

BIOLOGY
PAPER 1
(THEORY)

T8035041

Maximum Marks: 70

Time Allotted: Three Hours

Reading Time: Additional Fifteen Minutes

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 carrying *one / two mark(s)*.
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 [].

Instruction to Supervising Examiner

1. Kindly read **aloud** the Instructions given on page 1 to all the candidates present in the examination hall.
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SECTION A – 20 MARKS

Question 1

Answer the following questions briefly.

- (i) A sports person quenched his thirst by drinking some tender coconut water. [1]
Name the part of the fruit from where the liquid content is derived.
- (ii) In a particular ecosystem, there were 1000 species at a given time. After 5 years, [1]
200 more species were added. Calculate the growth rate of the population.
- (iii) Rachel attained puberty at the age of fourteen years. She conceived for the first [1]
time at the age of thirty years.
How many primary oocytes did she lose till the time of conception?
- (iv) How many nuclei are present in the central cell of the mature embryo sac of [1]
angiosperms before fertilisation?
- (v) A woman's first child suffered from Down's syndrome. During her second [1]
pregnancy, she wanted to find out whether her second child would be normal or not.
Which method will the gynaecologist adopt to test the genetic abnormality in the embryo?
- (vi) Derive a name for a restriction endonuclease which was extracted in the [1]
5th order from the RY13 strain of *E. coli*.
- (vii) A pistillate flower of a tetraploid angiosperm is pollinated by a pollen grain from [1]
a staminate flower of a diploid plant.
What would be the level of the ploidy in the endosperm of seeds thus formed?
- (viii) Observe the relationship between the first two words / terms and then fill in the [1]
fourth word / term.
Lipase: *Candida lipolytica* :: Taq polymerase: _____
- (ix) The capacitation of sperms plays a significant role in the process of fertilisation [1]
in humans.
Which of the following events are associated with the process of capacitation?
I. Large quantity of Ca^{+2} ions enter the sperm to enhance the permeability of the acrosome.
II. Antifertilisin reacts with the fertilisin protein.
III. Membrane covering the sperm head and acrosome gets removed.
- (a) I and II only
(b) I and III only
(c) II and III only
(d) I, II and III

- (x) What is the purpose of the Red Data Book? [1]
- (a) To list the endangered species
 - (b) To promote sustainable development
 - (c) To check the growth of the animal species
 - (d) To identify areas for conservation
- (xi) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. [1]
- Assertion:** The eyes of octopus and horse are evidence of convergent evolution.
- Reason:** Eyes of both the organisms have the same structure and serve the same function.
- (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 both the statements carefully and choose the correct option. [1]
- Assertion:** In a pond ecosystem, pyramid of biomass shows a sharp decrease in the biomass at higher trophic levels.
- Reason:** Primary producers convert only 10% of the energy of sunlight into net primary productivity.
- (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) A forest has a GPP of 20,000 kcal/m²/year, and 40% of this energy is used for respiration. Calculate the amount of energy available as NPP. [1]
- (xiv) Ryan used a synthetic hair dye to colour his hair. Within a day of dyeing, red rashes appeared on his face causing constant itching. [1]
- What condition do these symptoms indicate?

(xv) Answer the following questions.

(a) Name the scientist who is considered the Father of Indian Ecology. [1]

(b) Expand the abbreviation SSBP. [1]

(xvi) A transformed bacterial cell contains a transgene that can produce one molecule of protein 'X' per cell. This bacterium duplicates every 20 minutes. It is cultured in a nutrient medium for 3 hours. [1]

How many molecules of protein 'X' will be produced by the end of this culture?

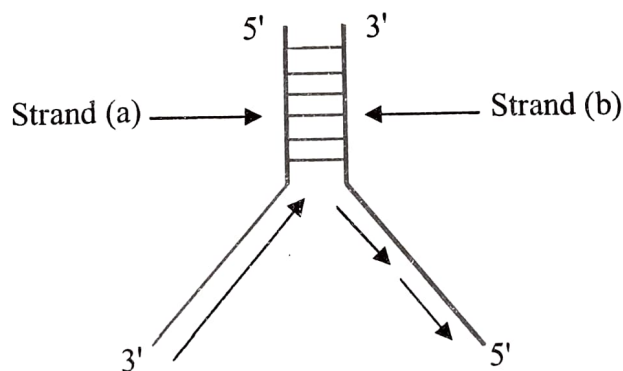
(xvii) Which drug is extracted from the leaves shown in the image given below? [1]



(xviii) Give a reason for each of the following.

(a) The period of lactational amenorrhoea is marked by the absence of menstruation. [1]

(b) The diagram given below shows a segment of DNA that codes for the enzyme pepsin. Anita used strand (b) for making mRNA to translate the enzyme pepsin. Even after repeated attempts, she could not create the enzyme. [1]

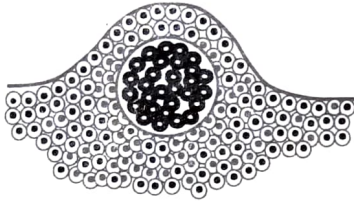


SECTION B – 14 MARKS

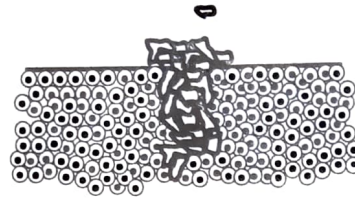
Question 2

[2]

The figure given below shows two different types of tumours, Type A and Type B. State *one* characteristic feature of each type.



Type A



Type B

Question 3

[2]

- (i) (a) Which trophic level has the most energy in an ecosystem?
(b) Expand PAR.

OR

- (ii) (a) In which year was the Earth Summit held?
(b) What was the main agenda of this historic summit?

Question 4

[2]

Discuss the role of two ovarian hormones in the process of *parturition* in humans.

Question 5

[2]

Akshay Shrivastav, a chemical engineer, launched *Navyakosh*, a unique biofertiliser. He started his company, LCB Fertilisers, in his backyard during the COVID-19 pandemic induced lockdown. His creation rapidly gained popularity among the farmers.

Tejraj Sahu, a farmer from Odisha, was one of those who had used the new biofertiliser, *Navyakosh* on his paddy field. The harsh sun and unseasonal rains had reduced water holding capacity of Sahu's field and prompted him to use this biofertiliser.

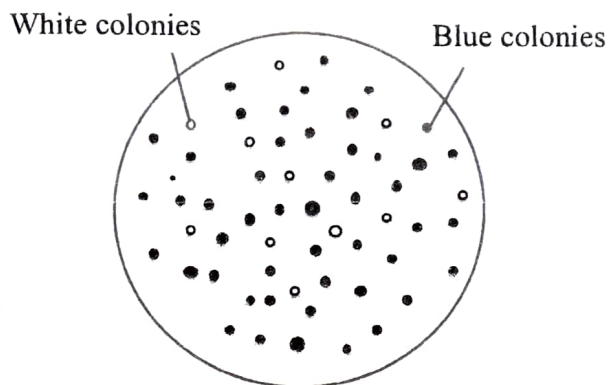
(Source (edited): www.thebetterindia.com)

- (i) How do you think the use of the biofertiliser, *Navyakosh* benefitted the paddy field?
(ii) Name the microbe that was used to create the biofertiliser, *Navyakosh*.

Question 6

[2]

The diagram given below shows a method of screening the transformed bacterial cells.



Explain how the differently coloured colonies help in identifying the transformed cells.

Question 7

[2]

As a student of food technology, Leena has planned to produce two dairy-based processed food products that would be completely organic in nature.

Suggest *any two* food products that Leena can produce.

Question 8

[2]

Explain *biopiracy* with the help of an example.

SECTION C – 21 MARKS

Question 9

[3]

- (i) An organism living at an extremely hot place is likely to have a high GC content in its DNA. Give a reason to explain.
- (ii) If you are given the exact quantity of G and T, how will you calculate the quantity of A and C in the DNA? Why is this not possible in the RNA molecule?

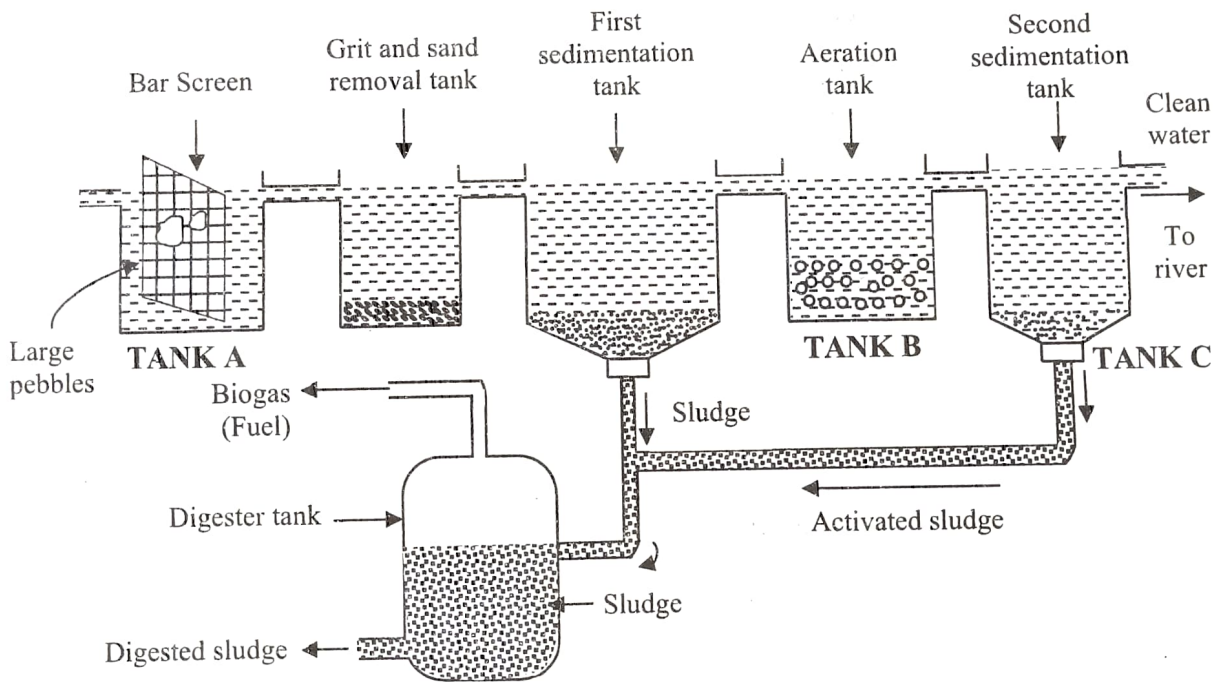
Question 10

Michelle, a zookeeper was collecting data on rabbits. She found that in a population of 1000 rabbits, 360 had long ears (LL), 150 had medium ears (Ll), and 490 had short ears (ll) at a given time.

- Calculate the frequency of rabbits with heterozygous traits.
- Name the principle applied to calculate the frequency of rabbits.
- Michelle also studied the next generation of rabbits and found that their population decreased significantly to 400. Now, there are 336 rabbits with long ears and 64 rabbits with short ears. Give a reason to explain the change in gene frequencies in the new population.

Question 11

Microbes have been used by humans in household, industrial and agricultural setups. One such use is shown in the diagram given below.



- Tank A** represents primary treatment of sewage while **Tank B** shows its secondary treatment. State *one* difference between the two kinds of sewage treatment.
- Identify the tank in which flocs are added.
- What is the purpose of using microbes in sewage treatment?

Question 12

[3]

- (i) Draw and explain the Logistic population growth curve.

OR

- (ii) What is *parasitism* in population interactions? Explain *any two* types of parasitism with one example each.

Question 13

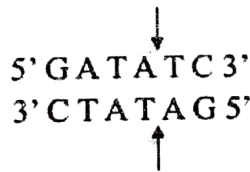
[3]

Draw a neat and well labelled diagram of T.S. of mammalian testis.

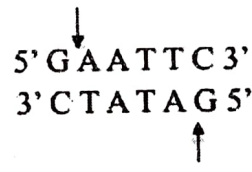
Question 14

[3]

- (i) What is the role of restriction endonucleases in rDNA technology?
- (ii) A biotechnologist was given two restriction endonucleases (RE-A and RE-B) with the following restriction sites:



RE-A



RE-B

After the action of respective endonucleases, the fragments separated from the restriction sites. Draw the separated fragments on both the sites.

Question 15

[3]

Draw a neat flowchart depicting the life cycle of a *retrovirus* in the infected human cell.

SECTION D – 15 MARKS

Question 16

[5]

- (i) Answer the following questions.
- Discuss *any three* contrivances for prevention of self-pollination in flowering plants.
 - Oranges can be produced by processes like Apomixis and Polyembryony. State *two* differences between these processes.

OR

- (ii) (a) Mention *one* example of each of the following:
- Bacterial STD
 - Viral STD
 - Protozoal STD
- (b) State *any two* artificial methods of contraception which also prevent transmission of STDs.

Question 17

- (i) Explain the Rivet Popper Hypothesis. [3]
- (ii) Briefly discuss the *narrowly utilitarian* and *broadly utilitarian* arguments for conserving biodiversity. [2]

Question 18

[5]

Consider the information given below about a family and answer the questions that follow.

- Rafiq, a ten year old boy, injured himself badly during the games period in school. He was rushed to a nearby hospital as the bleeding could not be stopped despite the first aid given to him.
- His uncle had lost his life in a similar condition.
- Rafiq's entire family underwent a genetic analysis to detect Bleeder's disease. His parents, sister Farah and paternal grandmother were tested to detect the disease.
- Rafiq's mother and grandmother were found to be carriers of the Bleeder's disease.

- (i) Draw a single pedigree chart to show the pattern of inheritance in Rafiq's family.
- (ii) What kind of inheritance pattern prevails in Rafiq's family?
- (iii) What are the chances of
 - (a) Farah suffering from the same disease?
 - (b) Farah being a carrier of the same disease?