

# BIOLOGY

## PAPER 1

### (THEORY)

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**Maximum Marks: 70**

**Time Allotted: Three Hours**

**Reading Time: Additional Fifteen Minutes**

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#### **Instructions to Candidates**

1. You are allowed an **additional fifteen minutes** for **only** reading the question paper.
2. You must **NOT** start writing during reading time.
3. This question paper has **11 printed pages and one blank page**.
4. It has **eighteen questions** in all. Answer **all** questions.
5. There are **four** sections in the paper: **A, B, C and D**. **Internal choices** have been provided in **one question** each in **Sections B, C and D**.
6. **Section A** consists of **one question**. Each subpart carries **one mark**.
7. While answering **Multiple Choice Questions** in **Section A**, you are required to write **only one option** as the answer.
8. **Section B** consists of **seven questions** each carrying **two marks**.
9. **Section C** consists of **seven questions** each carrying **three marks**.
10. **Section D** consists of **three questions** each carrying **five marks**.
11. **Diagrams should be drawn** wherever necessary using a **pencil** only.
12. The intended marks for questions are given in brackets [ ].

## SECTION A – 20 MARKS

### Question 1

- (i) Zara is suffering from cough and has bluish lips. Her mucus is mixed with blood. [1]  
What is the biological name of the causative organism responsible for Zara's condition?
- (ii) Observe the relation between the first two words and complete the analogy. [1]  
Dengue: *Aedes* :: Plague: \_\_\_\_\_
- (iii) If the number of chromosomes in the cells of the calyx is 16, how many [1]  
chromosomes will be formed in the endosperm after double fertilisation?
- (iv) A scientist isolates a second restriction endonuclease from the strain DC3 of [1]  
*Helicobacter pyogenes*.  
What would the scientist name it using the standard naming technique of restriction enzyme?
- (v) Meenu is suffering from a genetic disorder in which phenylpyruvic acid and its [1]  
metabolites accumulate in blood. It causes impairment of nervous tissues.  
Which enzyme deficiency has caused this disorder in Meenu?
- (vi) There were 770 frogs in a pond. 70 of them died within a month. [1]  
Calculate the death rate of the population of frogs in the pond.
- (vii) A farmer notices that the leaves of his cabbage plants are curling up because of [1]  
heavy infestation of aphids.  
Suggest one ecofriendly method to control their spread in the cabbage plants.
- (viii) In a particular plant with bilobed dithecos anther, there were 50 Pollen Mother [1]  
Cells. Only 25% could develop their pollen tubes.  
Calculate the number of pollen grains that would proceed for fertilisation.
- (ix) Choose the components that are required for the proper functioning of DNA [1]  
polymerase enzyme.
- (P) DNA template
  - (Q) A DNA primer
  - (R) An RNA primer
  - (S) Four different dNTPs
- (a) Only (P), (Q) and (R)
- (b) Only (P), (R) and (S)
- (c) Only (Q), (R) and (S)
- (d) Only (P), (Q) and (S)

(x) The left hind limb of a person was swollen like elephant's limb. Which one of the following was **MOST** likely the cause of swelling? [1]

- (a) Accumulation of uric acid
- (b) Blockage of blood vessels
- (c) Blockage of lymph vessels
- (d) Hypertrophy of skeletal muscles

(xi) Given below are two statements marked Assertion and Reason. Read the two statements carefully and choose the correct option. [1]

**Assertion:** RNAi technique is applied to plants and animals to protect them from pest infestation.

**Reason:** This technique inhibits the expression of certain genes in pests.

- (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) Given below are two statements marked Assertion and Reason. Read the two statements carefully and choose the correct option. [1]

**Assertion:** Individuals with Klinefelter syndrome lose their secondary sexual characters and develop gynecomastia.

**Reason:** The presence of the XYY chromosomal pattern leads to underdeveloped testes and reduced testosterone levels in affected males.

- (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) In a garden pea plant, the flowers are in axial (A) position. Find out the proportion of flowers in terminal position (a), if a cross is made between two heterozygous plants. [1]

(xiv) Name the autoimmune disorder that affects the skeletal muscles in humans. [1]

- (xv) Answer the following:
- (a) Expand the abbreviation IUI. [1]
- (b) The enzyme polynucleotide phosphorylase helps the *in-vitro* synthesis of RNA. Name the scientist who discovered this enzyme. [1]
- (xvi) Shama complained of severe itching in certain parts of her body where patches as shown below appeared on her skin. Write the biological name of the causative agent responsible for her condition. [1]

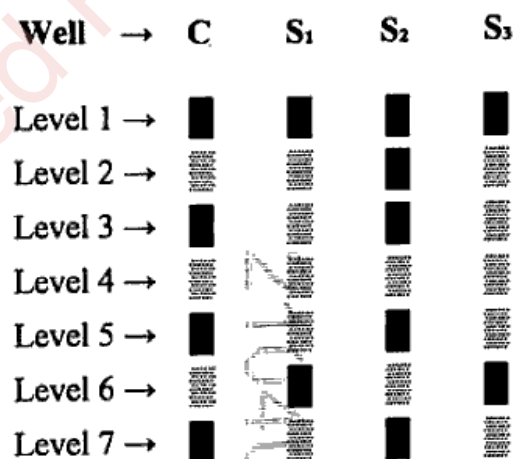


- (xvii) Name the chemical messenger that activates Natural Killer T-cells and macrophages. [1]
- (xviii) Give a reason for each of the following:
- (a) Kanika was suffering from SCID and needed *periodic infusion* of transformed lymphocytes. [1]
- (b) In HIV infected persons, the immune system is compromised. [1]

### SECTION B - 14 MARKS

#### Question 2 [2]

The diagram below shows DNA banding patterns obtained after DNA samples collected from a crime scene were subjected to gel electrophoresis. Samples from crime scene are denoted by C and three suspects are represented by S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub>.



- (i) Which suspect's DNA sample matches the sample collected from the crime scene?
- (ii) Mention the principle on which DNA profiling is based.

### Question 3

[2]

In a group discussion on pollination, Shubham argued that Cleistogamy was a type of Xenogamy whereas Ameena was of the opinion that it was a kind of Autogamy. Whose argument is correct? Justify.

### Question 4

[2]

- (i) The amount of energy at the fourth trophic level in the food chain given below is 4 J.

Grass → Zebra → Crocodile → Vulture

What will be the amount of energy available at the sunlight and transducer level?

OR

- (ii) Roselin had an aquarium at her home with 10 fish in it. In a year, a fish gave birth to 7 fish. During this period, 3 adult fish had died. Roselin's father purchased 2 more pairs of fish from market for the aquarium. Later, Roselin gifted 4 fish from the aquarium to her friend.

Find out the growth rate of fish in Roselin's aquarium.

### Question 5

[2]

Anthony is a scientist who has been provided with raw materials to obtain a specific biological product in large quantities. His laboratory has two large vessels for this purpose – one with a sparger and the other vessel with a stirrer.

Which vessel will be more advantageous to Anthony? Why?

### Question 6

[2]

The data given below shows a significant decline in the population of migratory birds in a wetland in Southern India over the last three years.

Year	Population of Birds	Aquatic Plants (%)	Aquatic Area (ha)
2023	10,000	85	350
2024	8000	60	280
2025	5000	45	220

Based on the above data, interpret two reasons for change in the population of migratory birds.

**Question 7**

[2]

*Paramecium caudatum* and *Paramecium aurelia*, were growing in separate culture media in a laboratory. When both the species were transferred to the same culture medium for growth, it was observed that *Paramecium caudatum* got eliminated from the habitat after some time.

Identify and explain the type of ecological interaction between the aforementioned species of *Paramecia* on the basis of Gause's principle.

**Question 8**

[2]

In an experiment to produce recombinant cells, a plasmid without selectable marker was chosen as the vector for cloning a gene.

- (i) Predict the outcome of this experiment.
- (ii) Name an artificial chromosome that can be used as a vector to transfer the recombinant DNA in *Penicillium notatum*.

**SECTION C – 21 MARKS****Question 9**

[3]

- (i) How is mature insulin different from pro-insulin secreted by pancreas in humans?
- (ii) Name the company that produced genetically engineered insulin for the first time.
- (iii) Why is functional insulin produced by rDNA technology better than the ones produced earlier?

**Question 10**

[3]

A biologist surveyed islands of different sizes and consolidated the results in the form of the data given below. Study the data carefully and answer the questions that follow.

Name of Islands	Island Area (sq. km)	No. of mammalian species
P	1	5
Q	10	18
R	100	60
S	1000	150

- (i) What pattern do you observe in the above data?
- (ii) Name the scientist who proposed the concept of relationship between area and species.
- (iii) Write the mathematical expression for this relationship.

**Question 11**

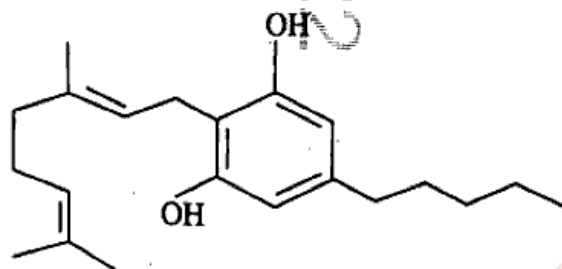
[3]

- (i) Draw a flowchart to show the process of sex determination in honeybees.
- (ii) If there are 16 chromosomes in the somatic cells of a male honeybee, how many chromosomes would be present in spermatozoa?

**Question 12**

[3]

Study the chemical structure of an addictive drug shown below and answer the questions that follow.



- (i) Mention the scientific name of the source plant of the above drug.
- (ii) State *any one* effect of this drug on human body.
- (iii) What is meant by *withdrawal symptom*?

**Question 13**

[3]

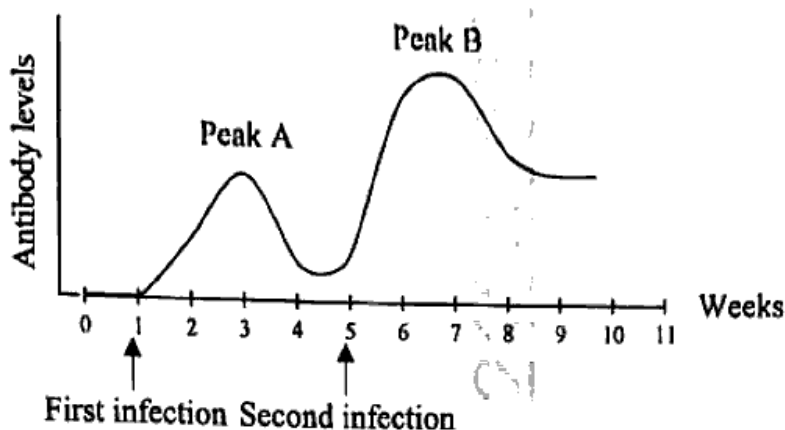
A researcher compares two embryos, X and Y.

- Embryo X shows equal division of the zygote, forming two cells that are almost identical in size.
  - Embryo Y shows an unequal first division and produces a small apical cell and a large basal cell.
- (i) Which embryo is likely to develop into a normal dicot embryo?
  - (ii) What is the fate of:
    - (a) Apical cell?
    - (b) Basal cell?

Question 14

[3]

- (i) The graph given below shows the level of antibodies in the blood after exposure to a pathogen.



- (a) What types of responses of the immune system do the peaks A and B represent?
- (b) Name the type of antibody that is at the highest level in the 7<sup>th</sup> week.

OR

- (ii) *Plasmodium* is a digenetic parasite, completing its life cycle in humans and mosquitoes. In humans, it completes different parts of its life cycle in the liver and RBCs.

Draw a flow chart to outline its erythrocytic cycle in humans.



Question 15

[3]

The two structures shown below are formed in the process of spermatogenesis. Study them carefully and answer the questions that follow.



Structure A



Structure B

- (i) Identify the process which converts Structure A to Structure B.
- (ii) State *any two* modifications observable in Structure B.

## SECTION D – 15 MARKS

### Question 16

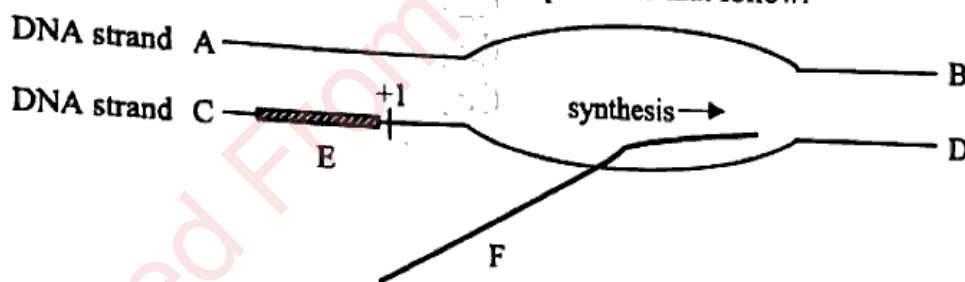
As a part of his research, Arun conducted a study on the number of locusts in a forest. He compiled his findings in the form of the following data. [5]

Day	Number of locusts
1	5
2	10
5	25
10	50
15	105
20	170
25	280
30	360
35	200

- (i) Construct a growth curve based on the above data. What type of a growth curve is obtained?
- (ii) Write a mathematical expression for the growth curve obtained.

### Question 17

Study the diagram given below and answer the questions that follow. [5]



- (i) Identify the parts marked 'E' and 'F'.
- (ii) Explain the post-transcriptional modifications that occur in part 'F'.

### Question 18

- (i) Outline *three* major steps in the process of *artificial hybridisation*.
- (ii) Discuss the role of pollen–pistil interaction in ensuring successful hybrid formation.

OR

(iii) Draw a flowchart to represent the process of oogenesis.

(iv) Differentiate between *oogenesis* and *spermatogenesis* on the following basis:

(a) Number of products

(b) Gonadal hormones

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