

PRACTICE QUESTIONS (TERM I) 2021-22

BIOLOGY

CLASS XII

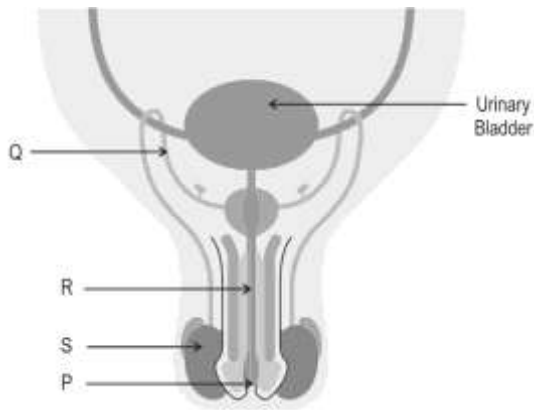
1. Which of the following represent the male gametophyte in flowering plants?
 - A. stamen
 - B. anther
 - C. pollen sac
 - D. pollen grain

2. *Viola* plants represent the largest genus of cleistogamous flowers.

Which of the following is NOT a requirement for *Viola* plants to assure propagation?

- A. flowering
 - B. fertilisation
 - C. bisexual flowers
 - D. external pollinators
3. In some species of flowering plants, fruits develop without the process of fertilisation. Which of these can be an identifying factor of such fruits?
 - A. They are not developed from the ovary.
 - B. They are always composite.
 - C. They are always seedless.
 - D. They are not juicy.
 4. Which of these statements about food storage in seeds is/ are TRUE
 - 1: It is stored in the endosperm in albuminous seeds.
 - 2: It is stored in the cotyledons in albuminous seeds.
 - 3: It is stored in the cotyledons in ex-albuminous seeds.
 - 4: It is stored in the endosperm in the ex-albuminous seeds.
 - A. only 1
 - B. only 2
 - C. only 1 and 3
 - D. only 2 and 4

5. Look at the labelled diagram of the male reproductive system.



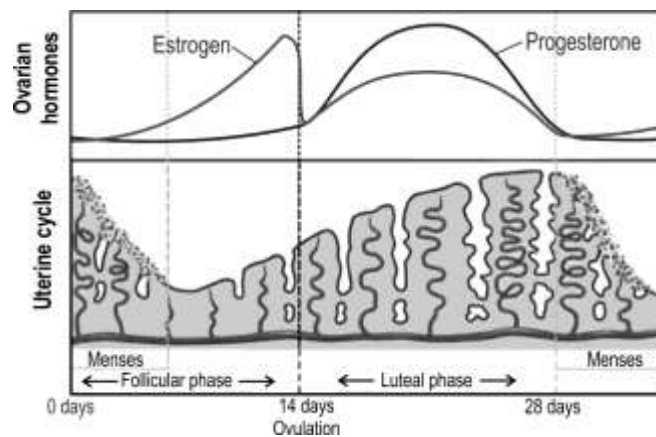
Identify the correct route of passage of sperm in the male reproductive tract.

- A. P-Q-R-S
- B. S-Q-R-P
- C. P-S-R-Q
- D. Q-R-S-P

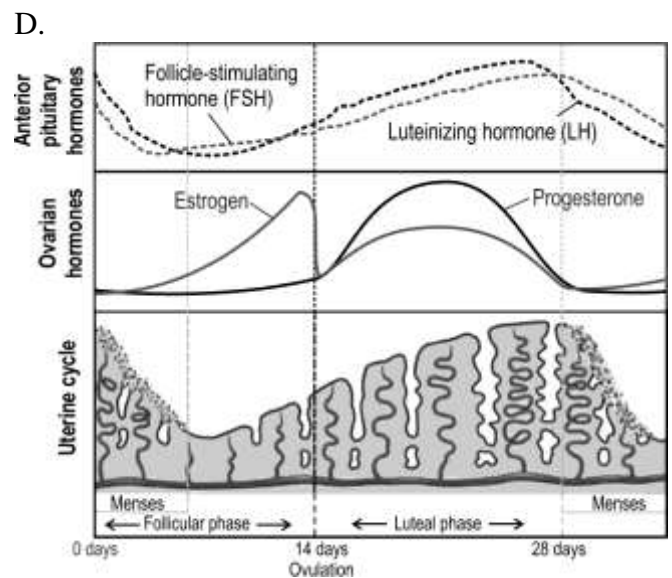
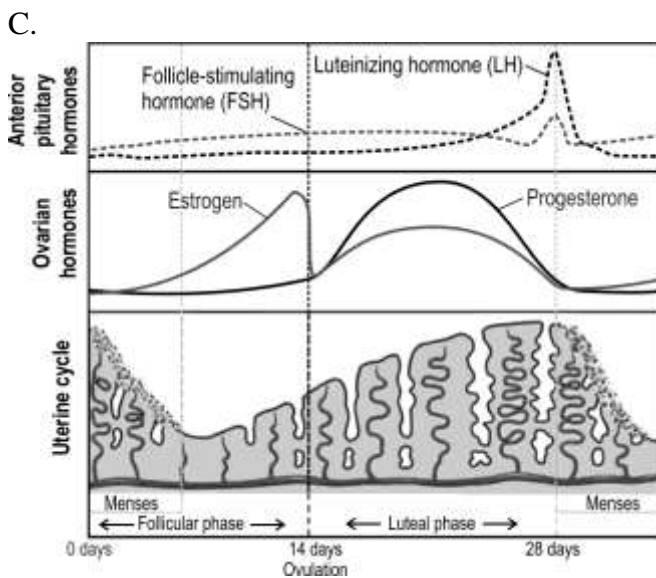
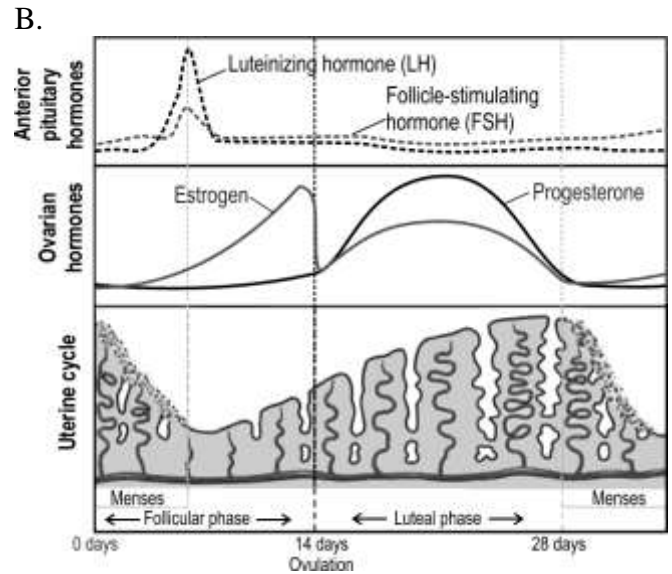
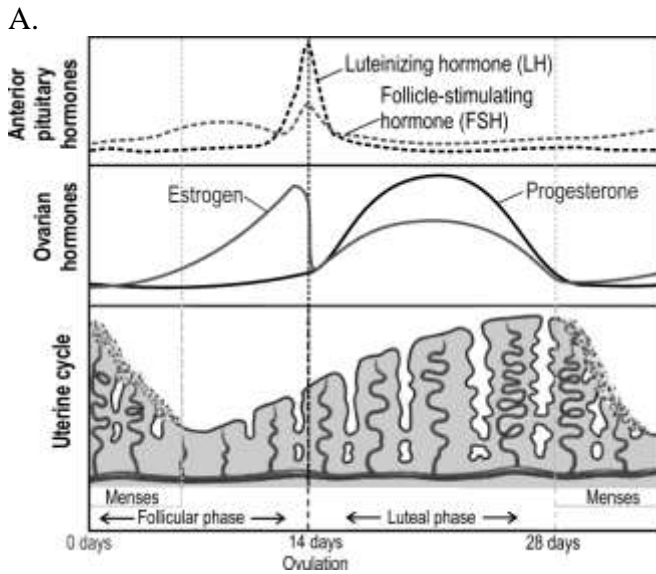
6. Pick the correct combination of sperm cell and egg cell that can lead to the formation of a male offspring.

- A. sperm cell having X chromosome + egg cell having Y chromosome
- B. sperm cell having X chromosome + egg cell having X chromosome
- C. sperm cell having Y chromosome + egg cell having X chromosome
- D. sperm cell having Y chromosome + egg cell having Y chromosome

7. Shown here is how the levels of hormones Estrogen and Progesterone change during the menstrual cycle.



Which of these correctly shows how the levels of Luteinizing hormone (LH) and Follicle-stimulating hormone (FSH) change during the same cycle?



8. Genetic disorders are sometimes classified into two broad types - Mendelian disorders and chromosomal disorders.

Which among the following is a chromosomal disorder?

- A. sickle cell anemia
- B. Down's syndrome
- C. color blindness
- D. thalassemia

9. Cystic fibrosis is an autosomal recessive disorder. Consider a cross between two carrier parents, each with genotype Ff.

What will be the genotype of the AFFECTED offspring in the F1 generation?

- A. ff
- B. FF
- C. ffff

D. FfFf

10. Sutton and Boveri conducted experiments to understand the pattern of inheritance of traits in organisms.

Which among the following statements was /were understood as result of experiments by Sutton and Boveri?

- 1: Genes are located on homologous chromosomes.
- 2: All genes on the same chromosome are linked.
- 3: Genes on homologous chromosomes get separated during anaphase of meiotic division.
- 4: Frequency of gene pairs on the same chromosome is a measure of the distance between the genes.

- A. only 1
- B. only 1 and 3
- C. only 2,3 and 4
- D. only 1,3 and 4

11. If a wrong type of pollen or pollen from a different species lands on the stigma, which of these is NOT formed?

- A. egg cell
- B. embryo
- C. embryo sac
- D. (all of the above will be formed)

12. An anther is made up of the following major parts: lobes, theca and sporangia. The theca are cavities in which the sporangia develop.

Which of the following types of anther structure can develop into a tetrasporangiate anther?

- A. filamentous
- B. monothecous
- C. dithecous
- D. unlobed

13. Which of the following statements about genes responsible for X-linked disease inheritance is/are TRUE?

- 1: They are located on the X chromosome.
- 2: They are passed on from mother to female child only.
- 3: They are passed to all male offsprings from male parent.
- 4: They are passed to all male offsprings from affected mother.

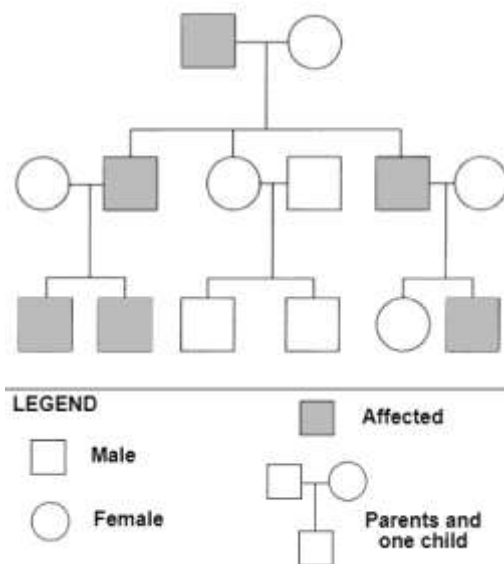
- A. only 1
- B. only 1 and 4
- C. only 2, 3 and 4
- D. only 1, 2 and 3

14. A single gene is usually seen to exhibit a single phenotypic expression. Pleiotropic genes, however, can impact multiple phenotypic expressions.

Which of these genetic disorders have multiple phenotypic expressions being impacted by a change in a single gene?

- A. thalassemia
- B. haemophilia
- C. phenylketonuria
- D. Down's syndrome

15. Consider the pedigree chart given below.



Since only males and offsprings from the affected males are getting affected, the gene responsible for the genetic disease is likely to be located on which of the following?

- A. Y chromosome
- B. X chromosome
- C. autosomal chromosomes
- D. (both sex chromosomes and autosomes)

16. Which of these is/are function(s) of placenta?

- i. production of hormones
 - ii. exchange of respiratory gases
 - iii. production of antibodies
 - iv. removal of nitrogenous waste from foetus to mother
- A. only ii and iii
 - B. only i, ii and iii
 - C. only i, ii and iv
 - D. all – i, ii, iii and iv

17. Consider a test cross between a homozygous recessive yellow seeded plant with a plant having an unknown seed. 50% of the offsprings in F1 generation have yellow seeds and 50% have green seeds.

Which of the following statements is/are TRUE about the cross?

- 1: The unknown seed is homozygous recessive for green.
 - 2: The unknown seed is heterozygous for green.
 - 3: All the offsprings in F2 generation will have green seeds.
 - 4: All the offsprings in F2 generation will have yellow seeds.
- A. only 1
 - B. only 2
 - C. only 1 and 4
 - D. only 2 and 3

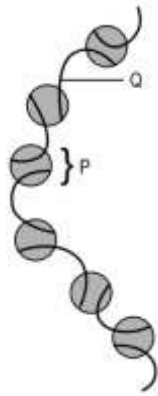
18. Given below are some statements about chromosomal disorders.

- 1: They can be caused due to failure in process completion during chromatid separation.
- 2: They can be caused due to failure in process completion during cytokinesis.
- 3: They arise only in sex chromosomes.
- 4: They can be inherited.

Which of the above-mentioned statements/s is/are TRUE?

- A. only 1
- B. only 2
- C. only 3 and 4
- D. only 1, 2 and 4

19. In the image depicting a level of the packaging of the DNA helix, identify P and Q.



- A. P: Base pairs; Q: DNA
- B. P: nucleosome; Q: DNA
- C. P: nucleosome; Q: chromatin
- D. P: histone; Q: chromosome

20. Which of these statements about seed dormancy are TRUE?

- 1: Seeds do not respire during dormancy.
 - 2: Seeds lose a lot of water before dormancy.
 - 3: Seeds have low metabolic rate during dormancy.
 - 4: Seeds have no metabolic activity during dormancy.
- A. only 1 and 3
 - B. only 2 and 3
 - C. only 1 and 4
 - D. only 1, 2 and 3

21. Consider the following genetic code:

RNA	G C U A C G G A G C U U C G G A G C U A G																				
Base	G	C	U	A	C	G	G	A	G	C	U	U	C	G	G	A	G	C	U	A	G
Codon	Codon 1			Codon 2			Codon 3			Codon 4			Codon 5			Codon 6			Codon 7		
Aminoacid	Alanine			Threonine			Glutamate			Leucine			Arginine			Serine			Stop		

Which among the following would cause a frameshift mutation?

- A. substitution of A by C in codon 2
- B. insertion of G after C in codon 4
- C. insertion of GCU after C in codon 6
- D. deletion of codon 3, GAG

22. Codons UCA, UCG, UCU, UCC, AGC, and AGU code for the amino acid serine.

What do these codons indicate?

- A. that the genetic code is universal
- B. that the genetic code is degenerate
- C. that UCA is the initiator codon
- D. that all amino acids are coded by six codons

23. The average Guanine content in yeast is found to be 18%.

Which of the following represents the nitrogenous base content percentages correctly from the above data?

- A. A: 18%; T: 18%; C: 36%
- B. A: 36%; T: 32%; C: 32%
- C. A: 32%; T: 32%; C: 18%
- D. A:18%; T: 18%; C:18%

24. If dark skin colour is controlled by dominant genes *MNO* and its recessive allele is *mno*, what can be DEFINITELY said about the offsprings that are dark-skinned?

- A. They all have two copies of the dominant alleles.
- B. They have at least one copy of the dominant allele.
- C. They all have very high exposure to sunlight.
- D. They do not have any exposure to sunlight.

25. Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.

Assertion (A): All genetic disorders, Mendelian or chromosomal, are transmitted from one generation to the other.

Reason (R): Genes are located on chromosomes.

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

26. Two statements are given - one labeled Assertion (A) and the other labeled Reason (R).

Assertion: RNA polymerases are able to catalyse all three steps of translation.

Reason: RNA polymerases contain an initiation factor and a termination factor in them.

Which of the following is correct?

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

27. Two statements are given - one labeled Assertion (A) and the other labeled Reason (R).

Assertion: INVO cell is a new cost-effective technology for in vitro fertilisation (IVF) in which the sperm and the egg are mixed in a lab, put in a small capsule which is

inserted into the vagina for a five days incubation period, post which the capsule is removed, and the embryos are implanted inside the uterus as usual.

Reason: Instead of growing the embryo in an incubator, allowing it to develop in the natural environment in woman's vagina reduces the cost in case of INVO cell as compared to regular IVF technology.

Which of the following is correct?

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

28. Two statements are given - one labeled Assertion (A) and the other labeled Reason (R).

Assertion: Apomictic fruits are seedless.

Reason: Apomictic fruits are formed without fertilisation.

Which of the following is correct?

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

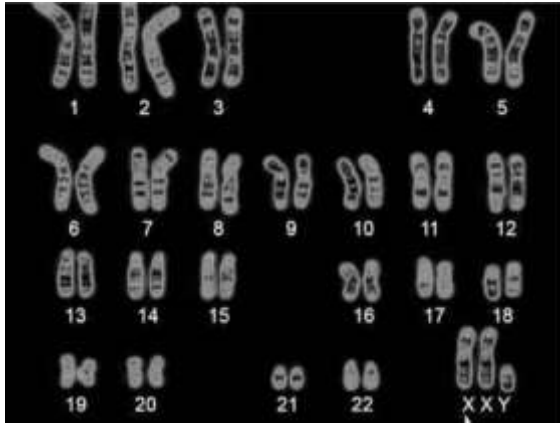
29. Globozoospermia is a rare condition that affects only males. It is characterized by sperm cells having a round head and no acrosome. What would this condition lead to?

- A. inability of the sperms to fertilise the egg
- B. inability of the male to produce enough sperms
- C. formation of zygote that is haploid instead of diploid
- D. formation of zygotes with a missing sex chromosome

30. Identify the correct sequence of processes that happen in an adult female leading to child birth.

- A. fertilisation → implantation → development of foetus → ovulation → birth
- B. ovulation → fertilisation → implantation → development of foetus → birth
- C. implantation → ovulation → development of foetus → fertilisation → birth
- D. menstruation → fertilisation → ovulation → development of foetus → birth

31. Study the human karyotype given below.



Which among the following does the karyotype represent?

- A. a normal human female.
- B. a normal human male.
- C. a sterile human female.
- D. a sterile human male.

32. The following statements were noted by a student of grade 12 after studying about Morgan's dihybrid cross experiments with *Drosophila*.

1. Two genes chosen in a dihybrid cross are always located on the same chromosome.
2. Genes on the same chromosome are often linked.
3. Linked genes segregate independently during gamete formation.
4. Linked genes do not always obey the law of independent assortment.

Which of these statement(s) is/are TRUE?

- A. only 1
- B. only 1 and 2
- C. only 2 and 4
- D. all- 1, 2, 3 and 4

33. In an experiment involving three types of crosses, the following results were observed in F1 progeny:

Cross 1: Only one parental character is expressed.

Cross 2: Both the parental characters are partially expressed.

Cross 3: Both the parental characters are expressed.

Which of the following conclusions is most likely to be correct?

- A. Cross 1 represents codominance; cross 2 represents incomplete dominance and cross 3 represents complete dominance.
- B. Cross 1 represents codominance; cross 2 represents complete dominance and cross 3 represents incomplete dominance.
- C. Cross 1 represents complete dominance; cross 2 represents incomplete dominance and cross 3 represents codominance.
- D. Cross 1 represents incomplete dominance; cross 2 represents codominance and cross 3 represents complete dominance.

34. In a cross between full green pods (FFGG) and constricted yellow pods (ffgg), the percentage of heterozygous dominant offsprings in F1 is:
- A. 25%
 - B. 50%
 - C. 75%
 - D. 100%

35. Enlisted are some events during fruit formation.
- 1: The egg cell is fertilised by a male gamete.
 - 2. The thalamus withers away.
 - 3. The ovules form seeds.
 - 4. The ovary develops into the fleshy fruit.

Which of these events is/are NOT TRUE for an apple fruit?

- A. only 1
 - B. only 2
 - C. only 2 and 4
 - D. only 2,3 and 4
36. Why is the endosperm in flowering plants $3n$?
- A. because it is formed from 3 antipodal cells
 - B. because it is formed from 2 male gametes and an egg cell
 - C. because it is formed from 2 male gametes and a polar nucleus
 - D. because it is formed from 1 male gamete and 2 polar nuclei
37. When McLeod, Avery and McCarty experimented to establish the chemical nature of the 'Transforming Principle', which of the following statement/s helped them reach their conclusion?
- 1: Proteases did not affect transformation
 - 2: DNases did not affect transformation.
 - 3: RNases did not affect transformation.
 - 4: The R strain could synthesise the polysaccharide coat.
- A. only 1 and 2
 - B. only 1 and 3
 - C. only 1, 3 and 4
 - D. only 2,3 and 4
38. Consider the following statements about the genetic code and identify which of them is/ are INCORRECT.
- 1: AUG is an initiator codon.
 - 2: Codons in bacteria and animals usually are different.
 - 3: All codons are triplets of amino acids and code for base pairs.
 - 4: All codons are triplets of base pairs and code for amino acids.
- A. only 3
 - B. only 2 and 3
 - C. only 1 and 4
 - D. only 1, 2 and 3

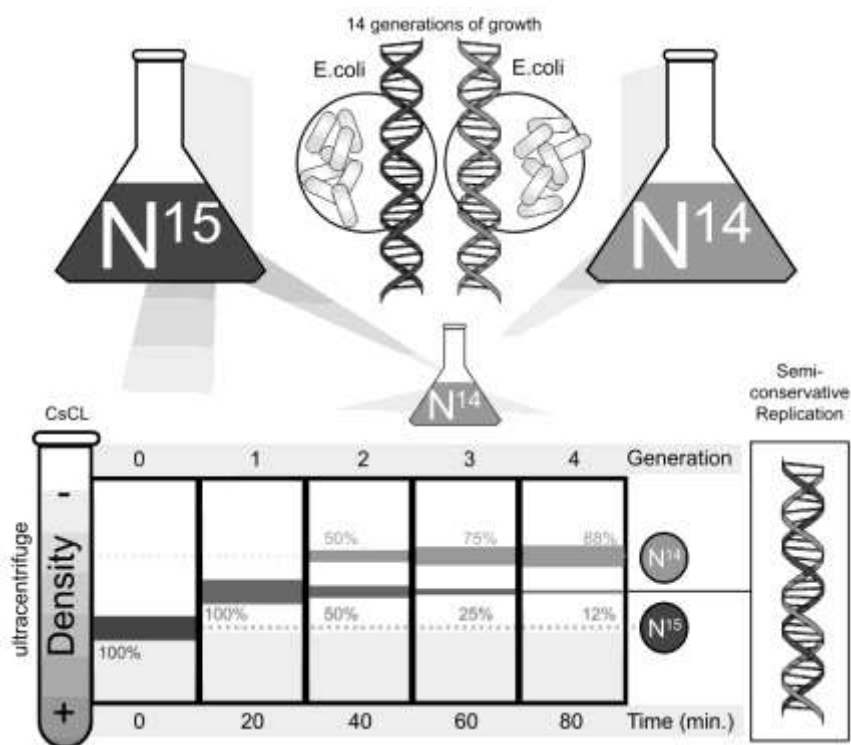
39. Given below are statements on the structure of the DNA double helix.

- 1: The helix generally is wound clockwise.
- 2: Purines and pyrimidines are paired by different number of hydrogen bonds.
- 3: The two strands run in parallel polarity.
- 4: The sugar in DNA backbone is a pentose sugar.

Which of the above statement/s is/are NOT TRUE?

- A. only 1
- B. only 2
- C. only 3
- D. only 2 and 4

40. The diagram below represents Meselson and Stahl's experiment on DNA replication.



For several generations, *E. coli* was grown in a medium containing an isotope of nitrogen, N^{15} . DNA was extracted periodically, at successive generations, and it was subjected to ultracentrifugation to check the percentage of the isotope that was transmitted across generations.

How did the centrifugation process help in providing evidence of the nature of DNA replication?

- A. It mixed the medium well.
- B. It destroyed the heavy isotope.
- C. It allowed the DNA with N^{14} to settle down.
- D. It separated the DNA with nitrogen isotopes based on densities.

41. Which of the following correctly represents the path taken by the sperm (indicated by the arrows) inside the female reproductive system till the point it may meet an egg cell (indicated by the point)?

A.



B.



C.



D.



42. Recent studies have indicated that one of the possible reasons behind male infertility is certain mutations in the mitochondrial DNA of the sperms that affect the way mitochondria in the sperms function. What could be a possible effect of such a mutation on the sperm?

- A. It lowers the sperm count.
- B. It lowers the sperm motility.
- C. It lowers the ability to penetrate the egg.
- D. It lowers the ability to produce hormones.

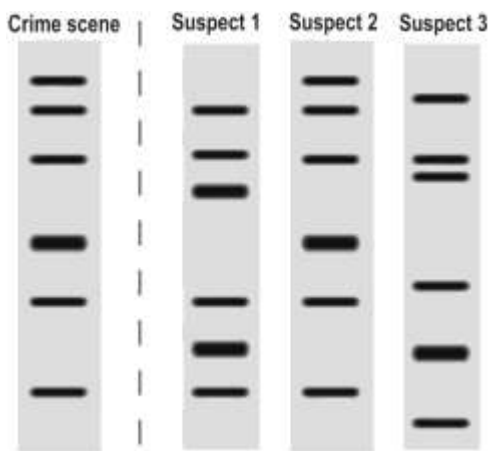
43. Which of the following is paired correctly with respect to their functions?

- A. mRNA: catalyses translation
- B. rRNA: initiates transcription
- C. tRNA: reads genetic code
- D. rRNA: provides template

44. When glucose is substituted by lactose in the growth medium of the *E. coli* bacteria, lactose enters the cells and acts as an inducer of the lac operon. It then leads to transcription of enzymes that enable effective digestion of lactose.

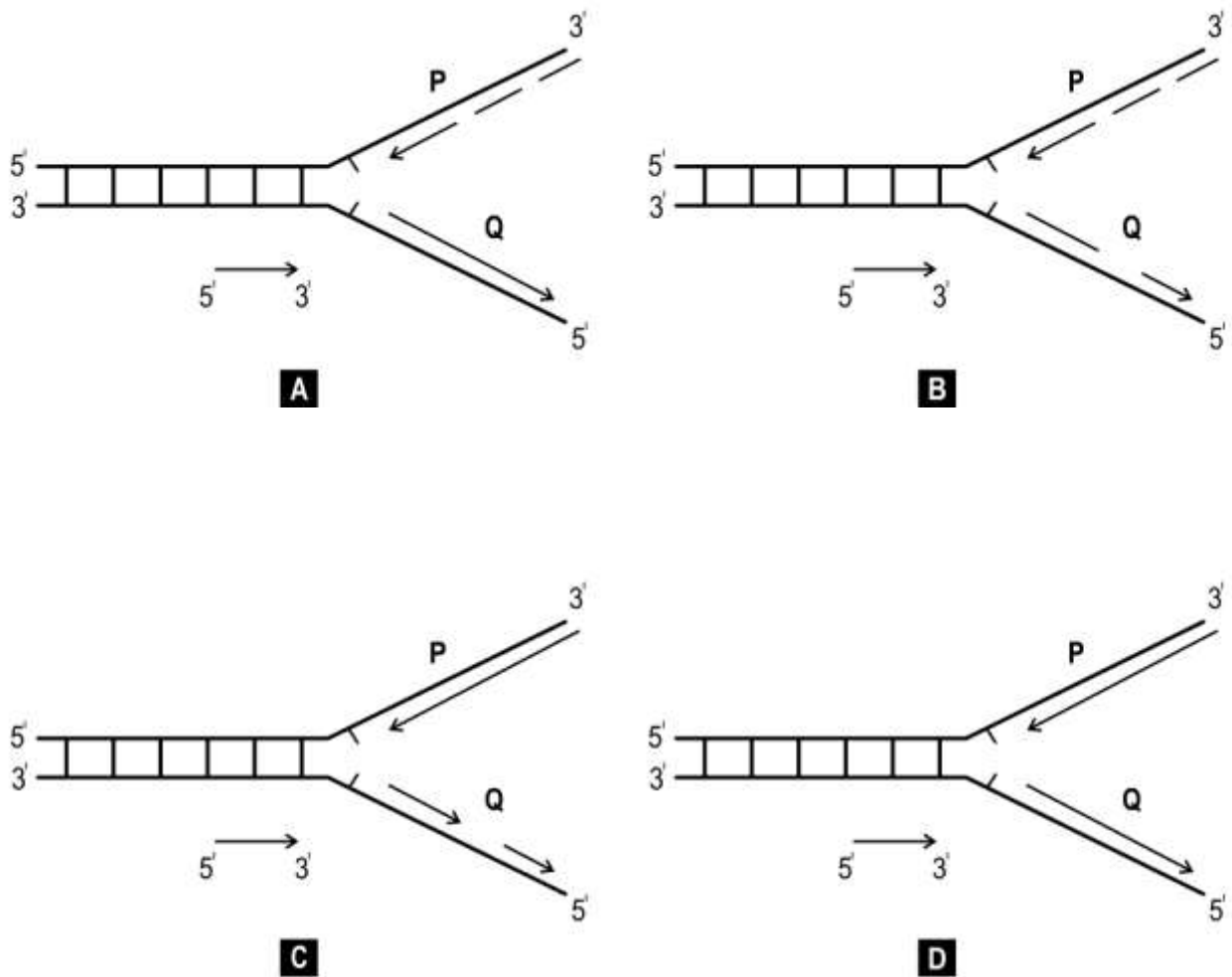
Instead of lactose an unknown sugar medium is used and there is no glucose in the medium. How would the unknown sugar affect the lac operon?

- A. It will induce the lac operon.
 - B. It will have no effect on the lac operon.
 - C. It will enable its conversion to lactose which will then induce the lac operon.
 - D. It may or may not induce the lac operon depending on whether the repressor is being produced or not.
45. The image below shows the DNA fingerprinting evidence obtained from a crime scene by the forensic department.

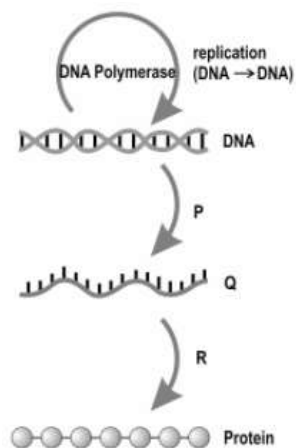


Who is most likely guilty of the crime?

- A. Suspect 1
 - B. Suspect 2
 - C. Suspect 3
 - D. (The DNA fingerprint of the criminal is not there.)
46. How does an anticodon on a tRNA molecule help?
- A. It signals the stop of translation.
 - B. It helps to initiate a 5' -> 3' translation.
 - C. It ensures accurate reading of the code on the mRNA.
 - D. It enables translation in the opposite polarity to the mRNA.
47. Which one of the images of the replicating fork given below represent the process correctly?



48. In the representation of the Central Dogma of Molecular Biology given below, identify P, Q and R.



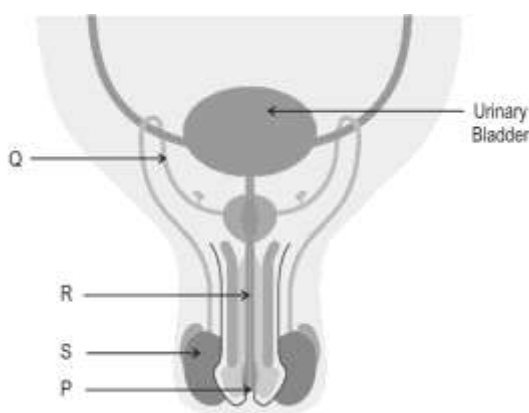
- A. P: ligase; Q: histone; R: polymerase
- B. P: translation; Q: mRNA; R: transcription
- C. P: splicing; Q: mRNA; R: capping

D. P: transcription; Q: mRNA; R: translation

Case: Answer questions 49 to 52 based on the information given below.

A new birth control method for men known as RISUG for Reversible Inhibition of Sperm Under Guidance is under testing. The procedure involves injection of a nontoxic polymer inside of the vas deferens. The polymer forms a coating on the inner lining of vas deferens. As sperms pass through, they are chemically disabled by the polymer. Hence, there is ejaculation but the sperms are incapable of fertilising the egg. At any stage if needed, the polymer film can be dissolved and removed using specific injections.

49. At which of these points would the polymer be injected?



- A. P
- B. Q
- C. R
- D. S

50. What effect would the polymer have on the sperms?

- A. It may be preventing the sperms from moving ahead.
- B. It may be damaging the membrane or the tail of the sperms.
- C. It may be reversing the direction of movement of the sperms.
- D. It may be controlling the frequency at which sperms are released.

51. In another birth control method vasectomy, a small part of the vas deferens is removed or tied up. What advantage does RISUG give over vasectomy?

- A. It can be performed on males of any age.
- B. It does not involve the female partner of the male.
- C. It is being tested currently and hence more reliable.
- D. It allows the male to go back to the fertile state whenever needed.

52. In one of the trials that was being conducted to check the effectiveness of the method, one of the conditions was for males to have had two children in the past. What could be the reason for having such a condition?

- A. to ensure that they could not produce more children in future
- B. to ensure that the procedure didn't have any side effects on their children
- C. to ensure that the males were fertile and their partners had conceived in the past
- D. to ensure that they were educated enough to understand how the method worked

Case: Answer questions 53 to 55 based on the information given below.

A student researching on an artificial crop improvement project in wheat growing in a certain field saw that wheat plants were covered with bags made up of butter paper.



53. What is the purpose of covering these plants with butter paper bags?
- A. to reduce transpiration
 - B. to reduce photosynthesis
 - C. to hide the identity of the plants
 - D. to prevent unwanted pollination
54. A process called emasculation is carried out before bagging. In which of these cases can the process of emasculation be avoided?
- A. when the flowers are very large
 - B. when the flowers are very small
 - C. when the flowers are pistillate
 - D. when the flowers are staminate
55. Which of the following is NOT a desired outcome of such crop improvement techniques?
- A. to create disease-free varieties
 - B. to create high-yielding varieties
 - C. to conserve desired characters
 - D. to increase female flowers
56. Which among the following statements about the exons is TRUE?
- A. They are stop codons.

- B. They are start codons.
- C. They are coding sequences.
- D. They are intervening sequences.

57. It is found that 99.9 percent of the base sequences in humans are identical.

Given below are number of base pairs that match with a sample from a human male individual. Which of them is definitely from a different individual?'

- A. $3 * 10^9$
- B. $3 * 10^6$
- C. $3 * 10^3$
- D. $3 * 10^8$

58. hnRNA is converted to mRNA after which of the following in transcription?

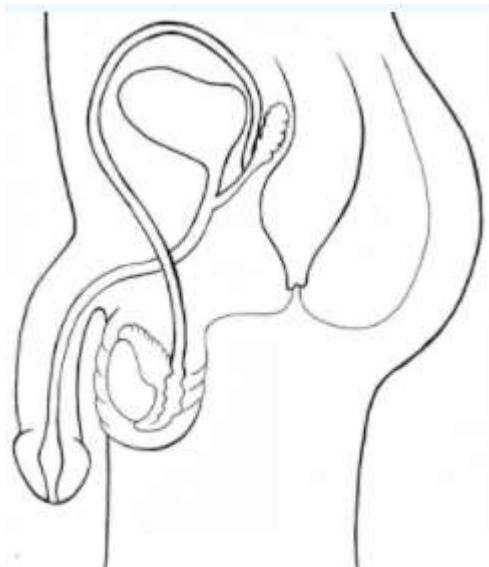
- A. initiation
- B. capping
- C. splicing
- D. tailing

59. Consider a cross where some offsprings in a generation have genotype ppqrr.

Which of these CAN be a genotype of either parent?

- A. PPQQRR
- B. PPQqRr
- C. PpQqRr
- D. PpQQRr

60. Shown here is a representation of the male reproductive system.



One of its important parts is missing. Which one?

- A. urinary bladder
- B. seminal vesicles

- C. prostate gland
- D. vas deferens

*****End of Paper*****

Answer Key

1	D	31	D
2	D	32	C
3	C	33	C
4	C	34	D
5	B	35	B
6	C	36	D
7	A	37	B
8	B	38	B
9	A	39	C
10	B	40	D
11	B	41	B
12	C	42	B
13	B	43	C
14	C	44	B
15	A	45	B
16	D	46	C
17	B	47	C
18	D	48	D
19	B	49	B
20	B	50	B
21	B	51	D
22	B	52	C
23	C	53	D
24	B	54	C
25	D	55	C
26	C	56	C
27	A	57	B
28	D	58	D
29	A	59	C
30	B	60	C

Practice Questions 2021-22

Class XII

Term 2

Subject: Biology (044)

Time: 2 hours

Max. marks: 35

General instructions:

1. All questions are compulsory.
2. The question paper has three sections and 13 questions. All questions are compulsory.
3. Section–A has 6 questions of 2 marks each; Section–B has 6 questions of 3 marks each; and Section–C has a case-based question of 5 marks.
4. 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.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION A

1. Malaria, caused by *Plasmodium* is often characterised by high fever recurring every three to four days. Explain why this happens.

[2 marks]

2. Rural energy shortage has been largely mitigated by biogas plants.

- (a) What is the primary flammable gas present in biogas?
- (b) Why is cattle dung used to produce biogas?

[2 marks]

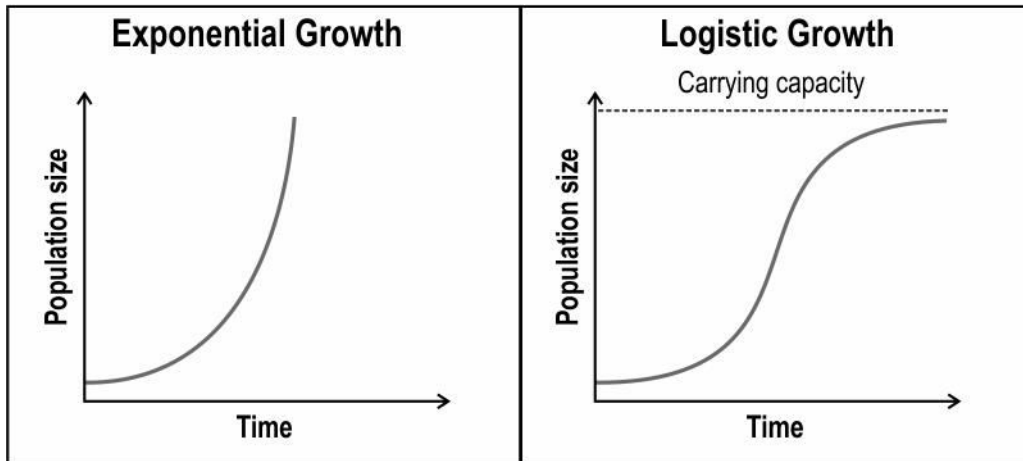
OR

Nicotine stimulates the adrenal gland and increases blood pressure and heart rate.

- (a) Despite higher heart rate leading to faster pumping of the blood, why would a smoker show oxygen deficiency in the body?
- (b) Why does a chronic smoker experience withdrawal symptoms if he abruptly discontinues smoking?

[2 marks]

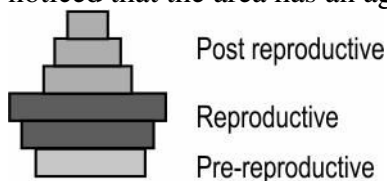
3. The population growth can be exponential (unimpeded) or logistic (competitive). These growth curves can be represented by the graphs as shown below:



- (a) Define carrying capacity.
 (b) What limits the growth of organisms as seen in the graphs above?

[2 marks]

4. While studying the human population data of a particular geographical area it was noticed that the area has an age pyramid as shown below.



- (a) What kind of natality and mortality rate of the pre-reproductive population contributes the kind of shorter base of the age pyramid as shown above?
 (b) Why do we usually have an age pyramid with a broader base?

[2 marks]

5. For an individual 'X' with a history of lung cancer in the parents, doctors advised certain genetic testing processes that help in detecting the inheritance of mutations.

(a) Malignant tumours spread rapidly and avoid detection. α -interferon is a biological response modifier and can target specific disease causing mechanisms. How does α -interferon help in the treatment of malignant tumours?

(b) For a cancer caused by inheritance of genetic mutations, how will the malignancy spread internally?

[2 marks]

6. *Eichhornia crassipes* (commonly known as water hyacinth) is an aquatic plant, native to the Amazon basin. It was introduced to the water bodies of India and other South-East Asian countries for industrial use of its fibres in making bags and footwear, as a substrate for biogas production and for its ability of uptake of heavy metals from the water bodies. However, *Eichhornia* has been named as the 'terror of bengal' due to its prolific,

invasive growth.

- (a) How does the growth of water hyacinth affect the growth of other native species?
- (b) There are a host of algae and fungi that form lichens in freshwater lakes. What would be the fate of freshwater snails that feed on such lichens if the algae and fungi are destroyed by growth of water hyacinth? Mention the scientific term used to denote such threats to biodiversity.

[2 marks]

OR

Conservation of biodiversity is vital to maintain the balance in ecosystem.

- (a) Mention ONE condition when ex-situ conservation is a more viable process to conserve a species.
- (b) What are the TWO most important parameters that help in naming an area as a biodiversity hotspot?

[2 marks]

SECTION B

7. A pest control program needed to be developed for the Sunderbans mangrove ecosystem and biocontrol methods were being explored.

- (a) Why would biocontrol methods be the best method for a pest control program in a biome like Sunderbans?
- (b) What is the difference in the action of a biocontrol agents as against the action of chemical pesticides?
- (c) Mention any two points of vital information about the pests that the designers of the pest control program need to be aware of?

[3 marks]

OR

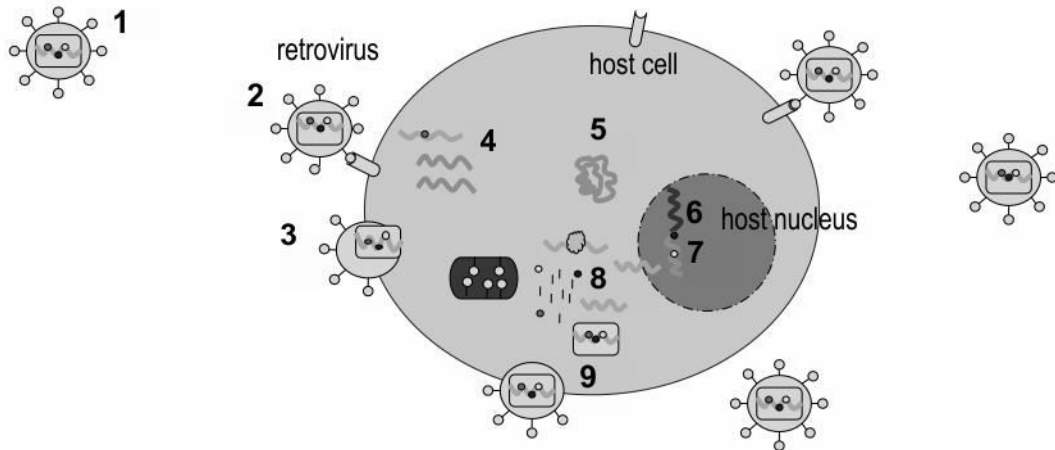
Lymphocytes are an integral part of our immune system and help in the humoral and cell-mediated immune response process.

- (a) Specify the type of lymphocytes that mediate humoral immune response and the ones that mediate cell-mediated immunity.
- (b) What is the chemical nature of antibodies?
- (c) How is an organ rejected by the body due to 'unmatched' transplant?

[3 marks]

8. The image below represents the replication of a retrovirus.

In the image, steps 1- 5 depict different stages in the invasion of the retrovirus into the host cell and steps 6 - 9 show the invasion of the host DNA and the processes resulting out of it.



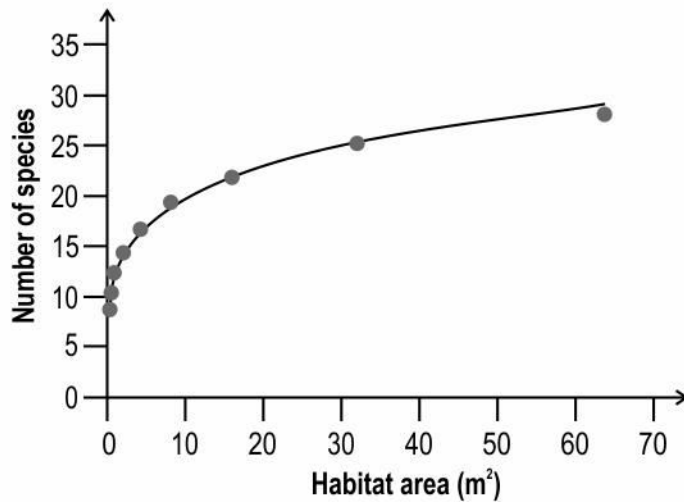
- (a) Why does the retrovirus need to use reverse transcriptase to infect the host genome?
(b) What is the significance of step 7 and 8 (after the viral genome enters the host nucleus) as shown in the diagram?

[3 marks]

9. Diversity is seen in the living world at various levels. The distribution of biodiversity shows specific patterns that account for the species richness or paucity across the globe.

- (a) Explain, with reasons, how species diversity changes with changing latitudes.
(b) The graph below represents species-area relationship. What does such a graph signify?

Species-area Relationship



[3 marks]

10. In recombinant DNA technology, the endonuclease cuts the DNA into fragments.

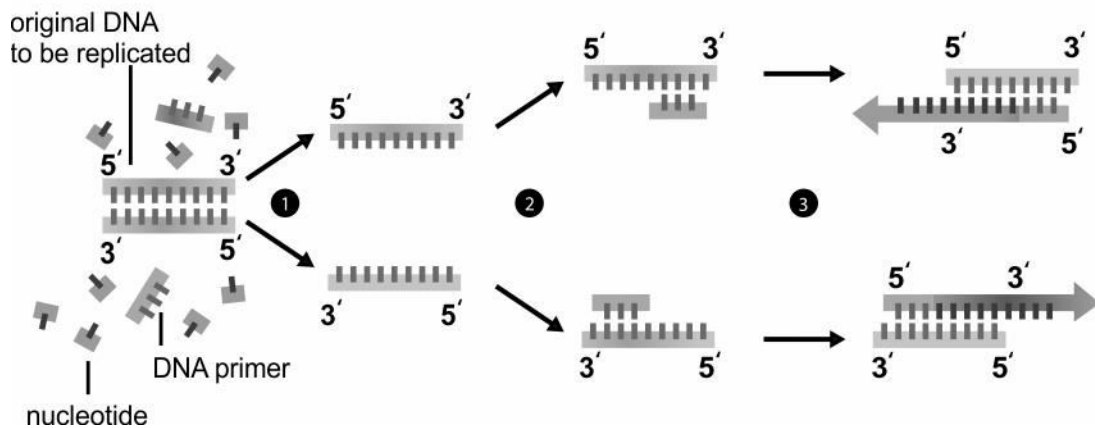
- Where does a restriction endonuclease cut the DNA strand?
- How is the restriction endonuclease able to cut the DNA strand as mentioned in (a)?
- DNA fragments formed by the action of endonuclease can be separated by gel electrophoresis. What is the principle on which gel electrophoresis works?

[3 marks]

11. Polymerase Chain Reaction (PCR) is often used to detect the presence of pathogens like bacteria and viruses, even though they may be in low concentration.

- What is the technique that allows PCR to detect low concentrations of pathogens?
- The image below shows steps involved in a PCR. Step 1 is denaturation, step 2 annealing and step 3 extension. During a PCR, if step 2 is bypassed, what would be the implication on the process?

Polymerase chain reaction - PCR



[3 marks]

12. Populations of organisms respond differently to the abiotic factors of the environment. Organisms that are able to maintain physiological homeostasis ensuring constant body temperature are called regulators while others that cannot, are termed as conformers.

Crocodiles are often seen basking in the sun more during certain periods of the year.



- Identify, with a reason, if the species described above is an environmental conformer or regulator.
- Crocodiles are usually sluggish and show minimum movement. How does such behaviour aid in conservation of body heat in a crocodile?
- If the geographical location of a population of crocodiles was to receive harsh winter conditions, what could be TWO most viable survival methods for the animals?

[3 marks]

SECTION C

Consider the information given below to answer the questions that follow:

When scientists look at improving food production and crop value, they have looked at the possibility of using arid conditions for increasing available farmlands.

Plants growing in low water content areas can have three modes of adaptation:
- drought escape: where the plants complete the life cycle before the dry season comes in

- drought avoidance: where the plants naturally have adaptations like reduced leaves, lower stomatal presence to reduce water loss

- drought tolerance: where the plants inherently have low water requirement and can grow in dry conditions

When any of these is genetically incorporated in a plant that otherwise grows in moderate water availability, it may impact physiological processes like mobilisation and storage of minerals, maturation of flowers and fruits etc.

The National Academies Press published a report titled *Transgenic Plants and World Agriculture (2000)*. In the chapter named *Examples of GM crops that can benefit World Agriculture*, the report speaks about techniques for developing pest resistance in GM crops and its advantages.

"There is clearly a benefit to farmers if transgenic plants are developed that are resistant to a specific pest. For example, papaya-ringspot-virus-resistant papaya has been commercialised and grown in Hawaii since 1996. (Gonsalves 1998).

Developments resulting in commercially produced varieties in countries such as the United States and Canada have centered on increasing shelf life of fruits and vegetables, conferring resistance to insect pests or viruses, and producing tolerance to specific herbicides. While these traits have had benefits for farmers, it has been difficult for the consumers to see any benefit other than, in limited cases, a decreased price owing to reduced cost and increased ease of production (Nelson et al. 1999; Falck-Zepeda et al. 1999).

A possible exception is the development of GM technology that delays ripening of fruit and vegetables, thus allowing an increased length of storage."

Ref: <https://www.nap.edu/read/9889/chapter/5>

13. Bt cotton is known to be a pest resistant GM crop. How does Bt cotton get its insect resistance?

[2 marks]

14. One advantage of incorporating pest resistance in GM crops is, obviously, that it helps in pest control. Traditionally, chemical pesticides have been used as pest control methods in agricultural farmlands.

(a) What is the environmental advantage of developing GM crops with pest

resistance?

(b) Name and explain the cellular defense mechanism that has been used to develop such pest resistance against specific nematodes.

[2 marks]

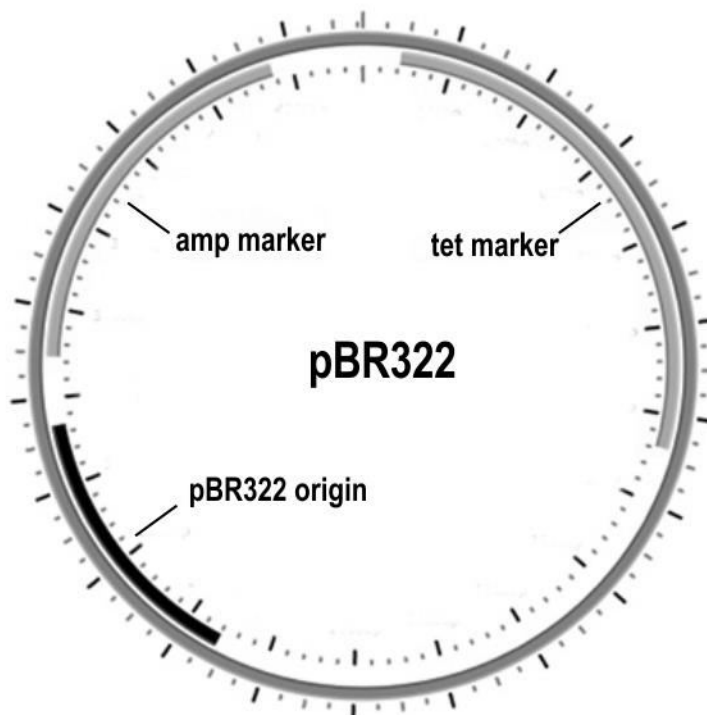
15. For a fruit plant naturally growing in moderate water availability, GM techniques can help in incorporating drought escape characteristics. This will reduce their life cycle duration and can have adverse impacts. State ONE such possible impact on the commercial value of the fruit.

[1 marks]

Answer the following questions in relation to the diagram and information on the pBR322 plasmid:

The ability of plasmids and bacteriophages to replicate inside a bacterial cell, independent of the chromosomal DNA control is used in the technique of cloning vectors.

E.coli cloning vector pBR322 has restriction sites, site of origin and antibiotic resistant genes that make it perfect as a cloning vehicle.



OR

pBR322 and normal *E. coli* genes were incorporated in the DNA of two test plant specimen A and B respectively.

Later, antibiotic ampicillin was administered to the two plant specimen to combat bacterial infections.

What would MOST LIKELY be the fate of each of the two test specimen and why?

[2 marks]

16. The sequences amp marker and tet marker are the selectable markers in the plasmid and help in transformation and can help in differentiating the non-recombinants from the transformants. This is done using 'chromogenic substrates'.

- (a) What is the chemical basis on which the chromogenic substance act?
- (b) Explain how the substrates help in the differentiation process.
- (c) Why are such chromogenic substrates advantageous in the separation of non-recombinants and transformants?

[2 marks]

17. Mention any TWO characteristics that are important for a cloning vector.

[1 marks]

*****End of Paper*****