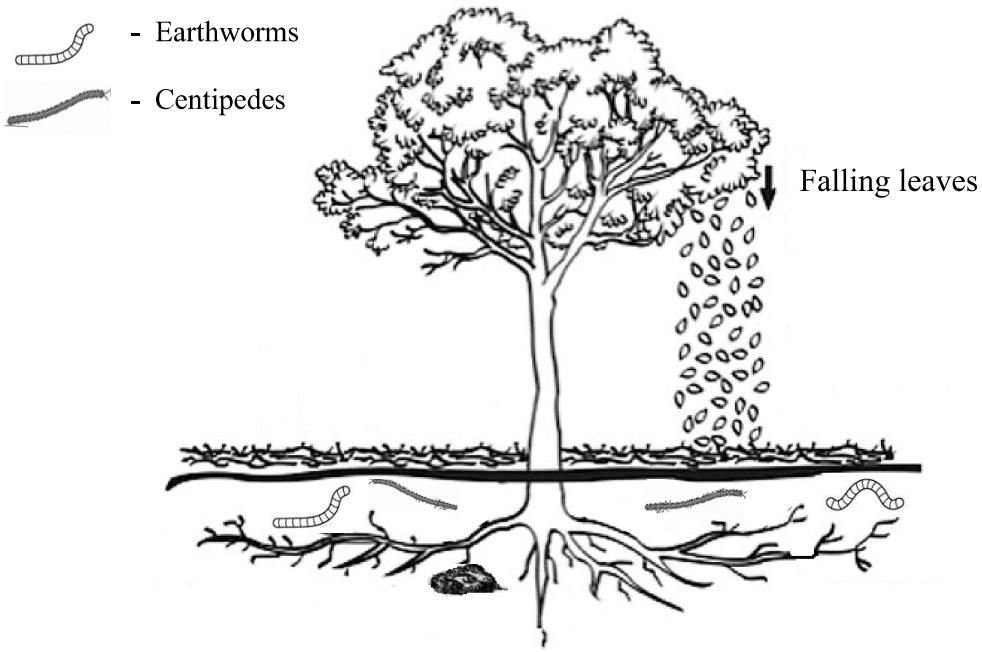
(i)	(a)	No, because of different species / incompatibility OR explained in terms of pistil-pollen interaction.
	(b)	• Geitonogamy- Transfer of pollen from anther to stigma of different flowers on the same plant. • It is considered equivalent to cross-pollination because pollen grains need to be transferred by biotic / Abiotic factor. • It is considered equivalent to self-pollination because flowers are on the same plant / same genotype.
OR		
(ii)	(a)	Fertilisation in angiosperms - • Pollen tube enters embryo sac- the tip of pollen tube bursts to release two male gametes. • One male gamete fuses with female gamete to produce diploid zygote (syngamy).

		• The other male gamete fuses with secondary nucleus to produce primary endosperm nucleus (triple fusion). • Double fertilisation discovered by Nawaschin. *(Any three points)*	
	(b)	• Location of Filiform apparatus: Synergid (tip of micropyle). • Filiform apparatus guides the pollen tube into embryo sac.	
	(c)	(1)	Fruits formed without fertilisation is parthenocarpy.
		(2)	Seeds formed without fertilisation is apomixis/ apogamy/ agamospermy

Question 17

[5]

The diagram given below shows the process of decomposition in the forest ecosystem. Observe the diagram carefully and answer the questions that follow.



(i) Why is breaking down of the complex organic matter an important event in the ecosystem?

(ii) The forest soil has a higher humus content than the desert soil. Give a reason to justify this statement.

(iii) Earthworms and centipedes play an important role in the decomposition process of forest ecosystem. At which stage of the decomposition are these organisms involved?

(iv) The net annual primary productivity of a particular wetland ecosystem is found to be 8,000 kcal/m^2 per year. If respiration by the aquatic producers is 11,000 kcal/m^2 per year, calculate the gross primary productivity for this ecosystem.

Comments of Examiners

(i) Many candidates could not understand this part of the question; consequently, many answers included phrases directly from the question, stating that the breakdown of organic matter took place.

(ii) Some candidates were not aware of the differences in climatic conditions between forests and deserts**.**

(iii) Instead of mentioning fragmentation or the first stage, many candidates referred to the secondary stage, catabolism, leaching, etc.

(iv) Instead of writing **NPP=GPP-R,** some candidates used **GPP=NPP-R**, resulting in an incorrect answer.

Suggestions for teachers

- Explain to the students the consequences of not having a breakdown of organic matter and how it affects the Earth, ecosystem, and biosphere.
- Make students aware of the recycling of nutrients.
- Link the differences in climatic conditions that support different types of vegetation.
- Teach the steps involved in decomposition in the correct order while teaching the process.
- Ensure that students learn the mathematical equations correctly.
- Provide practice for students with different types of calculation-based questions.

MARKING SCHEME

Question 17

(i)	The breakdown to small particles or fragmentation helps leaching and catabolic reactions to happen faster and more efficiently as particles are smaller. OR Increases the availability of organic matter for the microbes in the soil.
(ii)	Forest soil will have higher humus content than desert soil because there is very little vegetation in the desert area and abundant vegetation (organic matter) in the forest. OR Any other suitable conditions in forest soil is mentioned.
(iii)	In the 1st step i.e., fragmentation. OR Breaking down of dead parts (organic matter) to small particles.
(iv)	NPP = GPP – R GPP= 8000+11000= 19,000 kcal/m^2

Question 18

[5]

F. Griffith conducted a series of experiments on mice with two different strains of the bacterium *Diplococcus pneumoniae*.

(i) Describe the entire procedure of this experiment.

(ii) Write the conclusion of this experiment.

(iii) What would have been the result of the experiment if both the strains of the bacteria were first heat-killed, mixed and then injected in the mice?

Comments of Examiners

(i) Some candidates did not mention R strain and S strain, while explaining the procedure. However, others stated that the R strain killed the mice, while the S strain was harmless. They referred to R-II as heat-killed instead of S-III heat-killed. **The sequence was not followed**, leading to incorrect results being mentioned.

(ii) A number of candidates were found to be confused regarding the result. The operative word 'transforming' was missing. Some candidates incorrectly identified protein as the genetic material.

(iii) A few candidates could not understand the question and mentioned that '**rats die instead of survive**.'

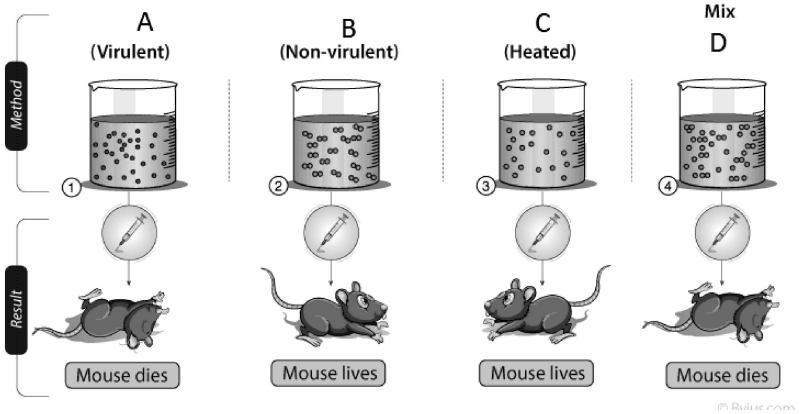
Suggestions for teachers

- Encourage students to use correct and specific terms in class instead of providing vague ideas.
- Ensure that students understand the terms 'virulent' and 'non-virulent' prior to the experiment.
- Clarify the concept of rough and smooth strains, emphasizing that R is non-virulent and S is the virulent strain, along with their roles.
- Teach Griffith's findings using key terms that explains them.
- Stress that DNA causes transformation.
- Familise students with FRQ and its effects.

MARKING SCHEME

Question 18

(i)



Or explained

1. Injected Virulent strain (S-strain) → mice died.
2. Injected Non Virulent strain (R-strain) → mice survive.
3. Injected Heat- killed Virulent strain (S-strain) → mice survive.

	4. Injected Mixed Non Virulent strain + Heat killed Virulent strain (s-strain) → mice died.
(ii)	DNA is the transforming principle / DNA is the genetic material. / Search for genetic material.
(iii)	The mice will live since both bacteria are dead and cannot cause infection.

Note: For questions having more than one correct answer/solution, alternate correct answers/solutions, apart from those given in the marking scheme, have also been accepted.