

Series : AABB4/3



SET-2

प्रश्न-पत्र कोड 57/3/2
Q.P. Code

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.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 12 हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 13 प्रश्न हैं ।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
- Please check that this question paper contains 12 printed pages.
- 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 check that this question paper contains 13 questions.
- **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 candidates will read the question paper only and will not write any answer on the answer-book during this period. *

जीव विज्ञान (सैद्धान्तिक) BIOLOGY (Theory)

निर्धारित समय : 2 घण्टे

Time allowed : 2 hours

अधिकतम अंक : 35

Maximum Marks : 35

57/3/2

281B

1

P.T.O.

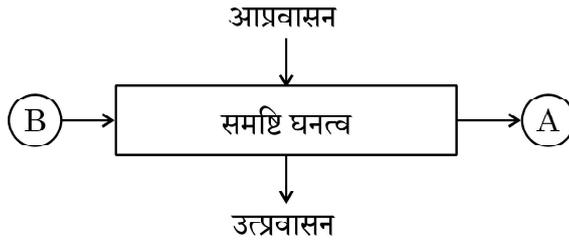
सामान्य निर्देश :

- (i) इस प्रश्न-पत्र में 13 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं।
- (ii) प्रश्न-पत्र में तीन खंड हैं – खंड अ, ब और स हैं।
- (iii) खंड - अ में 6 प्रश्न हैं, प्रत्येक प्रश्न के 2 अंक हैं। खंड - ब में 6 प्रश्न हैं, जिसमें प्रत्येक प्रश्न के 3 अंक हैं तथा खंड - स में एक प्रकरण आधारित प्रश्न है जिसका मान 5 अंक है।
- (iv) सामान्यतः कोई विकल्प नहीं है। परन्तु कुछ प्रश्नों में अंतर्निहित विकल्प दिए गए हैं। ऐसे प्रश्नों में विद्यार्थी को केवल एक विकल्प का ही उत्तर लिखना है।
- (v) जहाँ आवश्यक हो, वहाँ स्वच्छ, आनुपातिक तथा नामांकित चित्र बनाइए।

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खण्ड - अ

1. (क)



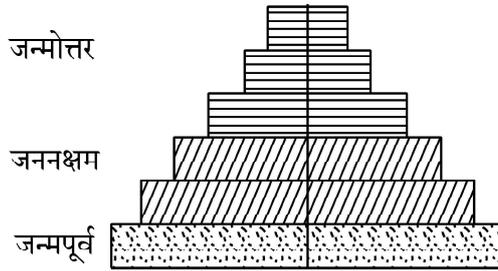
ऊपर दिए गए योजनात्मक प्रतिदर्श के आरेख का प्रेक्षण कीजिए तथा निम्नलिखित प्रश्नों के उत्तर लिखिए :

- (i) 'A' तथा 'B' को पहचानिए।
- (ii) दही के एक नमूने में जीवाणु समष्टि वृद्धि दर का परिकलन कीजिए जिसमें एक घण्टे की समयावधि में 1 मिलियन जीवाणु वृद्धि करके 2 मिलियन हो जाते हैं।

2

अथवा

(ख)



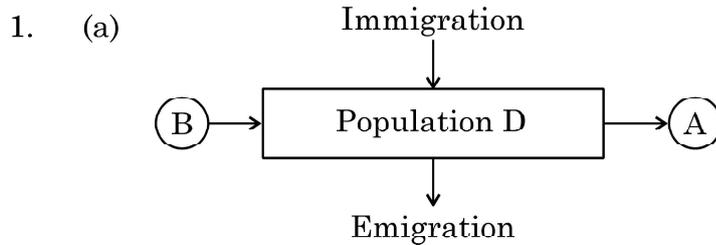
ऊपर दिए गए पिरैमिड को पहचानिए। आपने जिस आधार पर इसकी पहचान की है उस विशिष्ट लक्षण को लिखिए।



General Instructions :

- (i) This question paper contains **13** questions. **All** questions are compulsory.
- (ii) The question paper has **three** sections – Section **A**, **B** and **C**.
- (iii) **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.
- (iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt **only one** of the alternatives in such questions.
- (v) Wherever necessary, neat and properly labelled diagrams should be drawn.

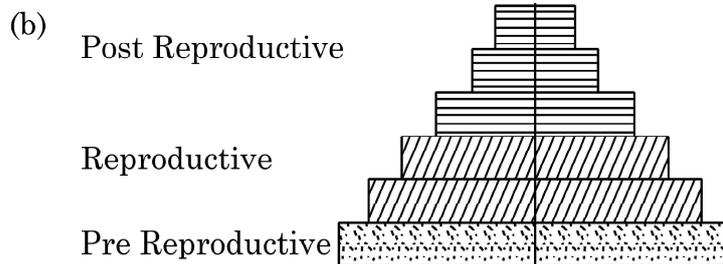
SECTION – A



Observe the schematic representation given above and answer the following questions :

- (i) Identify A and B.
- (ii) Calculate the growth rate of bacteria in a curd sample, where 1 million bacteria increased to two million, within a period of one hour. **2**

OR



Identify the type of pyramid given above. Write the identifying feature on the basis of which you identified it.



2. एक लड़का बाहर से फुटबॉल खेलकर आने के फौरन बाद जब सीधे ही वायु अनुकूलित (एयर कंडीशन्ड) कमरे में प्रविष्ट हुआ तो उसे ऐलर्जी के लक्षण उत्पन्न हो गए। ऐसी परिस्थिति में प्रेक्षित होने वाले कोई दो अभिलक्षण लिखिए। ऐसी परिस्थितियों से हमारा शरीर किस प्रकार संघर्ष करता है ? 2

3. (क) (i) उस पौधे का वैज्ञानिक नाम लिखिए जिससे प्राकृतिक कैनेबिनाइड्स प्राप्त किए जाते हैं।
(ii) ड्रग को प्राप्त करने के लिए पौधे के जिन भागों का उपयोग किया जाता है उनके नाम लिखिए।
(iii) यह ड्रग मानव शरीर को किस प्रकार प्रभावित करती है ? 2

अथवा

(ख) मानव आंत्र के उपकला आस्तरों (लाइनिंग) को द्वितीयक लसीकाभ अंग माना जाता है। कथन की न्यायसंगतता सिद्ध कीजिए।

4. फ्लॉक्स क्या हैं ? वाहितमल के जैविक उपचार में उनकी भूमिका लिखिए। 2

5. जैवविविधता के संरक्षण की 'स्व-स्थाने (इन-सिटू)' तथा 'बाह्य-स्थाने (एक्स-सिटू)' संरक्षण के तरीके एक-दूसरे से किस प्रकार भिन्न हैं ? 2

6. मिट्टी की उर्वरता सुधारने के उद्देश्य से किसानों को प्रायः निम्नलिखित सूक्ष्मजीवों को खेत में डालने की सलाह दी जाती है। व्याख्या कीजिए।

(i) राइजोबियम

(ii) ऐनाबीना 2



2. A boy developed some allergic reactions when he straight entered into his air conditioned room after a game of football outside his house. Write any two symptoms that could be noticed in such condition. How does our body combat such conditions ? 2

3. (a) (i) Write the Scientific name of the plant from where natural cannabinoids are obtained.

(ii) Mention the parts of the plant that are used for extracting the drug.

(iii) How does the drug affect human body ? 2

OR

(b) Epithelial lining of our intestine is considered as secondary lymphoid organ. Justify the statement.

4. What are flocs ? State their role in biological treatment of sewage. 2

5. How are '*in-situ*' and '*ex-situ*' approaches of biodiversity conservations different from each other ? 2

6. Farmers are often suggested to use the following organisms in their crop land so as to improve the soil fertility.

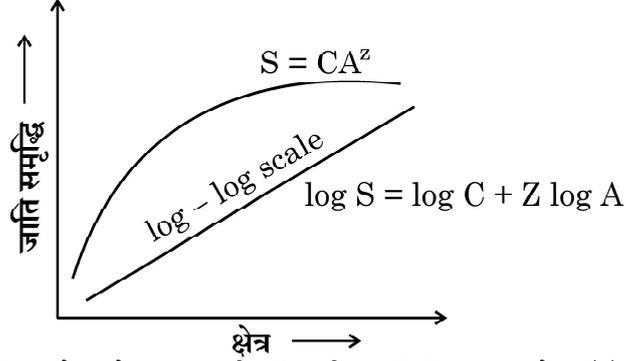
(i) *Rhizobium* (ii) *Anabaena*

Explain. 2



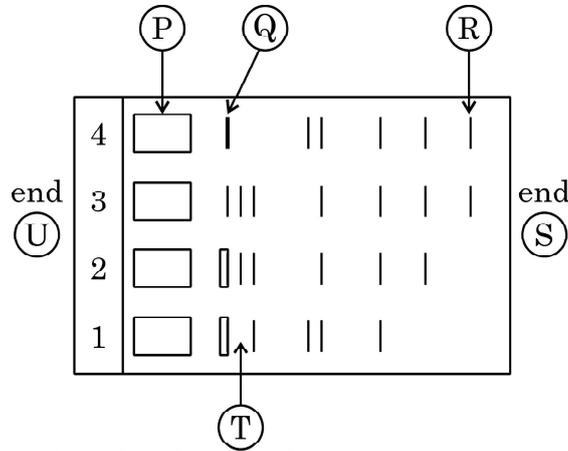
खण्ड - ब

7. "आनुवंशिक अभियांत्रिकी में पुनर्योगज डी.एन.ए. के निर्माण में प्रतिबंधन एंडोन्यूक्लीएज का उपयोग किया जाता है।" केवल योजनात्मक प्रवाह चार्ट द्वारा इसके विभिन्न चरणों की व्याख्या कीजिए। 3
8. (क) एलेक्जेंडर वॉन हम्बोल्ट के द्वारा किए गए दक्षिणी अमेरीका के गहन अन्वेषण के आधार पर उनके द्वारा निष्पादित निष्कर्ष लिखिए।
 (ख) नीचे दिए गए ग्राफ का अध्ययन कीजिए :



एलेक्जेंडर वॉन हम्बोल्ट के अनुसार किसी जाति (स्पीशीज) तथा क्षेत्र संबंध के संदर्भ में ग्राफ में उपयोग किए गए संकेत S, A, Z तथा C क्या बताते हैं ? 3

9. (क) नीचे दिए आरेख द्वारा जैव वैद्युत के संचलन (इलेक्ट्रोफोरेसिस) प्रक्रम को योजनाबद्ध चरणों द्वारा निरूपित किया गया है। 3



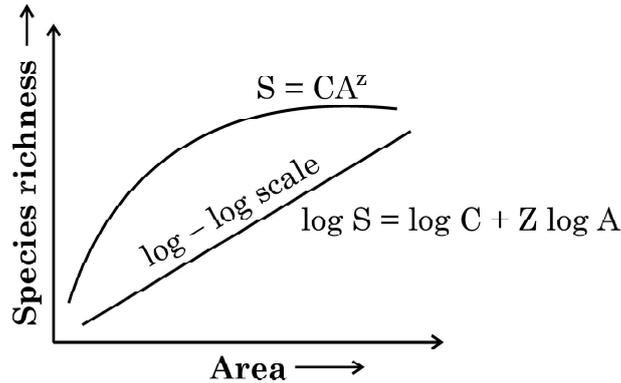
निम्नलिखित को निर्दिष्ट करने वाले अक्षरों को पहचानिए :

- (i) ऐनोड सिरा
 (ii) मैट्रिक्स (आधात्री) में सबसे छोटे/हल्के डी.एन.ए खंड
 (iii) ऐगारोज जेल
 (ख) क्षालन (एल्यूशन) क्या है ? इस प्रक्रम में क्षालन (एल्यूशन) का महत्त्व लिखिए।



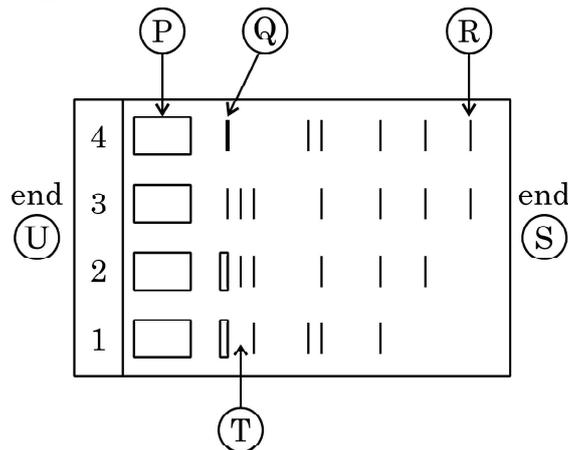
SECTION - B

7. Restriction endonucleases are used in genetic engineering to form recombinant DNA. Explain only with the help of a flow chart the steps carried in the formation of a recombinant DNA. 3
8. (a) Write the inference drawn by Alexander von Humboldt after his extensive explorations of South Americal jungle.
- (b) Study the graph given below :



As per Alexander von Humboldt, what do the symbols S, A, Z and C in the graph stand for, in respect of a species and area relationship? 3

9. (a) Given below is the stepwise schematic representation of the process of electrophoresis. Identify the 'alphabets' representing (i) Anode end (ii) smallest/lightest DNA strand in the matrix (iii) Agarose gel 3



- (b) What is elution? State the importance of elution in this process.



10. (क) संस्पर्श संदमन (कांटेक्ट इनहिबिसन) के गुणधर्म की व्याख्या कीजिए तथा प्रसामान्य मानव कोशिका तथा कैंसर कोशिकाओं पर इसका प्रभाव लिखिए ।
 (ख) कैंसर के उपचार में α -इंटरफेरॉन जैसे जैविक अनुक्रिया रूपांतरकों की आवश्यकता क्यों होती है ? इस रोग के उपचार में वे किस प्रकार कार्य करते हैं ? 3
11. 'क्राई-प्रोटीन' क्या हैं ? एक समुचित उदाहरण की सहायता से समझाइए कि यह जैव पीड़कनाशी के रूप में कैसे कार्य करता है । 3
12. (क) दो उदाहरणों की सहायता से 'सहविलुप्तता' की संकल्पना की व्याख्या कीजिए । 3
 अथवा
 (ख) "वन हमें असीमित लाभ प्रदान करते हैं ।" तीन विभिन्न क्षेत्रों की सहायता से व्याख्या कीजिए कि यह किस प्रकार होता है ।

खण्ड – स
(प्रकरण आधारित)

13. (क) नीचे दिए गए प्रकरण को ध्यानपूर्वक पढ़कर संबंधित प्रश्नों के उत्तर लिखिए :
- मोनटाना, संयुक्त राज्य अमेरिका के येलोस्टोन नेशनल पार्क में सन् 1976 में शिन एवं उनके सहयोगियों द्वारा यूबैक्टिरियल सूक्ष्म-जीवाणु थर्मस एक्केटिकस से टैक पॉलीमरेज नामक एंजाइम को पृथक किया गया । टैक पॉलीमरेज ने शीघ्र ही पीसीआर के लिए पहले से उपयोग किए जाने वाले ई.कोलाई से प्राप्त डी.एन.ए. पॉलीमरेज को सफलतापूर्वक विस्थापित कर (हटा) दिया और इस खोज ने पीसीआर तकनीक में क्रांति ला दी ।
- (i) टैक पॉलीमरेज की खोज के बाद इसने पीसीआर तकनीक में ई.कोलाई से प्राप्त डीएनए पॉलीमरेज का स्थान ले लिया । समुचित कारणों की सहायता से व्याख्या कीजिए कि इस बदलाव की आवश्यकता क्यों महसूस की गई ?
- (ii) प्रारंभक क्या है तथा पीसीआर में इसका क्या महत्त्व है ?
- (iii) नैदानिक युक्ति के रूप में पीसीआर का महत्त्व लिखिए । 5

अथवा



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10. (a) Explain the property of contact inhibition and its effect on normal human cells and cancerous cells.
- (b) Why are biological modifiers like α -interferon required for cancer treatment ? How do they act to treat the disease ? 3

11. What are cry-proteins ? With the help of a suitable example, explain how it acts as a biological pesticide. 3

12. (a) Explain the concept of “co-extinction” by taking two examples. 3

OR

- (b) “Forests provide intangible benefits to us.” Explain by taking three different areas, how.

SECTION – C

(Case Based)

13. (a) Read the paragraph given below and answer the questions that follow :
- Enzyme Taq polymerase, is extracted from a eubacterial microorganism *Thermus aquaticus* from Yellowstone National Park in Montana, USA and isolated by Chien et al. (1976). Taq polymerase successfully replaced the DNA polymerase from E.coli that was being used in PCR earlier and this shift revolutionised the PCR technique.
- (i) Taq polymerase after its discovery replaced E.coli DNA polymerase in PCR technique. Explain giving reasons why was the need felt for the change ?
- (ii) What is a primer and its importance in PCR ?
- (iii) Write the importance of PCR as a diagnostic tool. 5

OR

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(ख) निम्नलिखित अनुच्छेद को पढ़कर संबंधित प्रश्नों के उत्तर लिखिए :

विभिन्न तकनीकों, उपकरणों और प्रक्रमों के प्रयोग से मानव कल्याण के यथा स्वास्थ्य, चिकित्सा, औषध, कृषि इत्यादि के विभिन्न क्षेत्रों में समाधान के उद्देश्य से जैव प्रौद्योगिकी 'वांछित जीन' के इर्द-गिर्द चारों ओर घूमती रहती है। चिकित्सा के क्षेत्र में जैव प्रौद्योगिकी की बड़ी सफलता जीन चिकित्सा है।

- (i) उस मानव रोग का नाम लिखिए जिसके लिए जीन चिकित्सा का सर्वप्रथम उपयोग किया गया।
 - (ii) रोगी के लसीकाणुओं के उपयोग द्वारा रोग के उपचार की जीन चिकित्सा के विभिन्न चरणों की व्याख्या कीजिए। चिकित्सा की यह विधि स्थाई उपचार का तरीका क्यों नहीं है ?
 - (iii) जीन चिकित्सा का वह कौन सा संभावित तरीका है जो रोग का स्थाई उपचार कर सकता है और इस पर अनुसंधान कार्य भी प्रगति पर है ?
-



(b) Read the following paragraph and answer the questions that follow :

Biotechnology revolves around the “gene of interest”, with an objective to open various avenues for human welfare in health, medicine, pharma, agriculture etc. using different techniques, tools and processes. One of the breakthroughs of biotechnology in medicine is the gene therapy.

- (i) Name the human disease for which the gene therapy was used for the first time.
 - (ii) Explain the steps of gene therapy carried to cure the disease using the lymphocytes of the patient. Why is this therapy not a permanent cure of the disease ?
 - (iii) Write the possible permanent cure of the disease by the gene therapy that is in progress.
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Strictly Confidential: (For Internal and Restricted use only)
Senior Secondary School Term II Examination, 2022
Marking Scheme – BIOLOGY (SUBJECT CODE — 044)
(PAPER CODE — 57/3/2)

General Instructions: -

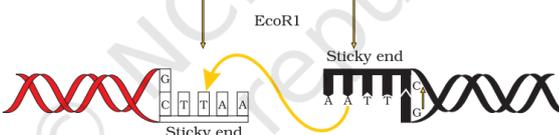
1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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 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 marks be awarded to them. In class-X, 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, marks should be awarded.**
4. 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. 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.
5. Evaluators will mark(\checkmark) wherever answer is correct. For wrong answer ‘X’ be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
6. 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 totalled up and written in the left-hand margin and encircled. This may be followed strictly.
7. 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.
8. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

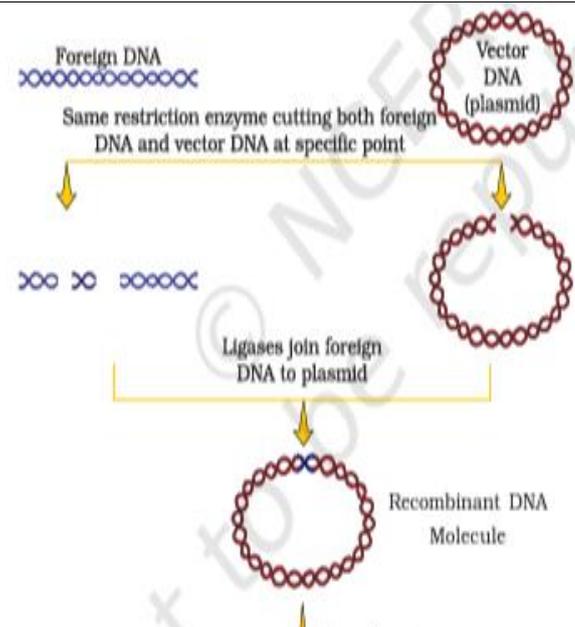
10. A full scale of marks 0-35 has to be used. Please do not hesitate to award full marks if the answer deserves it.
11. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 30 answer books per day in main subjects and 35 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
12. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
 - Leaving answer or part thereof unassessed in an answer book.
 - Giving more marks for an answer than assigned to it.
 - Wrong totalling of marks awarded on a reply.
 - Wrong transfer of marks from the inside pages of the answer book to the title page.
 - Wrong question wise totalling on the title page.
 - Wrong totalling of marks of the two columns on the title page.
 - Wrong grand total.
 - Marks in words and figures not tallying.
 - 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.
13. 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.
14. Any unassessed portion, non-carrying over of marks to the title page, or totalling 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.
15. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
16. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

MARKING SCHEME
Senior Secondary School Examination TERM–II, 2022
BIOLOGY (Subject Code — 044)
[Paper Code — 57/3/2]

Maximum Marks : 35

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
SECTION - A		
1.	(a)(i) A - Mortality/No. of deaths in population B - Natality/No. of births in population	½ + ½
	(ii) 1 bacteria per bacteria per hour $\left[\text{Growth rate} = \frac{2 \text{ million} - 1 \text{ million}}{1 \text{ million}} \right]$	1
	OR	
	(b) <ul style="list-style-type: none"> • Expanding, Age pyramid • The number of individuals in the ‘pre-reproductive’ age group is more than the ‘reproductive’ age group. 	½ + ½ 1
		2
2.	<ul style="list-style-type: none"> • Sneezing, watery eyes, running nose, difficulty in breathing and any other symptom (any two) • Body produces IgE antibodies/ give exaggerated response to the antigens/release chemicals like histamine and serotonin from mast cells. 	½ + ½
		1
3.	(a) (i) <i>Cannabis sativa</i>	½
	(ii) Flower tops or inflorescences, leaves and resin (any two)	½ + ½
	(iii) Influences cardio vascular system	½
	OR	
(b) Provide site for interaction of lymphocytes with the antigen, lymphocytes proliferate to become effector cells.	1 + 1	
		2
4.	<ul style="list-style-type: none"> • Masses of bacteria associated with fungal filaments to form mesh like structures. • Consume major part of organic matter in the effluent / lower BOD significantly/reduces polluting potential . 	1
		1
5.	<i>In situ</i> conservation — conservation and protection of whole ecosystem and its biodiversity at all levels in their natural habitat.	

	<p>Whereas <i>Ex situ</i> conservation involves taking out the threatened animals and plants from their natural habitat and placed in special settings where they can be protected and given special care.</p> <p>*(Note- Give 2 marks if both the points are given correctly or no mark for any one correct point)</p>	2
		2
6.	<p>(i) Forms symbiotic association with roots of leguminous plants and helps in Nitrogen fixation</p> <p>(ii) Helps in Nitrogen fixation in aquatic or terrestrial environment and serves as biofertilizer / increases organic matter of soil.</p>	1 1 2
SECTION - B		
7.	<p>Restriction endonuclease cuts both DNA (vector and foreign DNA) at the same site (a little away from the centre of palindrome sites)</p> <p style="text-align: center;">↓</p> <p>Leaves single stranded portion at the ends of each DNA strand / formation of sticky ends on each DNA strand</p> <p style="text-align: center;">↓</p> <p>DNA fragments join at sticky ends by DNA ligase to form rDNA.</p> <p style="text-align: center;">//</p> <p style="text-align: center;">Action of Restriction enzyme</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>The enzyme cuts both DNA strands at the same site</p> <p>Vector DNA</p>  </div> <div style="text-align: center;"> <p>EcoRI cuts the DNA between bases G and A only when the sequence GAATTC is present in the DNA</p> <p>Foreign DNA</p>  </div> </div> <p style="text-align: center;">↓</p> <div style="display: flex; justify-content: center; align-items: center;">  </div> <p style="text-align: center;">↓</p> <p style="text-align: center;">DNA fragments join at sticky ends</p> <div style="text-align: center;">  <p>Recombinant DNA</p> <p style="text-align: center;">//</p> </div>	1 1 1 // 1 1 1 //

		1
		1
		1
		3
8.	<p>(a) Species richness increased with increasing explored area up to a limit</p> <p>(b) S = Species richness Z = Slope of the line / regression coefficient A = Area C = Y-intercept</p>	1
		$\frac{1}{2} \times 4$
		3
9.	<p>(a) (i) S (ii) R (iii) T</p> <p>(b) <ul style="list-style-type: none">● Process of cutting of separated bands of DNA , and extracting from the agarose gel.● Purified DNA is used in rDNA technology / genetic experiments.</p>	$\frac{1}{2} \times 3$
		$\frac{1}{2} + \frac{1}{2}$
		$\frac{1}{2}$
		3
10.	<p>(a) <ul style="list-style-type: none">● Contact inhibition—The property of normal cells by virtue of which contact with other cells inhibits their uncontrolled growth.● Normal cells do not grow any further till ‘in contact with other cells’, whereas cancerous cells lost this property and continue to divide to form tumor.</p> <p>(b) <ul style="list-style-type: none">● Destroys tumor● Activates the immune system of patients.</p>	1
		$\frac{1}{2} + \frac{1}{2}$
		$\frac{1}{2}$
		$\frac{1}{2}$
		3
11.	<ul style="list-style-type: none">● Toxic insecticidal proteins/ pro-toxin /crystal proteins produced by cry genes of <i>Bacillus thuringiensis</i>.● e.g., in Bt Cotton / Bt corn/rice / tomato/ soyabean(any other correct example of any crop or any insect)● Bt toxin protein exists as inactive protoxins, which get activated inside the	1
		$\frac{1}{2}$

<p>(iii) Early detection of diseases like cancer / AIDS/ genetic disorder, by amplification of desired genes (when very low concentration of bacteria or virus before setting of the disease symptoms).</p>	<p>$\frac{1}{2} + \frac{1}{2}$</p>
<p>OR</p>	
<p>(b) (i) Adenosine deaminase (ADA) deficiency.</p>	<p>1</p>
<p>(ii) ●Lymphocytes from the patient’s blood are grown in a culture medium outside the body</p>	<p>$\frac{1}{2}$</p>
<p>Using retroviral vector, a functional ADA cDNA, is introduced into these lymphocytes.</p>	<p>$\frac{1}{2} + \frac{1}{2}$</p>
<p>Modified lymphocytes injected back to the patient body.</p>	<p>$\frac{1}{2}$</p>
<p>●Lymphocytes are mortal / not immortal, the patient requires repeated/periodic infusion.</p>	<p>$\frac{1}{2} + \frac{1}{2}$</p>
<p>(iii) Gene is obtained from bone marrow cells producing ADA is introduced into cells at <u>early embryonic</u> stage.</p>	<p>1</p>
<p>5</p>	

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