



Series SSRR3/3



SET-2

प्रश्न-पत्र कोड
Q.P. Code

57/3/2

रोल नं.

Roll No.

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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 (I) पृष्ठ 27 हैं ।

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

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

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

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

NOTE

Please check that this question paper contains 27 printed pages.

Please check that this question paper contains 33 questions.

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.

Please write down the serial number of the question in the answer-book before attempting it.

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 students 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



सामान्य निर्देश :

निम्नलिखित निर्देशों को ध्यानपूर्वक पढ़िए और उनका पालन कीजिए :

- (i) इस प्रश्न-पत्र में **33** प्रश्न हैं । सभी प्रश्न अनिवार्य हैं ।
- (ii) प्रश्न-पत्र पाँच खण्डों में विभाजित है – खण्ड क, ख, ग, घ एवं ङ ।
- (iii) **खण्ड क** – प्रश्न संख्या 1 से 16 तक बहुविकल्पीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न 1 अंक का है ।
- (iv) **खण्ड ख** – प्रश्न संख्या 17 से 21 तक अति लघु-उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न 2 अंकों का है ।
- (v) **खण्ड ग** – प्रश्न संख्या 22 से 28 तक लघु-उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न 3 अंकों का है ।
- (vi) **खण्ड घ** – प्रश्न संख्या 29 तथा 30 केस-आधारित प्रश्न हैं । प्रत्येक प्रश्न 4 अंकों का है । इन उप-प्रश्नों में से एक उप-प्रश्न में आंतरिक विकल्प का चयन दिया गया है ।
- (vii) **खण्ड ङ** – प्रश्न संख्या 31 से 33 तक दीर्घ-उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न 5 अंकों का है ।
- (viii) प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड ख, ग तथा घ में आंतरिक विकल्प का प्रावधान दिया गया है । परीक्षार्थी को इन प्रश्नों में से किसी एक प्रश्न का उत्तर लिखना है ।
- (ix) ध्यान दें कि दृष्टिबाधित परीक्षार्थियों के लिए अलग प्रश्न-पत्र है ।
- (x) जहाँ कहीं आवश्यक हो, साफ सुथरे और उचित रूप से नामांकित चित्र बनाए जाने चाहिए ।

खण्ड क

प्रश्न संख्या 1 से 16 तक बहुविकल्पीय प्रकार के 1 अंक के प्रश्न हैं ।

16×1=16

1. बीजाण्डावरण कोशिकाओं तथा सहाय कोशिकाओं से विकसित होने वाले असंगजनित भ्रूणों की सूत्रगुणता होगी क्रमशः :

| | |
|--------------|--------------|
| (A) $n, 2n$ | (B) $2n, n$ |
| (C) $3n, 2n$ | (D) $2n, 3n$ |
2. एक डीएनए खंड में 2500 न्यूक्लियोटाइड्स हैं, जिनमें से 240 ग्वानीन हैं । तो इस डीएनए खंड में दो हाइड्रोजन बंध वाले क्षारों (बेसों) की संख्या कितनी होगी ?

| | |
|----------|----------|
| (A) 480 | (B) 720 |
| (C) 1010 | (D) 2020 |



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, C and D 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.* $16 \times 1 = 16$

1. The ploidy of the apomictic embryos developing from the integument cells and synergids respectively would be :
(A) $n, 2n$ (B) $2n, n$
(C) $3n, 2n$ (D) $2n, 3n$
2. A DNA fragment has 2500 nucleotides, out of which 240 are Guanine. How many bases having double hydrogen bonds between them does this DNA fragment possess ?
(A) 480 (B) 720
(C) 1010 (D) 2020



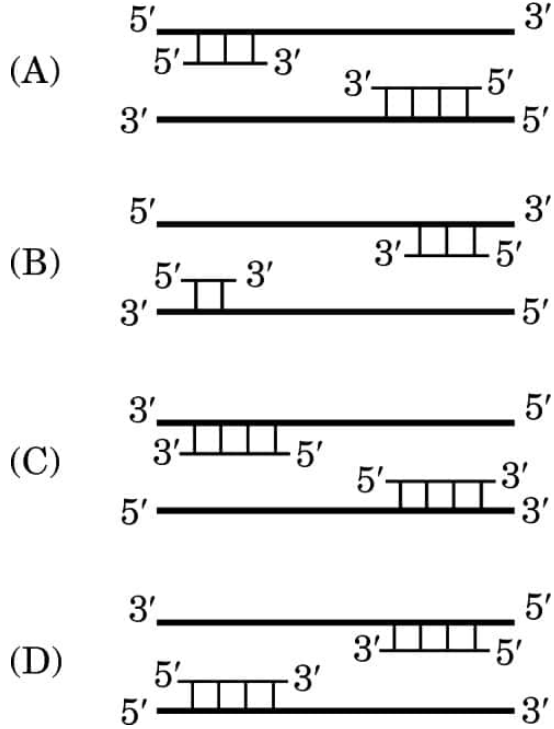
3. निषेचन के बिना बीज उत्पन्न करने की प्रणाली का विकास इस कुल के पुष्पी पादपों में हुआ है :
- (A) एस्टेरेसी (B) सोलेनेसी
(C) मालवेसी (D) लिलिएसी
4. लुई पाश्चर ने स्वतः जनन के सिद्धान्त को अपने प्रयोगों द्वारा खारिज कर दिया । इसके लिए उसने उपयोग किया, पहले से जीवाणुरहित फ्लास्क तथा :
- (A) जीवित यीस्ट (B) मृत यीस्ट
(C) जीवित जीवाणु (D) मृत जीवाणु
5. इंग्लैंड में 1850 के दशक के पश्चात् पश्च-औद्योगीकरण युग में प्राकृतिक वरण के प्रभाव के फलस्वरूप श्वेत पंखों वाले शलभों की संख्या, गहरे (काले) पंखों वाले शलभों की संख्या की अपेक्षा :
- (A) कम थी (B) अधिक थी
(C) दोनों की संख्या कम थी (D) दोनों की संख्या अधिक थी
6. लाल पुष्प वाले स्नेपड्रेगन पौधे का संकरण श्वेत पुष्प वाले स्नेपड्रेगन पौधे के साथ कराया गया । F_1 पीढ़ी में प्राप्त संतति का स्वपरागण कराने पर प्राप्त संतति का अनुपात था :
- (A) 50% लाल : 50% श्वेत
(B) 25% गुलाबी : 50% श्वेत : 25% लाल
(C) 50% लाल : 50% गुलाबी
(D) 25% लाल : 50% गुलाबी : 25% श्वेत
7. निम्नलिखित क्रोमोसोमीय विकार में से कौन-से व्यष्टि (व्यक्ति) छोटे कद (बौने), अल्पविकसित स्त्रीवत् लक्षण तथा बन्ध्य अंडाशय युक्त होते हैं ?
- (A) डाउन सिंड्रोम (B) टर्नर सिंड्रोम
(C) क्लाइनफेल्टर सिंड्रोम (D) पटाऊ सिंड्रोम



3. The mechanism to produce seeds without fertilisation has evolved in the given family of the flowering plants :
- (A) Asteraceae (B) Solanaceae
(C) Malvaceae (D) Liliaceae
4. Louis Pasteur dismissed the theory of spontaneous generation by his experiments using pre-sterilised flasks and :
- (A) Live yeast (B) Killed yeast
(C) Live bacteria (D) Killed bacteria
5. After the 1850s in the post-industrialization era in England, the expected effect of natural selection on the number of white-winged moths as compared to the dark-winged moths was :
- (A) Less in number (B) More in number
(C) Both were less in number (D) Both were more in number
6. A Snapdragon plant bearing red colour flowers was crossed with a Snapdragon plant bearing white colour flowers. The F_1 progeny on selfing produced the progeny in the ratio of :
- (A) 50% Red : 50% White
(B) 25% Pink : 50% White : 25% Red
(C) 50% Red : 50% Pink
(D) 25% Red : 50% Pink : 25% White
7. In which of the following chromosomal disorders do individuals have short stature, underdeveloped feminine character and sterile ovaries ?
- (A) Down's syndrome (B) Turner's syndrome
(C) Klinefelter's syndrome (D) Patau's syndrome



8. PCR में डीएनए के प्रवर्धन के लिए निम्नलिखित में से कौन-सा उपक्रामकों के तापानुशीलन को सही प्रकार से निरूपित करता है ?



9. एक रोगी ज्वर, ठिठुरन, खाँसी, सिरदर्द तथा नीले नाखूनों व होंठों युक्त लक्षणों से पीड़ित है । यह अभिलक्षण दर्शाने वाला रोग है :

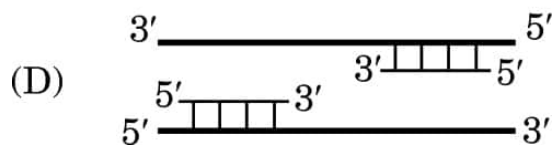
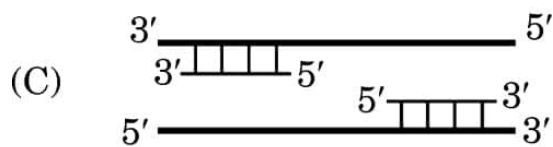
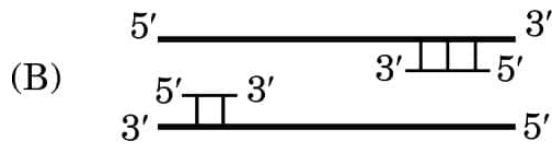
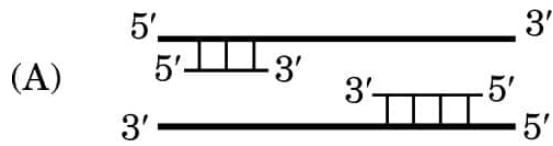
- (A) मलेरिया (B) टाइफॉइड
(C) सामान्य जुकाम (D) न्यूमोनिया

10. एक प्रयोग में ई. कोलाई को $^{14}\text{NH}_4\text{Cl}$ युक्त संवर्धन माध्यम में विकसित किया (^{14}N नाइट्रोजन का हल्का समस्थानिक है) । उसके पश्चात् इसे नाइट्रोजन के भारी समस्थानिक (^{15}N) युक्त संवर्धन माध्यम में 6 पीढ़ियों तक संवर्धित किया गया । 6 पीढ़ियों के बाद उनके डीएनए को निष्कर्षित किया गया तथा CsCl घनत्व प्रवणता पर अपकेन्द्रण द्वारा निष्कर्षित किया गया । CsCl घनत्व प्रवणता अपकेन्द्रण पर डीएनए के सही घनत्व (हल्का/संकरित/भारी) और पट्टियों के अनुपात की पहचान कीजिए ।

- (A) संकरित : भारी, 1 : 16
(B) हल्का : भारी, 1 : 31
(C) संकरित : भारी, 1 : 31
(D) हल्का : भारी, 1 : 05



8. Which one of the following represents the correct annealing of primers to the DNA to be amplified in the PCR ?



9. A patient is suffering from fever, chills, cough, headache and bluish finger nails and lips. These symptoms are of the disease :

- (A) Malaria (B) Typhoid
(C) Common cold (D) Pneumonia

10. In an experiment, *E. coli* is grown in a medium containing $^{14}\text{NH}_4\text{Cl}$. (^{14}N is the light isotope of Nitrogen) followed by growing it for six generations in a medium having heavy isotope of nitrogen (^{15}N). After six generations, their DNA was extracted and subjected to CsCl density gradient centrifugation. Identify the correct density (Light/Hybrid/Heavy) and ratio of the bands of DNA in CsCl density gradient centrifugation.

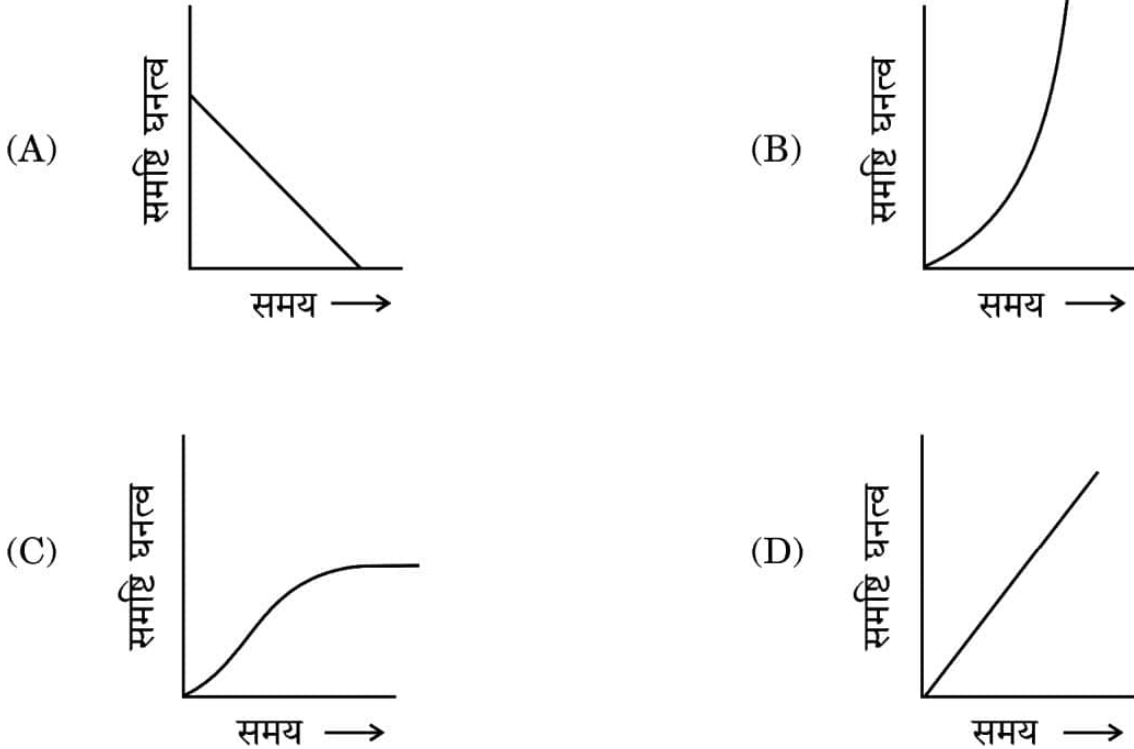
- (A) Hybrid : Heavy, 1 : 16
(B) Light : Heavy, 1 : 31
(C) Hybrid : Heavy, 1 : 31
(D) Light : Heavy, 1 : 05



11. प्रथम पुनर्योगज डीएनए के प्रतिकृतीयन के लिए, स्टैनले कोहेन तथा हरबर्ट बोयर द्वारा उपयोग किए गए डीएनए पॉलीमरेज़ का स्रोत है :

- (A) थर्मस एक्वेटिकस (B) साल्मोनेला टाइफीमूरियम
(C) एशरिक्किआ कोलाई (D) हीमोफिलस इन्फ्लुएंज़ी

12. प्रकृति में उगने वाली समष्टि जिसके लिए सीमित संसाधन उपलब्ध हैं, के लिए निरूपित समष्टि वृद्धि वक्र है :

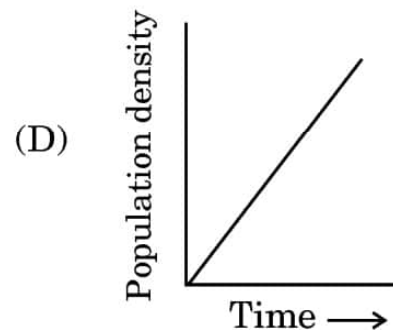
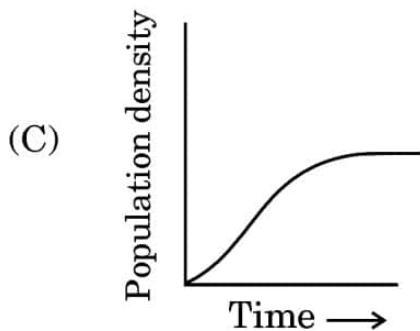
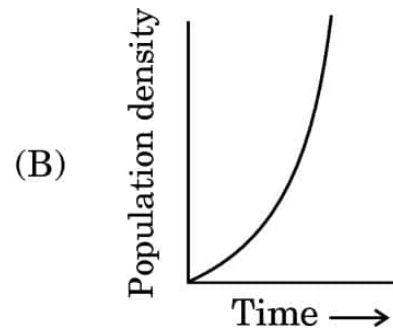
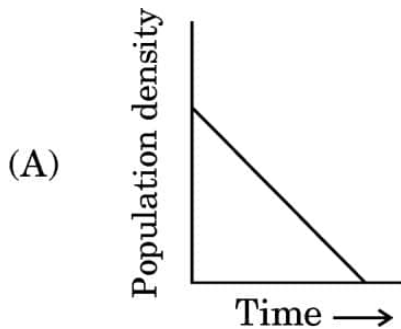


प्रश्न संख्या 13 से 16 के लिए, दो कथन दिए गए हैं — जिनमें एक को अभिकथन (A) तथा दूसरे को कारण (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए ।

- (A) अभिकथन (A) और कारण (R) दोनों सही हैं और कारण (R), अभिकथन (A) की सही व्याख्या करता है ।
(B) अभिकथन (A) और कारण (R) दोनों सही हैं, परन्तु कारण (R), अभिकथन (A) की सही व्याख्या नहीं करता है ।
(C) अभिकथन (A) सही है, परन्तु कारण (R) ग़लत है ।
(D) अभिकथन (A) ग़लत है, परन्तु कारण (R) सही है ।



11. For the replication of the first recombinant DNA, Stanley Cohen and Herbert Boyer used the DNA polymerase of :
- (A) *Thermus aquaticus* (B) *Salmonella typhimurium*
(C) *Escherichia coli* (D) *Haemophilus influenzae*
12. The population growth curve applicable for a population growing in nature with limited resources available to them will be :



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. **अभिकथन (A) :** अधिकतर आवृतबीजियों में युग्मनज हृदयाकार भ्रूण बनाता है, जो उसके पश्चात् प्राक्भ्रूण में विकसित हो जाता है ।
कारण (R) : युग्मनज बीजाण्डद्वार के निकट भ्रूण-कोष में स्थित होता है तथा एक भ्रूण में विकसित हो जाता है ।
14. **अभिकथन (A) :** सुकेंद्रकियों में प्रारंभिक अनुलेख (प्रतिलिपि) से अव्यक्तेक को हटाने के लिए समबंधन (स्प्लाइसिंग) प्रक्रम से गुज़रना पड़ता है ।
कारण (R) : सुकेंद्रकियों में प्रारंभिक अनुलेख (प्रतिलिपि) में व्यक्तेक व अव्यक्तेक दोनों होते हैं तथा अव्यक्तेक अक्रिय होते हैं ।
15. **अभिकथन (A) :** विलोडक बायोरिऐक्टर में ऑक्सीजन उपलब्धता और उसके एकसमान मिश्रण में सहायता करता है ।
कारण (R) : विलोडित-हौज बायोरिऐक्टर का आधार आमतौर पर समतल होता है ।
16. **अभिकथन (A) :** किसी व्यक्ति द्वारा ऐल्कोहॉल के चिरकाली (बहुत अधिक समय तक) प्रयोग से यकृत को क्षति (सिरोसिस) पहुँचती है ।
कारण (R) : ऐल्कोहॉल की लत अक्सर इसके आदी व्यक्ति के पूरे परिवार के लिए मानसिक तथा आर्थिक कष्ट का कारण बन जाती है ।

खण्ड ख

17. (क) एक स्थलीय पारितंत्र में अपघटन चक्र के दौरान बनने वाले 'ह्यूमस' के महत्वपूर्ण अभिलक्षण लिखिए ।

2

अथवा

- (ख) (i) लॉग-लॉग पैमाने पर चमगादड़ तथा मछलियों के लिए जाति समृद्धि तथा क्षेत्र के बीच संबंध का ग्राफीय निरूपण कीजिए ।
(ii) एक लघुगणक पैमाने पर इस संबंध का समीकरण लिखिए ।

2

18. वैक्सीन (टीका) क्या है ? जब इसे शरीर में प्रविष्ट कराया जाता है, तो यह किस आधार पर (प्रकार) कार्य करता है, लिखिए ।

2



13. *Assertion (A)* : The zygote gives rise to heart-shaped embryo and subsequently proembryo in most angiosperms.
Reason (R) : The zygote is present at the micropylar end of the embryo sac and develops into an embryo.
14. *Assertion (A)* : Primary transcripts in eukaryotes are subjected to splicing to remove the introns.
Reason (R) : Primary transcripts contain both exons and introns and the introns are non-functional in eukaryotes.
15. *Assertion (A)* : The stirrer facilitates the even mixing of oxygen availability in a bioreactor.
Reason (R) : Stirred-tank bioreactors generally have a flat base.
16. *Assertion (A)* : The chronic use of alcohol by a person leads to cirrhosis.
Reason (R) : Alcohol addiction at times becomes the cause of mental and financial distress to the entire family of the addicted person.

SECTION B

17. (a) Write important features of 'humus' formed during the decomposition cycle in a terrestrial ecosystem. 2
- OR**
- (b) (i) Graphically represent the relationship between species richness and area on a log-log scale for bats and fishes.
(ii) Write the equation for the relationship as on a logarithmic scale. 2
18. What is a vaccine ? Write the basis on which it acts when administered in the body. 2



19. उल्बवेधन (ऐम्नियोसेंटेसिस) तकनीक में अपनाई जाने वाली कार्यविधि का उल्लेख कीजिए ।
इस तकनीक के किन्हीं दो लाभों की सूची बनाइए ।

2

20. m-RNA का एक काल्पनिक लघु खंड जो एक सक्रिय पॉलीपेप्टाइड शृंखला का कूट लेखन करता है, के दिए गए आँकड़े (डाटा) पर विचार कीजिए तथा आगे दिए गए प्रश्नों के उत्तर लिखिए :

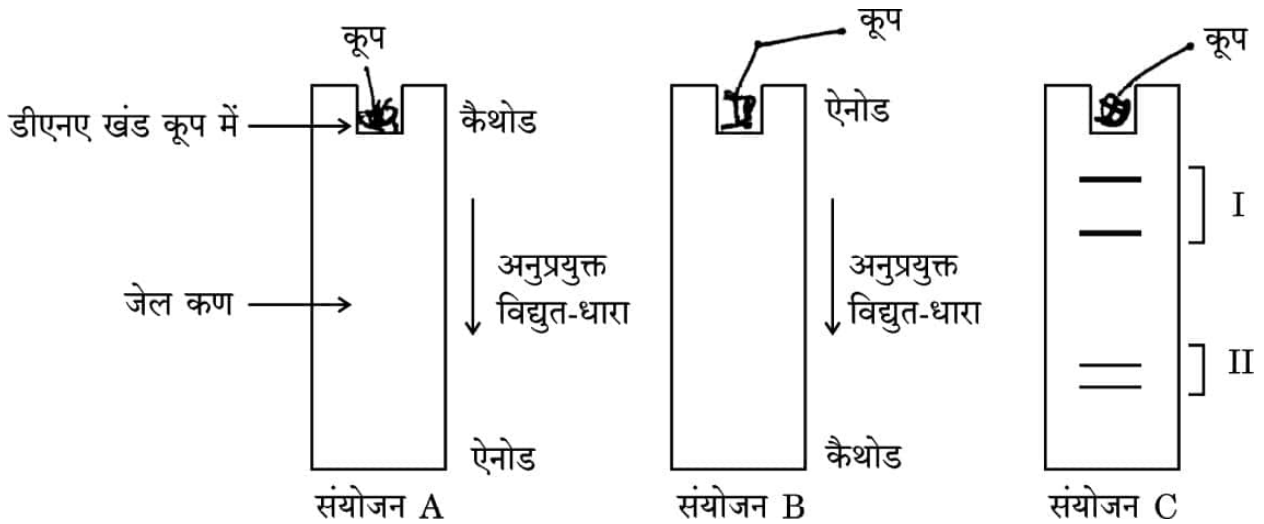
mRNA 5' – UCAUUACCACGAUUCUUUAAAAGA – 3'

(क) यदि 5वें (पाँचवें) प्रकूट (कोडॉन) में 'U' के स्थान पर 'C' प्रतिस्थापित हो जाए, तो दिए गए प्रकूटों (कोडॉनों) से कितने ऐमीनो अम्ल बनेंगे ? अपने उत्तर की व्याख्या कीजिए ।

(ख) उपर्युक्त mRNA के समान mRNA में जहाँ चौथे प्रकूट (कोडॉन) में यदि 'C' के स्थान पर 'U' हो, तो संश्लेषित होने वाले पॉलीपेप्टाइड में ऐमीनो अम्लों की संख्या लिखिए । अपने उत्तर की न्यायसंगतता सिद्ध कीजिए ।

2

21. विभिन्न लंबाई वाले डीएनए खंडों के मिश्रण से वैद्युत कण संचलन (इलेक्ट्रोफोरेटिक) पृथक्करण के लिए संयोजनों A, B तथा C का अध्ययन करके आगे दिए गए प्रश्नों के उत्तर दीजिए :



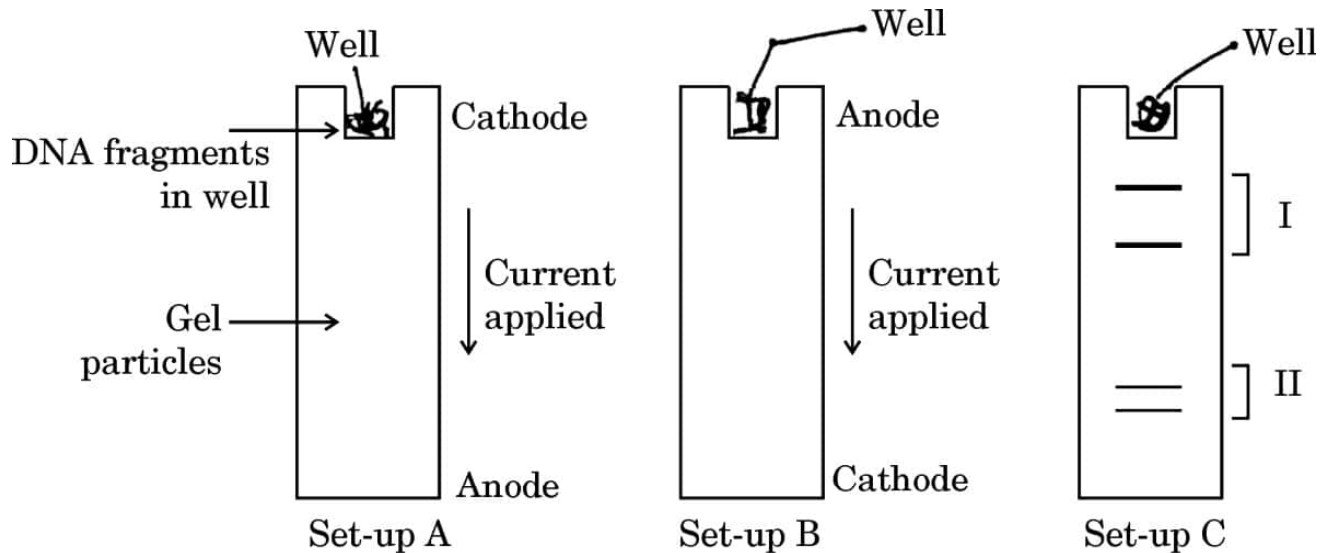
(क) दो संयोजनों A तथा B में से किसमें आप डीएनए खंडों को पृथक् हुआ देखेंगे तथा क्यों ? अपने उत्तर की न्यायसंगतता सिद्ध कीजिए ।

(ख) संयोजन-C में I तथा II में से कौन-सी पट्टी लंबे डीएनए खंडों वाली है । अपने उत्तर की न्यायसंगतता सिद्ध कीजिए ।

2



19. State the procedure followed in the technique of amniocentesis. List any two advantages of this technique. 2
20. Consider the given data of a hypothetical small portion of mRNA that codes for a functional polypeptide chain and answer the questions that follow :
- mRNA 5' – UCAUUACCACGAUUCUUUAAAAGA – 3'
- (a) How many amino acids will be formed from the given codons, if substitution of 'U' by 'C' takes place at the 5th codon ? Explain your answer.
- (b) Write the number of amino acids that would be in the polypeptide synthesised by a similar mRNA as above, where in the fourth codon instead of 'C' there is 'U'. Justify your answer. 2
21. With reference to the set-ups (A, B and C) given below, of the electrophoretic separation of a mixture of DNA fragments of varied lengths, answer the questions that follow :



- (a) In which one of the two Set-ups, A or B, would you see the DNA fragments separated and why ? Justify your answer.
- (b) In Set-up C, which one of the two, I / II, are the bands of longer fragments of DNA ? Justify your answer. 2



खण्ड ग

22. (क) मानव शुक्राणु का चित्र बनाइए तथा इसके निम्नलिखित भागों को नामांकित कीजिए :

- (i) जो शुक्राणु की गतिशीलता में सहायक है
- (ii) जो अरीय किरीट (कोरोना रेडिएटा) तथा ज़ोना पेल्सुसिडा के वेधन में सहायक है
- (iii) जो मानव अंडाणु के कोशिकाद्रव्य में प्रवेश करता है

(ख) मानव में निषेचन के दौरान बहुशुक्राणुता को कैसे अवरोधित किया जाता है ? उल्लेख कीजिए ।

3

23. (क) (i) बायोगैस संयंत्र में घरेलू वाहित मल की अपेक्षा गोबर का उपयोग करने के दो प्रमुख कारणों की सूची बनाइए ।
- (ii) बायोगैस संयंत्र में बची हुई कर्दम (स्लरी) के किसी एक उपयोग का उल्लेख कीजिए ।

3

अथवा

(ख) चिकित्सकों द्वारा सामान्यतः निम्नलिखित रोगियों के उपचार में उपयोग किए जाने वाले जैवसक्रिय अणु तथा उनके सूक्ष्मजीवीय स्रोत का नाम लिखिए :

3

- (i) मायोकार्डियल इंफार्क्शन
- (ii) रुधिर कोलेस्टेरोल का उच्च स्तर
- (iii) अंग प्रतिरोपण



SECTION C

- 22.** (a) Draw a diagram of a human sperm. Label the following parts in it :
- (i) Which helps in the motility of the sperm
 - (ii) Which helps in penetrating through the corona radiata and zona pellucida
 - (iii) Which enters into the cytoplasm of the human egg
- (b) Mention how is polyspermy prevented during the course of fertilization in humans. 3
-
- 23.** (a) (i) List two major reasons for using cow-dung in a biogas plant instead of using domestic sewage.
- (ii) Mention one use of the unspent slurry of the biogas plant. 3
- OR**
- (b) Name the bioactive molecule and its microbial source generally used by physicians to treat the patients for : 3
- (i) Myocardial infarction
 - (ii) High blood cholesterol level
 - (iii) Organ transplantation



24. मटर के पौधों के पुष्प रंग (वर्ण) बैंगनी/सफेद (V/v) तथा पुष्प की स्थिति अक्षीय/अंत्य (A/a) वाले पौधों के बीच तीन क्रॉस (संकरण) कराए गए। नीचे दी गई तालिका में 'a', 'b' तथा 'c' क्रॉस में जनक के दृश्यप्ररूप (फीनोटाइप) तथा F_1 संतति के फीनोटाइप का अध्ययन कीजिए।

| जनक पौधे (फीनोटाइप) | F_1 पीढ़ी (फीनोटाइप) |
|--|---|
| (a) बैंगनी, अक्षीय \times सफेद, अक्षीय | 6/16 सफेद, अक्षीय 2/16 सफेद, अंत्य 6/16 बैंगनी, अक्षीय 2/16 बैंगनी, अक्षीय |
| (b) बैंगनी, अक्षीय \times सफेद, अंत्य | 1/4 बैंगनी, अक्षीय 1/4 बैंगनी, अंत्य 1/4 सफेद, अक्षीय 1/4 सफेद, अंत्य |
| (c) बैंगनी, अक्षीय \times बैंगनी, अक्षीय | 3/4 बैंगनी, अक्षीय 1/4 सफेद, अक्षीय |

क्रॉस 'a', 'b' तथा 'c' के प्रत्येक क्रॉस में प्रत्येक जनक के जीनोटाइप का आकलन कीजिए (पता लगाइए)।

3

25. (क) 'एआरटी' के लाभों का उल्लेख कीजिए।

(ख) सहायक जनन प्रौद्योगिकियों की 'आईसीएसआई' तथा 'एआई' विधियों की व्याख्या कीजिए।

3



24. Three crosses were carried out in pea plants with respect to flower colour violet/white (V/v) and flower position axial/terminal (A/a). Study in the table the crosses 'a', 'b' and 'c' where parental phenotypes and their F₁ progeny phenotypes are given.

| <i>Parental plants (Phenotypes)</i> | <i>F₁ Progeny (Phenotypes)</i> |
|-------------------------------------|---|
| (a) Violet, axial × white, axial | 6/16 white, axial 2/16 white, terminal 6/16 violet, axial 2/16 violet, axial |
| (b) Violet, axial × white, terminal | 1/4 violet, axial 1/4 violet, terminal 1/4 white, axial 1/4 white, terminal |
| (c) Violet, axial × violet, axial | 3/4 violet, axial 1/4 white, axial |

Find the genotypes of each of the parental pairs of crosses 'a', 'b' and 'c'. 3

25. (a) Mention the advantages of 'ART'.
(b) Explain the 'ICSI' and 'AI' methods of assisted reproductive technologies. 3



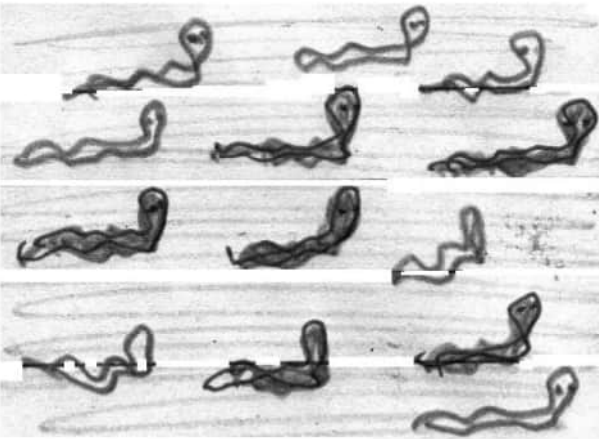
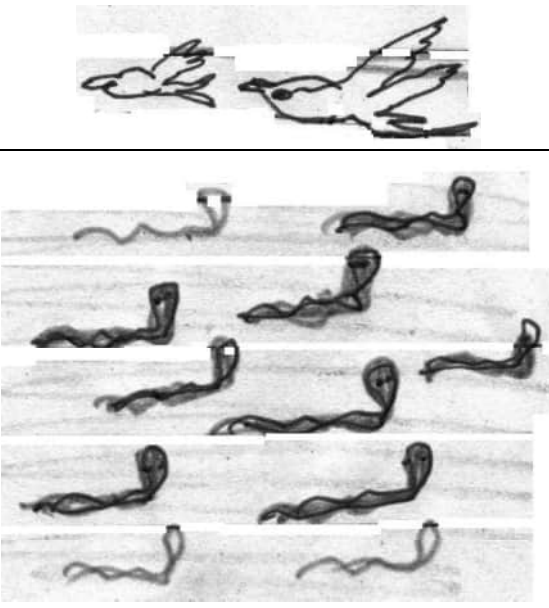
26. (क) उस जीवाणु का वैज्ञानिक नाम लिखिए जिसका उपयोग गोलक शलभ कृमि रोधी जीएम (GM) कपास फसल के पौधे तैयार करने में जैव-प्रौद्योगिकी में बड़े स्तर पर किया जाता है ।
- (ख) जीएम (GM) कपास फसल कीटों के आक्रमण का प्रतिरोध करने में किस प्रकार समर्थ होती है, व्याख्या कीजिए ।
27. मेडिटेरेनियन ऑर्किड *ऑफ्रिस* तथा मक्षिका की एक जाति के बीच सहोपकारिक (म्यूच्यूअलिस्टिक) संबंध का वर्णन कीजिए ।
28. एक भूरे रेत (मृदा) वाले मरुस्थल में रहने वाले साँपों की समष्टि में होने वाले परिवर्तन को दो समयावधियों 'एक' तथा 'दो' को निम्न चित्र द्वारा दर्शाया गया है । इनका अध्ययन कीजिए तथा उसके आगे दिए गए प्रश्नों के उत्तर दीजिए । भूरे सर्प तथा धूसर सर्प एलीलों A/a (प्रभावी/अप्रभावी) द्वारा निरूपित किए गए हैं ।

| समष्टि-एक | समष्टि-दो (पक्षियों का प्रवासन) |
|-----------|------------------------------------|
| | |

- (क) यदि समष्टि-एक में अप्रभावी विशेषक की आवृत्ति 9% है, तो समयुग्मजी प्रभावी तथा विषमयुग्मजी प्रभावी साँपों (सर्पों) की आवृत्ति का परिकलन कीजिए ।
- (ख) विकास की उस क्रियाविधि का नाम लिखिए जिसके फलस्वरूप समष्टि-एक से समष्टि-दो का विकास हुआ ।



26. (a) Give the scientific name of the bacteria widely used in biotechnology to create a GM cotton crop resistant to bollworm attacks.
- (b) Explain how GM cotton crop is able to resist insect attacks. 3
27. Describe the mutualistic relationship that exists between the Mediterranean orchid *Ophrys* and a bee species. 3
28. A population of snakes lived in a desert with brown sand. Study the drawings given below showing the change in the population from 'one' to 'two' over time and answer the question that follows. Brown snakes and Grey snakes are represented by alleles A/a (Dominant/recessive).

| Population-one | Population-two (Migration of Birds) |
|---|--|
|  |  |

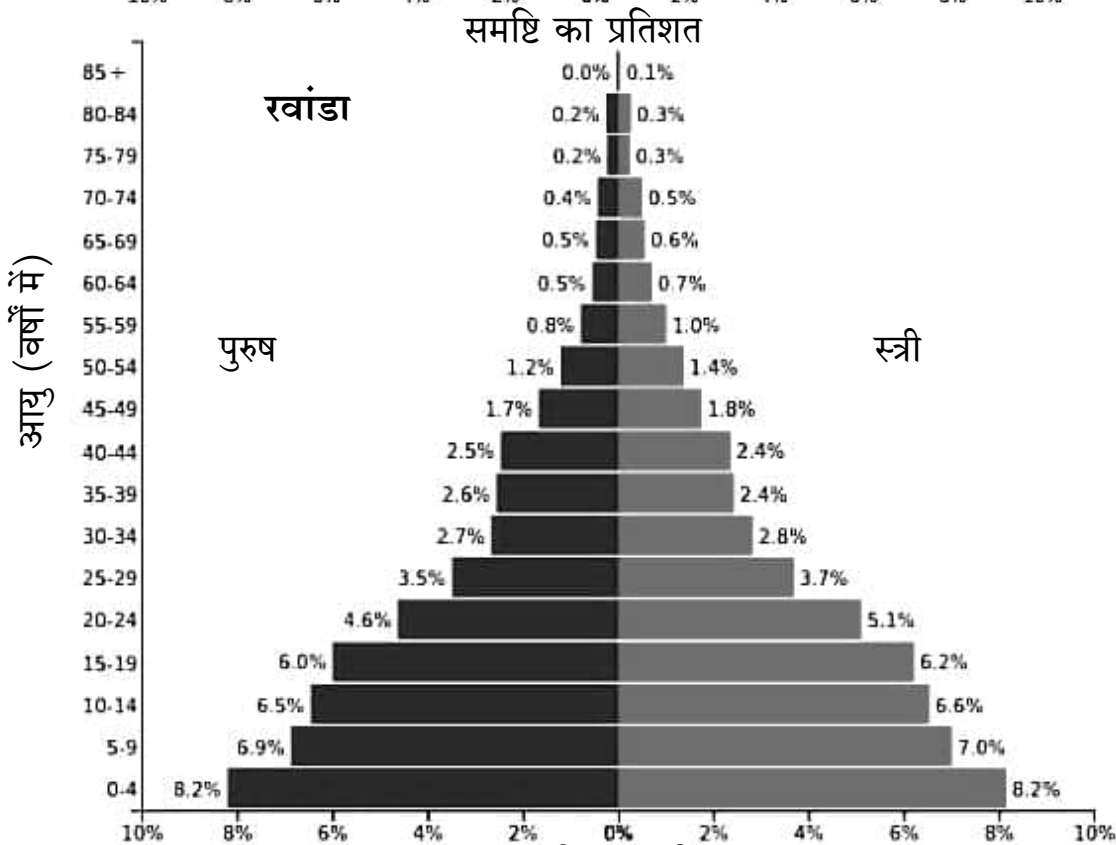
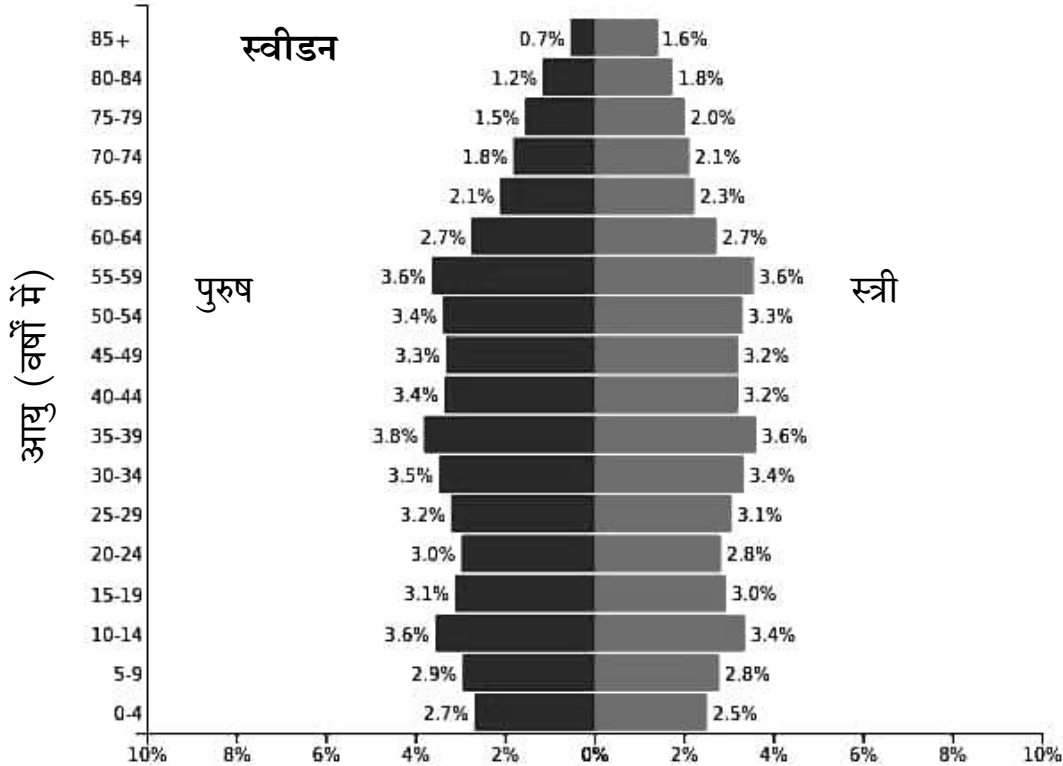
- (a) If the frequency of the recessive trait is 9% in population-one, work out the frequency of homozygous dominant and heterozygous dominant snakes.
- (b) Name the mechanism of evolution that must have operated so that population-two evolved from population-one. 3



खण्ड घ

प्रश्न संख्या 29 तथा 30 केस-आधारित प्रश्न हैं। प्रत्येक प्रश्न के 3 उप-प्रश्न हैं जिसके एक उप-प्रश्न में आंतरिक विकल्प दिया गया है।

29. नीचे दिए गए आरेखों में स्वीडन तथा रवांडा की मानव समष्टि (जनसंख्या) के तुलनात्मक आयु वितरण को दर्शाया गया है (अंतर्राष्ट्रीय डाटा बेस 2003)। इसका अध्ययन करके संबंधित निम्नलिखित प्रश्नों के उत्तर लिखिए :

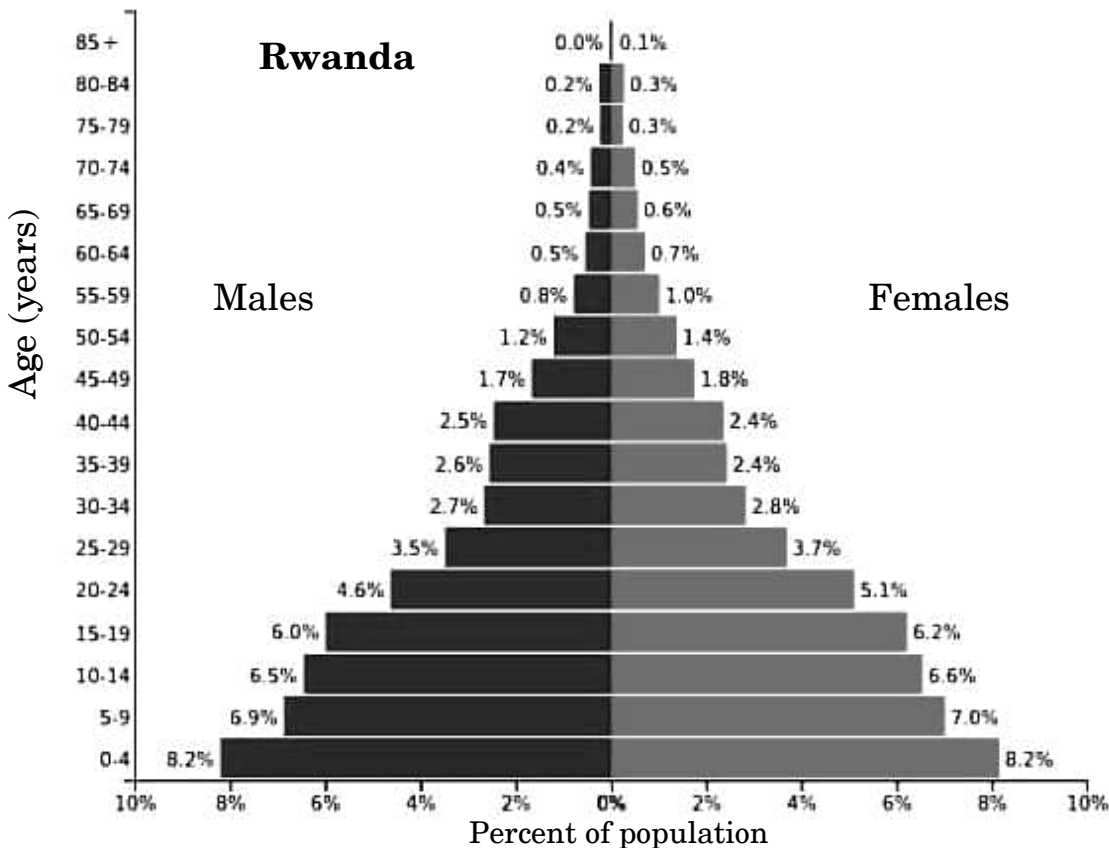
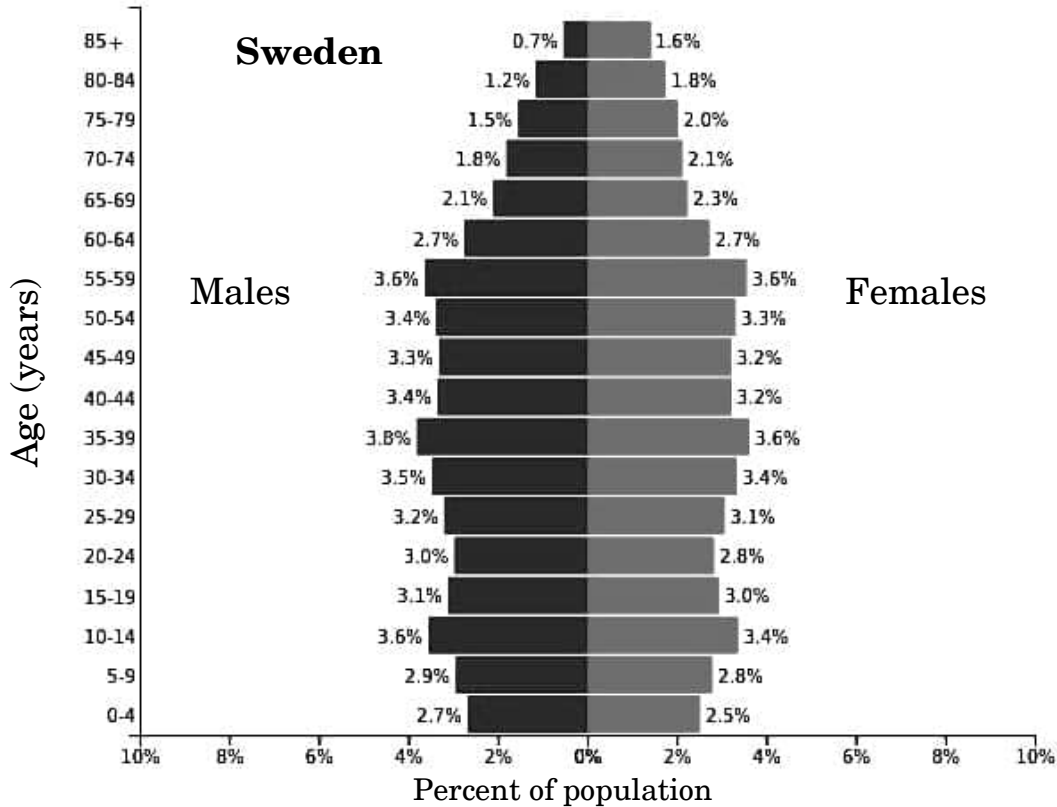




SECTION D

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

29. Study the figures given below that depict the comparative age distribution of human populations in Sweden and Rwanda. (International Data Base 2003) and answer the questions that follow :





- (क) रवांडा के वृहद् आधार वाले आयु पिरैमिड से क्या निष्कर्ष निकाला जा सकता है ?
चित्र में दिए गए आँकड़ों की सहायता से अपने उत्तर का समर्थन (पुष्टि) कीजिए । 2
- (ख) स्वीडन की जनसंख्या का आयु वितरण आधार से शीर्ष तक लगभग एक जैसा चौड़ा है । यह क्या इंगित करता है ? 1
- (ग) ऊपर दिए गए स्वीडन के जनसंख्या आयु पिरैमिड के प्रकार का नाम लिखिए । 1
- अथवा**
- (ग) उपर्युक्त दर्शाए गए रवांडा के आयु पिरैमिड का प्रकार लिखिए । 1

30. निम्नलिखित परिच्छेद को पढ़कर आगे दिए गए प्रश्नों के उत्तर दीजिए ।

पुनर्योगज डीएनए प्रौद्योगिकी में प्रतिबंधन एंजाइमों का उपयोग किया जाता है, क्योंकि वे डीएनए में विशिष्ट अनुक्रम को पहचान कर उस बिंदु पर काटते हैं । BamHI इसी प्रकार का एक प्रतिबंधन एंजाइम है, जो 5' G-G-A-T-C-C 3' के पहचान अनुक्रम से बंध कर प्रत्येक रज्जुक को G तथा G के बीच काटता है । जबकि AluI पहचान अनुक्रम 5' A-G-C-T 3' से बंध कर इन अनुक्रमों के प्रत्येक रज्जुक को G तथा C के बीच से काटता है ।

- (क) यदि दिए गए डीएनए रज्जुक को काटने के लिए AluI का उपयोग किया जाए, तो डीएनए के कितने खंड बनेंगे ? बनने वाले प्रत्येक खंड का अनुक्रम उसकी ध्रुवणता के साथ लिखिए । 1
- 5' C - C - G - T - A - G - C - T - A - T - C - A - G - C - T - G - G 3'
| | | | | | | | | | | | | | | |
3' G - G - C - A - T - C - G - A - T - A - G - T - C - G - A - C - C 5'
- (ख) दिए गए उसी डीएनए रज्जुक पर पुनर्योगज डीएनए अणु बनाने के लिए BamHI अथवा AluI प्रतिबंधन एंजाइमों में से किसको अधिमानता (प्राथमिकता) दी जाएगी और क्यों ? 1
- (ग) द्विकुण्डली डीएनए के दो रज्जुकों से बंधन के पश्चात् डीएनए के दो रज्जुकों को काटने के लिए किस विशिष्ट स्थल (बिंदु) पर प्रतिबंधन एंजाइम कार्य करेगा ? प्रतिबंधन एण्डोन्यूक्लिएज़ द्वारा डीएनए में पहचाने जाने वाले विशिष्ट न्यूक्लियोटाइड अनुक्रम का पारिभाषिक पद/वैज्ञानिक नाम लिखिए । 2

अथवा

- (ग) प्रतिबंधन एण्डोन्यूक्लिएज़ EcoRI द्वारा डीएनए पर पहचाने जाने वाले विशिष्ट पहचान अनुक्रम को लिखिए । 2



- (a) What can be inferred from the very broad base of Rwanda's age pyramid ? Support your answer with the data provided in the figure. 2
- (b) Sweden has an age distribution that is approximately of the same width near its base as at the apex. What does this indicate ? 1
- (c) Name the type of age pyramid shown above for Sweden. 1

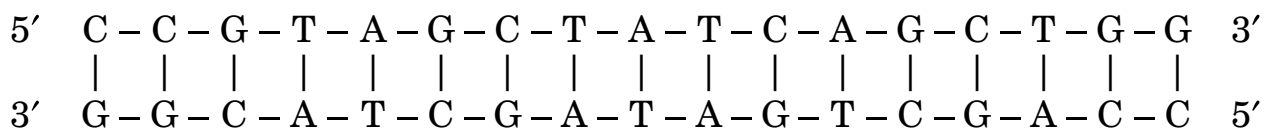
OR

- (c) Name the type of age pyramid shown above for Rwanda. 1

30. Read the passage given below and answer the questions that follow.

In recombinant DNA technology, restriction enzymes are used as they recognize and cut DNA within a specific recognition sequence. BamH I is one such restriction enzyme which binds at the recognition sequence 5' G-G-A-T-C-C 3' and cleaves this sequence between G and G on each strand, whereas Alu I binds at the recognition sequence 5' A-G-C-T 3' and cleaves these sequences between G and C on each strand.

- (a) If Alu I is used to cut the given DNA strand, how many DNA fragments would be formed ? Write the sequence of each fragment formed with its polarity. 1



- (b) Which one of the two restriction enzymes BamH I or Alu I will preferably be used on the same given DNA strand to make a recombinant DNA molecule and why ? 1
- (c) After binding to the two strands of the double helix DNA, where specifically does the restriction enzyme act to cut the two strands of DNA ? Write the specific term used for the specific nucleotide sequences of DNA recognised by a restriction endonuclease. 2

OR

- (c) Write the specific sequence of DNA segment recognised by the restriction endonuclease EcoRI. 2



खण्ड ड

31. (क) (i) प्लाज़्मोडियम के मानव शरीर में प्रविष्ट होने के बाद से संक्रमित व्यक्ति को मादा ऐनोफेलीज़ मच्छर द्वारा काटे जाने तक की अवधि में प्लाज़्मोडियम के जीवन चक्र का वर्णन कीजिए ।
- (ii) प्लाज़्मोडियम के जीवन चक्र में मादा ऐनोफेलीज़ के शरीर में सम्पन्न होने वाली दो परिघटनाओं का उल्लेख कीजिए ।

5

अथवा

- (ख) (i) सुदम अर्बुद तथा दुर्दम अर्बुद के बीच दो अंतर लिखिए ।
- (ii) कैंसर के अभिज्ञान हेतु किन्हीं तीन निदानात्मक तकनीकों की व्याख्या कीजिए ।

5

32. (क) (i) परपरागण को प्रोत्साहित करने हेतु पुष्पी पौधों द्वारा विकसित किन्हीं चार युक्तियों की व्याख्या कीजिए ।
- (ii) पौधे स्वपरागण को हतोत्साहित क्यों करते हैं ? कोई एक कारण लिखिए ।

5

अथवा

- (ख) एक सामान्य मानव स्त्री के आर्तव चक्र की अंडाशयी तथा गर्भाशयी प्रावस्थाओं की व्याख्या पीयूष तथा अंडाशयी हॉर्मोनों की भूमिका के साथ निम्नलिखित प्रावस्थाओं के अंतर्गत कीजिए :

5

- (i) पुटकीय प्रावस्था/प्रचुरोद्भव प्रावस्था
- (ii) स्रावी प्रावस्था
- (iii) आर्तव प्रावस्था

33. (क) “विषमयुग्मजी अवस्था में दोनों एलीलों के प्रभाव की स्पष्ट अभिव्यक्ति सहप्रभाविता (कोडोमिनेंस) में परिलक्षित होती है ।” मानव रुधिर वर्ग ABO की वंशागति की सहायता से कथन की व्याख्या कीजिए ।

5

अथवा



SECTION E

31. (a) (i) Describe the life cycle of *Plasmodium* from the time it enters the human body till a female *Anopheles* mosquito bites an infected person.
- (ii) Mention the two events of *Plasmodium* life cycle that occur within the female *Anopheles* body. 5

OR

- (b) (i) Write two differences between malignant tumor and benign tumor.
- (ii) Explain any three diagnostic techniques for the detection of cancer. 5

32. (a) (i) Explain any four devices that flowering plants have developed to encourage cross-pollination.
- (ii) Why do plants discourage self-pollination ? State any one reason. 5

OR

- (b) Explain the ovarian and uterine events taking place along with the role of pituitary and ovarian hormones, during menstrual cycle in a normal human female under the following phases : 5
- (i) Follicular phase/proliferative phase
- (ii) Luteal phase/secretory phase
- (iii) Menstrual phase

33. (a) "The influence of both the alleles in a heterozygous state is clearly expressed in codominance." Explain with the help of inheritance of ABO blood group in humans. 5

OR



(ख) “लैक प्रचालेक (लैक-ओपेरॉन) में जीनों के एक समूह का नियमन तथा अभिव्यक्ति एक साथ एक इकाई के रूप में होता है।”

(i) लैक ओपेरॉन में संरचनात्मक जीनों की सक्रियता के ‘आरंभन (स्विचिंग ऑन)’ की कार्यविधि (प्रणाली) की व्याख्या कीजिए।

(ii) “‘लैक प्रचालेक’ के नियमन को ऋणात्मक नियमन कहा जाता है।” कारण का उल्लेख करते हुए कथन की न्यायसंगतता (औचित्य) सिद्ध कीजिए।

5



- (b) “A group of genes are regulated and expressed together as a unit in *lac* operon.”
- (i) Explain the mechanism of switching ‘on’ of the structural genes of *lac* operon.
- (ii) “Regulation of ‘*lac* operon’ is referred to be negatively regulated.” Justify giving a reason.

5



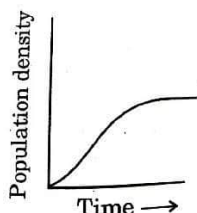
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Senior Secondary School Certificate Examination, 2024
SUBJECT NAME BIOLOGY (Q.P. CODE 57/3/2)

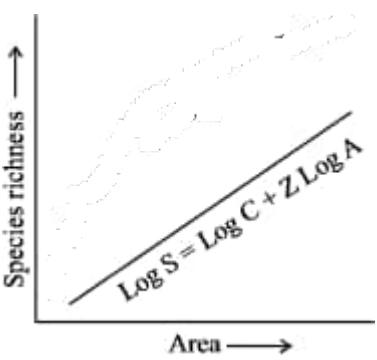
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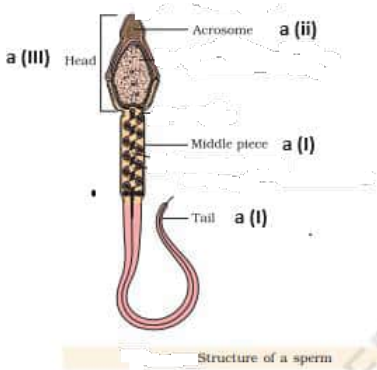
| | |
|----------|--|
| 1 | You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. |
| 2 | “Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its’ leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc may invite action under various rules of the Board and IPC.” |
| 3 | Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one’s own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-XII, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded. |
| 4 | The Marking scheme carries only suggested value points for the answers These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly. |
| 5 | The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators. |
| 6 | Evaluators will mark(✓) wherever answer is correct. For wrong answer CROSS ‘X’ be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. This is most common mistake which evaluators are committing. |
| 7 | If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly. |
| 8 | If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly. |
| 9 | If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note “Extra Question” . |

| | |
|----|---|
| 10 | No marks to be deducted for the cumulative effect of an error. It should be penalized only once. |
| 11 | A full scale of marks_____ (example 0 to 70 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it. |
| 12 | Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper. |
| 13 | <p>Ensure that you do not make the following common types of errors committed by the Examiner in the past:-</p> <ul style="list-style-type: none"> • Leaving answer or part thereof unassessed in an answer book. • Giving more marks for an answer than assigned to it. • Wrong totaling of marks awarded on an answer. • Wrong transfer of marks from the inside pages of the answer book to the title page. • Wrong question wise totaling on the title page. • Wrong totaling of marks of the two columns on the title page. • Wrong grand total. • Marks in words and figures not tallying/not same. • Wrong transfer of marks from the answer book to online award list. • Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) • Half or a part of answer marked correct and the rest as wrong, but no marks awarded. |
| 14 | While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks. |
| 15 | Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously. |
| 16 | The Examiners should acquaint themselves with the guidelines given in the “ Guidelines for Spot Evaluation ” before starting the actual evaluation. |
| 17 | Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words. |
| 18 | The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme. |

MARKING SCHEME
Senior Secondary School Examination, 2024
BIOLOGY (Subject Code-044)
[Paper Code: 57/3/2]

| | | | |
|--------------------|--|------------------------|---|
| 1. | (B)/ $2n, n$ | 1 | 1 |
| 2. | (D)/ 2020 | 1 | 1 |
| 3. | (A)/ Asteraceae | 1 | 1 |
| 4. | (B)/ Killed yeast | 1 | 1 |
| 5. | (A)/ Less in number | 1 | 1 |
| 6. | (D)/ 25% Red : 50% Pink : 25% white | 1 | 1 |
| 7. | (B)/ Turner's syndrome | 1 | 1 |
| 8. | (B)/ <div style="text-align: center;"> $\begin{array}{c} 5' \text{-----} 3' \\ \quad \quad \quad \text{III} \\ 5' \quad 3' \quad \quad 3' \quad 5' \\ 3' \text{---II---} 5' \end{array}$ </div> | 1 | 1 |
| 9. | (D)/ Pneumonia | 1 | 1 |
| 10. | (C)/ Hybrid : Heavy, 1 : 31 | 1 | 1 |
| 11. | (C)/ <i>Escherichia. coli</i> | 1 | 1 |
| 12. | (C) / <div style="text-align: center;">  </div> | 1 | 1 |
| 13. | (D) / Assertion (A) is false, but Reason (R) is true. | 1 | 1 |
| 14. | (A) / Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). | 1 | 1 |
| 15. | (C)/ Assertion (A) is true, but Reason (R) is false | 1 | 1 |
| 16. | (B) / Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A) | 1 | 1 |
| SECTION – B | | | |
| 17. | (a) Humus – Dark coloured, amorphous, highly resistant to microbial activities, undergoes decomposition at slow rate, colloidal, reservoir of nutrients. (Any four features) OR | $\frac{1}{2} \times 4$ | |

| | | | | |
|-----|--|------------------------|--|---|
| | <p>(b)</p> <p>(i)</p>  <p>(ii) $\log S = \log C + Z \log A$</p> | 1 | | |
| | | 1 | | 2 |
| 18 | <ul style="list-style-type: none"> Vaccine is a preparation of antigenic proteins of pathogen or inactivated/weakened pathogen. It is based on the property of memory of immune system, the antibodies produced in the body in response to these antigens would neutralize the pathogenic agents and body will show amnestic or quick response | 1 | | |
| | | $\frac{1}{2} \times 2$ | | 2 |
| 19. | <ul style="list-style-type: none"> Procedure in amniocentesis some of the amniotic fluid of the developing foetus is take to analyze the Foetal cells and dissolved substances Advantages <ul style="list-style-type: none"> to detect genetic disorders such as sickle cell anemia, Down syndrome, haemophilic etc. to determine the survivability of the foetus | 1 | | |
| | | $\frac{1}{2} \times 2$ | | 2 |
| 20. | <p>(a) 8 amino acids, genetic code is read in triplets and there is no change in the number of triplets/ no change in reading frame.</p> <p>(b) 3 amino acids, the 4th codon now reads as UGA – a stop codon</p> | $\frac{1}{2} \times 2$ | | |
| | | $\frac{1}{2} \times 2$ | | 2 |
| 21. | <p>(a) - Set up A,</p> <ul style="list-style-type: none"> DNA fragments being negatively charged move towards the anode on applying the electric field <p>(b) - I</p> <ul style="list-style-type: none"> Smaller fragments will move faster as compared to longer fragments of DNA/ longer fragments will move slower as compared to smaller fragments of DNA | $\frac{1}{2}$ | | |
| | | $\frac{1}{2}$ | | |
| | | $\frac{1}{2}$ | | |
| | | $\frac{1}{2}$ | | 2 |

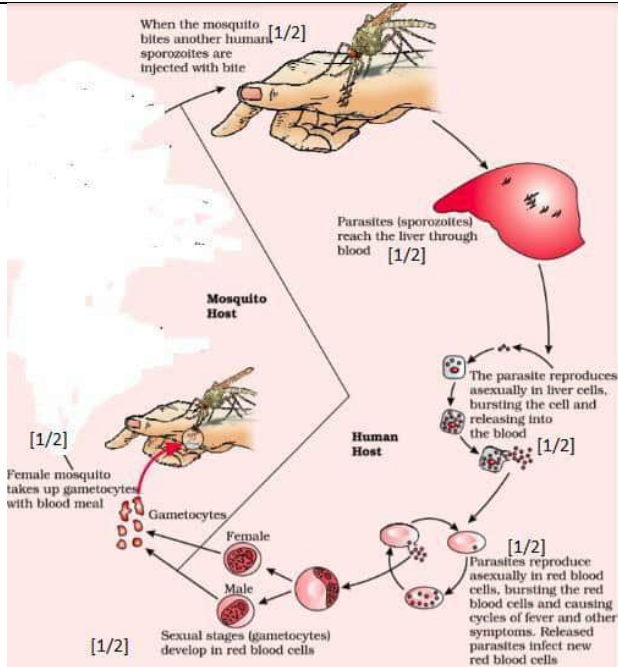
| | SECTION – C | | | | | | | | | | | | | | | | | | |
|-------|---|---|-------------------------------|--------------------|------------------|-----|-----------------------|---------------|----------------------|------|------------------------------|---------|----------------------------|-------|-----------------------|---------------|-------------------------------|--|---|
| 22. | <p>(a) (i) Middle piece + tail (ii) Acrosome (iii) Head</p>  <p>(b) Sperm coming in contact with the zona pellucida layer of ovum and induces changes in the membrane, that block the entry of additional sperm thus, ensures that only one sperm fertilizes the ovum.</p> | <p>$\frac{1}{2} \times 3$</p> <p>$\frac{1}{2} \times 3$</p> | 3 | | | | | | | | | | | | | | | | |
| 23. | <p>(a)</p> <p>(i) -Cow dung has methanogens or <i>Methanobacterium</i> -Cow dung is rich in cellulosic material -Bacteria grows anaerobically on cellulosic material to produce large amount of methane. (Any two points)</p> <p>(ii) Used as manure/ fertilizer (Organic)</p> <p style="text-align: center;">OR</p> <table border="1"> <thead> <tr> <th></th><th></th><th>Bioactive molecule</th><th>Microbial source</th></tr> </thead> <tbody> <tr> <td>(i)</td><td>Myocardial infarction</td><td>Streptokinase</td><td><i>Streptococcus</i></td></tr> <tr> <td>(ii)</td><td>High blood cholesterol level</td><td>Statins</td><td><i>Monoascus purpureus</i></td></tr> <tr> <td>(iii)</td><td>Organ transplantation</td><td>Cyclosporin A</td><td><i>Trichoderma polysporum</i></td></tr> </tbody> </table> | | | Bioactive molecule | Microbial source | (i) | Myocardial infarction | Streptokinase | <i>Streptococcus</i> | (ii) | High blood cholesterol level | Statins | <i>Monoascus purpureus</i> | (iii) | Organ transplantation | Cyclosporin A | <i>Trichoderma polysporum</i> | <p>1 x 2</p> <p>1</p> <p>$\frac{1}{2} \times 2$</p> <p>$\frac{1}{2} \times 2$</p> <p>$\frac{1}{2} \times 2$</p> | 3 |
| | | Bioactive molecule | Microbial source | | | | | | | | | | | | | | | | |
| (i) | Myocardial infarction | Streptokinase | <i>Streptococcus</i> | | | | | | | | | | | | | | | | |
| (ii) | High blood cholesterol level | Statins | <i>Monoascus purpureus</i> | | | | | | | | | | | | | | | | |
| (iii) | Organ transplantation | Cyclosporin A | <i>Trichoderma polysporum</i> | | | | | | | | | | | | | | | | |
| 24. | <p>(a) 1 mark is to be awarded if attempted</p> <p>(b) Violet, axial × White, terminal Parents are heterozygous dominant × homozygous recessive. $VvAa \times vvaa$</p> | <p>1</p> <p>1</p> | | | | | | | | | | | | | | | | | |

| | | | |
|-----|---|---|---|
| | (c) Violet, axial \times Violet, axial heterozygous for flower colour and homozygous dominant for flower position $VvAA \times VvAA$ | 1 | 3 |
| 25. | (a) ART could help infertile couples assisted to have children. (b) - ICSI (Intra Cytoplasmic Sperm Injection), A sperm is directly injected into the ovum. - AI – (Artificial insemination), Semen collected from the husband or a healthy donor is artificially introduced into the Vagina or the uterus of the female (IUI) | 1 $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ | 3 |
| 26. | (a) <i>Bacillus thuringiensis</i> (b) GM cotton crop contains Bt toxin protein which exists as inactive protoxins, but once bollworm ingest the inactive toxin it is converted into an active form due to the alkaline pH of the gut of the worm, which solubilizes the crystals of the prototoxin, activated toxin binds to the surface of the midgut epithelial cells of the worm and creates pores that cause swelling and lysis and death of the insect caterpillar. | 1 $\frac{1}{2} \times 4$ | 3 |
| 27. | -Ophrys employs 'sexual deceit' to get the pollination done as one petal of its flower bears an uncanny resemblance to the female bee in size colour and markings -The male bee is attracted as it perceives it as female and 'pseudocopulates' with the flower and during that process gets dusted with pollen from that flower. -When the same bee 'pseudocopulates' with another flower it transfers the pollen to it and thus pollinates the flower | 1 x 3 | 3 |
| 28. | (a) Hardy – Weinberg Equilibrium. $P^2 + 2pq + q^2 = 1$ $AA + 2Aa + aa = 1$ | | |

| | | | |
|-----|---|--|---|
| | <p>Since Frequency of grey snakes in the population = $9\% = \frac{9}{100} = .09$</p> <p>$q^2 = .09$</p> <p>$q = 0.3$</p> <p>Since $p + q = 1$</p> <p>$p = 1 - q$</p> <p>$p = 1 - 0.3$</p> <p>$p = 0.7$</p> <p>The frequency of homozygous dominant (AA) is equal to $P^2 = 0.49$</p> <p>Or the % frequency of homozygous dominant = 49%</p> <p>The frequency of heterozygous dominant (Aa) is equal to</p> <p>$2pq = 2 \times 0.7 \times 0.3 = 0.4$ Or % frequency of Aa = 42%</p> <p>(b) Natural selection</p> | <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> | 3 |
| | SECTION - D | | |
| 29. | <p>(a) - Rwanda – very broad base of Rwanda's age distribution indicates a rapidly growing population/ population explosion/ Increasing population/ expanding population ,</p> <p>- Because large number of individuals are in pre-reproduction age group.</p> <p>(b) It indicates that number of individuals in pre-reproductive and post-reproductive age groups are same.</p> <p>(c) Declining age pyramid.</p> <p>OR</p> <p>(c) Expanding age pyramid.</p> | <p>1+1</p> <p>1</p> <p>1</p> <p>1</p> | 4 |

| | | | | |
|-----|--|-------|-----|--|
| 30. | <p>(a)</p> <ul style="list-style-type: none">• 3/Three fragments• | <hr/> | 1/2 | |
|-----|--|-------|-----|--|

| | | | |
|-----|--|--|---|
| | <p> $\begin{array}{c} \text{5' - C - C - G - T - A - G 3' } \quad 3' \\ \quad \quad \quad \quad \quad \\ \text{3' G - G - C - A - T - C} \end{array}$ </p> <p> $\begin{array}{c} \text{5' - C - T - A - T - C - A - G 3' } \quad \text{G 3' } \\ \quad \quad \quad \quad \quad \quad \\ \text{3' - G - A - T - A - G - T - C 5' } \quad \text{- C 5' } \end{array}$ </p> <p> $\begin{array}{c} \text{5' C - T - G - G - 3' } \\ \quad \quad \quad \\ \text{3' G - A - C - C - 5' } \end{array}$ </p> <p>(b)</p> <ul style="list-style-type: none"> Alu I , Alu I site is present in the given sequence and BamH I site is not given. <p>(c)</p> <ul style="list-style-type: none"> Sugar phosphate backbone Palindrome sequence / recognition site/ restriction site <p>OR</p> <p>(c) 5' G-A-A-T-T-C 3' 3' C-T-T-A-A-G 5'</p> <p>(Note : 1 mark for polarity and 1 mark for correct sequence)</p> | <p>1/2</p> <p>1/2+ 1/2</p> <p>1 1</p> <p>2</p> | 4 |
| | SECTION - E | | |
| 31. | <p>(a) (i) Life cycle of the Plasmodium from the period it enters the human body till a female <i>Anopheles</i> mosquito bites an infected person.</p> <p>-Plasmodium enters the human body as sporozoites (through the bite of infected <i>Anopheles</i> mosquito)</p> <p>-The plasmodium reproduces asexually in the liver cells initially;</p> <p>-And then on releasing it in blood to attack the Red Blood cells (RBCs)</p> <p>-Parasite (plasmodium) reproduces asexually in Red Blood cells (RBCs)</p> <p>-Resulting in rupture/ bursting of the RBCs</p> <p>-Several sexual stages (gametocytes) develop in RBCs</p> <p>-Female <i>Anopheles</i> mosquito takes up gametocytes with blood meal.</p> <p>/</p> | 1/2 x 6 | |



1/2 x 6

- (ii) - Fertilization of male and female gametocytes,
 -production of sporozoites,
 -migration of sporozoites into salivary glands of mosquito

(Any two)

1+ 1

OR

(b) (i)

| | |
|--|--|
| | |
| | |

1 +1

(Any two corresponding differentiation points)

Malignant cancer

- 1) Mass proliferating cells called neoplastic or tumor cells grows rapidly.
- 2) It spreads to other parts of the body or causes metastasis.
- 3) Invading and damaging the normal tissues

Benign Cancer

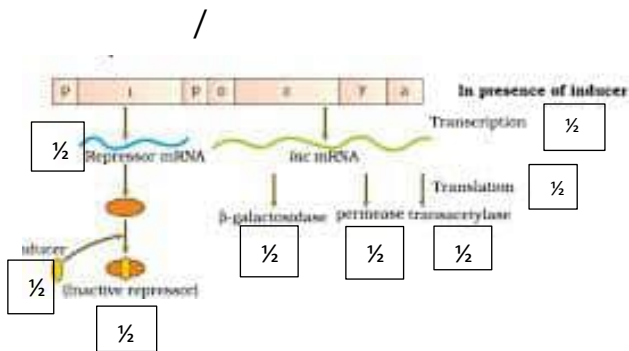
- 1) Tumor cells grows slowly.
- 2) It is confined to their original location, or causes no metastasis
- 3) Causes little damage in the tissue

| | | | |
|--|--|-------|---|
| | <p>(ii)</p> <ul style="list-style-type: none"> - Biopsy and/histopathological studies- a piece of suspected tissue or blood or bone marrow cut into thin section is stained and examined by pathologist. - Radiography- use of X-rays, CT -Computed tomography to generate 3-dimensional image of the internal organs by using X-rays. -MRI- uses strong magnetic field and non ionising radiations to accurately detect pathological and physiological changes in the living tissue. -Antibodies against specific antigens are used for detection of certain cancer. - Technique of Molecular Biology applied to detect genes in an individual with inherited susceptibility to certain cancer. <p style="text-align: right;">(Any three techniques)</p> | 1+1+1 | 5 |
|--|--|-------|---|

| 32. | <p>(a) (i) - Pollen release and stigma receptivity are not synchronized/ Either the pollen is released before the stigma becomes receptive or stigma becomes receptive much before the release of pollen.</p> <ul style="list-style-type: none"> - Anther and the stigma are placed at different positions so that pollen cannot come in contact with the stigma of the same flower. - Self-incompatibility/genetic mechanism/prevention of self- pollen from fertilizing the ovules by inhibiting pollen germination or pollen tube growth in the pistil. - Production of unisexual flower. <p>(ii) To prevent inbreeding depression/ to have more variations for better adaptation.</p> <p style="text-align: center;">OR</p> <p>(b) Menstrual cycle in a normal human female</p> | 1x4 | | | | | | | | | | | | | |
|------|---|--|--|---------------|---------------|-----|--|--|--|------|----------------------------------|---|---|--|--|
| | | 1 | | | | | | | | | | | | | |
| | | 1+1 | | | | | | | | | | | | | |
| | | 1+1 | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th></th><th></th><th>Uterine event</th><th>Ovarian event</th></tr> </thead> <tbody> <tr> <td>(i)</td><td>Proliferative phase/ Follicular phase</td><td>Endometrium of the uterus regenerates through proliferation under the influence of estrogen follicles.</td><td>Primary follicles in the ovary grow to become Graafian follicles under FSH. (Secretion of estrogens by the growing follicles).</td></tr> <tr> <td>(ii)</td><td>Luteal phase/ Secretory phase</td><td>Maintenance of the endometrium (thickness) in the presence of progesterone.</td><td>Ruptured Graafian follicle transforms into corpus luteum. (secretes large</td></tr> </tbody> </table> | | | Uterine event | Ovarian event | (i) | Proliferative phase/ Follicular phase | Endometrium of the uterus regenerates through proliferation under the influence of estrogen follicles. | Primary follicles in the ovary grow to become Graafian follicles under FSH. (Secretion of estrogens by the growing follicles). | (ii) | Luteal phase/ Secretory phase | Maintenance of the endometrium (thickness) in the presence of progesterone. | Ruptured Graafian follicle transforms into corpus luteum. (secretes large | | |
| | | Uterine event | Ovarian event | | | | | | | | | | | | |
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| | | | | | | | | |
|-----|---|-------|-----------------|---|---|--|-----------------------------|------------------------|
| | | | | | amounts of progesterone). | | | |
| | | (iii) | Menstrual phase | Breakdown of the endometrium lining of the uterus in the absences of progesterone from Corpus luteum. | Primary follicles start maturing and developing in the ovary under the effect of FSH. | | $\frac{1}{2} + \frac{1}{2}$ | 5 |
| 33. | <p>(a)</p> <ul style="list-style-type: none"> - The plasma membrane of the red blood cell has sugar polymers that protrude from its surface and the kind of sugar is controlled by the gene I present in blood. - The gene (I) has three alleles I^A I^B and i - The alleles I^A and I^B produce a slightly different form of the sugar. - I^A and I^B are completely dominant over i - When I^A and I^B are present as in AB blood group they both express their own type of sugars and show codominance. <p>(Note: Marks to be awarded if the above points are represented in the form of a table or cross)</p> <p style="text-align: center;">OR</p> <p>(b)</p> <p>(i) Switching 'on' of the lac operon</p> <ul style="list-style-type: none"> -The lac operon consists of one regulatory gene and three structural genes (z, y and a) -The i gene codes for the repressor of the lac operon -The Z gene codes for beta – galactosidase (β – gal) <p>(β galactosidase is responsible for hydrolysis of (disaccharide) lactose into galactose and glucose)</p> <ul style="list-style-type: none"> -y gene codes for permease (which increases the permeability of the cell to β-galactosides/lactose) -The repressor protein binds to the operator region and prevents RNA polymerase from transcribing the operon | | | | | | 1 x 5 | $\frac{1}{2} \times 8$ |

- Lactose is the inducer and regulates switching on and off of the operon
- In the presence of inducer, lactose or allolactose, the repressor is inactivated by interaction with the inducer
- This allows RNA polymerase to access the promoter and transcription proceeds



(ii) Repressor binds to the operator to inhibit gene expression therefore it is referred to be negatively regulated.

1/2x8

1

5