Series : YWX6Z

SET~3

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **57/6/3**

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।
Candidates must write the Q.P. Code on the title page of the answer-book.

नोट

(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं।

(II) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।

(III) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **33** प्रश्न हैं।

(IV) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें।**

(V) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा। 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।

NOTE

(I) Please check that this question paper contains **27** printed pages.

(II) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(III) Please check that this question paper contains **33** questions.

(IV) **Please write down the Serial Number of the question in the answer-book at the given place before attempting it.**

(V) 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the candidates will read the question paper only and will not write any answer on the answer-book during this period.

#

जीव विज्ञान (सैद्धान्तिक)

BIOLOGY (Theory)

निर्धारित समय : 3 घण्टे | *अधिकतम अंक : 70*

Time allowed : 3 hours | *Maximum Marks : 70*

• • •

General Instructions :

Read the following instructions carefully and follow them :

(i) *This question paper contains **33** questions. **All** questions are **compulsory**.*

(ii) *Question paper is divided into **five** sections – Sections **A**, **B**, **C**, **D** and **E**.*

(iii) ***Section A** – questions number **1** to **16** are multiple choice type questions. Each question carries **1** mark.*

(iv) ***Section B** – questions number **17** to **21** are very short answer type questions. Each question carries **2** marks.*

(v) ***Section C** – questions number **22** to **28** are short answer type questions. Each question carries **3** marks.*

(vi) ***Section D** – questions number **29** and **30** are case-based questions. Each question carries **4** marks. Each question has subparts with internal choice in one of the subparts.*

(vii) ***Section E** – questions number **31** to **33** are long answer type questions. Each question carries **5** marks.*

(viii) *There is no overall choice. However, an internal choice has been provided in Sections B, D and E of the question paper. A candidate has to write answer for only **one** of the alternatives in such questions.*

(ix) *Kindly note that there is a separate question paper for Visually Impaired candidates.*

(x) *Wherever necessary, neat and properly labelled diagrams should be drawn.*

SECTION A

*Questions no. **1** to **16** are Multiple Choice Type Questions, carrying **1** mark each. Choose the best option.* $16 \times 1 = 16$

1. Cistron is a segment of DNA coding for a :

(A) Polypeptide only

(B) mRNA only

(C) Polypeptide, tRNA and rRNA

(D) mRNA, tRNA and rRNA

2. In a pedigree chart, if two unaffected individuals have a child with the trait, what is the most likely mode of inheritance for this trait ?

(A) Autosomal dominant (B) Autosomal recessive

(C) X-linked dominant (D) X-linked recessive

• • •

3. If a natural population with 200 individuals is in Hardy-Weinberg equilibrium for a gene with two alleles A and a, with the gene frequency of allele A of 0·8, the genotype frequency of Aa will be :

(A) 0·8 (B) 0·16

(C) 0·32 (D) 0·64

4. Select the statements that are true for a typical monocotyledonous embryo from the given options.

(i) Scutellum is present towards the centre of the embryonal axis.

(ii) Embryonal axis of the lower end has radicle and root cap covered by coleoptile.

(iii) The portion of embryonal axis above the level of attachment of scutellum is epicotyl.

(iv) Shoot apex and few leaf primordia of embryo are enclosed in a hollow foliar structure.

Choose the correct answer from the following :

(A) (i) and (ii) (B) (ii) and (iii)

(C) (iii) and (iv) (D) (i) and (iv)

5. Given below are a few statements with reference to the human sperm.

(i) Sperm head contains a large nucleus and a lot of cytoplasm.

(ii) Mitochondria in the middle piece of a sperm provides ATP for the sperm motility.

(iii) Posterior part of the sperm head is covered by acrosome.

(iv) Spermatids undergo maturation into spermatozoa by the process of spermiogenesis.

(v) Acrosomal secretions help in the entry of the sperm into the ovum at the time of fertilization.

Choose the option with all true statements from the given options :

(A) (i), (ii) and (iv) (B) (ii), (iii) and (v)

(C) (ii), (iv) and (v) (D) (i), (iii) and (iv)

• • •

6. A normal couple produces half the sons as haemophilic and half the daughters as carriers.

Choose the option that correctly indicates the chromosome on which the gene for this trait is located.

(A) X-chromosome of father

(B) Y-chromosome of father

(C) One X-chromosome of mother

(D) Both the X-chromosomes of the mother

7. If the sequence of bases in DNA is ATTCGATG, then the sequence of bases in the transcript will be :

(A) CAUCGAAU

(B) UAAGCUAC

(C) AUUCGAUG

(D) GUAGCUUA

8. In a translational unit UTRs are present at :

(A) 5′ end (after start codon) and 3′ end (after stop codon).

(B) 5′ end (before start codon) and 3′ end (before stop codon).

(C) 5′ end (after start codon) and 3′ end (before stop codon).

(D) 5′ end (before start codon) and 3′ end (after stop codon).

9. The lymphoid organ located within the lining of respiratory, digestive and urinogenital tract is :

(A) GEAC (B) MALT

(C) NACO (D) RCH

10. Land reptiles which went back into water about 200 mya to evolve into fish-like reptiles were :

(A) *Ichthyosaurus* (B) *Tyrannosaurus*

(C) *Stegosaurus* (D) *Brachiosaurus*

• • •

11. Certain viruses used as biological control agents belong to the genus :

(A) Nucleopolyhedrovirus

(B) Adenovirus

(C) Tobacco Mosaic Virus

(D) Rhinovirus

12. The cloning site present in the ampicillin resistance gene of *E. coli* cloning vector pBR322 is :

(A) BamH I (B) EcoR I

(C) Pst I (D) Sal I

*For Questions number **13** to **16**, two statements are given – one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

13. *Assertion (A) :* An antibody is a protein molecule made by the lymphocytes.

Reason (R) : An antibody binds to a specific foreign antigen and neutralizes its odd effects.

14. *Assertion (A) :* Male contraceptive 'Nirodh' works on the principle of avoiding chances of ovum and sperm meeting.

Reason (R) : It is made of thin rubber/latex sheath and is used to cover the penis before coitus.

• • •

15. *Assertion (A) :* In dihybrid crosses involving sex-linked genes in *Drosophila* generation of non-parental gene combinations are observed.

Reason (R) : Two genes present on different chromosomes show linkage and recombination in *Drosophila*.

16. *Assertion (A) :* Isolated single cells can be fused to produce somatic hybrids.

Reason (R) : Cells selected for somatic hybridisation have desirable characters.

SECTION B

17. (a) Why are restrictions imposed on MTP in India ? Up to how many weeks or trimesters, is MTP considered relatively safe for a female, if necessary to perform, by a medical practitioner ? 2

OR

(b) Expand PID. Name any two common viral infections transmitted through sexual contact in human females. 2

18. (a) (i) Explain why the milk produced by the mother during the initial days of lactation is considered to be very essential for the newborn infant.

(ii) What is the term used for the milk produced during the initial days of lactation ? 2

OR

(b) Many children in the metro cities are suffering from a very common exaggerated response of the immune system to certain weak antigens in air.

(i) What is the term used for the above mentioned disease ?

(ii) Name the main type of antibody produced by the immune system in response to this disease.

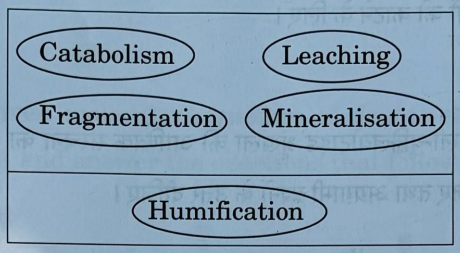
(iii) Which two main inflammation-causing chemicals are produced by the mast cells in such an immune response ? 2

...

19. (a) How is the interaction between *Ophrys* and its specific bee pollinator one of the best examples of co-evolution ? Explain. 2

OR

(b) Arrange the given important steps of decomposition in their correct order of occurrence in the breakdown of complex organic matter and explain the fourth step in the process. 2



20. The basic scheme of the essential steps involved in the process of recombinant DNA technology is summarised below in the form of a flow diagram. Study the given flow diagram and answer the questions that follow.

Step 1 Vector DNA (Plasmid) (cut using Restriction Enzyme) + Alien DNA (cut using Restriction Enzyme)

↓

Step 2 Recombinant DNA molecule

↓

Step 3 Transfer of recombinant DNA molecule in *E. coli* (Host)

↓

Step 4 Replication of the recombinant DNA molecule in *E. coli* to form multiple copies of the alien gene

(a) What is the technical term used for Step 4 in the above process ?

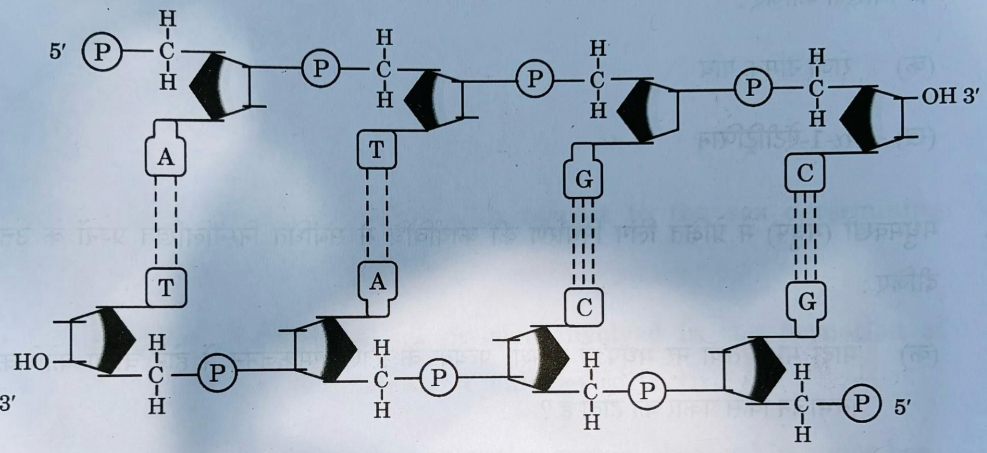
...

(b) Which of the given two combinations of restriction enzyme should be used in Step 1 ? Justify your answer.

(i) EcoR I to cut the plasmid and Hind III to cut the alien DNA.

(ii) EcoR I to cut both the plasmid and alien DNA. *2*

21. Study the given molecular structure of double-stranded polynucleotide chain of DNA and answer the questions that follow.



(a) How many phosphodiester bonds are present in the given double-stranded polynucleotide chain ?

(b) How many base pairs are there in each helical turn of double helix structure of DNA ? Also write the distance between a base pair in a helix.

(c) In addition to H-bonds, what confers additional stability to the helical structure of DNA ? *2*

SECTION C

22. (a) What do you mean by activated sludge in an STP ?

(b) Explain the biological treatment of the major part of the sludge transferred from the large aeration tank into the anaerobic sludge digesters before its final release into the natural water bodies. 3

23. Explain the beneficial role of the following, produced as a result of the processes of biotechnology, to mankind : 3

(a) Cow named Rosie

(b) α-1-antitrypsin

24. Answer the following questions with respect to the sex determining mechanism observed in honey bee. 3

(a) What is the type of cell division involved in the formation of gametes in a female bee and a male bee respectively ?

(b) Name the type of sex determination system observed in honey bee.

(c) What is the sex of honey bee formed from the unfertilised eggs ? Write the number of chromosomes present in it.

25. (a) Alien species are highly invasive and are a threat to indigenous species. Substantiate this statement with the help of any two examples.

(b) State any two criteria for determining biodiversity hotspots. 3

...

26. Explain how the addition of lactose in the medium regulates the switching on of the *lac* operon in bacteria. 3

27. (a) Name and explain the role of inner and middle walls of the human female uterus.

(b) Write the location and function of fimbriae in human female. 3

28. Flowering plants with hermaphrodite flowers have developed many reproductive strategies to ensure cross-pollination. Study the given outbreeding devices adopted by certain flowering plants and answer the questions that follow.

Pollen grains / Stigma	Pollen grains of Plant A	Pollen grains of Plant B	Pollen grains of Plant C
Stigma of Plant A	×	✓	✓
Stigma of Plant B	✓	×	✓
Stigma of Plant C	✓	✓	×

Note :

All plants belong to the same species.

× – No pollen tube growth/inhibition of pollen germination on stigma.

✓ – Pollen germination on stigma.

(a) Name and define the outbreeding device described in the above table.

(b) Explain what would have been the disadvantage to the plant in the absence of the given strategy. 3

• • •

SECTION D

Questions No. ***29*** *and* ***30*** *are case-based questions. Each question has* ***3*** *sub-questions with internal choice in one sub-question.*

29. Read the following passage and answer the questions that follow. *4*

According to evolutionary theory, every evolutionary change involves the substitution of a new gene for the old one and the new allele arises from the old one. Continuous accumulation of changes in the DNA coding for proteins leads to evolutionary differences. The chemical composition of DNA is basically the same in all living beings, except for differences in the sequence of nitrogenous bases. Given below are percentage relative similarities between human DNA and DNA of other vertebrates :

S.No.	Vertebrates	Percentage similarities
1.	Chimpanzee	100
2.	Gibbon	94
3.	Rhesus Monkey	88
4.	Lemur	47
5.	Treeshrew	28
6.	Mouse	21
7.	Hedgehog	19
8.	Chicken	10

(a) What is the term used for the substitution of a new gene for the old one and the new allele arising from the old one during evolutionary process ?

(b) Which one of the following holds true for the data provided in the above table ? *1*

(A) Greater the evolutionary distance, greater are the differences in the nitrogenous bases.

(B) Lesser the evolutionary distance, greater are the differences in the nitrogenous bases.

(C) Greater the evolutionary distance, lesser are the differences in the nitrogenous bases.

(D) Lesser the evolutionary distance, lesser are the differences in the nitrogenous bases.

(c) (i) To which category of evolution (divergent or convergent) does the following relationship belong to ? Justify your answer. *2*

Human and Rhesus Monkey

OR

(c) (ii) Differentiate between Convergent and Divergent evolution. *2*

30. Read the following passage and answer the questions that follow. *4*

Prevention is the frontline response to drug use. Effective interventions address the underlying conditions contributing to drug use, such as a lack of connection to family or community, instability, insecurity, trauma, mental health issues, etc. When addressed, these factors can effectively prevent the initiation of drug use and the progression to drug use disorders. Study the few key figures of drug use given below and answer the questions that follow.

People with drug use disorders, 2022 (in millions)

People who use drugs 2022

292 million people

20% over 10 years

3% (over 5 years 2018 – 2022)

1 in 11 in treatment

(p)

(q)

Table No. 1

1 in 18 (among women in treatment)

1 in 7 (among men in treatment)

- 13·9 million people who inject drugs
- 1·6 million living with HIV
- 1·4 million living with HIV & Hepatitis C

Table No. 2

(a) What do you infer from the figures in Table No. 1 about the people with drug use disorders, 2022 (in million) ? State any two of your observations. *1*

• • •

(b) How are Hepatitis C and HIV related to drug use disorders by people, as shown in Table No. 2 ? State the correlation between the two. *2*

(c) (i) Give the scientific name of (p) shown in Table No. 1. *1*

OR

(c) (ii) Give the scientific name of (q) shown in Table No. 1. *1*

SECTION E

31. (a) (i) Explain how human pro-insulin is processed in the cell to become a fully mature functional insulin.

(ii) Describe how human insulin is produced using the techniques of genetic engineering. *5*

OR

(b) (i) Explain the working of a simple stirred-tank bioreactor.

(ii) Describe what is meant by downstream processing. *5*

32. (a) (i) Describe the Species-Area relationship as observed by Alexander von Humboldt, for a wide variety of taxa in nature.

(ii) Draw the graph showing Species-Area relationship for $S = CA^Z$. What is the significance of 'Z' in Species-Area relationship ? *5*

OR

(b) (i) Describe the logistic population growth curve with the help of a suitable graphical representation.

(ii) Write the equation of Verhulst-Pearl logistic growth curve and explain what 'K' and 'r' suggest in the given equation. *5*

• • •

33. (a) (i) Explain the structure of a mature embryo sac of a typical flowering plant.

(ii) How is triple fusion achieved in these plants ? *5*

OR

(b) Describe the changes in the ovary and the uterus as induced by the changes in the level of pituitary and ovarian hormones during menstrual cycle in a human female. *5*