

BIOLOGY
PAPER 1
(THEORY)

Maximum Marks: 70

Time Allowed: Three Hours

*(Candidates are allowed additional 15 minutes for only reading the paper.
They must NOT start writing during this time.)*

This paper is divided into four sections – A, B, C and D.

Answer all questions.

Section – A consists of one question having sub-parts of one mark / two marks each.

Section – B consists of seven questions of two marks each.

Section – C consists of seven questions of three marks each, and

Section – D consists of three questions of five marks each.

*Internal choices have been provided in one question each in Section B,
Section C and Section D.*

The intended marks for questions or parts of questions are given in brackets [].

SECTION A – 20 MARKS

Question 1

Answer the following questions briefly.

- (i) In human plasma, five different types of immunoglobulins are found. [1]
Which type of immunoglobulin is responsible for allergic reactions?
- (ii) Some orchids live on the branches of mango trees. Name the type of interaction [1]
that exists between mango tree and the orchid.
- (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 [1]
the probability of their daughter being haemophilic?
- (v) Home-made fruit juices are turbid, while the bottled fruit juices purchased from [1]
the market are clear. Give a reason for this difference.

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Turn over

- (vi) The number of lily plants in a pond was found to be 50. After one year, the number [1] increased to 65. Calculate the natality of lily plants.
- (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 [1] from:
- Malaria
 - Ring worm
 - Dengue
 - Typhoid
- (x) Match the columns I and II with reference to weeks of pregnancy and development [1] of human embryo. Select the correct option from the choices given below:

| 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. |

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

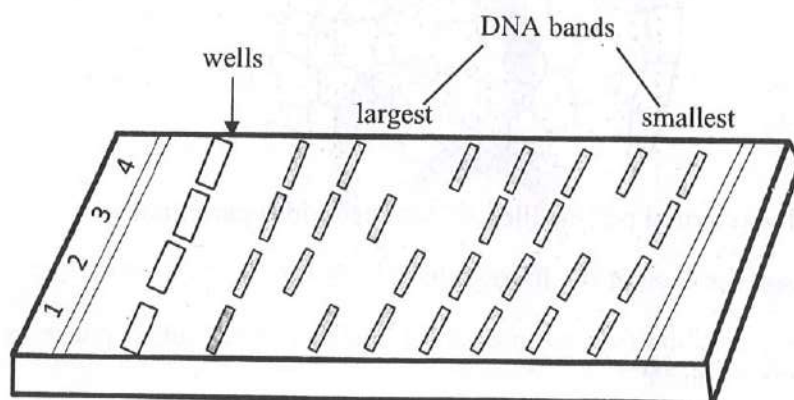
- (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion.
- (b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion.
- (c) Assertion is true and Reason is false.
- (d) Both Assertion and Reason are false.

(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.

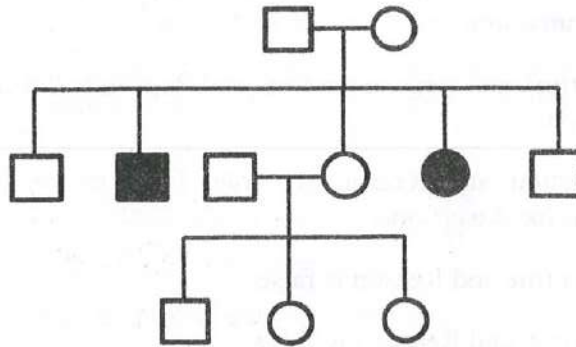
(xiii) The equipment shown below is used for the separation of DNA fragments. [1]



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

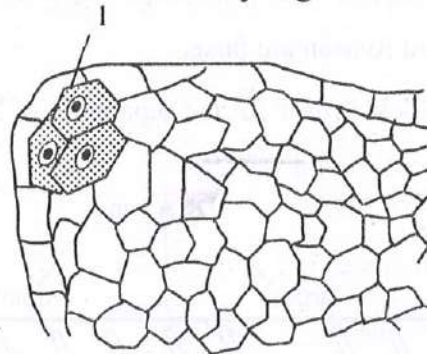
(xiv) In humans, somatic gene therapy was carried out to correct an immunodeficiency disease. Name this disease. [1]

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



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.

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.

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.

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.

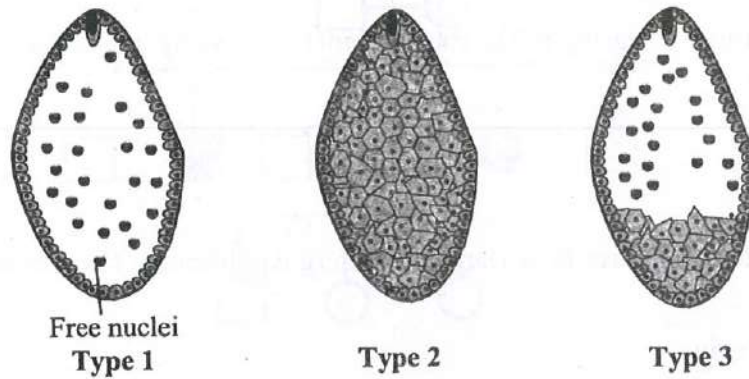


- (i) Give the biochemical reason for the disorder that changes the shape of the RBCs, as shown above.
- (ii) Draw a Punnett square to show the genotype of the mother of James.
- (iii) Name and define the type of 'point mutation' responsible for this disorder.

Question 5

[2]

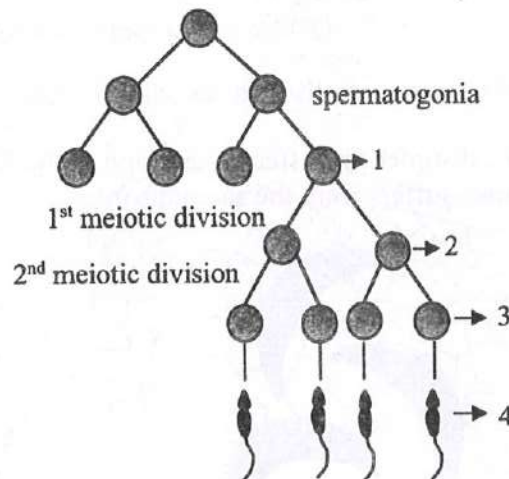
- (i) The diagram given below shows the three types of endosperms in angiosperms.



- (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'.

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

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.

Question 8

[2]

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

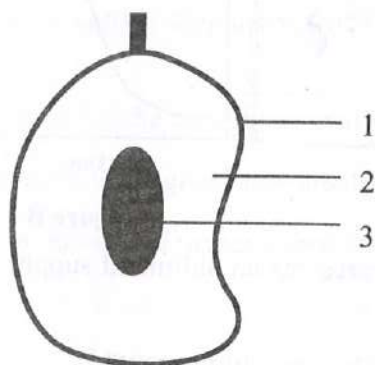
- (i) Lactic acid producing bacterium.
- (ii) Microbe known as Baker's yeast.
- (iii) Fungus which helps in the production of cyclosporin-A.
- (iv) Microbe used in the production of statins.

SECTION C – 21 MARKS

Question 9

[3]

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



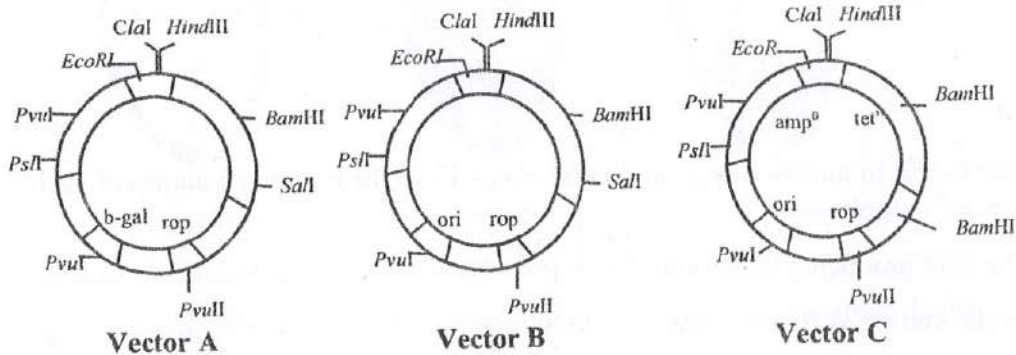
- (i) Identify the parts labelled '1', '2' and '3'.
- (ii) State the difference between a *true fruit* and a *false fruit*.
- (iii) What is the significance of formation of fruit in angiosperms?

Question 10

[3]

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

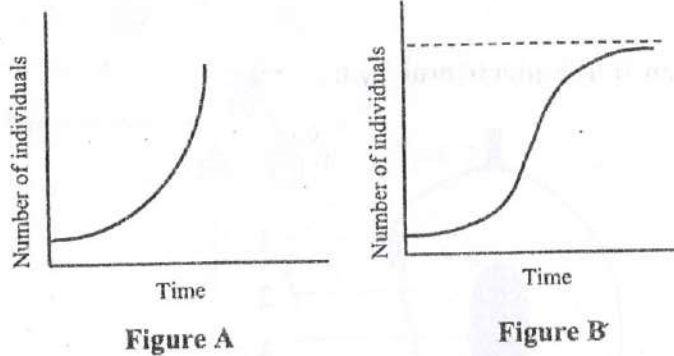
Which one of the vectors shown below should she choose? Justify your answer by giving two reasons.



Question 11

[3]

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



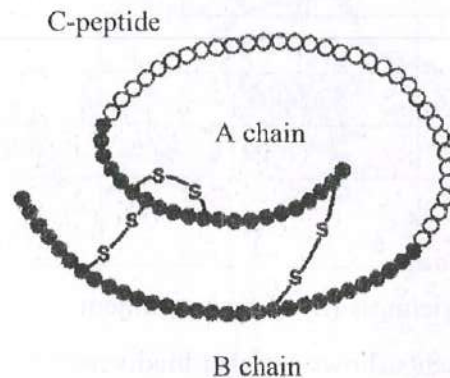
- (i) Which one of the two figures represents an unlimited supply of nutrients? Give a reason.
- (ii) Which figure depicts a challenge to population growth?
- (iii) Explain the term *reproductive fitness*.
- (iv) Give the mathematical expressions for Figure A and Figure B.

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?

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?

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.

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.

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?

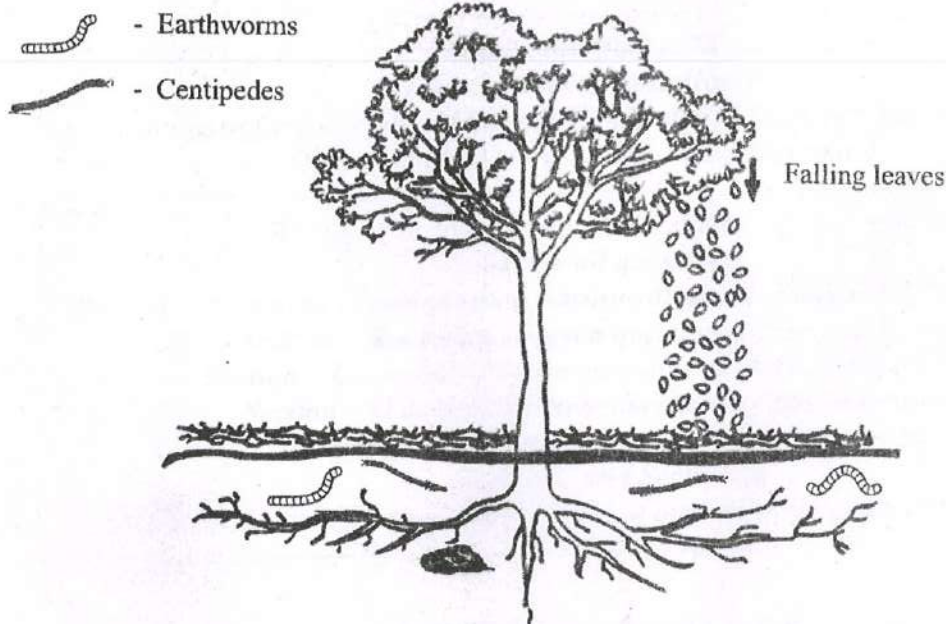
OR

- (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

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 $8,000 \text{ kcal/m}^2$ per year. If respiration by the aquatic producers is $11,000 \text{ kcal/m}^2$ per year, calculate the gross primary productivity for this ecosystem.

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?