

BIOLOGY
PAPER 1
(THEORY)

S4000866

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.

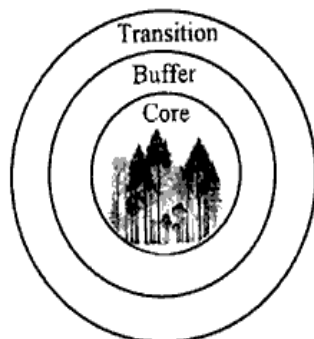
- (i) Name the vectorless method to insert a gene into the human egg cell. [1]
- (ii) How many meiotic divisions are necessary to produce 100 Zygotes? [1]
- (iii) In which week of pregnancy is the first movement of a human foetus felt? [1]
- (iv) Name the organism from which Ti plasmid has been isolated. [1]
- (v) Ritu has delivered a baby recently. Due to her busy office schedule, she was unable to breastfeed her baby and considered giving formula milk. The paediatrician advised her that mother's milk was very important for the newborn as it not only provided the baby with nutrition but also strengthened a specific type of antibody. [1]
- Name the type of antibody that the paediatrician referred to.
- (vi) Why can DNA molecule not pass through the cell membrane of the host cell? [1]
- (vii) How many cycles are required in PCR to obtain 130 copies of DNA? [1]
- (viii) The pregnancy test result of a woman was positive. Name the proteinaceous hormone responsible for the positive result. [1]
- (ix) Gametogenesis is the process of formation of male and female gametes. It involves three phases: multiplication, growth and maturation. [1]

Which of the following statements are correct for spermatogenesis, but **NOT** for oogenesis?

- I. It is initiated at puberty.
- II. It is controlled by FSH and LH.
- III. Gamete differentiates after completion of meiosis.
- (a) I and II only
- (b) I and III only
- (c) II and III only
- (d) I, II and III

(x) Identify the type of *in situ* conservation strategy shown below.

[1]



- (a) Zoological garden
- (b) Sacred grove
- (c) Botanical garden
- (d) Biosphere reserve

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

[1]

Assertion: Habitat fragmentation can result in extinction of species.

Reason: Fragmented habitats restrict the gene flow and reduce the size of the population, thereby making the species more vulnerable.

- (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: Net Primary Productivity is the amount of energy stored in an organism.

Reason: Net Primary Productivity is independent of Gross 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) Mahesh contracted malaria due to mosquito bite. After three days of infection, he experienced chills and shivering. [1]
Which toxin released by his RBCs caused these symptoms?
- (xiv) A diploid organism is heterozygous for five loci. How many types of gametes will it produce? [1]
- (xv) Answer the following questions:
- (a) Expand the abbreviation IUCN. [1]
- (b) Devi was doing a short study on a bacterial population. She observed that the bacterial growth was limited after a certain extent. Upon further investigation, she learnt that food supply became limited for the bacterial culture to keep growing as population growth occurred exponentially and food production increased arithmetically. [1]
Name the scientist who proposed the theory referred to above.
- (xvi) How many sperms will be produced from 50 primary spermatocytes? [1]
- (xvii) Observe the relationship between the first two words / terms and then fill in the fourth word / term. [1]
Fungal cell wall: *Chitinase* :: Bacterial cell wall: _____
- (xviii) Give a reason for each of the following:
- (a) Herbivores are considered predators in the ecological context. [1]
- (b) HIV is called a *retrovirus*. [1]

SECTION B – 14 MARKS

Question 2 [2]

- (i) Sushant's blood group is AB. He is married to Radhika whose blood group is O. They have three children Navya, Nishant and Nikita. One of them is an adopted child while the other two are their biological children. Navya has blood group B, Nishant's blood group is A and Nikita's is O.
- (a) The blood group analysis of the children reveals that Nikita is an adopted child. Give a reason.
- (b) In what ways does this ABO blood group system deviate from Mendelian genetics?

OR

- (ii) Two heterozygous pink coloured Snapdragon plants with the genotype (Rr) are crossed.

Draw a Punnett square to show the possible phenotypes and corresponding genotypes of the next generation offspring.

Question 3

[2]

Raghu has two hectares of paddy fields. The cattle feeds on the crop and discharges the dung in his field.

Suggest *one* method by which Raghu can use cattle dung as an effective source of energy. Name the microorganism that plays an important role in this process.

Question 4

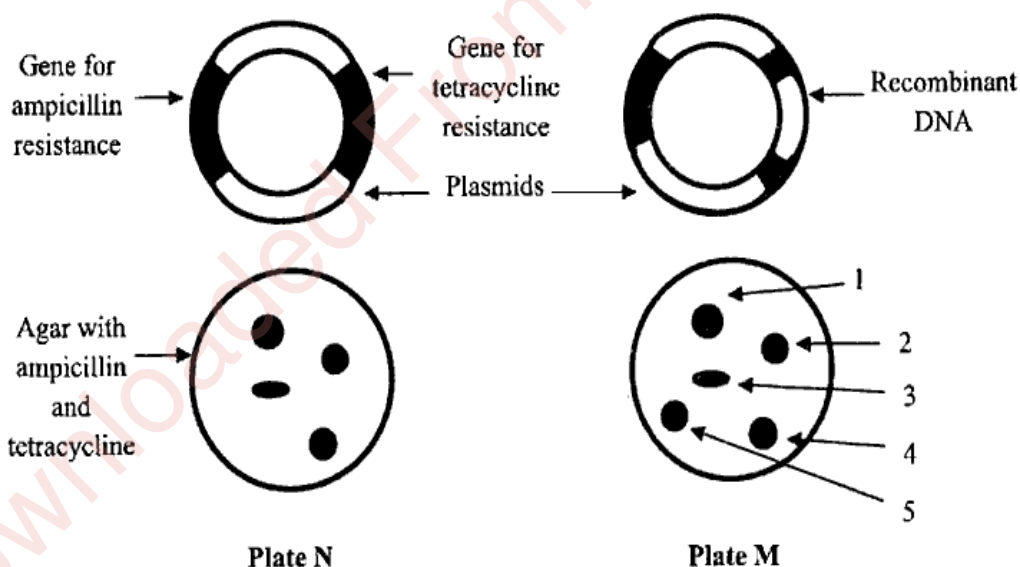
[2]

There are 11,50,000 tigers in a forest of 230 km² area. Calculate the population density of tigers in the forest.

Question 5

[2]

The diagram given below shows the steps involved in the procedure of selecting transformed bacteria. In replica plating, a sterile pad is pressed onto agar in **Plate M** and then onto the agar in **Plate N** mixed with antibiotics.



Identify the bacterial colony which has undergone transformation. Support your answer with a reason.

Question 6

[2]

Describe *any two* characteristics of Hydrophilous plants.

Question 7

[2]

Sixty-five year old Srinivas suffered from chronic heart disease. He visited his doctor every month for a checkup. In one of the visits, Srinivas underwent medical tests. On analysing the tests' report, the doctor prescribed administration of statins to him.

- (i) Why did the doctor prescribe the administration of statins to Srinivas?
- (ii) What is the biological name of the source of statins?

Question 8

[2]

List *any two* advantages of GMOs to farmers.

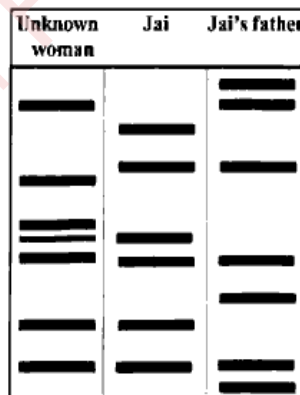
SECTION C – 21 MARKS

Question 9

[3]

Jai took over his father's company as the family heir. Soon after, an unknown woman claimed to be his biological mother. The forensic experts collected blood samples of Jai, his father and the woman and then performed DNA finger printing test to verify the woman's claim.

- (i) With reference to the DNA fingerprint shown below, state whether the woman is the mother of Jai or not. Justify your answer by giving a reason.

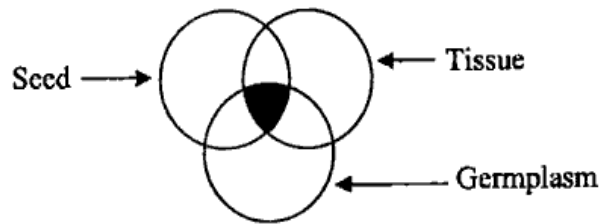


- (ii) What is the full form of VNTR?

Question 10

[3]

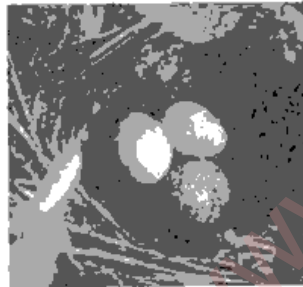
- (i) (a) Which ex-situ method of conservation occupies the shaded region in the Venn diagram given below?



- (b) Mention *any two* ex-situ methods of conservation, apart from the one depicted in subpart (a).

OR

- (ii) The image given below shows a nest with eggs laid by birds of two different species. The nest and eggs of one species belongs to **Bird A** while the egg of the second species has been laid by **Bird B**.



- (a) Which type of population interaction does the above image represent?
(b) Out of the two species of birds involved, state the species that is benefitted and the one that is at loss.

Question 11

[3]

Explain *autoimmune disease* with the help of two examples.

Question 12

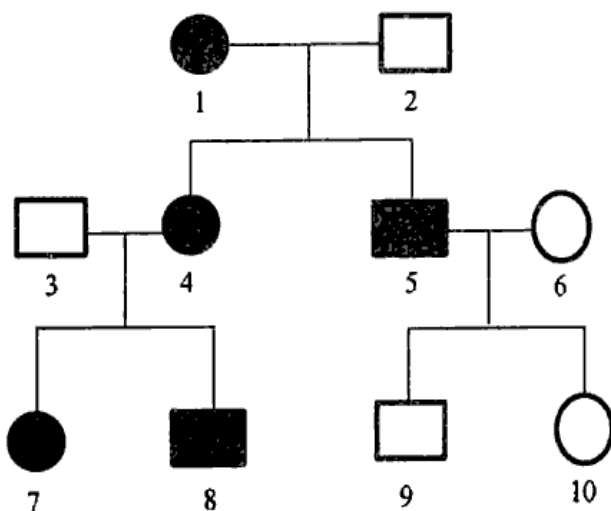
[3]

What is IPM? Describe *any two* biological methods of pest control.

Question 13

[3]

The pedigree chart given below shows the inheritance of a trait in three generations of a family. Study it carefully and answer the questions that follow.

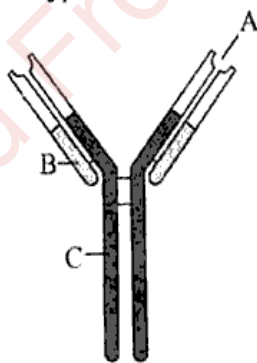


- Describe the pattern of inheritance shown above.
- Explain how a pedigree chart for a recessive trait would be different from a pedigree chart for a dominant trait.
- Why is the pattern of inheritance of an autosomal dominant trait different from that of a recessive sex-linked trait?

Question 14

[3]

The diagram given below shows a typical structure of immunoglobulin. Study it and answer the questions that follow.



- Identify the part of the antibody molecule which changes with a change in the molecular structure of the antigen.
- Explain the roles of IgA and IgE.

Question 15

[3]

Draw a well labelled diagram of L.S. of anatropous ovule.

SECTION D – 15 MARKS**Question 16**

[5]

Describe the process of development of embryo in dicot plants.

Question 17

[5]

Consider the information given below in a tabular form to answer subpart (i) and (ii).

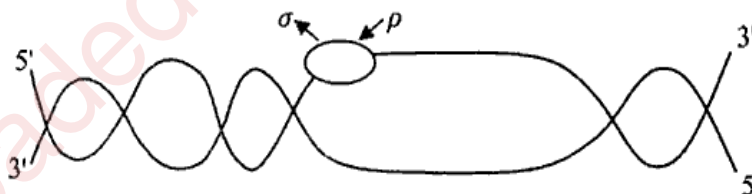
Countries	Age Groups		
	Less than 15 years	Between 15-44 years	More than 45 years
Y	10 lakhs	20 lakhs	25 lakhs
Z	30 lakhs	24 lakhs	15 lakhs

- Draw an age pyramid each for countries Y and Z.
- Interpret the growth rate of the countries Y and Z by referring to the age pyramid.
- The population of locusts in an area was found to be 500 at a given time. After two months, it was found that 200 locusts were added to the existing population, and around 50 had died. Another 100 were killed by peasants. Calculate the growth rate of the locusts.

Question 18

[5]

- Study the diagram given below and answer the questions that follow.



- What is the name of the process shown above?
- What product is released at the end of this process?
- Name the enzyme that binds with the promoter site.
- What is the role of *sigma* and *rho* factors in this process?

OR

- (ii) Answer the following questions based on the Watson-Crick model of DNA:
- (a) State *any two* key features of the Watson-Crick model of DNA.
 - (b) What are the roles of leading and lagging strands in the process of DNA replication?
 - (c) The approximate length of a DNA is about 2 meters and the size of the nucleus is about 5 micrometers.
How will histone proteins help in packaging this DNA in the nucleus?