**PRE-BOARD EXAMINATION – 2023**

**Std. 12** **BIOLOGY** **Time : 3 hrs.**

**15-12-2023** **Max. Marks : 70**

General Instructions:

i) All questions are compulsory.

ii) The question paper has five sections and 33 questions. All questions are compulsory.

iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.

iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

v) Wherever necessary, neat and properly labelled diagrams should be drawn.

## SECTION – A

1. During the pollen grain formation, the generative cell divides to give rise to the two male gametes. What is the ploidy of the generative cell? 1

(a) 2n (b) 3n (c) 4n (d) n

2. To produce 400 seeds, the number of meiotic divisions required will be 1

(a) 400 (b) 200 (c) 500 (d) 800

3. Which of the following amino acid residues will constitute the histone core? 1

(a) Asparagine and Arginine (b) Lysine and Arginine

(c) Glutamine and Lysine (d) Asparagine and Glutamine

4. All genes located on the same chromosome 1

(a) form different groups depending upon their relative distance.

(b) form one linkage group.

(c) will not form any linkage group.

(d) form interactive group that affect the phenotype.

5. Evolutionary convergence is development of a 1

(a) common set of functions in groups of different ancestry.

(b) dissimilar set of functions in closely related groups.

(c) common set of structures in closely related groups.

(d) dissimilar set of functions in unrelated groups.

6. At a particular locus, the frequency of allele A is 0.8 and that of allele a is 0.2. What would be the frequency of heterozygotes in a random mating population at equilibrium? 1

(a) 0.84 (b) 0.16 (c) 0.32 (d) 0.48

7. If Meselson and Stahl's experiment is continued for four generations in bacteria, the ratio of N15/N15: N15/N14: N14/N14 containing DNA in the fourth generation would be : 1

(a) 1:1:0 (b) 1:4:0 (c) 0:1:3 (d) 0:1:7

8. If a genetic disorder is transferred from a phenotypically normal but carrier female to only some of the male progeny, the disease is 1

(a) autosomal dominant (b) autosomal recessive

(c) sex-linked dominant (d) sex-linked recessive

9. Methanogens cannot be found in: 1

(a) aerobic sludge (digester) of a sewage treatment plant.

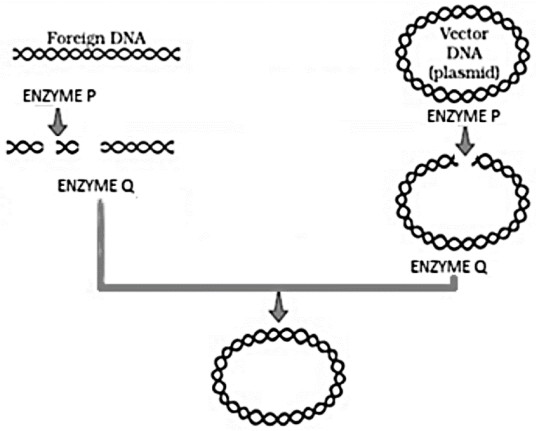
(b) gut of cattle.

(c) marshy areas.

(d) flooded paddy fields.

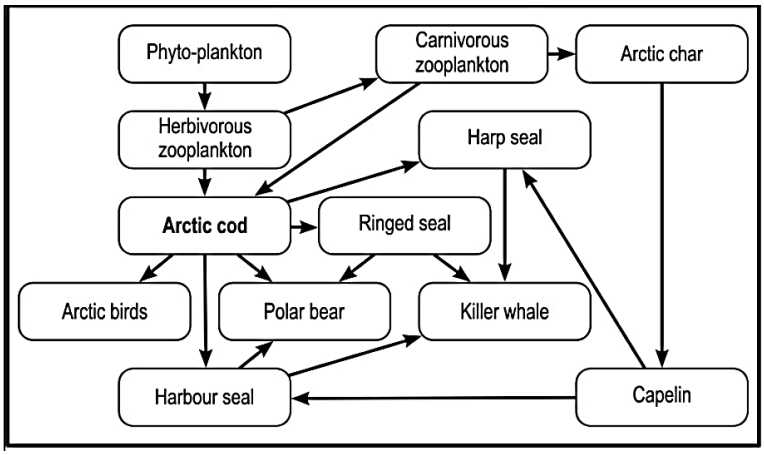
10. Name the enzymes 'P' and 'Q' that are involved in the processes given below. 1

(a) Enzyme P-Exonuclease and Enzyme Q-Permease.
(b) Enzyme P-Exonuclease and Enzyme Q- Ligase.
(c) Enzyme P-Restriction endonuclease and Enzyme Q-Ligase.
(d) Enzyme P-Endonuclease and Enzyme Q- Permease.




11. In RNAi, genes are silenced using 1
(a) ssDNA (b) dsDNA (c) dsRNA (d) ssRNA

12. Given below is a food web representative of the Arctic region.




Increasing temperatures have been causing changes in the ocean ecosystem. These changes have caused the population of Arctic cod to decline rapidly.
Which of the following statement/s is/are most likely to be TRUE based on this information? 1
P) The population of arctic birds will increase.
Q) The ringed seal will slowly become extinct.
R) The harbour seal will be dependent on capelins alone.

(a) only P (b) only R (c) only Q and R (d) all - P, Q and R

**Question Nos. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:**

A. Both A and R are true and R is the correct explanation of A.
B. Both A and R are true and R is not the correct explanation of A.
C. A is true but R is false.
D. A is false but R is true.

13. Assertion : In coconut, the water represents the free nuclear endosperm and the white kernel represents the cellular endosperm.
Reason : PEN undergoes a number of free nuclear divisions which are followed by cell wall formation. 1

14. Assertion: DNA is considered to be a better genetic material than RNA for most organisms.
Reason: 2'-OH group present in DNA makes it less reactive. 1

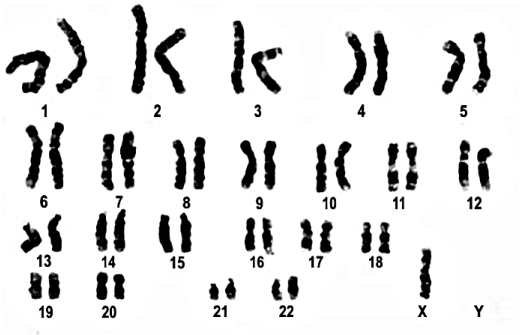
15. Assertion: Smoking can raise blood pressure and increase heart rate.
Reason: Nicotine stimulates adrenal glands to release adrenaline and nor-adrenaline into the blood circulation, both of which raise blood pressure and increase heart rate. 1

16. Assertion: In GMOs desirable DNA segment is introduced into a suitable host.
Reason: The gene transfer is done using a biolistic gene gun only. 1

**SECTION – B**

17. What stimulates pituitary to release the hormone responsible for parturition? Name the hormone. 2

18. Given below is the karyotype of an individual.




(a) What are the characteristic reproductive and physical features of such an individual?
(b) What is the category of such disorders called? How is it caused? 2

19. In a patient, a mass of cells removed from the liver was found to be producing large amounts of the enzyme pepsin. In the same patient, a tumor was found in the stomach.
(a) What property of a tumor can be identified based on the statements above? Give a reason to support your answer.
(b) What are tumors exhibiting the property identified in (a) called?
(c) How will the tumors identified in (b) affect liver cells? 2

20. Explain the role of enzymes in the extraction of DNA from *Rhizopus* in its purest form. 2

21. (a) Given below is a pyramid of biomass in an ecosystem where each bar represents the standing crop available in the trophic level. With the help of an example explain the conditions where this kind of pyramid is possible in nature?


(b) Will the pyramid of energy be also of the same shape in this situation? Give reason for your response.

(OR)

(a) Draw a pyramid of numbers where a large number of insects are feeding on the leaves of a tree. What is the shape of this pyramid?
(b) Will the pyramid of energy be also of the same shape in this situation? Give reason for your response. 2

**SECTION – C**

22. (a) Explain why non-occurrence of menstrual cycle could be indicative of pregnancy.
(b) The menstrual cycle can be divided into 4 phases: menstrual phase, follicular phase, ovulation phase, luteal phase. During the follicular phase, hormones like FSH and LH are released in good amounts. State TWO events that are triggered by LH. 3

23. Explain the functions of the following structures in the human male reproductive system. 3
(a) Scrotum (b) Leydig cells
(c) Male accessory glands

24. Suggest and explain the assisted reproductive techniques which will help a couple to have children, where the female had a blockage in the fallopian tube and the male partner had a low sperm count. 3

25. (a) How are fossils an evidence for evolution?
(b) "Anthropogenic action can lead to evolution." Explain with the help of an example. 3

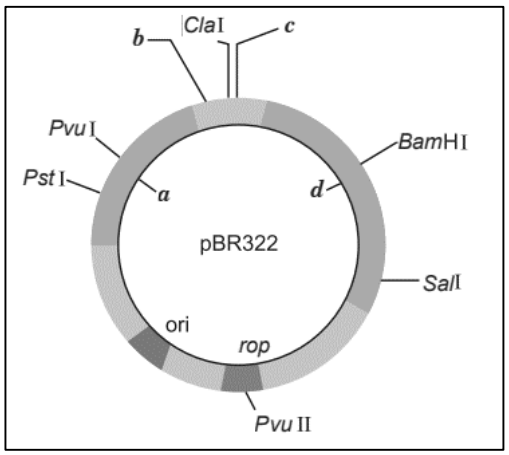
26. The primary effluent in the treatment of sewage is sent to tanks for secondary treatment in the presence of aerobic bacteria.
(a) How would the BOD of the effluent be affected if anaerobic bacteria are used for secondary treatment?
(b) Name one condition that should be maintained in a sludge digester where biogas is produced.
(c) The slurry formed after biogas production is recommended as manure for plants. Which nutrients will the slurry be rich in and why? 3

27. "Specific Bt Toxin gene is incorporated into cotton plant so as to control infestation of Bollworm". Mention the organism from which the gene was isolated and explain its mode of action.
(OR)
State the change which proinsulin undergoes at the time of its processing to become functional.
(a) Name the technique used by American company Eli Lilly for the commercial production of human insulin.
(b) How are the two polypeptides of a functional insulin chemically held together? 3

28. (a) There was loss of biodiversity in an ecosystem due to a new construction project in that area. What would be its impact on the ecosystem? State any three.
(b) List any three major causes of loss of biodiversity? 3

## SECTION – D

29. Gene of interest is introduced by a cloning vector into a host cell to bring about a desired phenotypic expression in a host cell. The cloning vectors used are plasmid and bacteriophage. Biotechnologists in their labs, for desired results engineered specialised cloning vectors. One such vector is pBR322. Study the diagram carefully and answer the questions that follow: 4

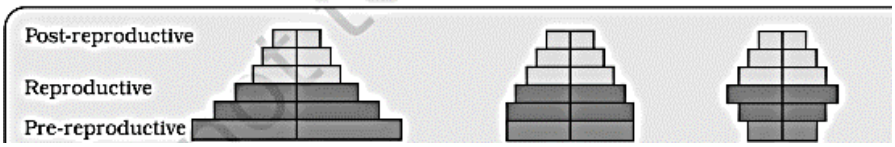



(i) What do '*Pvu*I' *and* '*Bam*HI' represent? State their functions.
(OR)
Biotechnologists always insert 'ori' gene in their engineered cloning vector. Justify the statement.

(ii) Identify the gene you would select for the role of a selectable marker in shown diagram. Explain why?

(iii) Why is *Agrobacterium tumefaciens,* a good cloning vector? Explain.

30. Study the three different age pyramids for human population given below and answer the questions. 4



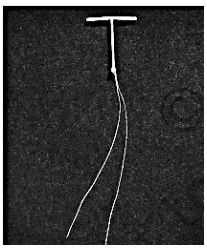

(i) Write the names given to each of these age pyramid.
(ii) Mention the ideal age pyramid for human population and why?
(iii) What would be the growth rate pattern when resources are unlimited? Write its equation.

(OR)

Which growth curve is obtained, when resources are limited? Write its equation.

## SECTION – E

31. Given below is the diagram of CuT, a commonly used contraceptive method. Based on the information, answer the following question:



(i) A mother of one year old daughter wanted to space her second child. Her doctor suggested CuT. Explain its contraceptive actions.
(ii) Bring out the main difference between CuT and LNG-20.
(iii) Write the names of Intra Uterine Devices along with their action?

(OR)

(i) A village health worker was taking a session with women. She tells the women that one has to be very careful while using oral pills as method of birth control. Wrong usage can actually promote conception. Analyze the statement and compare the merits and demerits of using oral pills and surgical methods of birth control.
(ii) What are venereal diseases? How can you prevent them? 5

32. Given below is a DNA sequence and the genetic code. Answer the questions based on these, assuming no post-transcriptional or post-translations modifications will take place.

- TACATGCCGTACTGTACC –

| First Base | Second Base: U | Second Base: C | Second Base: A | Second Base: G | Third Base |
|---|---|---|---|---|---|
| U | UUU, UUC – Phe | UCU, UCC, UCA, UCG – Ser | UAU, UAC – Tyr | UGU, UGC – Cys | U |
| | UUA, UUG – Leu | | UAA, UAG – STOP | UGA – STOP; UGG – Trp | C, A, G |
| C | CUU, CUC, CUA, CUG – Leu | CCU, CCC, CCA, CCG – Pro | CAU, CAC – His; CAA, CAG – Gln | CGU, CGC, CGA, CGG – Arg | U, C, A, G |
| A | AUU, AUC, AUA – Ile | ACU, ACC, ACA, ACG – Thr | AAU, AAC – Asn; AAA, AAG – Lys | AGU, AGC – Ser; AGA, AGG – Arg | U, C, A, G |
| | AUG – Met or Start | | | | |
| G | GUU, GUC, GUA, GUG – Val | GCU, GCC, GCA, GCG – Ala | GAU, GAC – Asp; GAA, GAG – Glu | GGU, GGC, GGA, GGG – Gly | U, C, A, G |

(a) Write the nucleotide sequence that will be obtained on transcription of this DNA sequence.
(b) Will translation of this sequence take place? Give a reason to support your answer.
(c) What is the amino acid sequence that will be formed? Identify the sequence of the first tRNA.
(d) If the first guanine base in the DNA sequence gets replaced by thymine, how will the amino acid sequence change?
(e) Name and describe the mutation that occurred in (d).

(OR)

In maize, the trait for the purple kernel (P) is dominant over the yellow kernel (p). A plant with purple kernels is crossed with another plant with yellow kernels and produces 2 offspring with purple kernels and 2 offspring with yellow kernels.
(a) What is the genotype of the parental maize plants?
(b) Draw a Punnett square to depict the cross between the two offspring with purple kernels.
(c) Identify the genotypic and phenotypic ratios obtained from the cross in (b).
(d) Describe a method that can definitely help with the identification of an unknown genotype of a plant with purple kernels. 5

33. (a) If a patient is advised anti-retroviral drug, name the possible infection he/ she is likely to be suffering from. Name the causative organism.
(b) Explain the sequence of events that follows when the causative organism in (a) attacks to cause deficiency in humans.
(c) Many microbial pathogens enter the gut of humans along with food. Name two physiological barrier that protects the body from such pathogens.

(OR)

In the late 18th century, smallpox was a widely spreading disease causing the death of several affected individuals in Britain. Edward Jenner, who pioneered the concept of vaccination, inoculated matter from the cowpox lesions of a dairymaid into an 8-year-old boy. Post-inoculation, the boy developed a mild fever, loss of appetite and discomfort but was better after a few days. Next, he was inoculated with matter from a smallpox lesion and he did not develop any disease.
(a) What form of immunity, now known, did Edward Jenner provide the boy with? Give a reason to support your answer.
(b) Describe the form/s of immunity that is provided when an individual is vaccinated/immunised? Use an appropriate example/s to justify your answer.
(c) Which form of immunization does not generate a memory response? Give a reason to support your answer. 5

-x-x-x-x-x-x-x-x-