



SET - 1

कोड नं.
Code No. 57/1/1

Series : BVM/1

रोल नं.
Roll No.

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

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 11 हैं।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 27 प्रश्न हैं।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, 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 11 printed pages.
- Code number 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 27 questions.
- **Please write down the Serial Number of the question 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 घंटे

अधिकतम अंक : 70

Time allowed : 3 hours

Maximum Marks : 70

सामान्य निर्देश :

- प्रश्न-पत्र में चार खण्डों में 27 प्रश्न दिए गए हैं। सभी प्रश्न अनिवार्य हैं।
- खण्ड - अ में प्रश्न संख्या 1 से 5 अति लघु-उत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 1 अंक का है।

- (iii) खण्ड - ब में प्रश्न संख्या 6 से 12 लघु-उत्तरीय प्रश्न प्रकार I के हैं, प्रत्येक प्रश्न 2 अंकों का है।
- (iv) खण्ड - स में प्रश्न संख्या 13 से 24 लघु-उत्तरीय प्रश्न प्रकार II के हैं, प्रत्येक प्रश्न 3 अंकों का है।
- (v) खण्ड - द में प्रश्न संख्या 25 से 27 दीर्घ-उत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 5 अंकों का है।
- (vi) प्रश्न-पत्र में समग्र पर कोई विकल्प नहीं है, फिर भी 1 अंक वाले दो प्रश्नों में, 2 अंकों वाले दो प्रश्नों में 3 अंकों वाले चार प्रश्नों में और 5 अंकों वाले सभी तीनों प्रश्नों में भीतरी चयन-विकल्प दिए गए हैं। प्रत्येक परीक्षार्थी को ऐसे प्रश्नों के दो विकल्पों में से कोई एक प्रश्न हल करना है।
- (vii) आवश्यकतानुसार, चित्रों का रेखन साफ-सुधरा एवं यथोचित लेबल होना चाहिए।

General Instructions :

- (i) There are total 27 questions and four sections in the question paper. All questions are compulsory.
- (ii) Section A contains questions number 1 to 5, very short answer type questions of one mark each.
- (iii) Section B contains questions number 6 to 12, short answer type-I questions of two marks each.
- (iv) Section C contains questions number 13 to 24, short answer type-II questions of three marks each.
- (v) Section D contains question number 25 to 27, long answer type questions of five marks each.
- (vi) There is no overall choice in the question paper, however, an internal choice is provided in two questions of one mark, two questions of two marks, four questions of three marks and all the three questions of five marks. In these questions, an examinee is to attempt any one of the two given alternatives.
- (vii) Wherever necessary, the diagram drawn should be neat and properly labelled.



खण्ड – अ

SECTION – A

1. ब्रितान की आनुवंशिकीविद् रे.सी. पनेट ने आनुवंशिक संकरण प्रदर्शित करने के लिए एक 'पनेट वर्ग' आरेख विकसित किया। किसी आनुवंशिक संकरण के संभाव्य परिणाम की गणना (अनुमान) का उल्लेख कीजिए। 1
British geneticist R.C. Punnett developed a graphical representation of a genetic cross called "Punnett Square". Mention the possible result this representation predicts of the genetic cross carried.
2. जीवन की उत्पत्ति के संबंध में लुई पाश्चर द्वारा किए गए प्रयोगों से प्राप्त दो प्रमुख परिणाम लिखिए। 1
State the **two** principal outcomes of the experiments conducted by Louis Pasteur on origin of life.
3. वायुमण्डल के उस स्तर का नाम लिखिए जो अच्छा ओज़ोन के साथ संबद्ध है। 1

अथवा

उस तकनीकी शब्द का नाम लिखिए जिसका उपयोग एक वन वृक्ष पर उगने वाले ऑर्किड की समष्टि के पारस्परिक संबंध का वर्णन करने में होता है।

Name the layer of the atmosphere that is associated with 'good ozone'.

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

4. वाहित मल के द्वितीयक उपचार के दौरान उत्पन्न 'ऊर्णिक' क्या हैं ? 1

अथवा

किन्हीं ऐसे दो स्थानों के नाम लिखिए जहाँ मीथैनोजेन मिल सकते हैं।

What are 'flocs', formed during secondary treatment of sewage ?

OR

Write any two places where methanogens can be found.

5. अगुणित काय वाले जीवों में जीवन चक्र की किस अवस्था में अर्धसूत्री विभाजन होता है ? इस प्रकार उत्पन्न उत्पादों के भविष्य का उल्लेख कीजिए। 1

At what stage does the meiosis occur in an organism exhibiting haploidic life cycle and mention the fate of the products thus produced.



खण्ड – ब

SECTION – B

6. आप पर्याते तथा आलू का कृत्रिम संकरण कर रहे हैं। इनमें से किसमें विपुसन चरण की आवश्यकता पड़ेगी और क्यों ? आप दोनों को थैली से आवृत्त करेंगे। एक कारण देते हुए औचित्य बताइए। 2

You are conducting artificial hybridization on papaya and potato. Which one of them would require the step of emasculation and why ? However for both you will use the process of bagging. Justify giving one reason.

7. जीन प्रवाह अथवा आनुवंशिक अपवाह (जेनेटिक ड्रिफ्ट) किसी समष्टि को कैसे प्रभावित करता है जिसमें दोनों में से कोई एक प्रक्रम चल रहा हो ? 2

How would the gene flow or genetic drift affect the population in which either of them happen to take place ?

8. प्रतिरक्षा अनुक्रियाएँ उत्पन्न करने में ‘बी-लसीकाणु’ तथा ‘टी-लसीकाणु’ की भूमिका में विभेद कीजिए। 2

अथवा

टीकाकरण का सिद्धान्त प्रतिरक्षा तंत्र की ‘स्मृति’ के गुण पर आधारित है। एक समुचित उदाहरण की सहायता से कथन की पुष्टि कीजिए।

Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

OR

Principle of vaccination is based on the property of “memory” of the immune system. Taking one suitable example, justify the statement.

9. विषाणु संक्रमित केले के पौधे से स्वस्थ पादपों के संवर्धन में ‘पूर्णशक्तता’ तथा ‘सोमाक्लोन’ की प्रासंगिकता का वर्णन कीजिए। 2

Explain the relevance of “Totipotency” and “Somaclones” in raising healthy banana plants from virus infected banana plants.

10. बायोरिएक्टरों में संवर्धन तंत्र की नियंत्रता किस प्रकार बनाए रखी जाती है और क्यों ? 2

How is a continuous culture system maintained in bioreactors and why ?



11. फसल उत्पादन बढ़ाने के लिए जी एम ओ के उपयोग से प्राप्त होने वाले चार लाभों की सूची बनाइए। 2

List any **four** ways by which GMO's have been useful for enhanced crop output.

12. एक स्वस्थ परितंत्र प्रदान करने वाली चार महत्वपूर्ण सेवाओं का उल्लेख कीजिए। 2

अथवा

एक उदाहरण की सहायता से प्रमाणित कीजिए कि एक परितंत्र में सहोपकारियों का (i) सह विकास होता है तथा (ii) यह जैव विविधता हास का एक प्रमुख कारण भी है।

Mention **four** significant services that a healthy forest ecosystem provide.

OR

Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss.

खण्ड – स

SECTION – C

13. संपूर्ण विश्व में पादप अभिजनन कार्यक्रम के उन्नयन में पराग भंडार (बैंक) एक अत्यंत महत्वपूर्ण भूमिका निभा रहे हैं। पराग बैंकों में परागकणों का परिक्षण किस प्रकार किया जाता है ? व्याख्या कीजिए। यह बैंक हमारे किसानों को किस प्रकार लाभ पहुँचा रहे हैं ? कोई दो तरीके लिखिए। 3

Pollen banks are playing a very important role in promoting plant breeding programme the world over. How are pollens preserved in the pollen banks ? Explain. How are such banks benefitting our farmer ? Write any two ways.

14. पुरुषों के जनन तंत्र में लिंग सहायक चार नलिकाओं के अंतर्संबंध को दर्शने के लिए नामांकित आरेख बनाइए। 3

अथवा

पुटक विकास की विभिन्न अवस्थाओं, पीतपिंड तथा अंडोत्सर्ग की विभिन्न अवस्थाओं को दर्शाते हुए स्त्री अंडाशय की आरेखीय काट का रेखाचित्र बनाइए।



Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

15. सटन और बोवेरी द्वारा प्रतिपादित 'वंशागति का क्रोमोसोम वाद' की मैडल द्वारा मटर के पौधे पर किए गए प्रयोगों से प्राप्त परिणामों से तीन प्रकार (आधारों) से तुलना कीजिए। 3

अथवा

- (a) टी.एच. मोरगन द्वारा ड्रोसोफिला मेलनोगैस्टर पर किए गए संकरण प्रयोगों के प्रेक्षणों के आधार पर उनके द्वारा प्रस्तावित संलग्नता तथा पुनर्योजन की व्याख्या कीजिए।
- (b) एल्फ्रेड स्टर्टेवेंट द्वारा जीन अनुक्रमण व्याख्या का आधार लिखिए।

Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Bovery with that of experimental results on pea plant presented by Mendel.

OR

- (a) Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.
- (b) Write the basis on which Alfred Sturtevant explained gene mapping.

16. प्रतिकृति द्विशाख की सहायता से डीएनए प्रतिकृति प्रक्रिया की व्याख्या कीजिए। डीएनए प्रतिकृति द्विशाख में एंजाइम डीएनए लाइगेज की क्या भूमिका है? 3

अथवा

उस अनुलेखन इकाई का नामांकित आरेख बनाइए जिससे नीचे प्रदर्शित आरएनए खण्ड का अनुलेखन हुआ है। उस एंजाइम का पूरा नाम लिखिए जिसने इस आरएनए का अभिलेखन किया है।



Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork ?

OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



17. (a) होमो इैक्टस तथा होमो हैबिलिस में दो अंतर लिखिए।
 (b) निम्नलिखित भूवैज्ञानिक कालों को पहले (पूर्वकाल) से बाद के सामयिक क्रम में पुनःस्थापित कीजिए :
 कार्बोनीफेरस, साइलूरियन, जूरासिक। 3
 (a) Write **two** differences between *Homo erectus* and *Homo habilis*.
 (b) Rearrange the following from early to late geologic periods :
 Carboniferous, Silurian, Jurassic.
18. जीवाणुओं के उस वर्ग का नाम लिखिए जो दूध को दही में परिवर्तित कर देते हैं। इस प्रक्रिया के प्रक्रम की व्याख्या कीजिए। इस प्रकार के जीवाणुओं की एक अन्य लाभकारी प्रक्रिया लिखिए। 3
 Name the group of bacteria involved in setting milk into curd. Explain the process they carry in doing so. Write another beneficial role of such bacteria.
19. मधुमक्खी पालन आय बढ़ाने का एक अच्छा उद्योग है। सफल मधुमक्खी पालन के लिए ध्यान रखने वाले बिंदुओं (चरणों) को लिखिए। उस भारतीय प्रजाति का नाम लिखिए जिसका इस कार्य के लिए सर्वाधिक उपयोग किया जाता है। 3
 Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.



20. (a) कॉलम-A में दिए जीवाणुओं का मिलान कॉलम-B में दिए गए उत्पाद से कीजिए।

| कॉलम - A | कॉलम-B |
|---------------------------------------|-----------------------|
| (H) <u>पेनीसीलियम नोटेटम</u> | (i) स्टैटिन |
| (I) <u>ट्राइकोडर्मा पॉलीस्पोरम</u> | (ii) ऐथानॉल |
| (J) <u>मोनास्कस परप्यूरिआ</u> | (iii) प्रतिजैविक |
| (K) <u>सैक्रेरोमाइसीज़ सैरीविसेएई</u> | (iv) साइक्लोस्पोरिन-ए |

(b) 'स्विस चीज' में बड़े-बड़े छिद्र क्यों बन जाते हैं ?

3

(a) Match the microbes listed under Column-A with the products mentioned under Column-B.

| Column – A | Column – B |
|-------------------------------------|--------------------|
| (H) <i>Penicillium notatum</i> | (i) Statin |
| (I) <i>Trichoderma polysporum</i> | (ii) ethanol |
| (J) <i>Monascus purpurea</i> | (iii) antibiotic |
| (K) <i>Saccharomyces cerevisiae</i> | (iv) Cyclosporin-A |

(b) Why does 'Swiss Cheese' develop large holes ?

21. इको आर-वन (EcoRI) की क्रिया द्वारा पुनर्योगज डीएनए निर्माण की प्रक्रिया का वर्णन कीजिए।

3

अथवा

पीसीआर तकनीक का उपयोग करते हुए 'लाभकारी जीन' के प्रवर्धन प्रक्रम का वर्णन कीजिए।

Describe the formation of recombinant DNA by the action of EcoRI.

OR

Describe the process of amplification of "gene of interest" using PCR technique.



22. समान आनुवंशिक रोग से ग्रसित दो बच्चे 'A' तथा 'B' जिनकी आयु क्रमशः 4 वर्ष एवं 5 वर्ष थी, चिकित्सालय (अस्पताल) गए। 'बालिका-A' की एंजाइम प्रतिस्थापन चिकित्सा की गई तथा उसे निर्धारित अंतराल पर पुनः आने की सलाह दी गई। जबकि 'बालिका-B' की चिकित्सा की गई जिसमें उसे चिकित्सा हेतु पुनः आने की आवश्यकता नहीं थी।

3

- (a) उस रोग का नाम लिखिए जिससे दोनों बालिकाएँ ग्रसित थीं।
- (b) 'बालिका-A' को दी गई चिकित्सा में उसे बार-बार अस्पताल जाने की आवश्यकता क्यों थी ?
- (c) 'बालिका-B' की स्थाई चिकित्सा किस प्रकार की गई ?

Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

- (a) Name the ailments the two girls were suffering from ?
- (b) Why did the treatment provided to girl A required repeated visits ?
- (c) How was the girl B cured permanently ?

23. जैव विविधता के बाह्य स्थाने (एक्स-सीटू) संरक्षण के छः लाभों की सूची बनाइए।

3

List **six** advantages of "ex-situ" approach to conservation of biodiversity.

24. शहर के नजदीक एक तालाब भ्रमण के दौरान रंगबिरंगे शैवाल आच्छादित विशाल जल क्षेत्र को देख दर्शक अत्यंत हर्षित/आङ्गादित हुए।

3

- (a) जीव विज्ञान के विद्यार्थी होने के नाते क्या आप उनके इस आङ्गाद से सहमत हैं ? अपने उत्तर की पुष्टि हेतु प्रमाण दीजिए।
- (b) शैवाल की इस प्रकार वृद्धि के कारण की व्याख्या कीजिए।

While on a visit to a pond in the city-neighbourhood, the visitors were delighted to find large expanse of water covered with colourful algal mass.

- (a) As a student of biology, do you agree with their delight ? Give reasons in support of your answer.
- (b) Explain the cause of such algal growth.



खण्ड – द

SECTION – D

25. (a) निम्नलिखित में प्रत्येक के एक-एक उपयोग की व्याख्या कीजिए।

- (A) उल्बवेधन (ऐमिओसेंटेसिस)
 - (B) स्तनपान अनार्तव (लैक्टेशनल एमेनोरिया)
 - (C) जेड आई एफ टी
- (b) “जनन एवं शिशु स्वास्थ्य अनुरक्षण कार्यक्रम” के उद्देश्यों को विद्यालय कार्यक्रम में दर्शने के लिए पोस्टर बनाइए।

$3 + 2 = 5$

अथवा

(a) किन्हीं दो तरीकों को समझाइए जिनके द्वारा असंगजननीय बीजों का विकास हो सकता है।

(b) असंगजननिक फसल का एक लाभ तथा एक हानि लिखिए।

(c) किसान ऐसा क्यों महसूस करते हैं कि संकर बीजों का उत्पादन महँगा सौदा है ?

$2 + 2 + 1 = 5$

(a) Explain **one** application of each one of the following :

- (A) Amniocentesis
- (B) Lactational amenorrhea
- (C) ZIFT

(b) Prepare a poster for the school programme depicting the objectives of :
“Reproductive and Child Health Care Programme”.

OR

(a) Explain any **two** ways by which apomictic seed can develop.

(b) List **one** advantage and **one** disadvantage of a apomictic crop.

(c) Why do farmers find production of hybrid seeds costly ?

26. अपूर्ण प्रभाविता (इंकंप्लीट डोमिनेंस) तथा सहप्रभाविता (को-डोमिनेंस) में अंतर स्पष्ट कीजिए। प्रत्येक के एक-एक उदाहरण की सहायता से उत्तर की पुष्टि कीजिए।

अथवा

(a) आनुवंशिक कूट गूढ़लिपि का अर्थ निकालने में निम्नलिखित वैज्ञानिकों के योगदान लिखिए :

जॉर्ज गेमो, हरगोविन्द खुराना, मार्शल नीरेनबर्ग, सेवेरो ओकोआ

(b) प्रोटीन जैव संश्लेषण में आनुवंशिक कूट का महत्व बताइए।

$4 + 1 = 5$



Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.

OR

- (a) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow ; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa

- (b) State the importance of a Genetic code in protein biosynthesis.

27. (a) जीव विज्ञान के विद्यार्थी होने के नाते आपके अनुसार 'समष्टि' क्या है ?
 (b) "किसी जाति के लिए समष्टि का आकार एक स्थैतिक प्राचल नहीं है।" किसी क्षेत्र में दी गई अवधि में समष्टि घनत्व में होने वाले परिवर्तन के संदर्भ में उपरोक्त कथन की न्यायसंगतता सिद्ध कीजिए।

अथवा

- (a) जलारंभी अनुक्रमण क्या है ?
 (b) जलारंभी अनुक्रमण तथा शुष्कतारंभी अनुक्रमण की मूल अन्वेषक प्रजाति तथा चरम समुदाय की तुलना कीजिए।
 (c) द्वितीयक जलारंभी अनुक्रमण में मूल अन्वेषक प्रजाति का प्रकार जिन कारकों पर निर्भर करता है, उनकी सूची बनाइए। इस अनुक्रमण की गति प्राथमिक अनुक्रमण से तीव्र क्यों है ? **1 + 2 + 2 = 5**

- (a) What is "population" according to you as a biology student ?
 (b) "The size of a population for any species is not a static parameter." Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.

OR

- (a) What is hydrarch succession ?
 (b) Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.
 (c) List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession ?



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. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. 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.**
3. 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.
4. 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.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. 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 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.
 - 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.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.
12. 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.
13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
14. 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.
15. 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.

Question Paper Code 57/1/1

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

1. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called “Punnett Square”. Mention the possible result this representation predicts of the genetic cross carried.

Ans. (Probability of) all genotypes / genotypic ratio

[1 mark]

2. State the two principal outcomes of the experiments conducted by Louis Pasteur on origin of life.

Ans. Life comes from pre-existing life / biogenesis , dismissed the concept of spontaneous generation
 $= \frac{1}{2} + \frac{1}{2}$

[1 mark]

3. Name the layer of the atmosphere that is associated with ‘good ozone’.

Ans. Stratosphere

[1 mark]

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Ans. Commensalism

[1 mark]

4. What are ‘flocs’, formed during secondary treatment of sewage ?

Ans. Masses of bacteria associated with fungal filament (to form mesh like structure)

[1 mark]

OR

Write any two places where methanogens can be found.

Ans. Anaerobic sludge (digester) , rumen of cattle / ruminants / stomach of cattle / gut of cattle , marshy area , flooded rice fields , biogas plant (**Any two**) $= \frac{1}{2} + \frac{1}{2}$

[1 mark]

5. At what state does the meiosis occur in an organism exhibiting haploid life cycle and mention the fate of the products thus produced.

Ans. After zygote formation = ½

haploid organism / haploid spores / (haploid) gametophyte = ½

[1 mark]

SECTION - B

(Q. Nos. 6 - 12 are of two marks each)

6. You are conducting artificial hybridization on papaya and potato. Which one of them would require the step of emasculation and why ? However for both you will use the process of bagging. Justify giving one reason.

Ans. Potato = 1

Flowers of potato have both male and female reproductive parts in same flower / bisexual flowers / monoecious plant = ½

Bagging : To prevent unwanted pollens from coming on the stigma = ½

[2 marks]

7. How would the gene flow or genetic drift affect the population in which either of them happen to take place ?

Ans. Results in changed frequency of genes (or alleles) in both populations , causing variation , leading to evolution / speciation / founder effect = 1 + 1

(Any two)

[2 marks]

8. Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

Ans. B-lymphocytes : Produce antibodies = 1

T-lymphocytes : Help B-lymphocytes to produce antibodies / kills the pathogen directly (Killer T-cells)= 1

[2 marks]

OR

Principle of vaccination is based on the property of “memory” of the immune system. Taking one suitable example, justify the statement.

- Ans.** When a vaccine / heat killed pathogen / attenuated pathogen / weakened pathogen / a preparation of antigenic proteins of pathogen is introduced into the body to prevent chicken pox / measles / any other example it produces antibodies against antigen / pathogen , = 1

It generates B and T memory cells that recognize the pathogen quickly on subsequent exposure , to produce large amount of antibodies which inactivate the pathogen causing the disease
 $= \frac{1}{2} + \frac{1}{2}$ (*Any other correct example of a disease can also be substituted*)

[2 marks]

- 9.** **Explain the relevance of “Totipotency” and “Somaclones” in raising healthy banana plants from virus infected banana plants.**

Ans. Totipotency : Capacity of (apical / axillary) meristematic tissue of banana plant , which are virus free , to generate whole plant through tissue culture (micropropagation) $= \frac{1}{2} \times 3$

Somaclones : Plants produced are genetically identical to the original plant $= \frac{1}{2}$

[2 marks]

- 10. How is a continuous culture system maintained in bioreactors and why ?**

Ans. Used medium is drained out from one side of the bioreactor and fresh medium is added from the other side = 1

This type of culturing method produces a larger biomass leading to higher yields (of desired protein) $= 1$

[2 marks]

- 11. List any four ways by which GMO's have been useful for enhanced crop output.**

Ans. Make crops more tolerant to abiotic / cold / heat / drought / salt stresses / Reduces reliance on chemical pesticides (pest-resistant crops) / Reduce post harvest losses / Increased efficiency of mineral usage by plant (prevents early exhaustion of soil fertility) / Enhanced nutritional value of food (example vitamin A enriched rice / starch) / To create tailor-made plants for non food purposes (to supply alternative resources of fuels / pharmaceuticals to industries)
 $= (\text{Any four}) = \frac{1}{2} \times 4$

[2 marks]

- 12. Mention four significant services that a healthy forest ecosystem provide.**

Ans. Purify air / Production of O_2 / Purify water / Mitigate droughts and floods / Nutrient cycling / Generating fertile soils / Provide wildlife habitat / Maintain biodiversity / Pollinate crops / Provide site for carbon storage / Provide aesthetic - cultural - spiritual values / economic benefits / from nature food / industrial products / products of medicinal importance (*Any four*) $= \frac{1}{2} \times 4$

[2 marks]

OR

Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss.

- Ans. Fig species is pollinated only by (its partner) wasp species where the female wasp uses the fruit of fig species as a site for egg laying and nourishing its larvae (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) / Moth deposits its egg in the locule of the ovary of *Yucca* plant and the flower in turn gets pollinated by the moth (mutualists tend to co-evolve / evolution of flower and its pollinator species are tightly linked) (*Any other relevant example explained*) = 1

When any one of these two species become extinct - the other species associated with it in obligatory way also becomes extinct and leads to biodiversity loss = 1

[2 marks]

SECTION-C

(Q. Nos. 13 - 24 are of three marks each)

- 13. Pollen banks are playing a very important role in promoting plant breeding programme the world over. How are pollens preserved in the pollen banks ? Explain. How are such banks benefitting our farmer ? Write any two ways.**

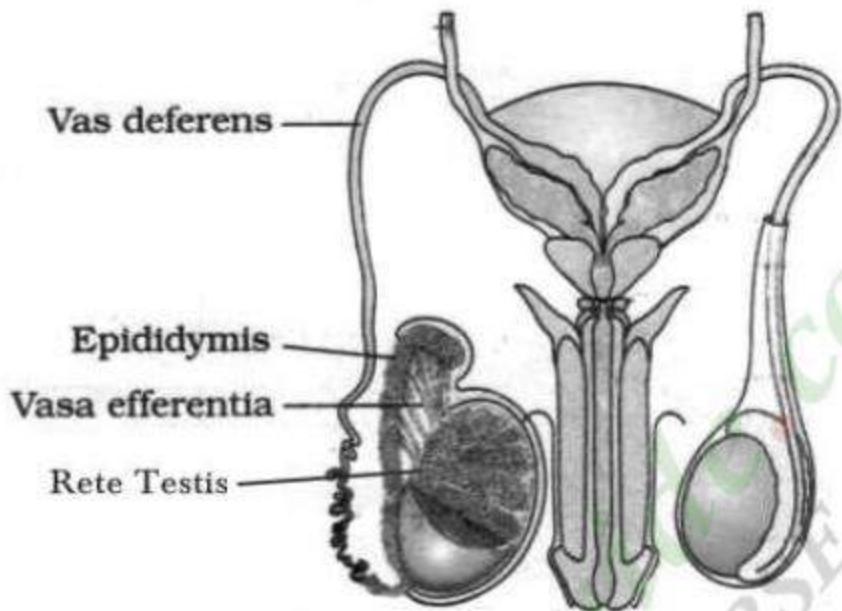
- Ans. Cryopreservation / preserved in liquid nitrogen (-196°C) = 1

Availability of pollen of different genetic strains (for wider use) / Cryopreservation increases viability of pollens (which can be used in crop breeding programmes) / Can be preserved / stored for longer duration / Conserve large number of species / To prevent complete extinction of any species / Maintain biodiversity (*Any two*) = 1 + 1

[3 marks]

- 14. Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.**





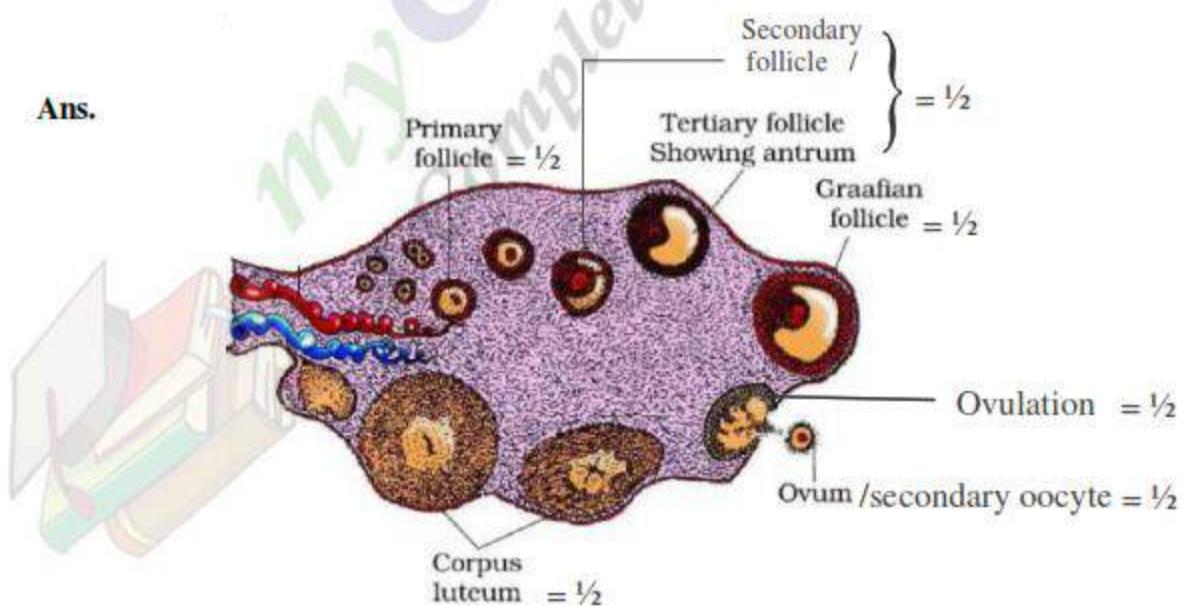
Correct diagram with : 1 labelling = $\frac{1}{2}$, 2 labellings = 1, 3 labellings = 2, 4 labellings = 3

[3 marks]

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

Ans.



$$= \frac{1}{2} \times 6$$

[3 marks]

- 15.** Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Boveri with that of experimental results on pea plant presented by Mendel.

| Sutton and Boveri | Mendel |
|---|---|
| 1. Chromosomes occur in pairs | 1. Factors occur in pairs |
| 2. Chromosomes segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete | 2. Factors segregate at gamete formation stage and only one of each pair is transmitted to a gamete |
| 3. Independent pairs of chromosomes segregate independently of each other | 3. One pair of factors segregate independently of another pairs |

= 1×3

[3 marks]

OR

- (a) Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.
- (b) Write the basis on which Alfred Sturtevant explained gene mapping.

Ans. (a) Linkage : - Physical association of genes on a chromosome ,

- Two genes did not segregate independently of each other
- F_2 (phenotypic) ratio deviates (significantly) from 9:3:3:1 (*Any two*) = $\frac{1}{2} \times 2$

Recombination: -Tightly linked genes tend to show fewer recombinant frequency / 1.3% = $\frac{1}{2}$

- Loosely linked genes show higher percentage of recombinant frequency / 37.2% = $\frac{1}{2}$

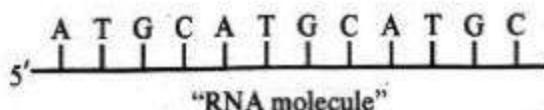
- (b) He used the frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes and mapped their position on the chromosome = 1

[2 + 1 = 3 marks]

- 16.** Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork ?

OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Ans. Non evaluative , because the choice question is faulty , full marks to be awarded to all examinees who attempt either of the choice questions.

- 17.** (a) Write two differences between *Homo erectus* and *Homo habilis*.
- (b) Rearrange the following from early to late geologic periods: Carboniferous, Silurian, Jurassic.

| Ans. (a) | <i>Homo erectus</i> | <i>Homo habilis</i> |
|----------|-----------------------|---------------------------------|
| (i) | Brain capacity 900 cc | Brain capacity 650 – 800 cc = 1 |
| (ii) | (Probably) ate meat | (Probably) did not eat meat = 1 |

(b) Silurian → Carboniferous → Jurassic = 1

(No mark to be awarded if all the three are not in proper sequence)

[2 +1 = 3 marks]

- 18.** Name the group of bacteria involved in setting milk into curd. Explain the process they carry in doing so. Write another beneficial role of such bacteria.

Ans. (group of) LAB / (group of) Lactic acid Bacteria / *Lactobacillus* species = 1

LAB produce acid that coagulate and partially digest the milk proteins = 1

Increases Vitamin B₁₂ / Checks disease causing microbes in the stomach = 1

[3 marks]

- 19.** Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.

Knowledge of the nature and habits of bees / selection of suitable location for keeping the beehive / catching and hiving of swarms (group of bees) / management of beehives during different seasons / handling and collection of honey and bee wax (**Any four**) = $\frac{1}{2} \times 4$

- *Apis indica* = 1

[3 marks]

- 20.** (a) Match the microbes listed under Column-A with the products mentioned under Column-B.

Column - A

- (H) *Penicillium notatum*
- (I) *Trichoderma polysporum*
- (J) *Monascus purpurea*
- (K) *Saccharomyces cerevisiae*

Column - B

- (i) Statin
- (ii) ethanol
- (iii) antibiotic
- (iv) Cyclosporin-A

(b) Why does 'Swiss Cheese' develop large holes ?

- | | | |
|-----|-------------------------------------|--------------------|
| (a) | (H) <i>Penicillium notatum</i> | (iii) antibiotic |
| | (I) <i>Trichoderma polysporum</i> | (iv) Cyclosporin-A |
| | (J) <i>Monascus purpureus</i> | (i) Statin |
| | (K) <i>Saccharomyces cerevisiae</i> | (ii) ethanol |

$$= \frac{1}{2} \times 4$$

(b) Due to production of large amount of CO₂ (by *Propionibacterium sharmanii*) = 1

[3 marks]

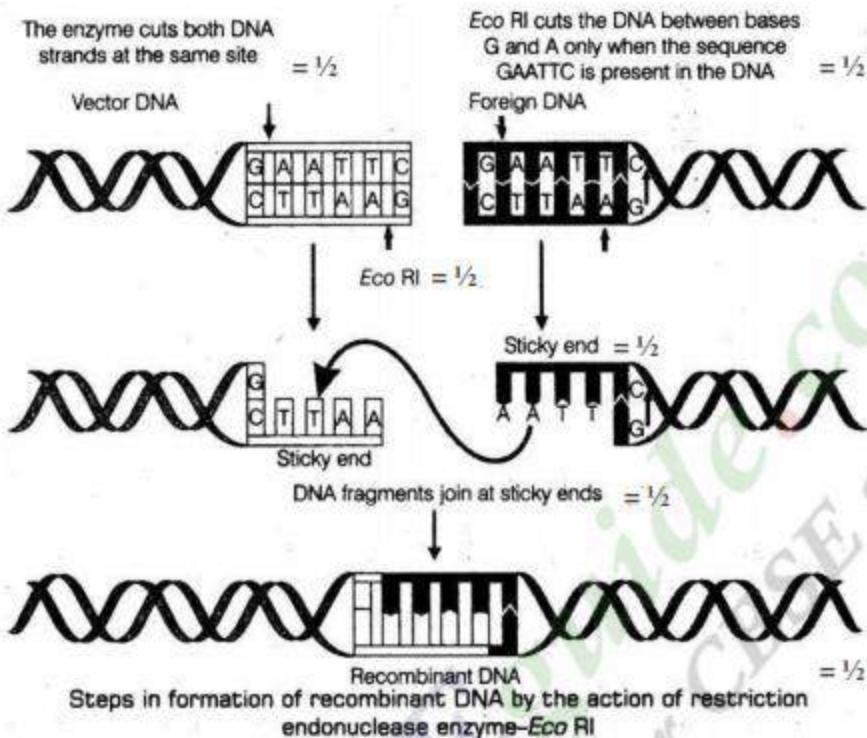
21. Describe the formation of recombinant DNA by the action of EcoRI.

Ans. EcoRI identifies its palindromic sequence on both vector DNA and foreign DNA / 5' GAATTC3' , cuts strands of DNA little away from the centre of palindromic sites , but between same two bases (G and A) , this leaves single stranded portion at the end (sticky ends) on each strand , for recombination both vector DNA and foreign DNA , with similar sticky ends are joined by the enzyme DNA ligase = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the above explanation

//





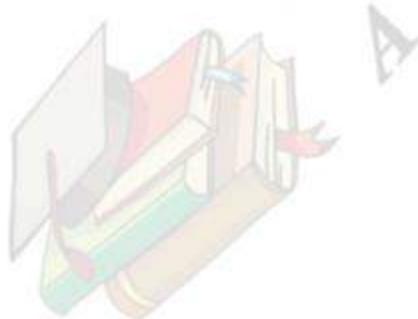
OR

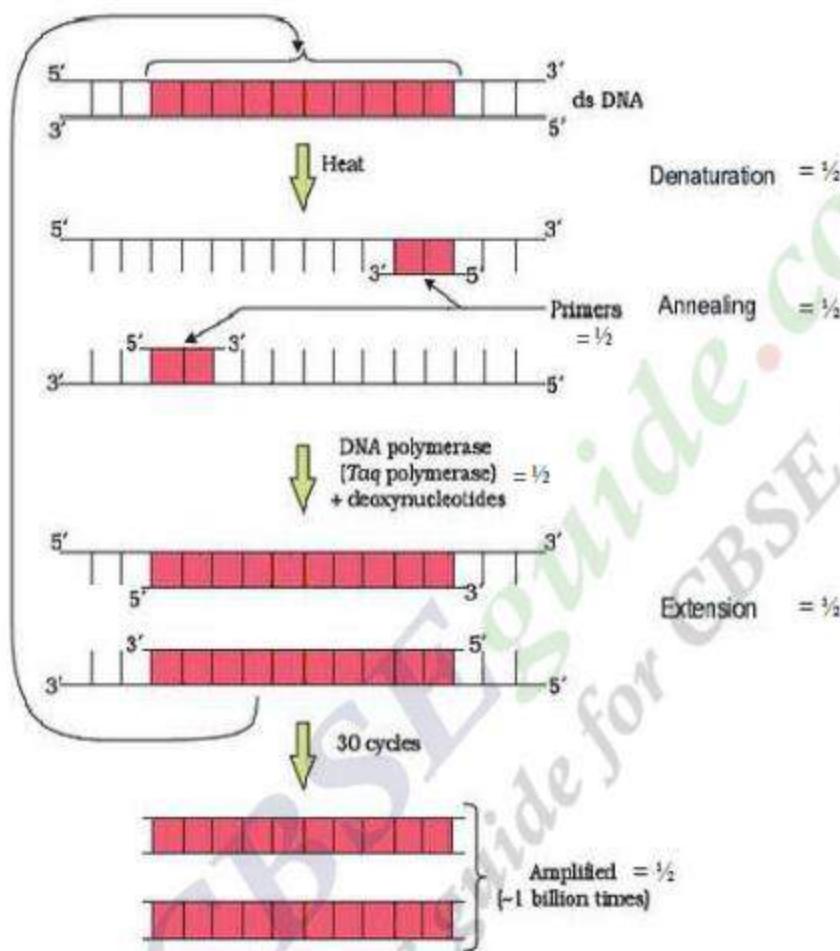
Describe the process of amplification of “gene of interest” using PCR technique.

Ans. Denaturation of desired DNA into two strands, each acting as templates, for each strands separate set of primer (two sets of primer) used, with the help of deoxy(ribo)nucleotides and Taq polymerase (DNA polymerase isolated from *Thermus aquaticus*), extension of DNA template occurs, resulting in replication of desired DNA (amplification) = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the above explanation

//





[3 marks]

22. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

- Name the ailments the two girls were suffering from ?
- Why did the treatment provided to girl A required repeated visits ?
- How was the girl B cured permanently ?

Ans. (a) Adenosine deaminase (ADA) deficiency = 1

- (b) (In Enzyme Replacement Therapy) functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited time period = 1 + 1

- (c) [As there is no permanent cure at the age of five hence 1 mark of this answer allocated to part (b)]

[$2 + 1 = 3$ marks]

23. List six advantages of “ex-situ” approach to conservation of biodiversity.

An endangered / threatened species can be conserved / genetic strains of commercially important plants can be preserved for a long time (seed banks) / biodiversity loss is reduced / gametes of threatened species can be preserved in a viable and fertile condition for long periods (using cryopreservation) / eggs can be fertilized in -vitro / plants can be propagated using tissue culture / economically beneficial / conserve large number of species / aesthetic value = (*Any six points*)

[$\frac{1}{2} \times 6 = 3$ marks]

24. While on a visit to a pond in the city-neighbourhood, the visitors were delighted to find large expanse of water covered with colourful algal mass.

- (a) **As a student of biology, do you agree with their delight ? Give reasons in support of your answer.**
- (b) **Explain the cause of such algal growth.**

Ans. (a) No = $\frac{1}{2}$

These algal mass (algal bloom) causes deterioration of the water quality , increase fish mortality , are (extremely) toxic to humans and animals, imparts distinct colour to water bodies (*Any three*) = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

- (b) Presence of large amount of nutrients / nitrates and phosphates/ nitrogen and phosphorus in water body = 1

[$2 + 1 = 3$ marks]

SECTION-D

(Q. Nos. 25 - 27 are of five marks each)

25. (a) Explain one application of each one of the following :

- (A) Amniocentesis
(B) Lactational amenorrhea
(C) ZIFT

- (b) Prepare a poster for the school programme depicting the objectives of :**

“Reproductive and Child Health Care Programme”.

Ans. (a) A. To detect chromosomal disorders / sex determination (legally banned) / detect genetic disorder / Karyotyping = 1

- B. To prevent pregnancy / means of natural contraception = 1
 - C. To assist an infertile couple to have children by transferring the zygote / early embryo / embryo at eight blastomere stage into fallopian tube = 1
 - (b) A poster made on RCH - **Any relevant slogan or sketch made should be awarded marks** e.g. Hum Do Hamare Do , Do Boond Zindagi Ke , Beti Bachao Beti Padhao , Stop STD , Gender selection and detection is punishable, 
- (Any other relevant theme) = 2**

[3 + 2 = 5 marks]

OR

- (a) **Explain any two ways by which apomictic seed can develop.**
- (b) **List one advantage and one disadvantage of a apomictic crop.**
- (c) **Why do farmers find production of hybrid seeds costly ?**
 - (a) (i) A diploid egg is formed without reduction division which develops into embryo without fertilization = 1
 - (ii) Some cells of the nucellus (which are diploid in nature) start dividing and develop into embryo = 1
- (b) Advantage : No segregation of characters in hybrid progeny / Apomictic hybrid can be used to grow crop year after year / economical as ordinary hybrid seeds are costly = 1

Disadvantage : Can not control deleterious genetic mutation / it reduces genetic diversity from parents to offspring plants due to lack of variations (in asexual reproduction) / lack ability to adapt to changing environment = 1
- (c) Hybrid seeds are costly as farmers have to purchase seeds year after year /production of hybrid seeds is a technical and expensive method to be done under controlled conditions = 1

[2 + 2+ 1 = 5 marks]

- 26. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.**

Ans.

Incomplete Dominance

F1 generation does not resemble either of the parent but show an intermediate trait

Co-dominance

Both dominant alleles express themselves F1

= $\frac{1}{2} + \frac{1}{2}$

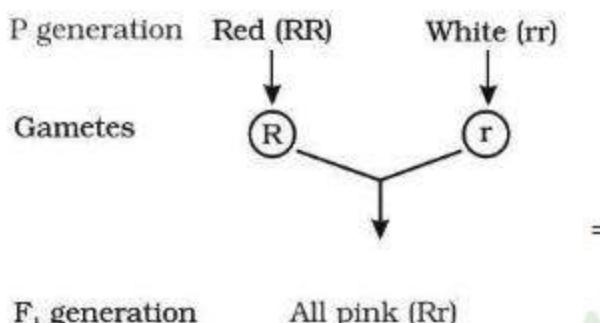
Example : Snapdragon / *Antirrhinum* sp /
dog flower / *Mirabilis jalapa* /

Example AB blood group in human = I

Four O'clock plant = I

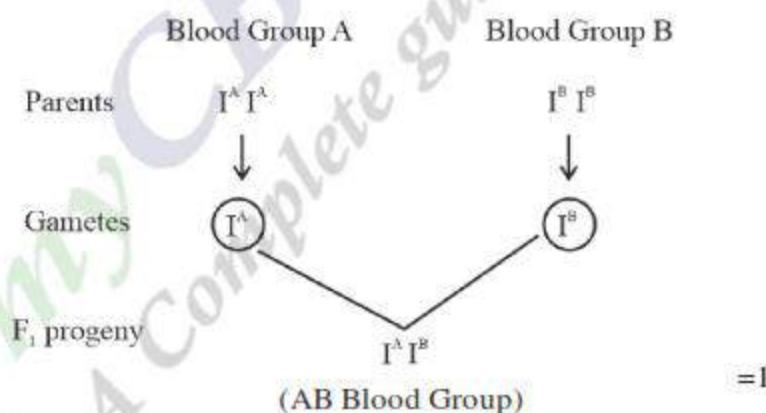
Incomplete dominance - When homozygous dominant and homozygous recessive parents are crossed all members of F1 progeny will show intermediate trait = I

//



Co dominance - When I^A and I^B are present together they both produce their own sugar / antigen = I

//



// (Any other suitable cross showing occurrence of I^A & I^B together in offsprings)

With $I^A i$ & $I^B i$ / $I^A I^A$ & $I^B i$ / $I^A i$ & $I^B I^B$ / $I^A I^B$ & $I^A I^B$ / $I^A I^B$ & $I^B i$ / $I^A I^B$ & $I^A i$

[5 marks]

OR

(a) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa

(b) State the importance of a Genetic code in protein biosynthesis.

Ans. (a) George Gamow : Proposed that the Genetic code is constituted of 3 nucleotides / provided proof that the codon is a triplet = 1

Hargobind Khorana : Synthesized RNA molecule with a defined combination of bases (homopolymers and copolymers) = 1

Marshall Nirenberg : Cell free system for protein synthesis / helped the genetic code to be deciphered= 1

Severo Ochoa : Described enzyme (Polynucleotide phosphorylase)which polymerises RNA with defined sequence in a template independent manner (enzymatic synthesis of RNA)= 1

(b) Genetic code - Codes for a specific amino acid which is required for protein synthesis / provides information about the specific amino acid that form a particular protein / polypeptide = 1

[4 + 1 = 5 marks]

27. (a) What is “population” according to you as a biology student ?

(b) “The size of a population for any species is not a static parameter.” Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.

Ans. (a) Total number of organisms of a species in a particular area at a particular time = 1

(b) The size of a population for any species is not a static parameter because of the factors like :-

Birth rate/ Natality = $\frac{1}{2}$, number of births during a given period = $\frac{1}{2}$

Death rate/ Mortality= $\frac{1}{2}$, number of deaths during a given period= $\frac{1}{2}$

Immigration = $\frac{1}{2}$, number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration= $\frac{1}{2}$

Emigration = $\frac{1}{2}$, number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration = $\frac{1}{2}$

[1 + 4 = 5 marks]

OR

- (a) What is hydrarch succession ?
- (b) Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.
- (c) List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession ?

Ans. (a) The gradual and fairly predictable changes in the species composition in a water body / wetter areas = 1

(b) Hydrarch : Pioneer species – Phytoplanktons = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

Xerarch : Pioneer species – Lichens = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

(c) Condition of soil, availability of water, seeds or other propagules = 1

Because (some) soil / sediment is already there, the rate of secondary succession is much faster than primary succession = 1

[$1 + 2 + 2 = 5$ marks]



Question Paper Code 57/1/2

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

1. What are 'flocs', formed during secondary treatment of sewage ?

Ans. Masses of bacteria associated with fungal filament (to form mesh like structure)

[1 mark]

OR

Write any two places where methanogens can be found.

Ans. Anaerobic sludge (digester) , rumen of cattle / ruminants / stomach of cattle / gut of cattle , marshy area , flooded rice fields , biogas plant (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

2. How did Charles Darwin express 'fitness' ?

Ans. Reproductive fitness

[1 mark]

3. At what state does the meiosis occur in an organism exhibiting haploidic life cycle and mention the fate of the products thus produced.

Ans. After zygote formation = $\frac{1}{2}$

haploid organism / haploid spores / (haploid) gametophyte = $\frac{1}{2}$

[1 mark]

4. Name the layer of the atmosphere that is associated with 'good ozone'.

Ans. Stratosphere

[1 mark]

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Ans. Commensalism

[1 mark]

5. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called "Punnett Square". Mention the possible result this representation predicts of the genetic cross carried.

Ans. (Probability of) all genotypes / genotypic ratio

[1 mark]

SECTION - B

(Q. Nos. 6 - 12 are of two marks each)

6. Express the process of pollination in *Vallisneria*.

- Ans. Long stalk of female flowers , Pollen released on the surface of water , Pollen grains are carried passively by water current , Pollen reach the stigma = $\frac{1}{2} \times 4$

[2 marks]

7. Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

- Ans. B-lymphocytes : Produce antibodies = 1

T-lymphocytes : Help B-lymphocytes to produce antibodies / kills the pathogen directly (Killer T-cells)= 1

[2 marks]

OR

Principle of vaccination is based on the property of “memory” of the immune system. Taking one suitable example, justify the statement.

- Ans. When a vaccine / heat killed pathogen / attenuated pathogen / weakened pathogen / a preparation of antigenic proteins of pathogen is introduced into the body to prevent chicken pox / measles / any other example it produces antibodies against antigen / pathogen , = 1

It generates B and T memory cells that recognize the pathogen quickly on subsequent exposure , to produce large amount of antibodies which inactivate the pathogen causing the disease = $\frac{1}{2} + \frac{1}{2}$ (*Any other correct example of a disease can also be substituted*)

[2 marks]

8. How would the gene flow or genetic drift affect the population in which either of them happen to take place ?

- Ans. Results in changed frequency of genes (or alleles) in both populations , causing variation , leading to evolution / speciation / founder effect (*Any two*) = 1 + 1

[2 marks]

9. Why is crossbreeding in animals practiced ? How is a breed Hisardale developed ?

- Ans. Cross breeding allows the desirable qualities of two different breeds to combine = 1

By crossing of Bikaneri ewes with Marino rams = 1

[2 marks]

10. β galactosidase enzyme is considered a better selectable marker. Justify the statement.

- Ans. Non-recombinant can be differentiated from recombinant on the basis of colour change (from colourless to blue), when grown on a chromogenic substrate, whereas the recombinant will not be able to show any colour change (due to insertional inactivation of the gene responsible for β galactosidase) = $\frac{1}{2} \times 3$

Non-cumbersome procedure / does not require simultaneous plating having different antibiotics / single step / easy process = $\frac{1}{2}$

[2 marks]

11. Mention four significant services that a healthy forest ecosystem provide.

- Ans. Purify air / Production of O₂ / Purify water / Mitigate droughts and floods / Nutrient cycling / Generating fertile soils / Provide wildlife habitat / Maintain biodiversity / Pollinate crops / Provide site for carbon storage / Provide aesthetic - cultural - spiritual values / economic benefits / from nature food / industrial products / products of medicinal importance (**Any four**) = $\frac{1}{2} \times 4$

[2 marks]

OR

Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss.

- Ans. Fig species is pollinated only by (its partner) wasp species where the female wasp uses the fruit of fig species as a site for egg laying and nourishing its larvae (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) / Moth deposits its egg in the locule of the ovary of *Yucca* plant and the flower in turn gets pollinated by the moth (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) (**Any other relevant example explained**) = 1

When any one of these two species become extinct - the other species associated with it in obligatory way also becomes extinct and leads to biodiversity loss = 1

[2 marks]

12. List any four ways by which GMO's have been useful for enhanced crop output.

- Ans. Make crops more tolerant to abiotic / cold / heat / drought / salt stresses / Reduces reliance on chemical pesticides (pest-resistant crops) / Reduce post harvest losses / Increased efficiency of mineral usage by plant (prevents early exhaustion of soil fertility) / Enhanced nutritional value of food (example vitamin A enriched rice / starch) / To create tailor-made plants for non food purposes (to supply alternative resources of fuels / pharmaceuticals to industries) = (**Any four**) = $\frac{1}{2} \times 4$

[2 marks]

SECTION-C

(Q. Nos. 13 - 24 are of three marks each)

- 13.** (a) Differentiate between geitonogamy and xenogamy.
 (b) Write the difference in the characteristics of the progeny produced as a result of the two processes.

| | | |
|------|--|---|
| Ans. | Geitonogamy | Xenogamy |
| | • Transfer of pollen grains from anther to the stigma of another flower of the same plant | • Transfer of pollen grains from anther to stigma of a different plant of the same species = 1 + 1 |
| | (b) Characters of progeny in geitonogamy are same as parents/no variation/introduces homozygosity (pure lines)/low rate of variation can cause inbreeding depression = $\frac{1}{2}$ | Characters of progeny in Xenogamy are different from parents/ variation is observed/genetically different from parent/ no inbreeding depression = $\frac{1}{2}$ |

- 14.** (a) Write two differences between *Homo erectus* and *Homo habilis*.
 (b) Rearrange the following from early to late geologic periods: Carboniferous, Silurian, Jurassic.

| | | |
|----------|---|---------------------------------|
| Ans. (a) | <i>Homo erectus</i> | <i>Homo habilis</i> |
| | (i) Brain capacity 900 cc | Brain capacity 650 – 800 cc = 1 |
| | (ii) (Probably) ate meat | (Probably) did not eat meat = 1 |
| | (b) Silurian → Carboniferous → Jurassic = 1 | |

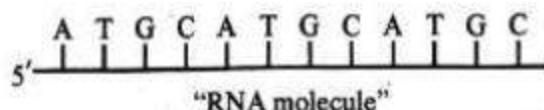
(No mark to be awarded if all the three are not in proper sequence)

[2 + 1 = 3 marks]

- 15.** Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork ?

OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Ans. Non evaluative , because the choice question is faulty , full marks to be awarded to all examinees who attempt either of the choice questions.

- 16.** Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Boveri with that of experimental results on pea plant presented by Mendel.

| Sutton and Boveri | Mendel |
|---|---|
| 1. Chromosomes occur in pairs | 1. Factors occur in pairs |
| 2. Chromosomes segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete | 2. Factors segregate at gamete formation stage and only one of each pair is transmitted to a gamete |
| 3. Independent pairs of chromosomes segregate independently of each other | 3. One pair of factors segregate independently of another pairs |
| | $= 1 \times 3$ |

[3 marks]

OR

- (a) Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.
- (b) Write the basis on which Alfred Sturtevant explained gene mapping.

Ans. (a) Linkage : - Physical association of genes on a chromosome ,

- Two genes did not segregate independently of each other
- F_2 (phenotypic) ratio deviates (significantly) from 9:3:3:1 (**Any two**) = $\frac{1}{2} \times 2$

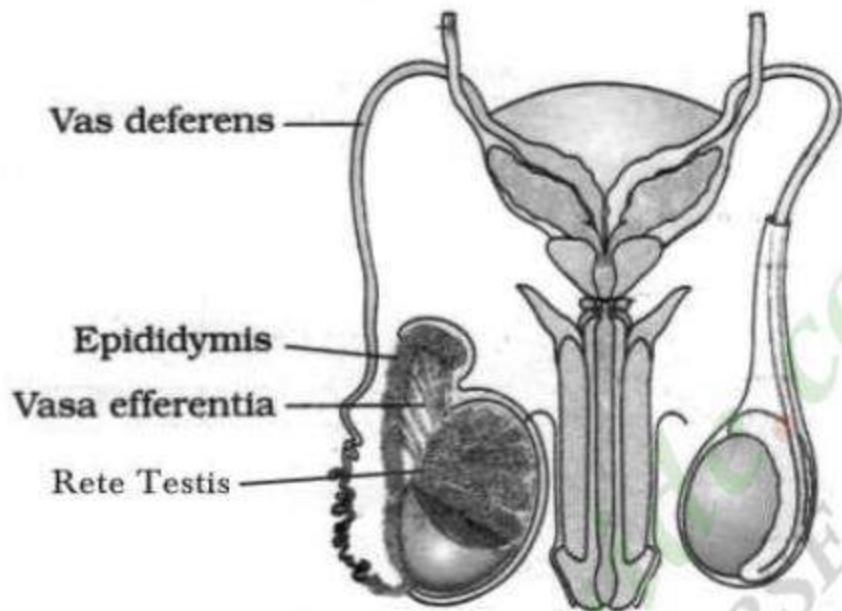
Recombination: -Tightly linked genes tend to show fewer recombinant frequency / 1.3% = $\frac{1}{2}$

-Loosely linked genes show higher percentage of recombinant frequency / 37.2% = $\frac{1}{2}$

- (b) He used the frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes and mapped their position on the chromosome = 1

[2 + 1 = 3 marks]

- 17.** Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.

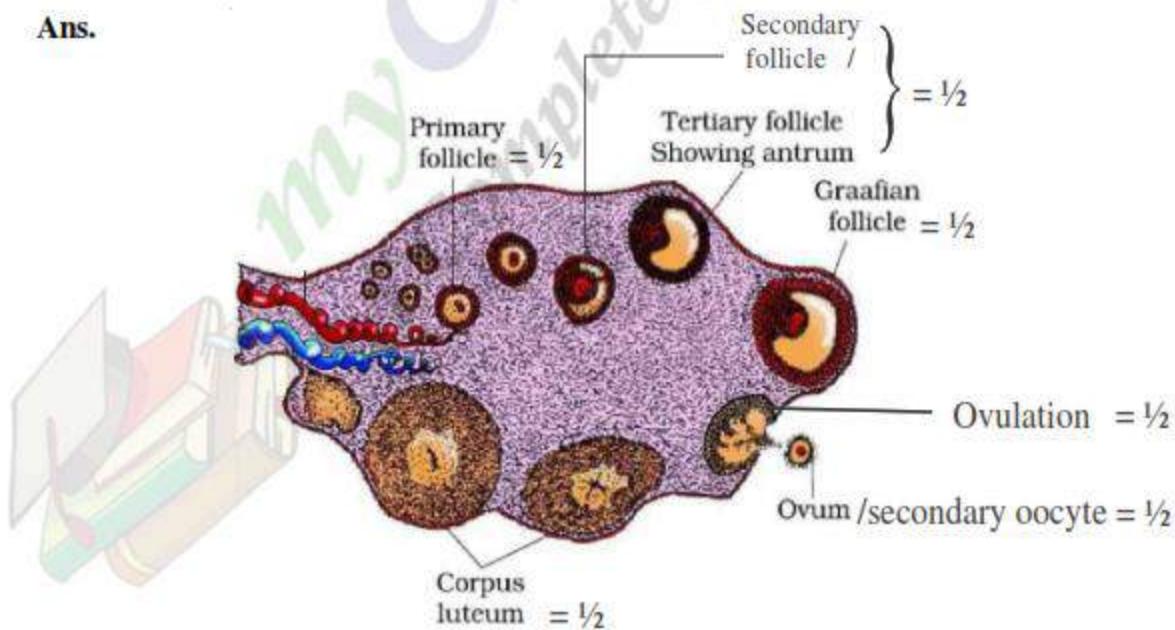


Correct diagram with : 1 labelling = $\frac{1}{2}$, 2 labellings = 1, 3 labellings = 2, 4 labellings = 3
[3 marks]

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

Ans.



$$= \frac{1}{2} \times 6$$

[3 marks]

18. How does the activity of each one of the following help in organic farming ?

- (a) *Mycorrhiza*
- (b) *Cyanobacteria*
- (c) *Rhizobium*

Ans. (a) *Mycorrhiza* : The fungal symbionts in these association absorb phosphorous from soil and pass it to plant. Plants also show resistance to root borne pathogens , tolerance to salinity / drought , an overall increase in plant growth and development (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

- (b) *Cyanobacteria* : Serve as an important biofertiliser by fixing atmospheric nitrogen , also add organic matter to the soil, and increase its fertility (*Any two*) = $\frac{1}{2} + \frac{1}{2}$
- (c) *Rhizobium* : Fix atmospheric nitrogen into organic forms , which is used by plant as nutrient/ increase soil fertility / symbiotic association in root nodules of leguminous plants (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[3 marks]

19. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

- (a) Name the ailments the two girls were suffering from ?
- (b) Why did the treatment provided to girl A required repeated visits ?
- (c) How was the girl B cured permanently ?

Ans. (a) Adenosine deaminase (ADA) deficiency = 1

- (b) (In Enzyme Replacement Therapy) functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited time period = 1 + 1
- (c) [As there is no permanent cure at the age of five hence 1 mark of this answer allocated to part (b)]

[2 + 1 = 3 marks]

20. While on a visit to a pond in the city-neighbourhood, the visitors were delighted to find large expanse of water covered with colourful algal mass.

- (a) As a student of biology, do you agree with their delight ? Give reasons in support of your answer.
- (b) Explain the cause of such algal growth.

Ans. (a) No = $\frac{1}{2}$

These algal mass (algal bloom) causes deterioration of the water quality , increase fish mortality , are (extremely) toxic to humans and animals, imparts distinct colour to water bodies
(Any three) = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

- (b) Presence of large amount of nutrients / nitrates and phosphates/ nitrogen and phosphorus in water body = 1

[2 + 1 = 3 marks]

21. (a) Match the microbes listed under Column-A with the products mentioned under Column-B.

| Column - A | Column - B |
|-------------------------------------|--------------------|
| (H) <i>Penicillium notatum</i> | (i) Statin |
| (I) <i>Trichoderma polysporum</i> | (ii) ethanol |
| (J) <i>Monascus purpurea</i> | (iii) antibiotic |
| (K) <i>Saccharomyces cerevisiae</i> | (iv) Cyclosporin-A |

- (b) Why does 'Swiss Cheese' develop large holes ?

| | | |
|-----|-------------------------------------|--------------------|
| (a) | (H) <i>Penicillium notatum</i> | (iii) antibiotic |
| | (I) <i>Trichoderma polysporum</i> | (iv) Cyclosporin-A |
| | (J) <i>Monascus purpureus</i> | (i) Statin |
| | (K) <i>Saccharomyces cerevisiae</i> | (ii) ethanol |

= $\frac{1}{2} \times 4$

- (b) Due to production of large amount of CO₂ (by *Propionibacterium sharmanii*) = 1

[3 marks]

22. Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.

Knowledge of the nature and habits of bees / selection of suitable location for keeping the beehive / catching and hiving of swarms (group of bees) / management of beehives during different seasons / handling and collection of honey and bee wax (**Any four**) = $\frac{1}{2} \times 4$

- *Apis indica* = 1

[3 marks]

23. Mention the special adaptations evolved in parasites and why ?

- Ans. - Loss of unnecessary sense organs , since they do not interact with external environment (eg. lacks eyes as they are found in an environment that lacks light) = $\frac{1}{2} \times 2$
- Presence of adhesive organs / suckers / hooks , to cling to the host = $\frac{1}{2} \times 2$
- Loss of digestive system , to absorb (digested) food from the host body = $\frac{1}{2} \times 2$
- High reproductive capacity , to increase the chances the survival = $\frac{1}{2} \times 2$
- If the host evolves special mechanism for resisting or rejecting the parasite - the parasite also evolves mechanism to counteract and neutralise them , in order to be successful with the same host species = $\frac{1}{2} \times 2$
- Presence of more than one host , to facilitate parasitisation of its primary host = $\frac{1}{2} \times 2$
- Loss of chlrophyll & leaves (*cuscuta*) , to derive its nutrition from the host plant which it parasitises = $\frac{1}{2} \times 2$
- Eggs resembles the host egg (crow) in size and colour , to reduce the chances of host bird detecting / ejecting the foreign eggs (koel) = $\frac{1}{2} \times 2$

(Any three special adaptations with reasons) = 1×3

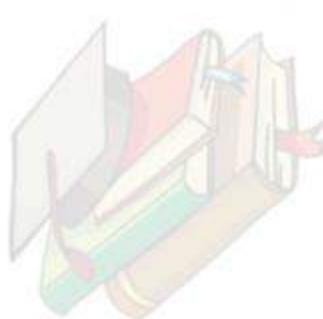
[3 marks]

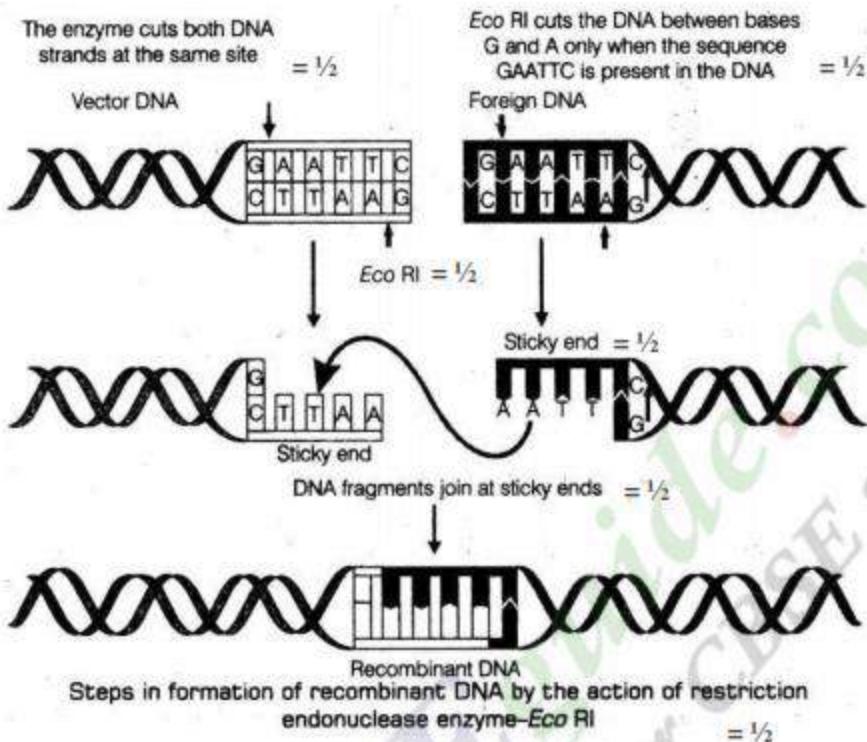
24. Describe the formation of recombinant DNA by the action of EcoRI.

- Ans. EcoRI identifies its palindromic sequence on both vector DNA and foreign DNA / 5' GAATTC3' , cuts strands of DNA little away from the centre of palindromic sites , but between same two bases (G and A) , this leaves single stranded portion at the end (sticky ends) on each strand , for recombination both vector DNA and foreign DNA , with similar sticky ends are joined by the enzyme DNA ligase = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation

//





OR

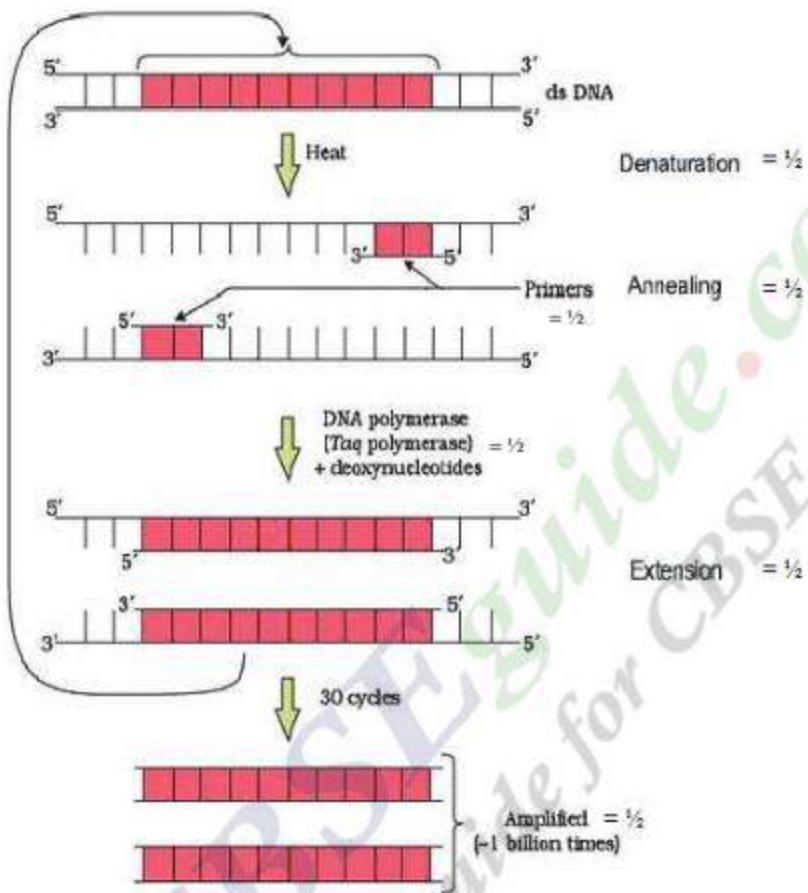
Describe the process of amplification of “gene of interest” using PCR technique.

Ans. Denaturation of desired DNA into two strands, each acting as a template, for each strand separate set of primer (two sets of primer) used, with the help of deoxy(ribo)nucleotides and Taq polymerase (DNA polymerase isolated from *Thermus aquaticus*), extension of DNA template occurs, resulting in replication of desired DNA (amplification) = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation



//



[3 marks]

SECTION-D

(Q. Nos. 25 - 27 are of five marks each)

25. Where does the process of megasporogenesis start in an angiosperm ? Describe the process upto the formation of embryo sac.

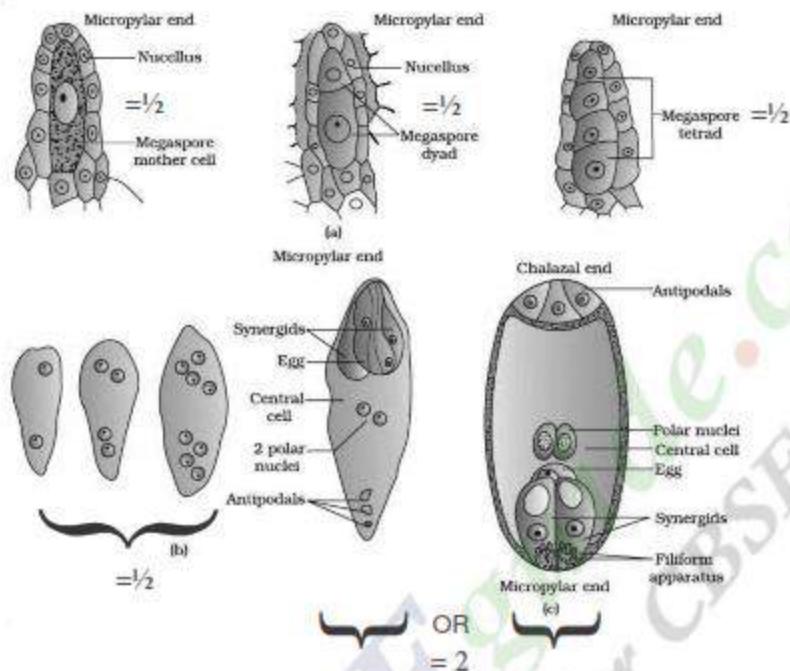
Ans. Nucellus / Ovules = 1

A single MMC / megasporangium undergoes meiosis , to produce four (haploid) megasporangia , one of the megasporangia functional, the nucleus of functional megasporangium undergoes free nuclear division , to form 2 nucleate - 4 nucleate - 8 nucleate embryo sac , cell wall formation occurs in six of 8 nuclei , two polar nuclei occur in the large central cell to form 8 nucleated and 7 celled embryosac = $\frac{1}{2} \times 8$

//

The following diagram can be considered in lieu of the explanation

//



OR

- Explain the process of fertilization in human.
- Name the embryonic stage that gets implanted in human females. Explain the process of implantation.

Ans. (a) When a sperm comes in contact with zona pellucida layer of ovum , induces the changes in membrane of ovum and blocks entry of other sperms , lytic enzymes / secretions from acrosome helps the entry of sperm head , completion of first meiotic division of secondary oocyte , formation of second polar body and ootid / ovum , fusion of nuclei of sperm and ovum forming zygote $= \frac{1}{2} \times 6$

- Blastocyst stage = 1

Process : Cells of blastocyst are arranged into an outer layer trophoblast (and an inner cell mass) / Trophoblast gets attached to endometrium , blastocyst becomes embedded in the endometrium of the uterus (and this is) called implantation $= \frac{1}{2} \times 2$

[3+2 = 5 marks]

26. (a) What is “population” according to you as a biology student ?
- “The size of a population for any species is not a static parameter.” Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.

- Ans. (a) Total number of organisms of a species in a particular area at a particular time = 1
- (b) The size of a population for any species is not a static parameter because of the factors like :-
- Birth rate/ Natality = $\frac{1}{2}$, number of births during a given period = $\frac{1}{2}$
- Death rate/ Mortality= $\frac{1}{2}$, number of deaths during a given period= $\frac{1}{2}$
- Immigration = $\frac{1}{2}$, number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration= $\frac{1}{2}$
- Emigration = $\frac{1}{2}$, number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration = $\frac{1}{2}$

[1 + 4 = 5 marks]

OR

- (a) **What is hydrarch succession ?**
- (b) **Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.**
- (c) **List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession ?**

- Ans. (a) The gradual and fairly predictable changes in the species composition in a water body / wetter areas = 1
- (b) Hydrarch : Pioneer species – Phytoplanktons = $\frac{1}{2}$
- Climax community – Forest/ trees = $\frac{1}{2}$
- Xerarch : Pioneer species – Lichens = $\frac{1}{2}$
- Climax community – Forest / trees = $\frac{1}{2}$
- (c) Condition of soil, availability of water, seeds or other propagules = 1
- Because (some) soil / sediment is already there, the rate of secondary succession is much faster than primary succession = 1

[1 + 2 + 1 + 1 = 5 marks]

27. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.

Ans.

Incomplete Dominance

F₁ generation does not resemble either of the parent but show an intermediate trait

Co-dominance

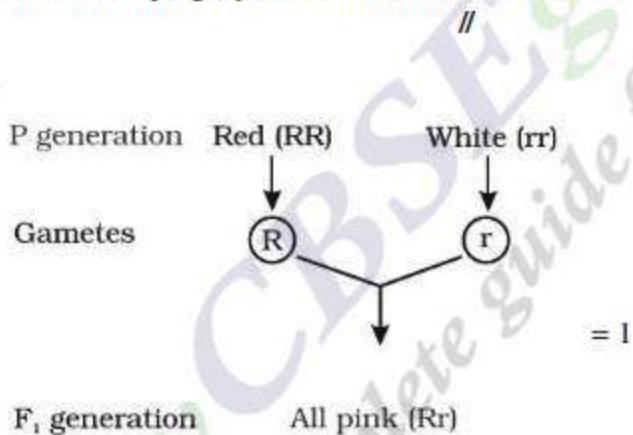
Both dominant alleles express themselves F₁
 $= \frac{1}{2} + \frac{1}{2}$

Example : Snapdragon / *Antirrhinum* sp /
 dog flower / *Mirabilis jalapa* /

Example AB blood group in human = 1

Four O'clock plant = 1

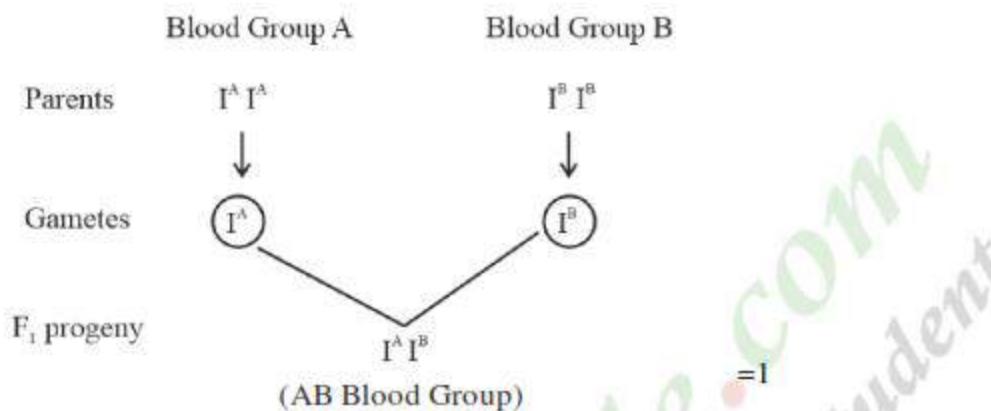
Incomplete dominance - When homozygous dominant and homozygous recessive parents are crossed all members of F₁ progeny will show intermediate trait = 1



Co dominance - When I^A and I^B are present together they both produce their own sugar / antigen = 1

//





// (Any other suitable cross showing occurrence of I^A & I^B together in offsprings)

With $I^A i$ & $I^B i$ / $I^A I^A$ & $I^B i$ / $I^A i$ & $I^B I^B$ / $I^A I^B$ & $I^A I^B$ / $I^A I^B$ & $I^B i$ / $I^A I^B$ & $I^A i$

[5 marks]

OR

- (a) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa

- (b) State the importance of a Genetic code in protein biosynthesis.

Ans. (a) George Gamow : Proposed that the Genetic code is constituted of 3 nucleotides / provided proof that the codon is a triplet = 1

Hargobind Khorana : Synthesized RNA molecule with a defined combination of bases (homopolymers and copolymers) = 1

Marshall Nirenberg : Cell free system for protein synthesis / helped the genetic code to be deciphered= 1

Severo Ochoa : Described enzyme (Polynucleotide phosphorylase)which polymerises RNA with defined sequence in a template independent manner (enzymatic synthesis of RNA) = 1

- (b) Genetic code - Codes for a specific amino acid which is required for protein synthesis / provides information about the specific amino acid that form a particular protein / polypeptide = 1

[4 + 1 = 5 marks]

Question Paper Code 57/1/3

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

- 1.** At what state does the meiosis occur in an organism exhibiting haploid life cycle and mention the fate of the products thus produced.

Ans. After zygote formation = $\frac{1}{2}$

haploid organism / haploid spores / (haploid) gametophyte = $\frac{1}{2}$

[1 mark]

- 2.** Write the number of chromosomes body cells of honey bee workers and drone have.

Ans. Honey bee workers : 32 = $\frac{1}{2}$

Drones : 16 = $\frac{1}{2}$

[1 mark]

- 3.** What are 'flocs', formed during secondary treatment of sewage ?

Ans. Masses of bacteria associated with fungal filament (to form mesh like structure)

[1 mark]

OR

Write any two places where methanogens can be found.

Ans. Anaerobic sludge (digester) , rumen of cattle / ruminants / stomach of cattle / gut of cattle , marshy area , flooded rice fields , biogas plant (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

- 4.** Name the layer of the atmosphere that is associated with 'good ozone'.

Ans. Stratosphere

[1 mark]

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Ans. Commensalism

[1 mark]

5. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called “Punnett Square”. Mention the possible result this representation predicts of the genetic cross carried.

Ans. (Probability of) all genotypes / genotypic ratio

[1 mark]

SECTION-B

(Q. Nos. 6 - 12 are of two marks each)

6. It is said apomixis is a type of asexual reproduction. Justify.

Ans. Apomixis is the formation of seeds or embryo without fusion of gametes / fertilization / Diploid egg cell is formed without reductional division and develops into the embryo without fertilization / Some cells of the nucellus start dividing and develop into embryo (**Any two**) = 1 + 1

[2 marks]

7. Mention four significant services that a healthy forest ecosystem provide.

Ans. Purify air / Production of O₂ / Purify water / Mitigate droughts and floods / Nutrient cycling / Generating fertile soils / Provide wildlife habitat / Maintain biodiversity / Pollinate crops / Provide site for carbon storage / Provide aesthetic - cultural - spiritual values / economic benefits / from nature food / industrial products / products of medicinal importance (**Any four**) = $\frac{1}{2} \times 4$

[2 marks]

OR

Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss.

Ans. Fig species is pollinated only by (its partner) wasp species where the female wasp uses the fruit of fig species as a site for egg laying and nourishing its larvae (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) / Moth deposits its egg in the locule of the ovary of *Yucca* plant and the flower in turn gets pollinated by the moth (mutualists tend to co-evolve / evolution of flower and its pollinator species are tightly linked) (**Any other relevant example explained**) = 1

When any one of these two species become extinct - the other species associated with it in obligatory way also becomes extinct and leads to biodiversity loss = 1

[2 marks]

8. Write the steps in sequence as carried in multiple ovulation embryo transfer technology.

Ans. Cow is administered with FSH like hormone , to induce follicular maturation and super ovulation / produce 6 – 8 eggs instead of one egg , animal is mated with an elite bull or artificially inseminated , fertilized eggs at 8 – 32 cells stages recovered non-surgically and transferred to surrogate mothers = $\frac{1}{2} \times 4$

[2 marks]

9. What is an origin of replication in a chromosome ? State its function.

Ans. This is the point on DNA where replication originates / starts = 1

It controls the copy number of linked DNA = 1

[2 marks]

10. List any four ways by which GMO's have been useful for enhanced crop output.

Ans. Make crops more tolerant to abiotic / cold / heat / drought / salt stresses /

Reduces reliance on chemical pesticides (pest-resistant crops) / Reduce post harvest losses / Increased efficiency of mineral usage by plant (prevents early exhaustion of soil fertility) / Enhanced nutritional value of food (example vitamin A enriched rice / starch) / To create tailor-made plants for non food purposes (to supply alternative resources of fuels / pharmaceuticals to industries) = *(Any four)* = $\frac{1}{2} \times 4$

[2 marks]

11. How is a continuous culture system maintained in bioreactors and why ?

Ans. Used medium is drained out from one side of the bioreactor and fresh medium is added from the other side = 1

This type of culturing method produces a larger biomass leading to higher yields (of desired protein)=1

[2 marks]

12. How would the gene flow or genetic drift affect the population in which either of them happen to take place ?

Ans. Results in changed frequency of genes (or alleles) in both populations , causing variation , leading to evolution / speciation / founder effect = 1 + 1

(Any two)

[2 marks]

SECTION-C

(Q. Nos. 13 - 24 are of three marks each)

13. How does a bisexual flowering plant ensures cross pollination ? Explain.

Ans. - Pollen release and stigma receptivity are non synchronized , either the pollen is released before the stigma becomes receptive / stigma becomes receptive before the release of pollen = $\frac{1}{2} \times 2$

- Anther and stigma are placed at different positions , pollen cannot come in contact with stigma of the same flower = $\frac{1}{2} \times 2$

- Self incompatibility , prevents self pollen from fertilising the ovules = $\frac{1}{2} \times 2$

[3 marks]

- 14.** Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.

Knowledge of the nature and habits of bees / Selection of suitable location for keeping the beehive / Catching and hiving of swarms (group of bees) / Management of beehives during different seasons / handling and collection of honey and bee wax (**Any four**) = $\frac{1}{2} \times 4$

- *Apis indica* = 1

[3 marks]

- 15.** Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork ?

OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Ans. Non evaluative , because the choice question is faulty , full marks to be awarded to all examinees who attempt either of the choice questions.

- 16.** (a) Write two differences between *Homo erectus* and *Homo habilis*.
 (b) Rearrange the following from early to late geologic periods: Carboniferous, Silurian, Jurassic.

| Ans. (a) | <i>Homo erectus</i> | <i>Homo habilis</i> |
|----------|---|---------------------------------|
| (i) | Brain capacity 900 cc | Brain capacity 650 – 800 cc = 1 |
| (ii) | (Probably) ate meat | (Probably) did not eat meat = 1 |
| (b) | Silurian → Carboniferous → Jurassic = 1 | |

(No mark to be awarded if all the three are not in proper sequence)

[2 +1 = 3 marks]

- 17.** List six advantages of “ex-situ” approach to conservation of biodiversity.

An endangered / threatened species can be conserved / genetic strains of commercially important plants can be preserved for a long time (seed banks) / biodiversity loss is reduced / gametes of threatened species can be preserved in a viable and fertile condition for long periods (using

cryopreservation) / eggs can be fertilized in -vitro / plants can be propagated using tissue culture / economically beneficial / conserve large number of species / aesthetic value

(Any six points) = $\frac{1}{2} \times 6$

[3 marks]

- 18. Effluent from the primary treatment of sewage is passed for secondary treatment. Explain the process till the water is ready to be released into natural water bodies.**

Ans. During treatment (after adding small amount of inoculum) primary effluent is constantly agitated mechanically in (large) aeration tanks and air is pumped into it , this allows the vigorous growth of useful microbes into flocs , the microbes consume the major part of the organic matter in the effluent , it reduces the BOD of the effluent , the effluent is then passed into settling tank where the bacterial flocs are allowed to sediment , major part of the activated sludge is pumped into aerobic sludge digester (and remaining water is released into natural water bodies) = $\frac{1}{2} \times 6$

[3 marks]

- 19. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.**

- (a) Name the ailments the two girls were suffering from ?
(b) Why did the treatment provided to girl A required repeated visits ?
(c) How was the girl B cured permanently ?

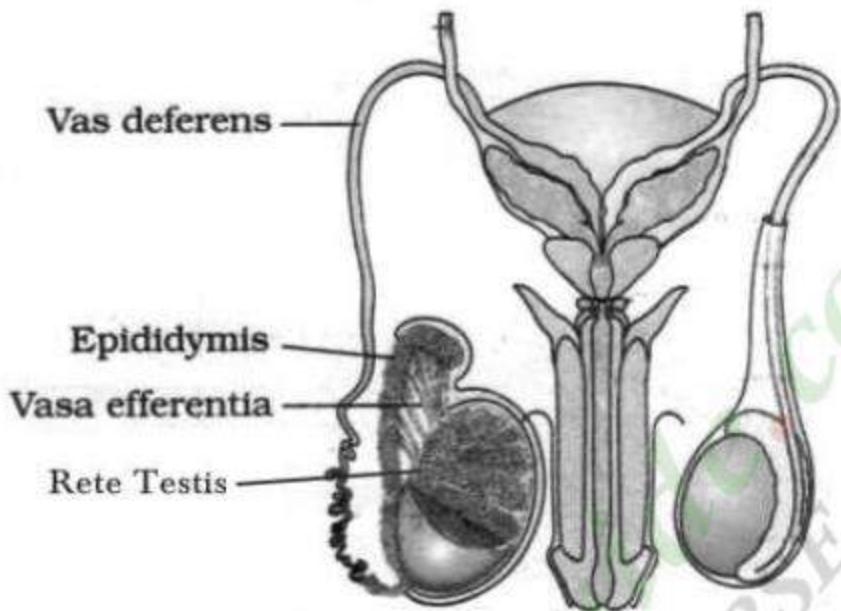
Ans. (a) Adenosine deaminase (ADA) deficiency = 1

(b) (In Enzyme Replacement Therapy) functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited time period = 1 + 1

(c) [As there is no permanent cure at the age of five hence 1 mark of this answer allocated to part (b)]

[2 + 1 = 3 marks]

- 20. Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.**

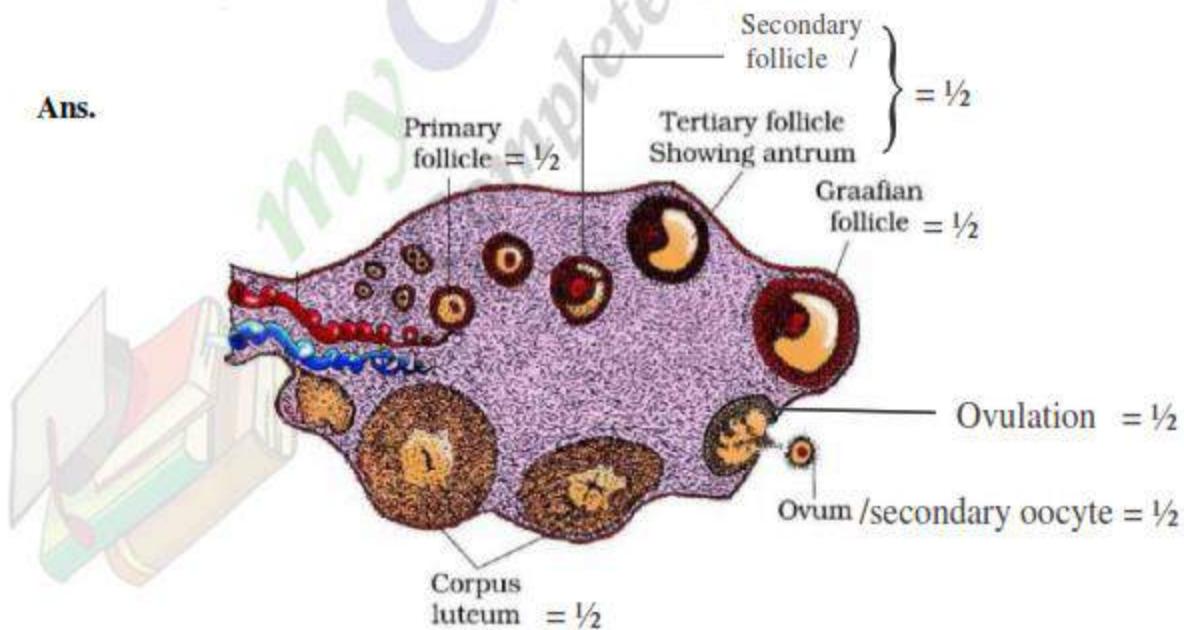


Correct diagram with : 1 labelling = $\frac{1}{2}$, 2 labellings = 1, 3 labellings = 2, 4 labellings = 3
[3 marks]

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

Ans.



$$= \frac{1}{2} \times 6$$

[3 marks]

- 21.** Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Boveri with that of experimental results on pea plant presented by Mendel.

| Sutton and Boveri | Mendel |
|---|---|
| 1. Chromosomes occur in pairs | 1. Factors occur in pairs |
| 2. Chromosomes segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete | 2. Factors segregate at gamete formation stage and only one of each pair is transmitted to a gamete |
| 3. Independent pairs of chromosomes segregate independently of each other | 3. One pair of factors segregate independently of another pairs |

$$= 1 \times 3$$

[3 marks]

OR

- (a) Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.
- (b) Write the basis on which Alfred Sturtevant explained gene mapping.

Ans. (a) Linkage : - Physical association of genes on a chromosome ,

- Two genes did not segregate independently of each other
- F_2 (phenotypic) ratio deviates (significantly) from 9:3:3:1 (**Any two**) = $\frac{1}{2} \times 2$

Recombination: -Tightly linked genes tend to show fewer recombinant frequency / 1.3% = $\frac{1}{2}$

-Loosely linked genes show higher percentage of recombinant frequency / 37.2% = $\frac{1}{2}$

- (b) He used the frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes and mapped their position on the chromosome = 1

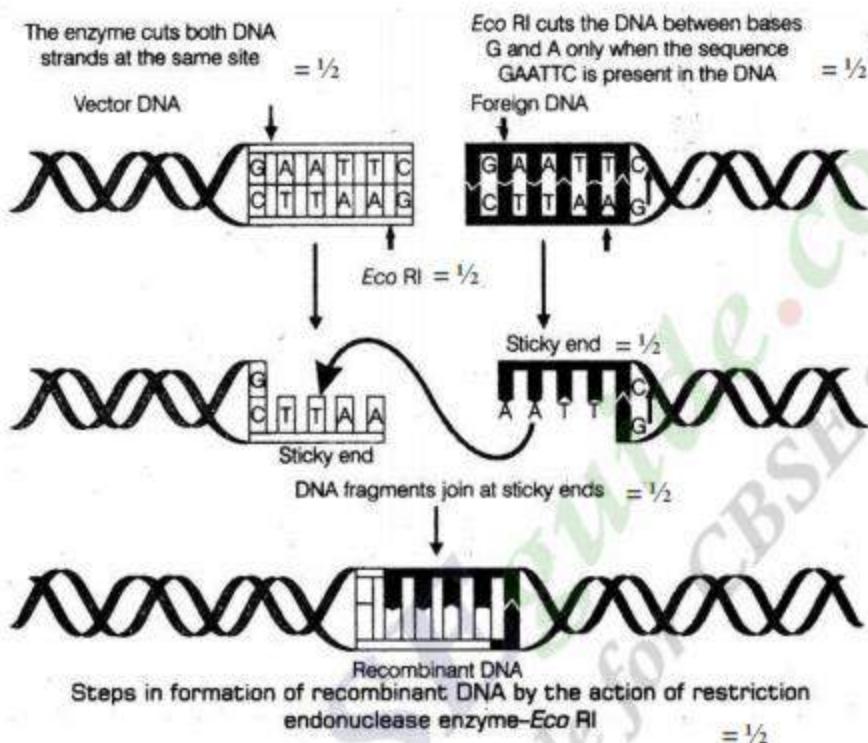
[2 + 1 = 3 marks]

- 22.** Describe the formation of recombinant DNA by the action of EcoRI.

Ans. EcoRI identifies its palindromic sequence on both vector DNA and foreign DNA / 5' GAATTC3' , cuts strands of DNA little away from the centre of palindromic sites , but between same two bases (G and A) , this leaves single stranded portion at the end (sticky ends) on each strand , for recombination both vector DNA and foreign DNA , with similar sticky ends are joined by the enzyme DNA ligase = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation

//



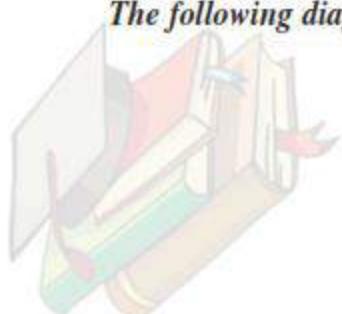
OR

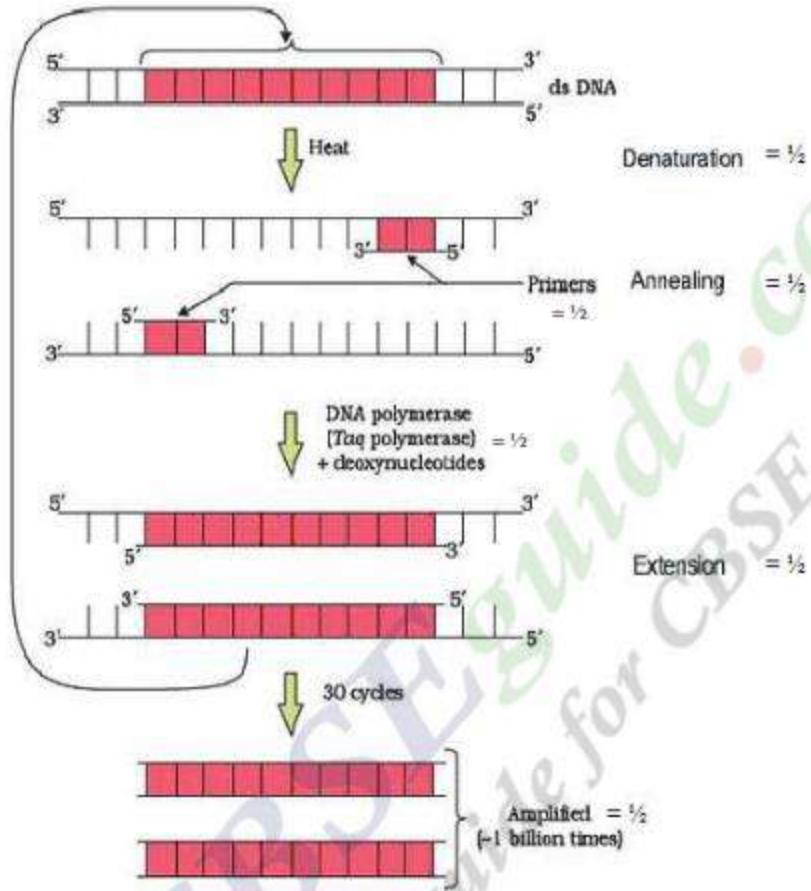
Describe the process of amplification of “gene of interest” using PCR technique.

- Ans. Ans. Denaturation of desired DNA into two strands, each acting as a template, for each strand separate set of primer (two sets of primer) used, with the help of deoxy(ribo)nucleotides and Taq polymerase (DNA polymerase isolated from *Thermus aquaticus*), extension of DNA template occurs, resulting in replication of desired DNA (amplification) = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation

//





[3 marks]

23. (a) Match the microbes listed under Column-A with the products mentioned under Column-B.

| Column - A | Column - B |
|---------------------------------|--------------------|
| <i>Penicillium notatum</i> | (i) Statin |
| <i>Trichoderma polysporum</i> | (ii) ethanol |
| <i>Monascus purpurea</i> | (iii) antibiotic |
| <i>Saccharomyces cerevisiae</i> | (iv) Cyclosporin-A |

- (b) Why does ‘Swiss Cheese’ develop large holes ?**

- (a) (H) *Penicillium notatum* (iii) antibioti

- (I) *Trichoderma polysporum* (iv) Cyclosporin-A

- (J) *Monascus purpureus* (i) Statin
 (K) *Saccharomyces cerevisiae* (ii) ethanol

$\equiv \frac{1}{2} \times 4$

- (b) Due to production of large amount of CO₂ (by *Propionibacterium sharmanii*) = 1

[3 marks]

24. Explain any two most important levels of biological organisation showing biodiversity with the help of an example each.

Ans. (i) Genetic diversity : High diversity at the genetic level over its distributional range = 1

Example : *Rouwolia vomitoria* growing in different himalayan ranges might be in terms of the potency and concentration of the active chemical that the plant produce / India has more than 50,000 genetically different strains of rice / 1,000 varieties of mango = $\frac{1}{2}$

(ii) Species diversity : Diversity at the species level = 1

Example : The Western Ghats have a greater amphibian species diversity than Eastern Ghats = $\frac{1}{2}$

(iii) Ecological diversity : At the ecosystem level = 1

Example : India for instance with its deserts / rain forests / mangroves / coral reefs / wetlands/ estuaries / alpine meadows have a greater ecosystem diversity than a Scandinavian country like Norway (**Any two examples of ecological diversity**) = $\frac{1}{2}$

(Any two levels of diversity) = $1\frac{1}{2} + 1\frac{1}{2}$

[3 marks]

SECTION D

(Q. Nos. 25 - 27 are of five marks each)

25. Differentiate between spermatogenesis and Oogenesis on the basis of

(i) **Time of initiation of the process**

(ii) Site of completion of the process

(iii) Nature of meiotic division undergone by gamete mother cells

(b) Name the hormones and state their role involved in controlling spermatogenesis in humans.

| Ans. (a) | | Spermatogenesis | Oogenesis |
|----------------------------|---|---|--|
| | Time of initiation | At puberty | During foetal stage / embryonic stage |
| | Site of completion | Seminiferous tubule | Fallopian tube / Ampullary - isthmic junction / Ampullary region |
| Nature of meiotic division | Equal cell division/ | Unequal cell division / | |
| | Continuous cell division/ | Suspended/ arrested at early embryonic stage/ | |
| | Formation of four daughter cells / spermatids | Formation of one egg / Ovum | |

$$= \frac{1}{2} \times 6$$

- (b) GnRH acts on anterior pituitary to secrete LH and FSH , LH acts on Leydig cell and stimulates synthesis and secretion of androgens , androgen stimulates spermatogenesis , FSH acts on sertoli cells which stimulate secretion of some factors which helps in the process of spermiogenesis = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

OR

- (a) Explain the process of double fertilization in angiosperms.
- (b) Why does the development of endosperm preceeds that of embryo ?
- (c) List the parts of a typical dicot embryo.

- Ans.** (a) (i) One male gamete fuses with egg cell in the embryo sac to form zygote ($2n$) , called syngamy = $\frac{1}{2} + \frac{1}{2}$
- (ii) Other male gamete fuses with two polar nuclei to form PEN (primary endosperm nucleus) ($3n$) , triple fusion = $\frac{1}{2} + \frac{1}{2}$
- (iii) Both syngamy and triple fusion together called as double fertilisation = $\frac{1}{2}$
- (b) Endosperm contains the reserve food material which is used for the nutrition of developing embryo = 1
- (c) Radicle , Plumule , Cotyledons = $\frac{1}{2} \times 3$

[$2\frac{1}{2} + 1 + 1\frac{1}{2} = 5$ marks]

26. (a) What is "population" according to you as a biology student ?
- (b) "The size of a population for any species is not a static parameter." Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.

Ans. (a) Total number of organisms of a species in a particular area at a particular time = 1

(b) The size of a population for any species is not a static parameter because of the factors like :-

Birth rate/ Natality = $\frac{1}{2}$, number of births during a given period = $\frac{1}{2}$

Death rate/ Mortality= $\frac{1}{2}$, number of deaths during a given period= $\frac{1}{2}$

Immigration = $\frac{1}{2}$, number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration= $\frac{1}{2}$

Emigration = $\frac{1}{2}$, number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration = $\frac{1}{2}$

[1 + 4 = 5 marks]

OR

- (a) What is hydrarch succession ?
- (b) Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.
- (c) List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession ?

Ans. (a) The gradual and fairly predictable changes in the species composition in a water body / wetter areas = 1

(b) Hydrarch : Pioneer species – Phytoplanktons = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

Xerarch : Pioneer species – Lichens = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

(c) Condition of soil, availability of water, seeds or other propagules = 1

Because (some) soil / sediment is already there, the rate of secondary succession is much faster than primary succession = 1

[1 + 2 + 1 + 1 = 5 marks]

27. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.

Ans.

Incomplete Dominance

F₁ generation does not resemble either of the parent but show an intermediate trait

Co-dominance

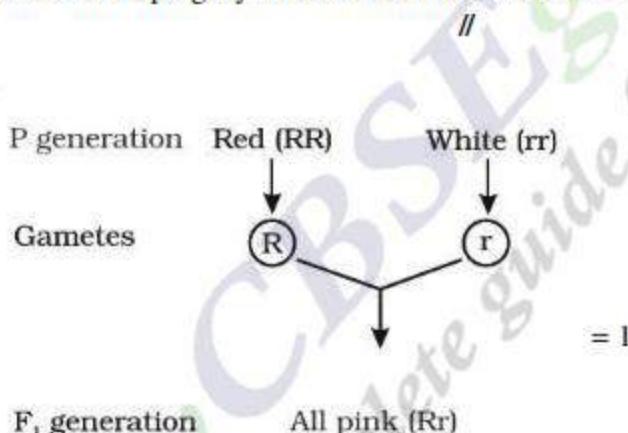
Both dominant alleles express themselves F₁
 $= \frac{1}{2} + \frac{1}{2}$

Example : Snapdragon / *Antirrhinum* sp / dog flower / *Mirabilis jalapa* /

Four O'clock plant = 1

Example AB blood group in human = 1

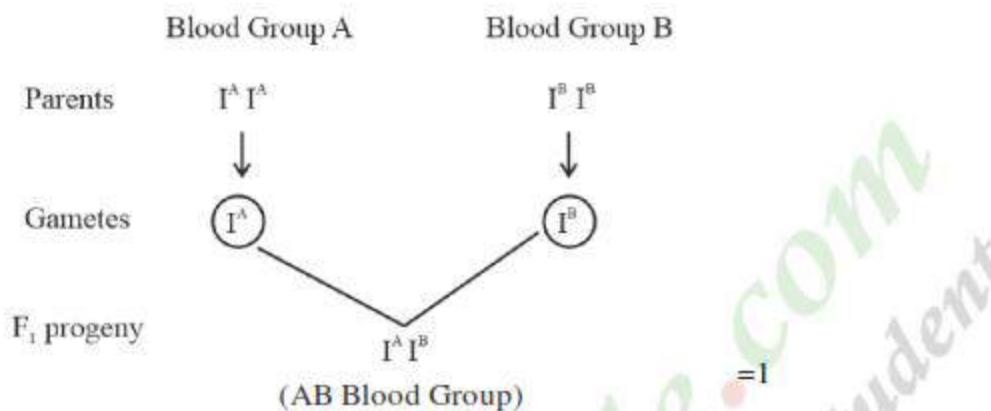
Incomplete dominance - When homozygous dominant and homozygous recessive parents are crossed all members of F₁ progeny will show intermediate trait = 1



Co dominance - When I^A and I^B are present together they both produce their own sugar / antigen = 1

//





// (Any other suitable cross showing occurrence of I^A & I^B together in offsprings)

With $I^A i$ & $I^B i$ / $I^A I^A$ & $I^B i$ / $I^A i$ & $I^B I^B$ / $I^A I^B$ & $I^A I^B$ / $I^A I^B$ & $I^B i$ / $I^A I^B$ & $I^A i$

[5 marks]

OR

- (a) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa

- (b) State the importance of a Genetic code in protein biosynthesis.

Ans. (a) George Gamow : Proposed that the Genetic code is constituted of 3 nucleotides / provided proof that the codon is a triplet = 1

Hargobind Khorana : Synthesized RNA molecule with a defined combination of bases (homopolymers and copolymers) = 1

Marshall Nirenberg : Cell free system for protein synthesis / helped the genetic code to be deciphered = 1

Severo Ochoa : Described enzyme (Polynucleotide phosphorylase)which polymerises RNA with defined sequence in a template independent manner (enzymatic synthesis of RNA) = 1

- (b) Genetic code - Codes for a specific amino acid which is required for protein synthesis / provides information about the specific amino acid that form a particular protein / polypeptide = 1

[4 + 1 = 5 marks]

SET-1

Series BVM/2

रोल नं.
Roll No.

कोड नं.
Code No. **57/2/1**

परीक्षार्थी कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।

Candidates must write the Code on the title page of the answer-book.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **11** हैं।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में **27** प्रश्न हैं।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, 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 **11** printed pages.
- Code number 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 **27** questions.
- **Please write down the Serial Number of the question 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

Time allowed : 3 hours

आधिकतम अंक : 70

Maximum Marks : 70

सामान्य निर्देश :

- (i) प्रश्न-पत्र में चार खण्डों में कुल 27 प्रश्न दिए गए हैं। सभी प्रश्न अनिवार्य हैं।
- (ii) खण्ड A में प्रश्न संख्या 1 से 5 अति लघु-उत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 1 अंक का है।
- (iii) खण्ड B में प्रश्न संख्या 6 से 12 लघु-उत्तरीय प्रश्न प्रकार I के हैं, प्रत्येक प्रश्न 2 अंकों का है।
- (iv) खण्ड C में प्रश्न संख्या 13 से 24 लघु-उत्तरीय प्रश्न प्रकार II के हैं, प्रत्येक प्रश्न 3 अंकों का है।
- (v) खण्ड D में प्रश्न संख्या 25 से 27 दीर्घ-उत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 5 अंकों का है।
- (vi) प्रश्न-पत्र में समग्र पर कोई विकल्प नहीं है, फिर भी 1 अंक वाले दो प्रश्नों में, 2 अंकों वाले दो प्रश्नों में, 3 अंकों वाले चार प्रश्नों में और 5 अंकों वाले सभी तीनों प्रश्नों में भीतरी चयन-विकल्प दिए गए हैं। प्रत्येक परीक्षार्थी को ऐसे प्रश्नों के दो विकल्पों में से कोई एक प्रश्न हल करना है।
- (vii) आवश्यकतानुसार, चित्रों का रेखन साफ-सुधरा एवं यथोचित लेबल होना चाहिए।

General Instructions :

- (i) There are a total of 27 questions and four sections in the question paper. All questions are compulsory.
- (ii) Section A contains questions number 1 to 5, very short-answer type questions of 1 mark each.
- (iii) Section B contains questions number 6 to 12, short-answer type I questions of 2 marks each.
- (iv) Section C contains questions number 13 to 24, short-answer type II questions of 3 marks each.
- (v) Section D contains questions number 25 to 27, long-answer type questions of 5 marks each.
- (vi) There is no overall choice in the question paper, however, an internal choice is provided in two questions of 1 mark, two questions of 2 marks, four questions of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any one of the two given alternatives.
- (vii) Wherever necessary, the diagram drawn should be neat and properly labelled.

खण्ड अ

SECTION A

1. उल्वबेधन (ऐम्नियोसेंटेसिस) पर वैधानिक प्रतिबंध को न्यायोचित सिद्ध करने के पक्ष में एक कारण दीजिए। 1

Give one reason to justify statutory ban on amniocentesis.

2. निम्नलिखित के कारण होने वाले मानव आनुवंशिक विकार का नाम लिखिए :
(a) किसी पुरुष में एक अतिरिक्त X-क्रोमोसोम होना
(b) किसी स्त्री में एक X-क्रोमोसोम का अभाव होना

अथवा

बताइए असुगुणिता (एन्युप्लॉइडी) का क्या परिणाम होता है। 1

Name a human genetic disorder due to the following :

- (a) An additional X-chromosome in a male
(b) Deletion of one X-chromosome in a female

OR

State what does aneuploidy lead to.

3. पौधों तथा प्राणियों से प्रत्येक का एक-एक उदाहरण दीजिए जो अपसारी विकास प्रदर्शित करते हैं। 1

Mention one example each from plants and animals exhibiting divergent evolution.

4. किन्हीं दो कायिक रोधों (फिजियोलॉजिकल बैरियर्स) के नाम लिखिए जो सहज प्रतिरक्षा प्रदान करते हैं। 1

अथवा

निम्नलिखित फ़सलों की किस्मों में से दो रोग प्रतिरोधी किस्मों का चयन कीजिए : 1

हिमगिरि, पूसा गौरव, पूसा कोमल, पूसा A-4

Name any two physiological barriers that provide innate immunity.

OR

Select two disease resistant crop varieties from the list of crop varieties given below :

Himgiri, Pusa Gaurav, Pusa Komal, Pusa A-4

5. परित्यक्त खेतों में कैलोट्रोपिस जैसी खरपतवार क्यों फलती-फूलती है ? दो कारण दीजिए। 1

Give two reasons as to why a weed such a *Calotropis* flourishes in abandoned fields.

खण्ड ब

SECTION B

6. मॉस तथा मेंढक दोनों को निषेचन के लिए माध्यम के रूप में जल की आवश्यकता होती है। इन दोनों जीवों में युग्मक-संलयन कहाँ संपन्न होता है और यह किस प्रकार सुनिश्चित होता है? 2

अथवा

प्राणियों की अंडप्रजक तथा सजीवप्रजक श्रेणियों के एक-एक उदाहरण देते हुए उन्हें वर्गीकृत करने का आधार लिखिए। 2

Mosses and frogs both need water as a medium for fertilisation. Where does syngamy occur and how is it ensured in both these organisms?

OR

Write the basis of categorising animals as oviparous or viviparous, giving one example of each.

7. (a) आपको अरंड तथा सेम के बीज दिए गए हैं। भूष-पोष का अवलोकन करने के लिए आप इनमें से किसका चयन करेंगे ?
 (b) पौधों में भूष-पोष का विकास भूष से पहले होता है। न्यायसंगतता सिद्ध कीजिए। 2
- (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm ?
 (b) The development of endosperm precedes that of embryo in plants. Justify.

8. डी.एन.ए. अणु की एक शृंखला में 546 न्यूकिलियोटाइड्स हैं। यदि इसमें ऐडेनीन न्यूकिलियोटाइड्स की संख्या 96 है, तो उसमें उपस्थित साइटोसीन न्यूकिलियोटाइड्स की संख्या कितनी होगी ? 2
 A segment of DNA molecule comprises of 546 nucleotides. How many cytosine nucleotides would be present in it if the number of adenine nucleotides is 96 ?
9. 'कायिक संकरण' किस प्रकार किया जाता है? कायिक संकर का एक उदाहरण दीजिए। 2
 How is 'somatic hybridization' carried out? Mention one example of a somatic hybrid.
10. जेल वैद्युत कण-संचलन (जेल-इलेक्ट्रोफोरेसिस) के दौरान डी.एन.ए. खंडों की उपस्थिति का मानसर्दर्शन (आभास) किस प्रकार किया जाता है? क्षालन (इलूशन) क्या होता है? 2
 How are DNA fragments visualised during gel-electrophoresis? What is elution?
11. मक्के की खेती करने वाला एक किसान अपनी फ़सल में मक्का-भेदक पीड़िक के आक्रमण की चिरकालिक समस्या से पीड़ित है। पर्यावरण के प्रति संवेदनशील होने के कारण वह कीटनाशक का छिड़काव नहीं करना चाहता। जैव-प्रौद्योगिकी के अपने ज्ञान के आधार पर इसका समाधान सुझाइए। इसे प्राप्त करने के लिए किए जाने वाले उपाय के विभिन्न चरण लिखिए। 2
 A corn farmer has perennial problem of corn-borer infestation in his crop. Being environmentally conscious he does not want to spray insecticides. Suggest solution based on your knowledge of biotechnology. Write the steps to be carried out to achieve it.
12. जर्मनी के प्रकृतिविद् अलेकजेंडर वॉन हम्बोल्ट द्वारा दक्षिणी अमेरिका के जंगलों में किए गए गहन अन्वेषण के समय उनके द्वारा किए गए 'दो' प्रेक्षण लिखिए। 2

अथवा

यदि किसी 'N' साइज़ की समष्टि में जन्म-दर को 'b' तथा मृत्यु-दर को 'd' द्वारा निरूपित किया जाता है, तब इकाई समय अवधि 't' में 'N' में वृद्धि अथवा हास निम्न प्रकार से होगा :

$$\frac{dN}{dt} = (b - d) \times N$$

उपर्युक्त समीकरण को इस प्रकार भी निरूपित कर सकते हैं :

$$\frac{dN}{dt} = r \times N, \text{ जिसमें } r = (b - d)$$

'r' क्या निरूपित करता है? किसी समष्टि के लिए 'r' का परिकलन करने का कोई एक महत्व लिखिए। 2

State 'two' observations made by German naturalist, Alexander von Humboldt during his extensive explorations in South American jungles.

OR

If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be :

$$\frac{dN}{dt} = (b - d) \times N$$

The equation given above can also be represented as :

$$\frac{dN}{dt} = r \times N, \text{ where } r = (b - d)$$

What does 'r' represent ? Write any one significance of calculating 'r' for any population.

खण्ड स

SECTION C

13. पुष्पी पादपों में टेपीटम एवं सहाय कोशिकाएँ कब और कहाँ उत्पन्न होती हैं ? उनके प्रकार्यों का वर्णन कीजिए। 3

अथवा

एक आवृतबीजी के नर युग्मकोट्टभिद में निम्नलिखित संरचनाएँ कहाँ उपस्थित होती हैं ? प्रत्येक के कार्य का उल्लेख कीजिए। 3

- (a) जनन-छिद्र
- (b) स्पोरोपोलेनिन
- (c) जनन कोशिका

When and where do tapetum and synergids develop in flowering plants ? Mention their functions.

OR

Where are the following structures present in a male gametophyte of an angiosperm ? Mention the function of each one of them.

- (a) Germ pore
- (b) Sporopollenin
- (c) Generative cell

14. अंडजनन परिघटनाओं के उचित अनुक्रम को प्रदर्शित करने के लिए एक प्रवाह चार्ट बनाइए। 3

Construct a flow chart exhibiting sequential events of oogenesis.

15. घास के भूण की अनुदैर्घ्य/अनुप्रस्थ-काट का आरेख बनाकर उसके भागों को नामांकित कीजिए। 3

अथवा

पुरुष की शुक्रजनक नलिका की काट के आरेखीय दृश्य (आवर्धित) का रेखाचित्र बनाइए तथा इसके भागों को नामांकित कीजिए। 3

Draw L.S. of an embryo of grass and label its parts.

OR

Draw a diagrammatic sectional view of a seminiferous tubule (enlarged) in humans and label its parts.

16. (a) उत्परिवर्तन कैसे घटित होते हैं ?
 (b) बिन्दु उत्परिवर्तन तथा फ्रेमशिफ्ट उत्परिवर्तन में अंतर स्पष्ट कीजिए। 3
 (a) How does mutation occur ?
 (b) Differentiate between point mutation and frameshift mutation.

17. “मेसेल्सन तथा स्टाल द्वारा अपने प्रयोगों में नाइट्रोजन के भारी समस्थानिक के उपयोग से यह सिद्ध हो गया कि डी.एन.ए. अर्ध-संरक्षी की तरह प्रतिकृति करता है।” व्याख्या कीजिए कि वे इस निष्कर्ष पर किस प्रकार पहुँचे। 3

अथवा

एक असीमकेन्द्रिकी के राइबोसोम में होने वाले स्थानांतरण (रूपांतरण) की क्रियाविधि की व्याख्या कीजिए। 3

"Use of heavy isotope of nitrogen by Meselson and Stahl demonstrated semi-conservative mode of replication of a DNA molecule." Explain how did they arrive at this conclusion.

OR

Explain the mechanism of translation that occurs in the ribosomes in a prokaryote.

- 18.** डार्विन के प्राकृतिक वरण के सिद्धान्त के अनुसार नए जीव रूपों के आविर्भाव की दर जीव के जीवन-चक्र अथवा जीवन-काल से संबद्ध है। एक उदाहरण की सहायता से स्पष्ट कीजिए। 3

According to Darwinian theory of natural selection the rate of appearance of new forms is linked to the life-cycle or the life-span of an organism. Explain with the help of an example.

- 19.** (a) न्यूमोनिया तथा सामान्य जुकाम के रोगकारक जीवों के नाम लिखिए।
(b) इन रोगों के लक्षणों में क्या अंतर है ?
(c) दोनों रोगों के दो उभयनिष्ठ लक्षण लिखिए। 3

अथवा

- (a) मलेरिया के रोगकारक जीव और रोगवाहक जीव के वैज्ञानिक नाम लिखिए तथा इस रोग के लक्षण लिखिए।
(b) ईडिस स्पी. द्वारा फैलने वाले दो रोगों के नाम लिखिए। 3
(a) Name the causative agents of pneumonia and common cold.
(b) How do these differ in their symptoms ?
(c) Mention two symptoms common to both.

OR

- (a) Write the scientific names of the causative agent and vector of malaria, and write its symptoms.
(b) Name any two diseases spread by *Aedes* sp.

- 20.** (a) अंतःप्रजनन तथा बहिःप्रजनन में अंतर स्पष्ट कीजिए।
 (b) पशु प्रजनन (पशुपालन) में अंतःप्रजनन के कोई तीन लाभ तथा एक महत्वपूर्ण हानि लिखिए। 3
- (a) Differentiate between inbreeding and outbreeding.
 (b) List any three advantages and one important disadvantage of inbreeding practice in animal husbandry.
- 21.** जैव-प्रौद्योगिकी प्रयोगशालाओं में सर्वाधिक उपयोग किए जाने वाले बायोरिएक्टर का नाम लिखिए। इस बायोरिएक्टर के अनिवार्य संघटकों का उल्लेख कीजिए जिससे अधिक मात्रा में वाँछित उत्पाद पाने के लिए संवर्धन माध्यम को अनुकूलतम परिस्थितियाँ उपलब्ध कराई जा सकें। 3
- Name the most commonly used bioreactor in biotechnology labs. Mention the most essential components this bioreactor must have so as to provide the optimum conditions to the culture medium, resulting in production of large volume of desired product.
- 22.** एक शिशु ए.डी.ए.-अभाव के साथ पैदा हुआ है।
 (a) जीवनपर्यन्त स्थायी उपचार का एक संभाव्य तरीका सुझाइए तथा उसकी व्याख्या भी कीजिए।
 (b) इस रोग के किसी अन्य संभाव्य उपचार का नाम लिखिए। 3
- A child is born with ADA-deficiency.
- (a) Suggest and explain a procedure for possible life-long (permanent) cure.
 (b) Name any other possible treatment for this disease.
- 23.** 'प्रसारी (बढ़ती) आयु पिरैमिड' तथा 'स्थिर आयु पिरैमिड' में अंतर स्पष्ट कीजिए। अपने उत्तर की आरेखों के साथ पुष्टि कीजिए। 3
- Differentiate between an 'Expanding age pyramid' and a 'Stable age pyramid'. Substantiate your answer with diagrams.
- 24.** किसी दिए गए क्षेत्र में 'विदेशी जातियों के आक्रमण' के जैव-विविधता पर प्रभाव का विश्लेषण कीजिए। दो उदाहरण भी दीजिए। 3
- Analyse the effects of 'Alien species invasion' on the biodiversity of a given area. Provide two examples.

खण्ड द

SECTION D

25. मेंडल ने 'पीले एवं गोल' बीज वाले समयुक्ती मटर के एक पौधे का 'हरे एवं झुर्रीदार' बीज वाले एक अन्य मटर के पौधे के साथ संकरण किया। उसने पाया कि F_2 -पीढ़ी की कुछ समष्टियों में जनक अभिलक्षणों के नए संयोजन परिलक्षित हो रहे हैं। जनक पौधों के अभिलक्षणों की F_2 -संतति में नए संयोजन के आविर्भाव की व्याख्या आप किस प्रकार करेंगे? पनेट वर्ग की सहायता से अपने उत्तर का समर्थन कीजिए।

5

अथवा

एस.एल. मिलर के प्रयोग का वर्णन कीजिए। उनके द्वारा किए गए प्रेक्षणों तथा पृथ्वी पर जीवन की उत्पत्ति के क्षेत्र में उनके योगदान पर टिप्पणी कीजिए।

5

Mendel crossed a homozygous pea plant having yellow and round seeds with another pea plant bearing green and wrinkled seeds. He found that in some of the F_2 population new combination of parental characters were observed.

How will you explain the appearance of a new combination of parental characters in F_2 -offsprings? Support your answer with the help of Punnett square.

OR

Describe S.L. Miller's experiment. Comment on the observations he made and his contribution towards the origin of life on Earth.

26. (a) सक्रिय प्रतिरक्षा तथा निष्क्रिय प्रतिरक्षा में अंतर स्पष्ट कीजिए।
 (b) मानव समष्टि को स्वस्थ रखने के लिए टीकाकरण और प्रतिरक्षीकरण के योगदान पर टिप्पणी कीजिए।

5

अथवा

शहरों में जनित व्यर्थ जल (बाहित मल) को प्राकृतिक जल स्रोतों में विसर्जित करने से पहले किए जाने वाले द्वितीयक उपचार का वर्णन कीजिए। इस प्रक्रम द्वारा होने वाले एक अन्य लाभ का उल्लेख कीजिए।

5

- (a) Differentiate between active and passive immunity.
 (b) Comment on the role of vaccination and immunization in keeping human population healthy.

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

27. बंगलुरु में प्लास्टिक की बोरी के उत्पादनकर्ता अहमद खान ने प्लास्टिक अपशिष्ट की समस्या का एक आदर्श हल ढूँढ़ निकाला। ठोस अपशिष्ट निपटान की चुनौतियों के समाधान हेतु अहमद खान द्वारा किए गए प्रयासों की व्याख्या पाँच चरणों में कीजिए। $1 \times 5 = 5$

अथवा

- (a) पारिस्थितिक पिरैमिड क्या निरूपित करते हैं? इन पिरैमिडों की किन्हीं दो सीमाओं का उल्लेख कीजिए।
- (b) एक उदाहरण की सहायता से जैव-मात्रा के एक उल्टे पिरैमिड का वर्णन कीजिए। $3+2=5$

A plastic sack manufacturer in Bengaluru, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management.

OR

- (a) What does an ecological pyramid represent? State any two limitations that these pyramids have.
- (b) Describe an inverted pyramid of biomass with the help of an example.



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. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. 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.**
3. 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.
4. 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.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. 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 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.
 - 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.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.
12. 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.
13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
14. 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.
15. 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.

Question Paper Code 57/2/1

SECTION-A

(Q. Nos. 1 - 5 are of one marks each)

1. Give one reason to justify statutory ban on amniocentesis.

Ans. Check/prevent female foeticide.

[1 Mark]

2. Name a human genetic disorder due to the following :

- (a) An additional X-chromosome in a male
(b) Deletion of one X-chromosome in a female

Ans. a) Klinefelter's Syndrome

b) Turner's Syndrome

= ½ + ½
[1 Mark]

OR

State what does aneuploidy lead to.

Individuals with abnormal number of chromosomes / Down's Syndrome / Turner's Syndrome / Klinefelter's Syndrome (or any other correct example)

[1 Mark]

3. Mention one example each from plants and animals exhibiting divergent evolution.

Ans. Thorn of Bougainvillea and tendrils of Cucurbita ,

forelimbs of whales , bats, cheetah and humans (all mammals) / vertebrate hearts / vertebrates brains
(Any one) /Any other correct example

= ½ + ½

[1 Mark]

4. Name any two physiological barriers that provide innate immunity ?

Ans Acid in Stomach/Saliva in mouth/tears in eyes (Any two)

= ½ + ½

[1 Mark]

OR

Select two disease resistant crop varieties from the list of crop varieties given below:

Himgiri, Pusa Gaurav, Pusa Komal, Pusa A-4

Ans Himgiri; Pusa Komal

= $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

5. Give two reasons as to why a weed such a Calotropis flourishes in abandoned fields.

Ans. Dry hairy seeds helps in dissemination / having xerophytic adaptations (thick hair on leaves & stems) / not grazed by animals as it produces poisonous substances / cardiac glycosides (any two)

$\frac{1}{2} + \frac{1}{2} = 1$

[1 Mark]

SECTION B

(Q Nos. 6-10 are of two marks each)

6. Mosses and frogs both need water as a medium for fertilisation. Where does syngamy occur and how is it ensured in both these organisms ?

Ans Frog -External fertilization / in water / outside the body , release of motile gametes / large number of gametes/ synchronised maturation of ova and sperms = $\frac{1}{2} + \frac{1}{2}$

Moss - Internal fertilization / inside the body of organism , male gametes are motile / large number of gametes. = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

OR

Write the basis of categorising animals as oviparous or viviparous, giving one example of each.

Ans. Egg laying (fertilised or unfertilised) , e.g. reptiles / birds / any other correct example = $\frac{1}{2} + \frac{1}{2}$

Give birth to young ones , e.g. majority of mammals / humans / any other correct example = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

7. (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm ?

(b) The development of endosperm precedes that of embryo in plants. Justify.

Ans. (a) Castor

= 1

(b) endosperm stores reserve food materials / provides nutrition to the developing embryo = 1

[2 Marks]

- 8. A segment of DNA molecule comprises of 546 nucleotides. How many cytosine nucleotides would be present in it if the number of adenine nucleotides is 96 ?**

Ans. $A + T = C + G$, Given $A = 96$ so $T = 96$, and $A + T = 192$

Given total Nucleotides = 546

$G + C = 546 - 192 = 354$ because $G = C$ so $C = 354 / 2$,

Cytosine = 177

1

1

[2 Marks]

- 9. How is 'somatic hybridization' carried out ? Mention one example of a somatic hybrid.**

Ans. Isolation of protoplast by digesting cell wall, Fusion of isolated protoplast of different varieties of plants with desired traits, Formation of hybrid protoplast which is further grown to form to new hybrid plant ,e.g Pomato (fusion of potato & tomato)

= $\frac{1}{2} \times 4$

[2 Marks]

- 10. How are DNA fragments visualised during gel-electrophoresis ? What is elution ?**

Ans. Separated DNA fragments stained with ethidium bromide ,followed by exposure to UV radiations ,removal of DNA bands from agarose gel, and its extraction from gel is elution

= $\frac{1}{2} \times 4$

[2 Marks]

- 11. A corn farmer has perennial problem of corn-borer infestation in his crop. Being environmentally conscious he does not want to spray insecticides. Suggest solution based on your knowledge of biotechnology. Write the steps to be carried out to achieve it.**

Ans. Isolation of Bt toxin genes from *Bacillus thuringiensis* , incorporated into corn,toxin coded by gene cry IAb in corn, kills the pests/ pest dies.

= $\frac{1}{2} \times 4$

[2 Marks]

- 12. State 'two' observations made by German naturalist, Alexander von Humboldt during his extensive explorations in South American jungles.**

Ans Within a region species richness increases with increasing explored area but only upto a limit, this relation for a wide variety of taxa turns out to be a rectangular hyperbola.

= 1 + 1

[2 Marks]

OR

If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be :

$$\frac{dN}{dT} = (b - d) \times N$$

The equation given above can also be represented as :

$$\frac{dN}{dT} = r \times N \text{ where } r = (b - d)$$

What does 'r' represent ? Write any one significance of calculating 'r' for any population.

- Ans r = intrinsic rate of natural increase , it is an important parameter for assessing impacts of any biotic or abiotic factor on population growth . = 1 + 1

[2 Marks]

SECTION C

(Q Nos. 13 - 24 are of three marks each)

- 13. When and where do tapetum and synergids develop in flowering plants ? Mention their functions.**

Ans Tapetum- Microsporogenesis ,Microsporangium(Anther), nourishes the developing pollen grains.

Synergids -Megasporogenesis, Megasporangium(ovule), synergids have filiform apparatus to guide the pollen tube into it. ½ × 6

[3 Marks]

OR

Where are the following structures present in a male gametophyte of an angiosperm ? Mention the function of each one of them.

- (a) Germ pore
- (b) Sporopollenin
- (c) Generative cell

Ans (a) Germ pore- Pollen grain exine , site from where pollen tube emerges .

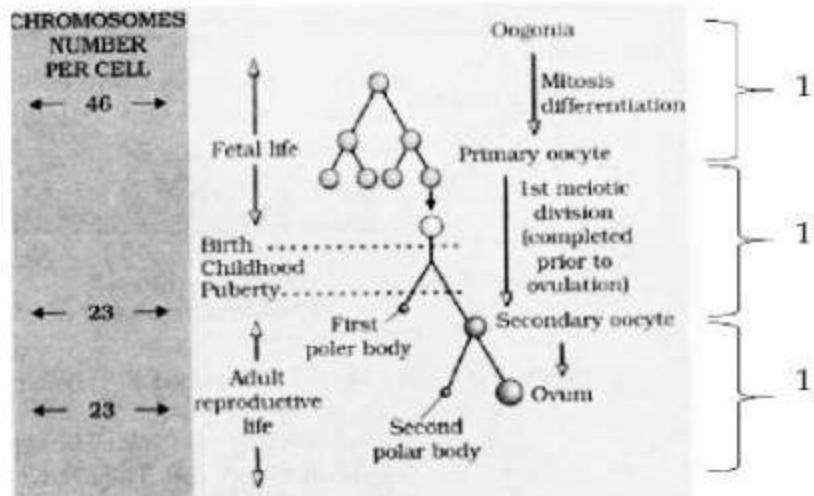
(b) Sporopollenin-Exine of pollengrains , protects the pollen grains from high temperature / and strong acids & alkali / enzymes / adverse condition

(c) Generative Cells - Pollen grains , give rise to two male gametes ½ × 6

[3 Marks]

- 14 Construct a flow chart exhibiting sequential events of oogenesis.**

Ans

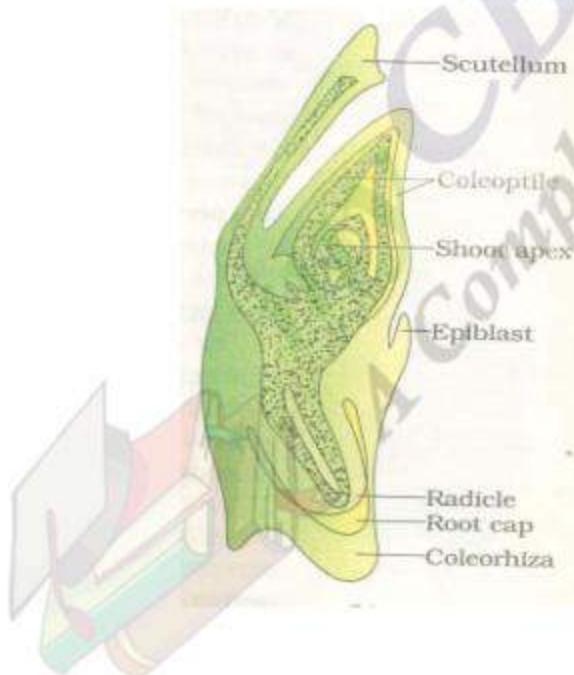


1 × 3

[3 Marks]

15. Draw L.S. of an embryo of grass and label its parts.

Ans



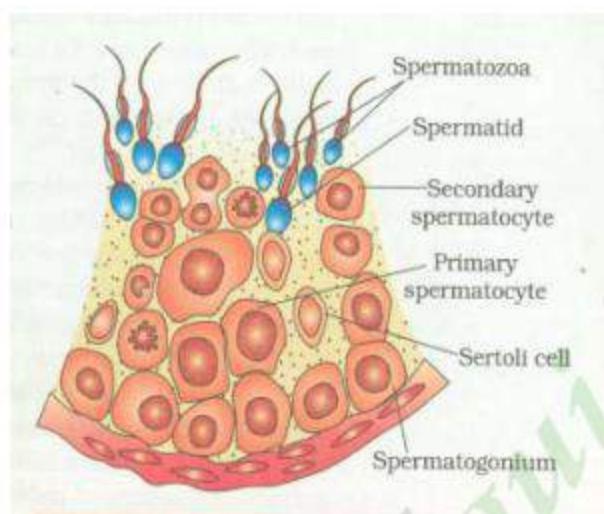
1 × 3

[3 Marks]

(Any Three Correctly Labelled Parts)

OR

Draw a diagrammatic sectional view of a seminiferous tubule (enlarged) in humans and label its parts.



(Any Three Labelled Parts)

= 1 × 3

[3 Marks]

16. (a) How does mutation occur ?

(b) Differentiate between point mutation and frameshift mutation.

Ans (a) Loss(deletion) or gain (insertion / duplication /addition) or change in position of DNA segments / chromosome

= 1

(b) mutation due to change in a single base pair of DNA is point mutation,

=1

Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion

= 1

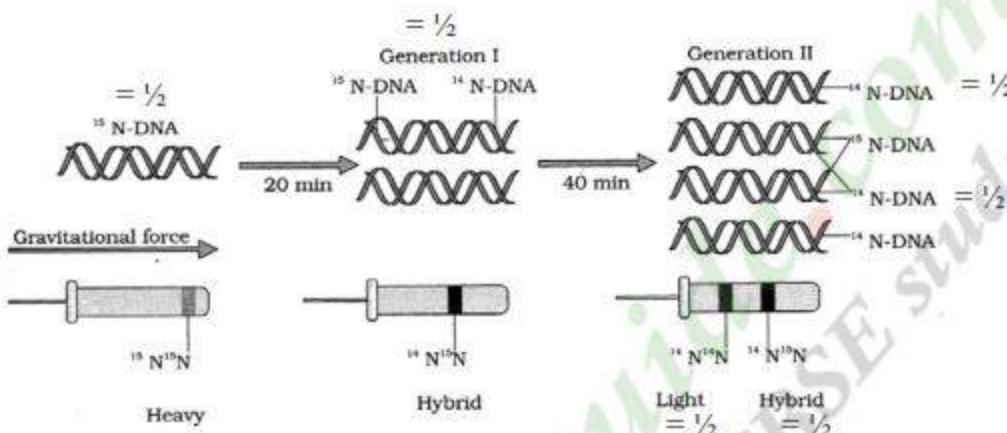
[3 Marks]

17. "Use of heavy isotope of nitrogen by Meselson and Stahl demonstrated semi-conservative mode of replication of a DNA molecule." Explain how did they arrive at this conclusion.

Ans Grown *E.coli* in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA , then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$, The extracted DNA are centrifuged in CsCl and measured to get their densities , DNA extracted from the culture after one generation (20 minutes) , showed intermediate

hybrid density , DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA
 $= \frac{1}{2} \times 6 = 3$

//
 A correctly labelled diagrammatic representation in lieu of the above explanation of experiment to be considered
 $= 3$



[3 Marks]

OR

Explain the mechanism of translation that occurs in the ribosomes in a prokaryote.

- Ans Charging of tRNA / aminoacylation of tRNA ,
 small subunit of ribosome binds to mRNA (5' end) ,

for initiation the ribosome binds to the mRNA at the start codon (AUG) that is recognised only by initiator tRNA,

In the elongation phase amino acid with tRNA sequentially bind to the appropriate codon on mRNA (forming complimentary base pairs with tRNA anticodon),

Ribosome moves from codon to codon along the mRNA and amino acids are added one by one in the two sites of the large subunit joined by peptide bond ,

Termination occurs when a release factor binds to the stop codon and releases the complete polypeptide.

$\frac{1}{2} \times 6$

[3 Marks]

- 18. According to Darwinian theory of natural selection the rate of appearance of new forms is linked to the life-cycle or the life-span of an organism. Explain with the help of an example.**

- Ans A colony of bacteria (say A) growing in a given medium has built in variation in terms of ability to utilise a feed component, a change in the medium composition would bring out only that part of the population(say B) that can survive under the new conditions , = 1+1

In due course of time this variant population outgrows the others and appears as new species thus organisms with shorter life-cycle or life-span will undergo evolution faster / for the same thing to happen in fish or fowl would take millions of years as life spans of these animals are in years. =1

[3 Marks]

19. (a) Name the causative agents of pneumonia and common cold.

(b) How do these differ in their symptoms ?

(c) Mention two symptoms common to both.

Ans (a) *Streptococcus pneumoniae/ Haemophilus influenzae, Rhinoviruses*

= $\frac{1}{2} + \frac{1}{2}$

(b) Different symptoms (any two)

= $\frac{1}{2} + \frac{1}{2}$

| Pneumonia | Common cold |
|--------------------------------------|------------------------------------|
| Infects alveoli of lungs | Infects nose & respiratory passage |
| chills | Sore throat |
| Lips /fingers may turn grey to black | Hoarseness |

(c) Common symptoms (any two)

= $\frac{1}{2} + \frac{1}{2}$

| | |
|-----------|-------------|
| Pneumonia | Common cold |
| Cough | Cough |
| Headache | Headache |

[3 Marks]

OR

(a) Write the scientific names of the causative agent and vector of malaria, and write its symptoms.

(b) Name any two diseases spread by Aedes sp.

Ans (a) *Plasmodium vivax / P. falciparum / P.malariae*, vector-Female *Anopheles* mosquito

= $\frac{1}{2} + \frac{1}{2}$

Symptoms - chill , high fever

= $\frac{1}{2} + \frac{1}{2}$

(b) Dengue, Chikungunya (or any other correct example)

= $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

- 20.** (a) Differentiate between inbreeding and outbreeding.
(b) List any three advantages and one important disadvantage of inbreeding practice in animal husbandry.

Ans (a) Inbreeding - Mating of more closely related individuals within the same breed for 4-6 generations.

Outbreeding- Breeding of unrelated animals may be of the same breed , but having no common ancestors for 4-6 generations/ different breeds/ different species. $= \frac{1}{2} + \frac{1}{2}$

(b) Advantages- develops pureline / increase homozygosity, accumulation of superior genes, elimination of less desired genes. $= \frac{1}{2} \times 3$

Disadvantages- Reduces fertility/ causes inbreeding depression. $= \frac{1}{2}$

[3 Marks]

- 21.** Name the most commonly used bioreactor in biotechnology labs. Mention the most essential components this bioreactor must have so as to provide the optimum conditions to the culture medium, resulting in production of large volume of desired product.

Ans Stirring type $= \frac{1}{2}$

agitator system, O₂ delivery system, foam control system, temperature control system, pH control system $\frac{1}{2} \times 5$

[3 Marks]

- 22.** A child is born with ADA-deficiency

- (a) Suggest and explain a procedure for possible life-long (permanent) cure.
(b) Name any other possible treatment for this disease.

Ans (a) Gene therapy, lymphocytes from the blood of a patient are grown in a culture outside the body, functional ADA cDNA is introduced into these lymphocytes, these cells are returned to the patient's body at early embryonic stage. $= \frac{1}{2} \times 4$

(b) Bone marrow transplantation , enzyme replacement therapy $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

- 23.** Differentiate between an 'Expanding age pyramid' and a 'Stable age pyramid'. Substantiate your answer with diagrams.

Ans

| | |
|---|---|
| Expanding age pyramid | Stable age pyramid |
| Population of pre-reproductive age is greater than population of reproductive age | Population of pre-reproductive age equals to population of reproductive age |

$$= \frac{1}{2} + \frac{1}{2}$$



1+1

[3 Marks]

24. Analyse the effects of 'Alien species invasion' on the biodiversity of a given area. Provide two examples.

Ans Introduction of alien species causes decline or extinction of indigenous species due to tough competition for utilization of resources =1

Examples:

Introduction of Nile perch in lake Victoria led to extinction of more than 200 species of Cichlid fish / Introduction of African cat fish (*Clarias gariepinus*) for aquaculture poses threat to indigenous catfish/ Threat posed to native species by invasive exotic weeds like carrot grass (*Parthenium*) / Lantana and water hyacinth (*Eichhornia*) / Extinction of Abingdon tortoise by introduction of goat. (any two) 1+1=2

[3 Marks]

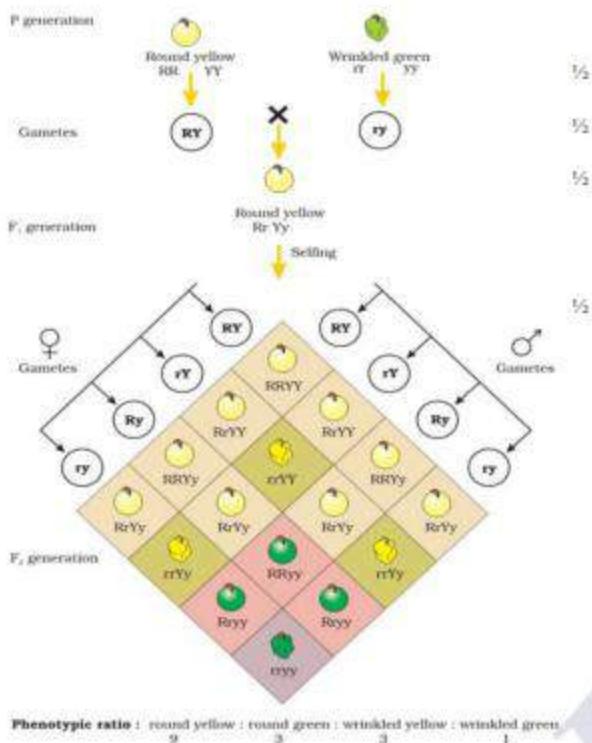
SECTION D

(Q. Nos. 25 - 27 are of five marks each)

25. Mendel crossed a homozygous pea plant having yellow and round seeds with another pea plant bearing green and wrinkled seeds. He found that in some of the F₂ population new combination of parental characters were observed.

How will you explain the appearance of a new combination of parental characters in F₂-offspring? Support your answer with the help of Punnett square.

Ans



Phenotypic ratio : round yellow : round green : wrinkled yellow : wrinkled green

Figure Results of a dihybrid cross where the two parents differed in two pairs of contrasting traits: seed colour and seed shape

2 marks for Punnett Square

When two pairs of traits are combined in a hybrid segregation of one pair of character is independent of the other pair of the characters. = 1

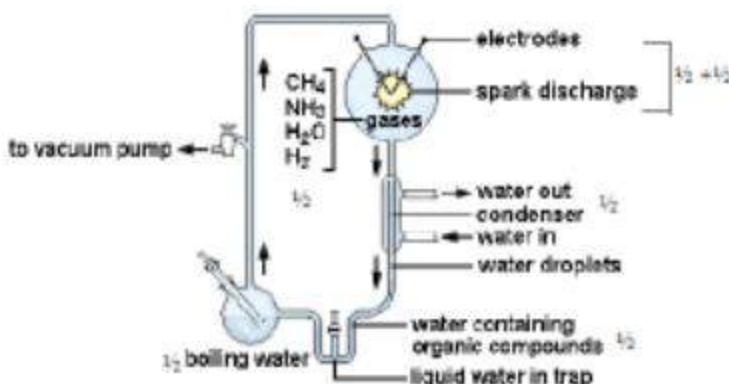
[5 Marks]

OR

Describe S.L. Miller's experiment. Comment on the observations he made and his contribution towards the origin of life on Earth.

Ans High temperature (800°C), high energy radiation, reducing atmosphere created, by electric discharge in a closed flask, containing $\text{CH}_4 + \text{H}_2 + \text{NH}_3$, and water vapours in the experimental setup .

//



(Labelling on diagram to be awarded marks in lieu of explanation)

$\frac{1}{2} \times 6 = 3$

Observation and Contribution -

- Formation of amino acids
- The first form of life arose slowly through evolutionary forces from non-living molecules/ abiogenesis.

1+1

[5 Marks]

26. (a) Differentiate between active and passive immunity.

(b) Comment on the role of vaccination and immunization in keeping human population healthy.

Ans (a)

| Active immunity | Passive immunity |
|--|---|
| Production of antibodies on exposure to antigen in host body | Introduction of readymade antibodies to protect against pathogen |
| Slow process and takes time to give full effective response | T lymphocyte production is fast and responds quickly by checking growth of pathogen |
| Natural infection induces active immunity | Inoculation of pathogen in other organisms synthesizes antibodies which are isolated and used for vaccination |

(Any two)1 + 1

(b) Role of vaccination / immunization:

- Antibodies produced in body against antigen neutralizes pathogenic agents.
- Vaccines also generate memory cell (B and T cells) that recognize quickly on subsequent exposure and controls growth of pathogen with massive production of antibodies
- preformed antibodies/ antitoxin protect our body from deadly microbes like tetanus and against snake venom

$$1 \times 3 = 3$$

[5 Marks]

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

Ans Process of secondary treatment :

Passing of primary effluent into large aeration tank which is constantly agitated mechanically & air is pumped into it that allows vigorous growth of useful aerobic microbes into flocs



Microbes consume major part of organic matter in effluent which significantly reduces BOD



Now effluent is passed into settling tank where flocs are allowed to settle/ sediment called activated sludge



Digestion of activated sludge by anaerobic microbes and effluents from secondary treatment can be released into river/ stream.



Resulted in production of Bio gas (CH_4 , H_2S and CO_2) which can be used as source of energy

$$1 \times 5 = 5$$

[5 Marks]

27. A plastic sack manufacturer in Bengaluru, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management.

Ans Developed polyblend- a fine powder of recycled modified plastic

1

Polyblend mixed with bitumen and used to lay roads (in collaboration with R V engineering college and Bangalore city corporation)

1

It enhanced water repellent property of bitumen and increase the road life .

1

Khan offered a price to rag pickers which enhanced their income and improved their livelihood.

1

Thus solid waste management was achieved by removal and proper disposal of plastic waste from the city

1

[5 Marks]

OR

- (a) **What does an ecological pyramid represent ? State any two limitations that these pyramids have.**
- (b) **Describe an inverted pyramid of biomass with the help of an example.**

Ans (a) Ecological pyramids represent the relationship between different trophic levels in terms of number ,biomass or energy

1

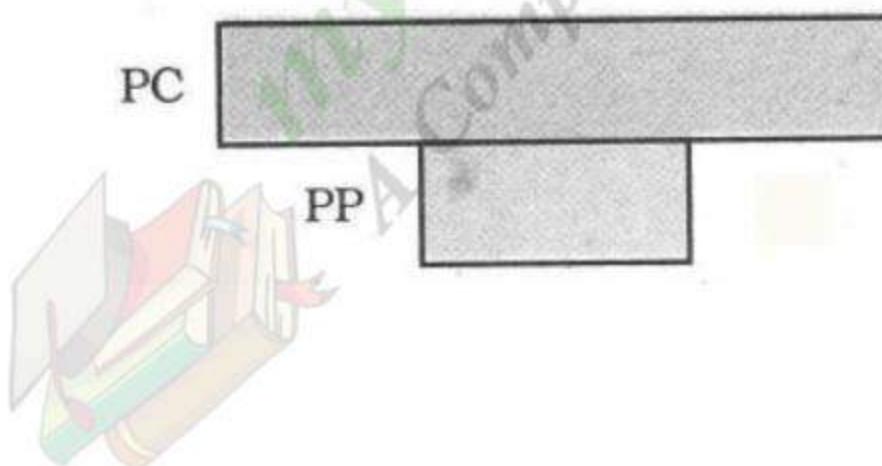
Limitations of pyramid:

It does not takes into account the same species belonging to two or more trophic levels / It assumes a single food chain which almost never exists in nature / It does not accommodate a food web / Saprophytes are not given any place even though they play vital role in the ecosystem.

(any two) $1 \times 2 = 2$

- (b) The pyramids of biomass in aquatic ecosystem/ sea is generally inverted

//



1

e.g biomass of fishes is much more than biomass of phytoplanktons.

1

[5 Marks]

Question Paper Code 57/2/2

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

1. Name any two physiological barriers that provide innate immunity.

Ans Acid in Stomach/Saliva in mouth/tears in eyes (Any two)

= ½ + ½

[1 Mark]

OR

Select two disease resistant crop varieties from the list of crop varieties given below :
Himgiri, Pusa Gaurav, Pusa Komal, Pusa A-4

Ans Himgiri; Pusa Komal

= ½ + ½

[1 Mark]

2. Mention one example each from plants and animals exhibiting divergent evolution.

Ans Thorn of Bougainvillea and tendrils of Cucurbita ,
forelimbs of whales , bats, cheetah and humans (all mammals) / vertebrate hearts / vertebrates brains
(Any one) /Any other correct example = ½ + ½

[1 Mark]

3. Name a human genetic disorder due to the following :

(a) An additional X-chromosome in a male

(b) Deletion of one X-chromosome in a female

Ans. a) Klinefelter's Syndrome

b) Turner's Syndrome

= ½ + ½

[1 Mark]

OR

State what does aneuploidy lead to.

Individuals with abnormal number of chromosomes / Down's Syndrome / Turner's Syndrome / Klinefelter's Syndrome (or any other correct example)

[1 Mark]

4. Give one reason to justify statutory ban on amniocentesis.

Ans Check/prevent female foeticide.

[1 Mark]

5. Name the pioneer species that invade in primary succession on bare rock and in water.

Ans Lichens, small phytoplanktons

= ½ + ½

[1 Mark]

SECTION – B

(Q. Nos. 6 - 12 are of two marks each)

6 State two' observations made by German naturalist, Alexander von Humboldt during his extensive explorations in South American jungles.

Ans Within a region species richness increases with increasing explored area but only upto a limit, this relation for a wide variety of taxa turns out to be a rectangular hyperbola. = 1 + 1

[2 Marks]

OR

If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be :

$$\frac{dN}{dT} = (b - d) \times N$$

The equation given above can also be represented as :

$$\frac{dN}{dT} = r \times N \text{ where } r = (b - d)$$

What does 'r' represent ? Write any one significance of calculating 'r' for any population.

Ans r = intrinsic rate of natural increase , it is an important parameter for assessing impacts of any biotic or abiotic factor on population growth . = 1 + 1

[2 Marks]

7. A segment of DNA molecule comprises of 546 nucleotides. How many cytosine nucleotides would be present in it if the number of adenine nucleotides is 96 ?

Ans Ans. $A + T = C + G$, Given $A = 96$ so $T = 96$, and $A + T = 192$

Given total Nucleotides = 546

$G + C = 546 - 192 = 354$ because $G = C$ so $C = 354 / 2$, 1

Cytosine = 177 1

[2 Marks]

- 8.** (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm ?

- (b) The development of endosperm precedes that of embryo in plants. Justify.

Ans (a) Castor

= 1

(b) endosperm stores reserve food materials / provides nutrition to the developing embryo = 1

[2 Marks]

- 9.** "For a common man both mango and strawberry are fruits, but not for a biology student. Justify.

Ans Mango is a true fruit as it develops from the ovary , strawberry is a false fruit as it is formed by the thalamus

= 1 + 1

[2 Marks]

- 10.** Explain the process of gel-electrophoresis technique.

Ans Separation of DNA fragments under an electric field in agarose gel , negatively charged DNA move towards anode and smaller fragments move farther , separated DNA fragments are stained with ethidium bromide followed by UV radiations , extraction of DNA bands by elution $= \frac{1}{2} \times 4$

[2 Marks]

- 11.** Why is the genetically engineered insulin by American company Eli Lilly preferred to the one produced by conventional methods ? Explain.

Ans Genetically engineered insulin does not develop Allergy, other type of reactions to the foreign proteins. $1+1$

[2 Marks]

- 12.** Mosses and frogs both need water as a medium for fertilisation. Where does syngamy occur and how is it ensured in both these organisms ?

Ans Frog -External fertilization / in water / outside the body , release of motile gametes / large number of gametes/ synchronised maturation of ova and sperms $= \frac{1}{2} + \frac{1}{2}$

Moss - Internal fertilization / inside the body of organism , male gametes are motile / large number of gametes. $= \frac{1}{2} + \frac{1}{2}$

[2 Marks]

OR

Write the basis of categorising animals as oviparous or viviparous, giving one example of each.

Ans. Egg laying (fertilised or unfertilised), e.g. reptiles / birds / any other correct example = $\frac{1}{2} + \frac{1}{2}$

Give birth to young ones , e.g. majority of mammals / humans / any other correct example= $\frac{1}{2} + \frac{1}{2}$

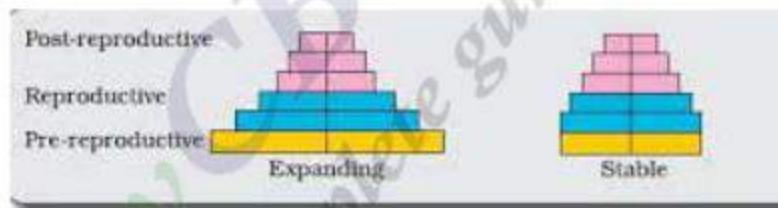
[2 Marks]

SECTION C

(Q Nos. 13-24 are of three marks each)

- 13. Differentiate between an 'Expanding age pyramid' and a 'Stable age pyramid'. Substantiate your answer with diagrams.**

| Ans | Expanding age pyramid | Stable age pyramid |
|-----|---|---|
| | Population of pre-reproductive age is greater than population of reproductive age | Population of pre-reproductive age equals to population of reproductive age |



= $\frac{1}{2} + \frac{1}{2}$

1+1

[3 Marks]

- 14. A child is born with ADA-deficiency.**

(a) Suggest and explain a procedure for possible life-long (permanent) cure.

(b) Name any other possible treatment for this disease.

Ans Gene therapy, lymphocytes from the blood of a patient are grown in a culture outside the body, functional ADA cDNA is introduced into these lymphocytes, these cells are returned to the patients body at early embryonic stage. = $\frac{1}{2} \times 4$

(b) Bone marrow transplantation , enzyme replacement therapy

$\frac{1}{2} + \frac{1}{2}$

[3 Marks]

- 15. Name the most commonly used bioreactor in biotechnology labs. Mention the most essential components this bioreactor must have so as to provide the optimum conditions to the culture medium, resulting in production of large volume of desired product.**

Ans Stirring type = $\frac{1}{2}$

agitator system, O₂ delivery system, foam control system, temperature control system, pH control system

$\frac{1}{2} \times 5$

[3 Marks]

- 16.** Name the enzyme that transcribes hnRNA in eukaryotes. Explain the steps that the hnRNA undergoes before it is processed into mRNA.

Ans RNA polymerase II =1

Capping- unusual nucleotide (methyl guanosine triphosphate) is added to the 5' end of the hnRNA,=1

Tailing-adenylate residues are added at 3' end in a template independent manner =1

[3 Marks]

- 17. (a)** Differentiate between inbreeding and outbreeding.

- (b)** List any three advantages and one important disadvantage of inbreeding practice in animal husbandry.

Ans (a) Inbreeding - Mating of more closely related individuals within the same breed for 4-6 generations.

Outbreeding- Breeding of unrelated animals may be of the same breed but having no common ancestors for 4-6 generations/ different breeds/ different species. $= \frac{1}{2} + \frac{1}{2}$

(b) Advantages -develops pureline / increase homozygosity, accumulation of superior genes, elimination of less desired genes. $= \frac{1}{2} \times 3$

Disadvantages- Reduces fertility/ causes inbreeding depression. $= \frac{1}{2}$

[3 Marks]

- 18.** Darwin on his voyage to Galapagos Islands had observed finches having different varieties of beaks. Write the explanation he gave for his observations and the conclusions he arrived at.

Ans Many varieties of finches in the same island , original seed eating finches were altered to become insectivorous and vegetarian finches, this process of evolution starting from a point and radiating to other area of geography(habitat) is called adaptive radiation. 1×3

[3 Marks]

- 19.** When and where do tapetum and synergids develop in flowering plants ? Mention their functions.

Ans Tapetum- Microsporogenesis ,Microsporangium(Anther), nourishes the developing pollen grains.

Synergids -Megasporogenesis, Megasporangium(ovule), synergids have filiform apparatus to guide the pollen tube into it. $\frac{1}{2} \times 6$

[3 Marks]

OR

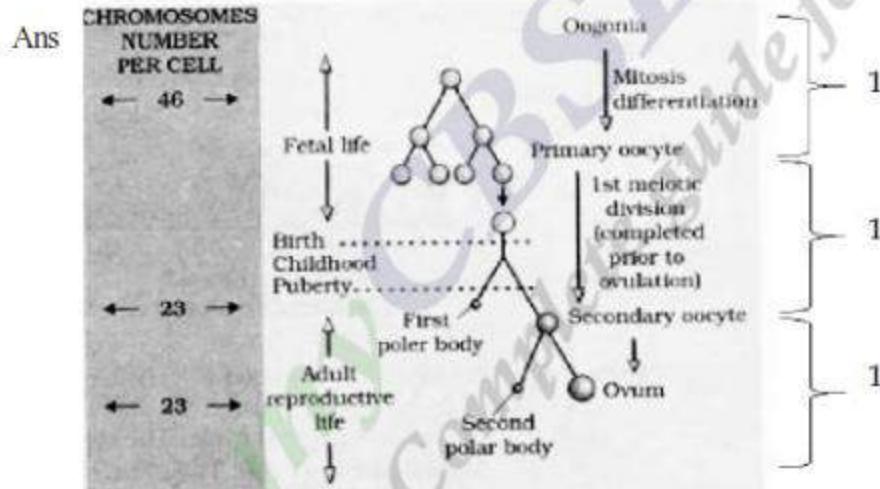
**Where are the following structures present in a male gametophyte of an angiosperm ?
Mention the function of each one of them.**

- (a) Germ pore
- (b) Sporopollenin
- (c) Generative cell

- Ans (a) Germ pore- Pollen grain exine , site from where pollen tube emerges .
- (b) Sporopollenin-Exine of pollengrains , protects the pollen grains from high temperature / and strong acids & alkali / enzymes / adverse condition
- (c) Generative Cells - Pollen grains , give rise to two male gametes

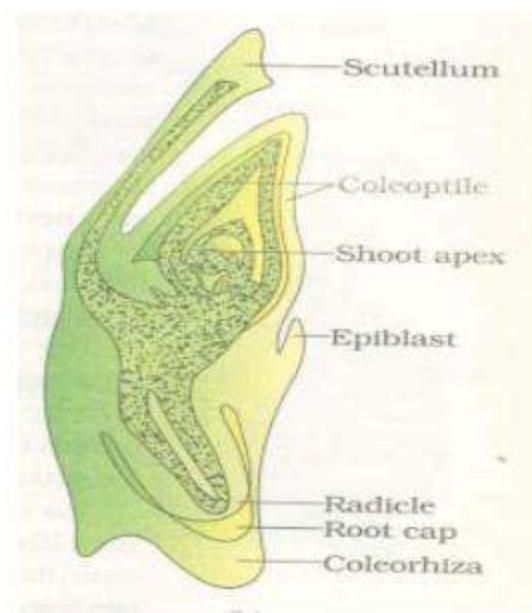
$\frac{1}{2} \times 6$
[3 Marks]

20. Construct a flow chart exhibiting sequential events of oogenesis.



21. Draw L.S. of an embryo of grass and label its parts.

Ans



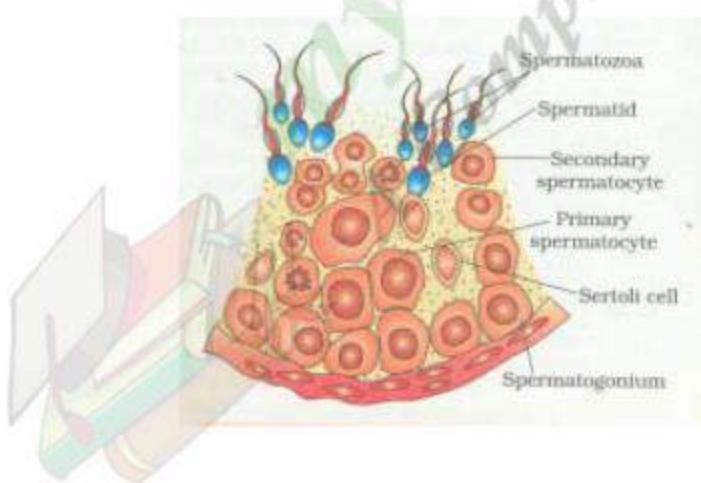
1 × 3

[3 Marks]

(Any Three Correctly Labelled Parts)

OR

Draw a diagrammatic sectional view of a seminiferous tubule (enlarged) in humans and label its parts.



(Any Three Labelled Parts)

= 1 × 3

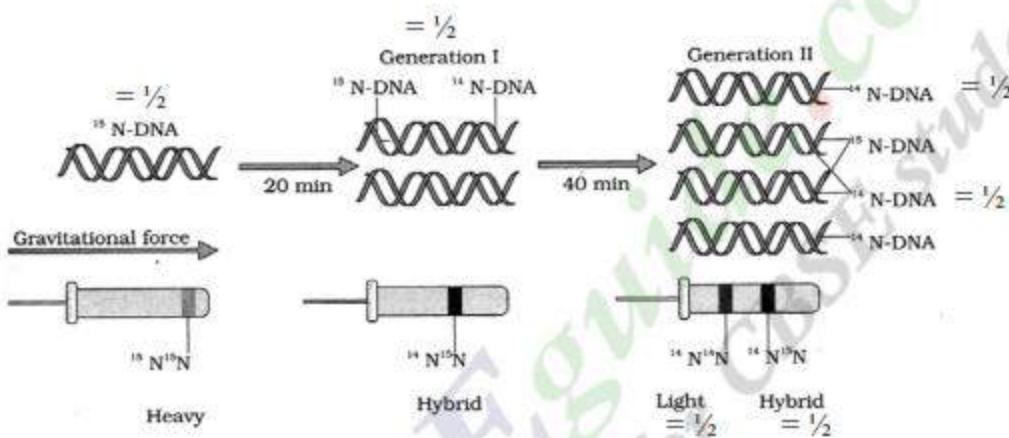
[3 Marks]

22. “Use of heavy isotopes of nitrogen by Meselson and Stahl demonstrated semi-conservative mode of replication of a DNA molecule.” Explain how did they arrive at this conclusion.

- ns Grown *E.coli* in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA , Then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$, The extracted DNA are centrifuged in CsCl and measured to get their densities , DNA extracted from the culture after one generation (20 minutes) , showed intermediate hybrid density , DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA
- $$= \frac{1}{2} \times 6 = 3$$

//

A correctly labelled diagrammatic representation in lieu of the above explanation of experiment to be considered



[3 Marks]

OR

Explain the mechanism of translation that occurs in the ribosomes in a prokaryote.

- Ans Charging of tRNA / aminoacylation of tRNA,
small subunit of ribosome binds to mRNA (5' end) ,

for initiation the ribosomes binds to the mRNA at the start codon (AUG) that is recognised only by initiator tRNA,

In the elongation phase amino acid with tRNA sequentially bind to the appropriate codon on mRNA(forming complimentary base pairs with tRNA anticodon),

Ribosome moves from codon to codon along the mRNA and amino acids are added one by one in the two sides of the large subunit joined by peptide bond ,

Termination occurs when a release factor binds to the stop codon and releases the complete polypeptide.

$\frac{1}{2} \times 6$

[3 Marks]

23. (a) Name the causative agents of pneumonia and common cold.

(b) How do these differ in their symptoms ?

(c) Mention two symptoms common to both.

Ans (a) *Streptococcus pneumoniae/Haemophilus influenzae, Rhinoviruses*

= $\frac{1}{2} + \frac{1}{2}$

(b) Different symptoms (any two)

= $\frac{1}{2} + \frac{1}{2}$

| Pneumonia | Common cold |
|--------------------------------------|------------------------------------|
| Infects alveoli of lungs | Infects nose & respiratory passage |
| chills | Sore throat |
| Lips /fingers may turn grey to black | Hoarseness |

(c) Common symptoms (any two)

= $\frac{1}{2} + \frac{1}{2}$

| | |
|-----------|-------------|
| Pneumonia | Common cold |
| Cough | Cough |
| Headache | Headache |

[3 Marks]

OR

(a) Write the scientific names of the causative agent and vector of malaria, and write its symptoms.

(b) Name any two diseases spread by *Aedes sp.*

Ans (a) *Plasmodium vivax / P.falciparum / P.malariae*, vector-Female *Anopheles* mosquito

= $\frac{1}{2} + \frac{1}{2}$

Symptoms - chill , high fever

= $\frac{1}{2} + \frac{1}{2}$

(b) Dengue, Chikungunya (or any other correct example)

= $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

24. What is productivity in an ecosystem ? Explain the relationship between gross primary productivity and net primary productivity in an ecosystem.

Ans Productivity in an ecosystem is the rate of biomass production , = 1

GPP- Rate of production of organic matter during photosynthesis. = 1

NPP- Gross primary production minus respiration losses 'R' / GPP-R = NPP only (if 'R' is not expanded $\frac{1}{2}$ may be given)

1+1+1

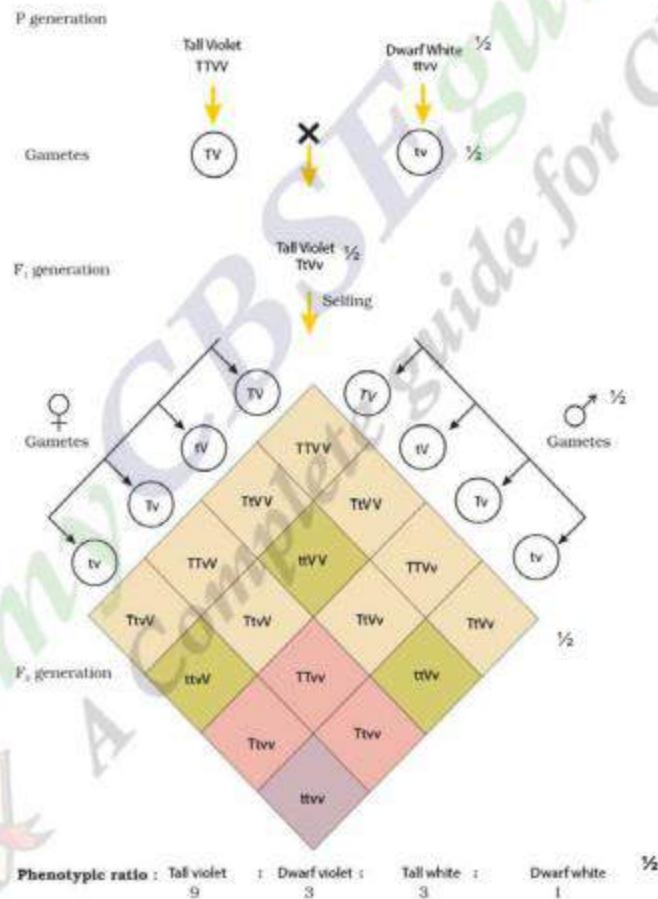
[3 Marks]

SECTION D

(Q No. 25 to 27 is of five marks each)

25. (a) Work out a cross upto F_2 -generation between true breeding tall pea plants bearing violet flowers and dwarf pea plants bearing white flowers.
- (b) Explain Mendel's laws of segregation and independent assortment on the basis of the cross.

Ans (a)



Correct Cross [3 Marks]

- (b) When the parent contains 2 alleles during gamete formation and the factor segregate from each other (and do not blend) such that a gamete receives only one of the two factors is called as law of segregation ,=1

when two pairs of traits are combined in a hybrid then segregation of one pair of characters is independent of the other pair of characters is the law of Independent Assortment = 1

[5 Marks]

OR

Answer the following questions based on the experiment conducted by S.L. Miller in 1953 :

- (a) Name the gases present in the closed flask.
- (b) Why was the flask fitted with electrodes ?
- (c) Write the observation he made.
- (d) State the significance of the observation made by him.

Ans (a) Methane, carbon dioxide, ammonia , hydrogen.

(b) Electric discharge to provide high temperature (800°C)

(c) Formation of amino acids.

(d) Life could have evolved from non-living organic molecules which would have been giant molecules(RNA, Proteins, Polysaccharides / Abiogenesis / chemical origin of life

2+1+1+1=5

26. A plastic sack manufacturer in Bengaluru, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management.

Ans Developed polyblend- a fine powder of recycled modified plastic

1

Polyblend mixed with bitumen and used to lay roads (in collaboration with R V engineering college and Bangalore city corporation)

1

It enhanced water repellent property of bitumen and increase the road life .

1

Khan offered a price to rag pickers which enhanced their income and improved their livelihood.

1

Thus solid waste management was achieved by removal and proper disposal of plastic waste from the city

1

OR

- (a) What does an ecological pyramid represent ? State any two limitations that these pyramids have.
- (b) Describe an inverted pyramid of biomass with the help of an example.

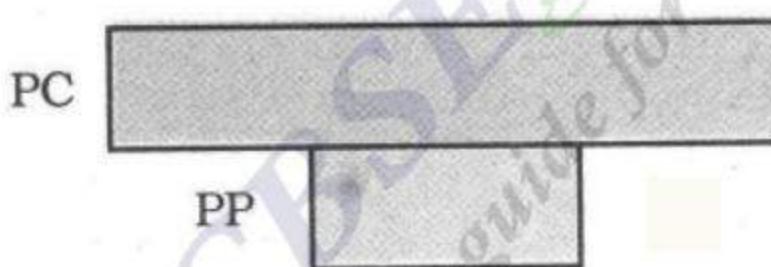
Ans (a) Ecological pyramids represent the relationship between different trophic levels in terms of number ,biomass or energy 1

Limitations of pyramid:

It does not takes into account the same species belonging to two or more trophic levels / It assumes a single food chain which almost never exists in nature / It does not accommodate a food web / Saprophytes are not given any place even though they play vital role in the ecosystem.

(any two) $1 \times 2 = 2$

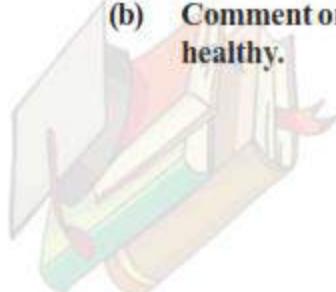
- (b) The pyramids of biomass in aquatic ecosystem/ sea is generally inverted



e.g. biomass of fishes is much more than biomass of phytoplankton. 1

[5 Marks]

27. (a) Differentiate between active and passive immunity.
(b) Comment on the role of vaccination and immunization in keeping human population healthy.



| Ans (a) | Active immunity | Passive immunity |
|---------|--|---|
| | Production of antibodies on exposure to antigen in host body | Introduction of readymade antibodies to protect against pathogen |
| | Slow process and takes time to give full effective response | T lymphocyte production is fast and responds quickly by checking growth of pathogen |
| | Natural infection induces active immunity | Inoculation of pathogen in other organisms synthesizes antibodies which are isolated and used for vaccination |

(Any two) 1 + 1

(b) Role of vaccination / immunization:

- Antibodies produced in body against antigen neutralizes pathogenic agents.
- Vaccines also generate memory cell (B and T cells) that recognize quickly on subsequent exposure and controls growth of pathogen with massive production of antibodies
- preformed antibodies/ antitoxin protect our body from deadly microbes like tetanus and against snake venom

$1 \times 3 = 3$

[5 Marks]

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

Ans Process of secondary treatment :

Passing of primary effluent into large aeration tank which is constantly agitated mechanically & air is pumped into it that allows vigorous growth of useful aerobic microbes into flocs



Microbes consume major part of organic matter in effluent which significantly reduces BOD



Now effluent is passed into settling tank where flocs are allowed to settle/ sediment called activated sludge



Digestion of activated sludge by anaerobic microbes and effluents from secondary treatment can be released into river/ stream.



Resulted in production of Bio gas (CH_4 , H_2S and CO_2) which can be used as source of energy

1×5

[5 Marks]

Question Paper Code 57/2/3

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

1. Mention one example each from plants and animals exhibiting divergent evolution.

Ans Thorn of Bougainvillea and tendrils of Cucurbita , forelimbs of whales , bats, cheetah and humans (all mammals) / vertebrate hearts / vertebrates brains
(Any one) /Any other correct example = $\frac{1}{2} + \frac{1}{2}$

[1Mark]

2. Give one reason to justify statutory ban on amniocentesis.

Ans Check/prevent female foeticide.

[1 Mark]

3. Name any two physiological barriers that provide innate immunity ?

Ans Acid in Stomach/Saliva in mouth/tears in eyes (Any two)

= $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

OR

Select two disease resistant crop varieties from the list of crop varieties given below:

Himgiri, Pusa Gaurav, Pusa Komal, Pusa A-4

Ans Himgiri; Pusa Komal

= $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

4. Name a human genetic disorder due to the following :

- (a) An additional X-chromosome in a male
(b) Deletion of one X-chromosome in a female

Ans. a) Klinefelter's Syndrome

b) Turner's Syndrome

= $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

OR

State what does aneuploidy lead to.

Individuals with abnormal number of chromosomes / Down's Syndrome / Turner's Syndrome / Klinefelter's Syndrome (or any other correct example)

[1 Mark]

5. Why is the rate of secondary succession much faster than that of primary succession ?

- Ans Some soil or sediment is already present (due to destruction of natural biotic communities present earlier.)

[1 Marks]

SECTION – B

(Q. Nos. 6- 12 are of two marks each)

6. State two' observations made by German naturalist, Alexender von Humboldt during his extensive explorations in South American jungles.

- Ans Within a region species richness increases with increasing explored area but only upto a limit, this relation for a wide variety of taxa turns out to be a rectangular hyperbola.

= 1 + 1

[2 Marks]

OR

If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be :

$$\frac{dN}{dT} = (b - d) \times N$$

The equation given above can also be represented as :

$$\frac{dN}{dT} = r \times N \text{ where } r = (b - d)$$

What does 'r' represent ? Write any one significance of calculating 'r' for any population.

- Ans r = intrinsic rate of natural increase , it is an important parameter for assessing impacts of any biotic or abiotic factor on population growth .

= 1 + 1

[2 Marks]

7. A segment of DNA molecule comprises of 546 nucleotides. How many cytosine nucleotides would be present in it if the number of adenine nucleotides is 96 ?

- Ans $A + T = C + G$, Given $A = 96$ so $T = 96$, and $A + T = 192$

Given total Nucleotides = 546

$$G + C = 546 - 192 = 354 \text{ because } G = C \text{ so } C = 354 / 2 ,$$

1

Cytosine = 177

=1

[2 Marks]

8. (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm ?

(b) The development of endosperm precedes that of embryo in plants. Justify.

Ans (a) Castor

=1

(b) endosperm stores reserve food materials / provides nutrition to the developing embryo =1

[2 Marks]

9. Name a distinguishing structure seen in a mature black pepper seed and not in a pea seed. State how does it develop.

Ans Perisperm is seen in a mature black pepper seed , the residual persistent nucellus is perisperm.

=1+1

[2 Marks]

10. Why does the insecticidal protein produced by *Bacillus thuringiensis* not kill the bacterium , but kills the cotton bollworm ? Explain

Ans The Bt toxin protein exist as inactive protoxins , it becomes active due to alkaline pH of the gut of cotton bollworm. =1+1

[2 Marks]

11. Write the palindromic nucleotide sequence that EcoRI reads , and indicate the site of its action .

Ans 5' - G AATTC - 3'

3'-CTTAAG 5'

1+1

[2 Marks]

12. Mosses and frogs both need water as a medium for fertilisation. Where does syngamy occur and how is it ensured in both these organisms ?

Ans Frog -External fertilization / in water / outside the body , release of motile gametes / large number of gametes/ synchronised maturation of ova and sperms = $\frac{1}{2}+\frac{1}{2}$

Moss - Internal fertilization / inside the body of organism , male gametes are motile / large number of gametes. = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

OR

Write the basis of categorising animals as oviparous or viviparous, giving one example of each.

Ans. Egg laying (fertilised or unfertilised), e.g. reptiles / birds / any other correct example = $\frac{1}{2} + \frac{1}{2}$

Give birth to young ones, e.g. majority of mammals / humans / any other correct example = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

SECTION C

(Q Nos. 13-24 are of 3 marks each)

13. Differentiate between an 'Expanding age pyramid' and a 'Stable age pyramid'. Substantiate your answer with diagrams.

Ans

| Expanding age pyramid | Stable age pyramid |
|---|---|
| Population of pre-reproductive age is greater than population of reproductive age | Population of pre-reproductive age equals to population of reproductive age |

= $\frac{1}{2} + \frac{1}{2}$



1+1

[3 Marks]

14. A child is born with ADA-deficiency

(a) Suggest and explain a procedure for possible life-long (permanent) cure.

(b) Name any other possible treatment for this disease.

Ans (a) Gene therapy, lymphocytes from the blood of a patient are grown in a culture outside the body, functional ADA cDNA is introduced into these lymphocytes, these cells are returned to the patient's body at early embryonic stage. = $\frac{1}{2} \times 4$

(b) Bone marrow transplantation, enzyme replacement therapy

$\frac{1}{2} + \frac{1}{2}$

[3 Marks]

15. Name the most commonly used bioreactor in biotechnology labs. Mention the most essential components this bioreactor must have so as to provide the optimum conditions to the culture medium, resulting in production of large volume of desired product.

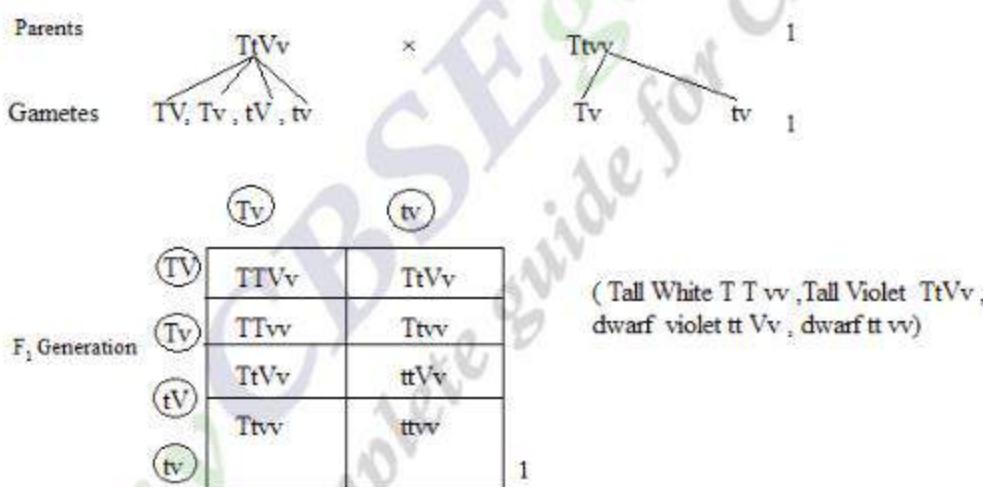
Ans Stirring type = 1/2

agitator system, O₂ delivery system, foam control system, temperature control system, pH control system

[3 Marks]

16. A tall pea plant bearing violet flowers is crossed with a tall pea plant bearing white flowers. In the F₁ Progeny , there were tall pea plants with white flowers, tall pea plants with violet flowers, dwarf pea plants with violet flowers and dwarf pea plants with white flowers. Work out the cross to show how is it possible.

ADS



[3 Marks]

17. (a) Differentiate between inbreeding and outbreeding.
(b) List any three advantages and one important disadvantage of inbreeding practice in animal husbandry.

Ans (a) Inbreeding - Mating of more closely related individuals within the same breed for 4-6 generations.

Outbreeding- Breeding of unrelated animals may be of the same breed but having no common ancestors for 4-6 generations/ different breeds/ different species. $= \frac{1}{2}$

- (b) Advantages develops pureline / increase homozygosity, accumulation of superior genes, elimination of less desired genes. = $\frac{1}{2} \times 3$

Disadvantages- Reduces fertility/ causes inbreeding depression.

= 1/2

[3 Marks]

18. Explain Hardy-Weinberg principle

Ans The frequency of occurrence of alleles of a gene is constant from generation to generation , it is expressed as $p^2 + 2pq + q^2 = 1$,

p and q represent the frequency of different alleles

1+1+1=3

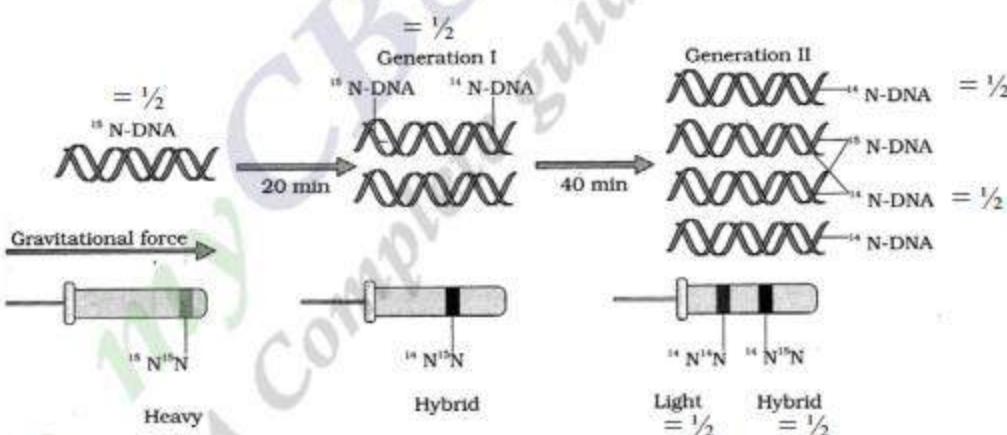
19. "Use of heavy isotope of nitrogen by Meselson and Stahl demonstrated semi-conservative mode of replication of a DNA molecule." Explain how did they arrive at this conclusion.

Grown *E.coli* in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA , then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$, The extracted DNA are centrifuged in CsCl and measured to get their densities , DNA extracted from the culture after one generation (20 minutes) , showed intermediate hybrid density , DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA

$= \frac{1}{2} \times 6 = 3$

A correctly labelled diagrammatic representation in lieu of the above explanation of experiment to be considered

= 3



[3 Marks]

OR

Explain the mechanism of translation that occurs in the ribosomes in a prokaryote.

Ans Charging of tRNA / aminoacylation of tRNA ,

small subunit of ribosome binds to mRNA (5'end) ,

for initiation the ribosome binds to the mRNA at the start codon (AUG) that is recognised only by initiator tRNA,

In the elongation phase amino acid with tRNA sequentially bind to the appropriate codon on mRNA (forming complimentary base pairs with tRNA anticodon),

Ribosome moves from codon to codon along the mRNA and amino acids are added one by one in the two sites of the large subunit joined by peptide bond ,

Termination occurs when a release factor binds to the stop codon and releases the complete polypeptide.

$\frac{1}{2} \times 6$

[3 Marks]

20. (a) Name the causative agents of pneumonia and common cold.

(b) How do these differ in their symptoms ?

(c) Mention two symptoms common to both.

Ans (a) *Streptococcus pneumoniae/Haemophilus influenzae, Rhinoviruses*

$= \frac{1}{2} + \frac{1}{2}$

(b) Different symptoms (any two)

$= \frac{1}{2} + \frac{1}{2}$

| Pneumonia | Common cold |
|--------------------------------------|------------------------------------|
| Infects alveoli of lungs | Infects nose & respiratory passage |
| chills | Sore throat |
| Lips /fingers may turn grey to black | Hoarseness |

(c) Common symptoms (any two)

$= \frac{1}{2} + \frac{1}{2}$

| | |
|-----------|-------------|
| Pneumonia | Common cold |
| Cough | Cough |
| Headache | Headache |

[3 Marks]

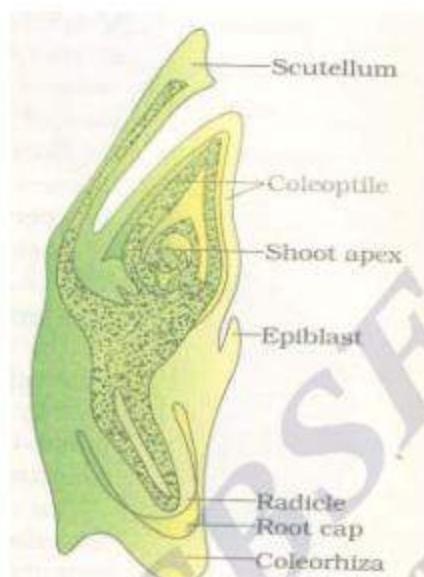
OR

(a) Write the scientific names of the causative agent and vector of malaria, and write its symptoms.

(b) Name any two diseases spread by Aedes sp.

- Ans (a) *Plasmodium vivax / P. falciparum / P. malariae*, vector-Female *Anopheles* mosquito = $\frac{1}{2} + \frac{1}{2}$
- Symptoms - chill & high fever = $\frac{1}{2} + \frac{1}{2}$
- (b) Dengue, Chikungunya (or any other correct example) = $\frac{1}{2} + \frac{1}{2}$
- [3 Marks]

21. Draw L.S of an embryo of grass and label its parts.



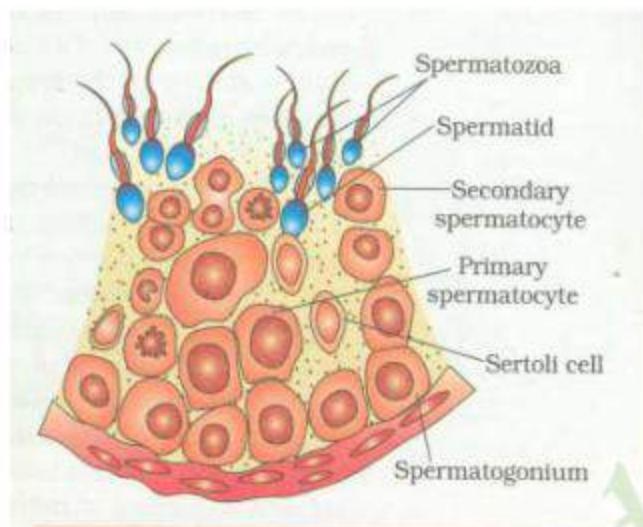
1×3

[3 Marks]

(Any Three Correctly Labelled Parts)

OR

Draw a diagrammatic sectional view of a seminiferous tubule (enlarged) in humans and label its parts.



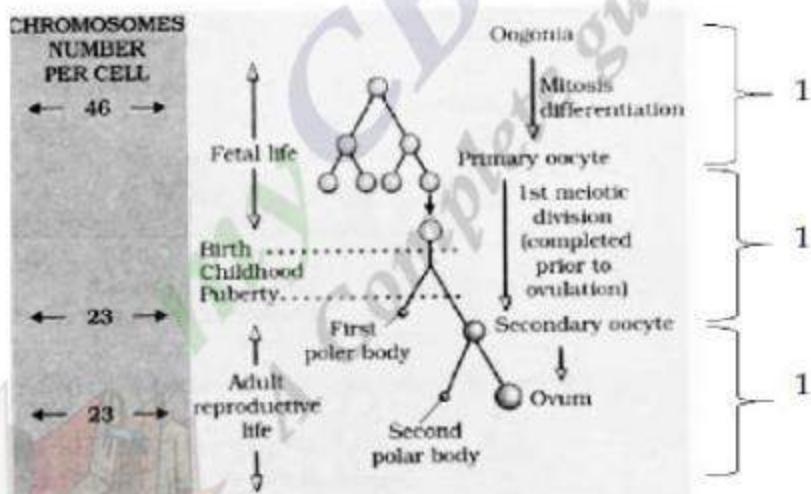
(Any Three Labelled Parts)

= 1 × 3

[3 Marks]

22. Construct a flow chart exhibiting sequential events of oogenesis.

Ans



1 × 3

[3 Marks]

23. When and where do tapetum and synergids develop in flowering plants ? Mention their functions.

Ans Tapetum- Microsporogenesis , Microsporangium(Anther), nourishes the developing pollen grains.

Synergids -Megasporogenesis, Megasporangium(ovule), synergids have filiform apparatus to guide the pollen tube into it. $\frac{1}{2} \times 6$

[3 Marks]

OR

**Where are the following structures present in a male gametophyte of an angiosperm ?
Mention the function of each one of them.**

- (a) Germ pore
- (b) Sporopollenin
- (c) Generative cell

Ans (a) Germ pore- Pollen grain exine , site from where pollen tube emerges .

(b) Sporopollenin-Exine of pollengrains , protects the pollen grains from high temperature / and strong acids & alkali / enzymes / adverse condition

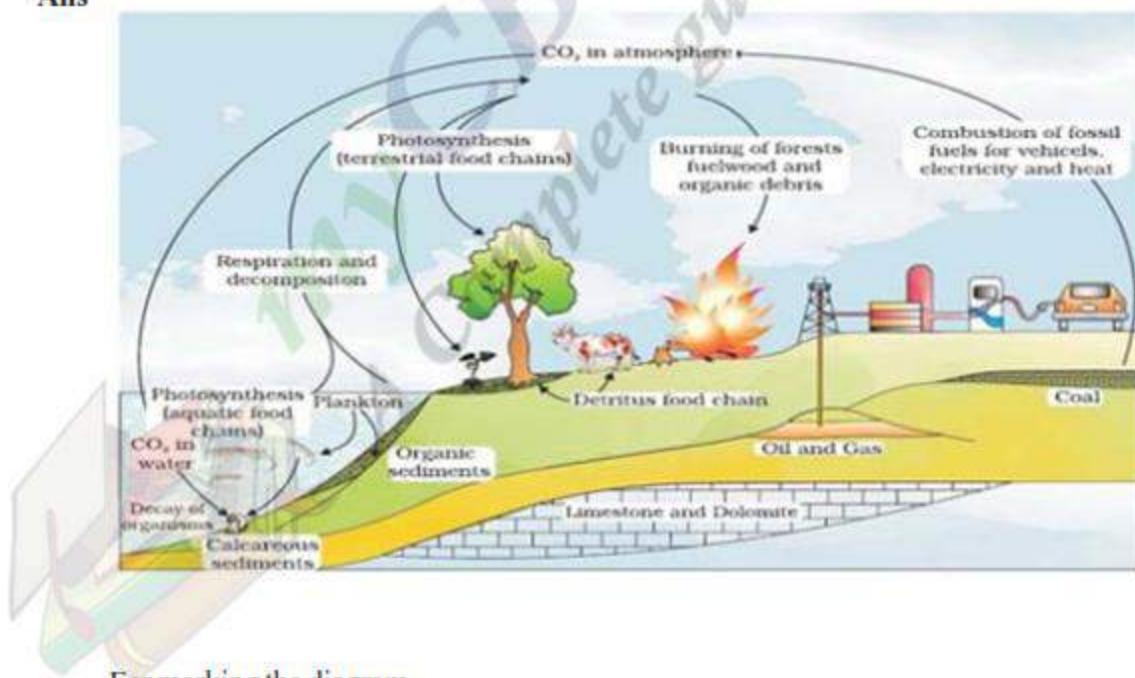
(c) Generative Cells - Pollen grains , give rise to two male gametes

$\frac{1}{2} \times 6$

[3 Marks]

24. Draw the carbon cycle in nature. How does deforestation affect this cycle ?

Ans



For marking the diagram -

Sources -respiration/ burning of forest / combustion of fuel (Any Two) $\frac{1}{2} + \frac{1}{2}$

CO_2 Fixation-Photosynthesis / limestone / Dolomite / oil , gas coal (Any Two) $\frac{1}{2} + \frac{1}{2}$

Effect of deforestation is enhanced CO₂ concentration in the atmosphere (because trees hold a lot of carbon in their biomass by photosynthesis).

= 1/2 + 1/2

SECTION D

(Q Nos. 25-27 are of 5 marks each)

25. A normal couple has a colour-blind child, whereas a child suffering from thalassemia is born to normal parents.

Compare the pattern of inheritance of these two traits in the said cases. State the reasons how is it possible.

$$\text{Ans} \quad X^c X \quad \times \quad XY$$

| | | |
|---|--------|------|
| | X^c | X |
| X | X^cX | XX |
| Y | X^cY | XY |

Colourblind Son

Colourblindness -Sex linked recessive , mother carrier(X^cX)

$$= 1 + \frac{1}{2}$$

Thalassemia - Autosomal recessive , both the parents are carrier

$$= 1 + \frac{1}{2}$$

[5 Marks]

OR

- (a) State the reasons for which Hershey and Chase carried out their experiments.

(b) Answer the following questions based on the experiments of Hershey and Chase :

(i) Name the different radioactive isotopes they used, and explain how they used them

(ii) Why did they need to agitate and spin their culture ?

(iii) Write their observations and the conclusions they arrived at.

Ans (a) To find out that DNA is the genetic material.

(b) P^{32} labelled DNA , S^{35} labelled protein capsule of Bacteriophage

(ii) To remove virus coat from bacteria, separation of virus particles from bacteria by agitation

and spinning.

1/2+1/2

- (iii) S³⁵ Radioactive detected in supernatant , Radioactive P³² detected in the cell , the proteins did not enter the bacteria from the viruses therefore DNA is the genetic material (that is passed from virus to bacteria) 1+1
[5 Marks]

26. A plastic sack manufacturer in Bengaluru, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management.

Ans Developed polyblend- a fine powder of recycled modified plastic 1

Polyblend mixed with bitumen and used to lay roads (in collaboration with R V engineering college and Bangalore city corporation) 1

It enhanced water repellent property of bitumen and increase the road life. 1

Khan offered a price to rag pickers which enhanced their income and improved their livelihood. 1

Thus solid waste management was achieved by removal and proper disposal of plastic waste from the city 1

[5 Marks]

OR

- (a) **What does an ecological pyramid represent ? State any two limitations that these pyramids have.**
- (b) **Describe an inverted pyramid of biomass with the help of an example.**

Ans (a) Ecological pyramids represent the relationship between different trophic levels in terms of number ,biomass or energy 1

Limitations of pyramid:

It does not takes into account the same species belonging to two or more trophic levels / It assumes a single food chain which almost never exists in nature / It does not accommodate a food web / Saprophytes are not given any place even though they play vital role in the ecosystem.

(any two) 1×2=2

- (b) The pyramids of biomass in aquatic ecosystem/ sea is generally inverted

//

PC

PP

1

e.g. biomass of fishes is much more than biomass of phytoplanktons.

1

[5 Marks]

27. (a) Differentiate between active and passive immunity.

(b) Comment on the role of vaccination and immunization in keeping human population healthy.

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh water bodies. Mention another benefit provided by this process.

Ans (a)

| Active immunity | Passive immunity |
|--|---|
| Production of antibodies on exposure to antigen in host body | Introduction of readymade antibodies to protect against pathogen |
| Slow process and takes time to give full effective response | T lymphocyte production is fast and responds quickly by checking growth of pathogen |
| Natural infection induces active immunity | Inoculation of pathogen in other organisms synthesizes antibodies which are isolated and used for vaccination |

(Any two)1 + 1

(b) Role of vaccination / immunization:

- Antibodies produced in body against antigen neutralizes pathogenic agents.
- Vaccines also generate memory cell (B and T cells) that recognize quickly on subsequent exposure and controls growth of pathogen with massive production of antibodies

- preformed antibodies/ antitoxin protect our body from deadly microbes like tetanus and against snake venom

$1 \times 3 = 3$

[5 Marks]

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

Ans Process of secondary treatment :

Passing of primary effluent into large aeration tank which is constantly agitated mechanically & air is pumped into it that allows vigorous growth of useful aerobic microbes into flocs



Microbes consume major part of organic matter in effluent which significantly reduces BOD



Now effluent is passed into settling tank where flocs are allowed to settle/ sediment called activated sludge



Digestion of activated sludge by anaerobic microbes and effluents from secondary treatment can be released into river/ stream.



Resulted in production of Bio gas (CH_4 , H_2S and CO_2) which can be used as source of energy

1×5

[5 Marks]





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SET-1
Series BVM/3

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परीक्षार्थी कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।

Candidates must write the Code on the title page of the answer-book.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **11** हैं।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में **27** प्रश्न हैं।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, 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 **11** printed pages.
- Code number 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 **27** questions.
- **Please write down the Serial Number of the question 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)

नियमित समय : 3 घण्टे

Time allowed : 3 hours

अधिकतम अंक : 70

Maximum Marks : 70

सामान्य निर्देशः

- (i) प्रश्न-पत्र में चार खण्डों में कुल 27 प्रश्न दिए गए हैं। सभी प्रश्न अनिवार्य हैं।
- (ii) खण्ड **A** में प्रश्न संख्या 1 से 5 अति लघु-उत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 1 अंक का है।
- (iii) खण्ड **B** में प्रश्न संख्या 6 से 12 लघु-उत्तरीय प्रश्न प्रकार I के हैं, प्रत्येक प्रश्न 2 अंकों का है।
- (iv) खण्ड **C** में प्रश्न संख्या 13 से 24 लघु-उत्तरीय प्रश्न प्रकार II के हैं, प्रत्येक प्रश्न 3 अंकों का है।
- (v) खण्ड **D** में प्रश्न संख्या 25 से 27 दीर्घ-उत्तरीय प्रश्न हैं, प्रत्येक प्रश्न 5 अंकों का है।
- (vi) प्रश्न-पत्र में समग्र पर कोई विकल्प नहीं है, फिर भी 1 अंक वाले दो प्रश्नों में, 2 अंकों वाले दो प्रश्नों में, 3 अंकों वाले चार प्रश्नों में और 5 अंकों वाले सभी तीनों प्रश्नों में भीतरी चयन-विकल्प दिए गए हैं। प्रत्येक परीक्षार्थी को ऐसे प्रश्नों के दो विकल्पों में से कोई एक प्रश्न हल करना है।
- (vii) आवश्यकतानुसार, चित्रों का रेखन साफ-सुधरा एवं यथोचित लेबल होना चाहिए।

General Instructions :

- (i) There are a total of 27 questions and four sections in the question paper. All questions are compulsory.
- (ii) Section **A** contains questions number 1 to 5, very short-answer type questions of 1 mark each.
- (iii) Section **B** contains questions number 6 to 12, short-answer type I questions of 2 marks each.
- (iv) Section **C** contains questions number 13 to 24, short-answer type II questions of 3 marks each.
- (v) Section **D** contains questions number 25 to 27, long-answer type questions of 5 marks each.
- (vi) There is no overall choice in the question paper, however, an internal choice is provided in two questions of 1 mark, two questions of 2 marks, four questions of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any one of the two given alternatives.
- (vii) Wherever necessary, the diagram drawn should be neat and properly labelled.

खण्ड अ

SECTION A

1. क्लोन जीवों में विविधता परिलक्षित क्यों नहीं होती ? दो कारण लिखिए। 1
Why are no variations seen in clones ? State two reasons.
2. एक डी.एन.ए. न्यूक्लियोटाइड तथा एक आर.एन.ए. न्यूक्लियोटाइड के मध्य अंतर स्पष्ट कीजिए। 1
Differentiate between a DNA and a RNA nucleotide.
3. डी व्रीज़ के अनुसार 'साल्टेशन' क्या है ? 1
What is 'Saltation' according to de Vries ?
4. उस जीव का वैज्ञानिक नाम लिखिए जिस पर कार्य करते हुए अलेक्जेंडर फ्लेमिंग ने प्रतिजैविक की सर्वप्रथम खोज की। उन्होंने जिस जीव पर कार्य किया वह कवक था अथवा जीवाणु ? 1

अथवा

अत्यधिक अंतःप्रजनन अवसादन की समस्या के निदान हेतु एक विधि का सुझाव दीजिए। 1

Write the scientific name of the organism Alexander Fleming worked on and discovered the first antibiotic. Was the organism he worked on a fungus or a bacterium ?

OR

Suggest a method to overcome excessive inbreeding depression.

5. ऐन्टार्कटिक क्षेत्र में 'ओजोन-छिद्र' के लिए उत्तरदायी प्रदूषक का नाम लिखिए। 1

अथवा

कार्बन डाइऑक्साइड के अतिरिक्त ग्रीनहाउस गैसों की सूची बनाइए। 1

Name the pollutant attributed to be the cause of 'ozone-hole' over the Antarctica region.

OR

List the greenhouse gases other than carbon dioxide.

खण्ड ब

SECTION B

6. (a) गेहूँ के पुष्प के किन्हीं दो विशिष्ट अभिलक्षणों की सूची बनाइए जो इसे वायु परागण का एक अच्छा उदाहरण बनाते हैं।

(b) ऐसा देखा गया है कि गेहूँ के संकरण के लिए पादप प्रजनक बहुधा 'पराग बैंक' से परागकणों को प्राप्त कर उनका उपयोग करते हैं। क्या आप इससे सहमत हैं? अपने उत्तर के समर्थन में एक कारण दीजिए। 2

(a) List any two characteristic features of wheat flowers that make it a good example of wind pollination.

(b) It is observed that plant breeders carrying out wheat hybridisation often take pollen grains from the 'pollen banks'. Do you agree? Give one reason in support of your answer.

7. टर्नर सिंड्रोम तथा डाउन सिंड्रोम में अंतर स्पष्ट कीजिए। 2

Differentiate between Turner's syndrome and Down's syndrome.

8. प्रतिरक्षा अनुक्रिया को विकसित करने में बी-लसीकाणुओं तथा टी-लसीकाणुओं के मध्य संबंध की व्याख्या कीजिए। 2

Explain the relationship between *B*-lymphocytes and *T*-lymphocytes in developing an immune response.

9. भारत सरकार ने जी.ई.ए.सी. नामक संस्थान की स्थापना क्यों की? कोई दो कारण लिखिए। 2

अथवा

प्राक्-इंसुलिन के इंसुलिन में रूपान्तरण का व्यवस्थात्मक निरूपण दीजिए। 2

Why has the Indian Government set up the organisation named GEAC? Give any two reasons.

OR

Give a schematic representation of the transformation of a pro-insulin into insulin.

10. 'Ori' क्या है ? संवाहक की क्लोनिंग में इसका महत्व लिखिए ।

2

अथवा

एक उचित उदाहरण की सहायता से 'वरणयोग्य चिह्नक' के महत्व की व्याख्या कीजिए ।

2

What is 'Ori'? State its importance during cloning of a vector.

OR

Explain the importance of 'selectable marker', with the help of a suitable example.

11. किसी आवास में एक जाति की 'पोषण क्षमता' क्या है ? संभार-तंत्र (लॉजिस्टिक) वृद्धि मॉडल को अधिक यथार्थपूर्ण क्यों माना जाता है ?

2

What is 'carrying capacity' of a species in a habitat ? Why is logistic growth model considered more realistic ?

12. "ऊर्जा का पिरैमिड सदैव ऊर्ध्वाधर (खड़ी) अवस्था में होता है तथा कभी अधोमुखी नहीं हो सकता ।" कथन की न्यायसंगतता सिद्ध कीजिए ।

2

Justify the statement, "Pyramid of energy is always upright, and can never be inverted."

खण्ड स

SECTION C

13. अपने शहरों में अति गंभीर वायु प्रदूषण की समस्या के समाधान हेतु किन्हीं तीन सुधारात्मक उपायों की व्याख्या कीजिए ।

3

अथवा

ध्वनि प्रदूषण के ऐसे कोई तीन तरीके लिखिए जो मानव शरीर पर दुष्प्रभाव डालते हैं । ध्वनि प्रदूषण को कम करने के लिए अपनाए जाने वाले किन्हीं तीन उपायों की सूची बनाइए ।

3

Explain any three remedial measures to overcome the acute air pollution in our cities.

OR

Write any three ways by which noise pollution affects the human body adversely. List any three steps that should be followed in order to reduce noise pollution.

14. (a) किसी पारितंत्र की प्राथमिक उत्पादकता क्या है तथा इसे किस प्रकार व्यक्त करते हैं ?
 (b) निम्नलिखित समीकरण क्या दर्शाता है, उसकी व्याख्या कीजिए।

एन.पी.पी. = जी.पी.पी. – आर

3

अथवा

- (a) उस प्रकार के अपरद का नाम लिखिए जिससे अपघटन तीव्र गति से होता है। ऐसे किन्हीं दो कारकों की सूची बनाइए जो अपघटन की दर को बढ़ाते हैं।
 (b) अपघटन प्रक्रम के दौरान ह्यूमीफिकेशन तथा खनिजीकरण प्रक्रिया के विभिन्न चरण लिखिए।
 (a) What is the primary productivity of an ecosystem and how is it expressed ?
 (b) Explain what does the equation given below show :

$$\text{NPP} = \text{GPP} - \text{R}$$

OR

- (a) Name the type of detritus that decomposes faster. List any two factors that enhance the rate of decomposition.
 (b) Write the different steps taken in humification and mineralisation during the process of decomposition.

15. (a) निम्नलिखित के अभिलक्षणों की तुलना कीजिए :
 (i) पृथुतापी (यूरीथर्मल) तथा तनुतापी (स्टेनोथर्मल) जीव
 (ii) पृथुलवणी (यूरीहैलाइन) तथा तनुलवणी (स्टेनोहैलाइन) जीव
 (b) ‘तुंगता बीमारी’ के प्रति हमारा शरीर किस प्रकार पर्यनुकूलित (एक्लिमेटाइज्ड) हो जाता है ?
 (a) Compare the characteristics of the following :
 (i) Eurythermal and Stenothermal organisms
 (ii) Euryhaline and Stenohaline organisms
 (b) How does our body get acclimatized to ‘altitude sickness’ ?

3

16. विषाणु संक्रमण की प्रारम्भिक अवस्था में रोग निदान की किन्हीं दो जैव-रासायनिक/आण्विक तरीके लिखिए। इनमें से किसी एक के सिद्धांत की व्याख्या कीजिए। 3

अथवा

वाहित मल के द्वितीय उपचार के दौरान अपनाए गए चरणों का वर्णन कीजिए। 3

Write any two biochemical/molecular diagnostic procedures for early detection of viral infection. Explain the principle of any one of them.

OR

Describe the steps that are followed during secondary treatment of sewage.

17. उत्तर भारत में खेती के लिए पादप प्रजनक गन्ने की उपयुक्त किसमें कैसे विकसित (उत्पन्न) करते हैं? वह इसे क्यों करते हैं? 3

How did the plant breeders produce suitable varieties of sugarcane for cultivation in North India? Why did they do it?

18. किसी पर्वतीय क्षेत्र के भ्रमण के दौरान, कुछ बच्चों में ऐलर्जी के लक्षण उत्पन्न हो गए हैं।
 (a) किन्हीं दो ऐलर्जी अभिलक्षणों की सूची बनाइए।
 (b) किन्हीं दो ऐलर्जनों के नाम लिखिए।
 (c) किन्हीं दो प्रतिऐलर्जनों (एंटीऐलर्जन्स) की सूची बनाइए। 3

While on an excursion to a hill station, some of the children developed allergic symptoms.

- (a) List any two allergic symptoms.
- (b) Name any two allergens.
- (c) List any two antiallergens.

19. “इंग्लैंड में औद्योगीकरण के पश्चात् काले वर्ण (गहरे रंग) वाले शलभों का प्रादुर्भाव प्राकृतिक वरण द्वारा विकास का एक चिह्नितिष्ठित उदाहरण है।” व्याख्या कीजिए। 3

“Appearance of melanised moths post-industrialisation in England is a classic example of evolution by natural selection.” Explain.

20. मानव जीनोम प्रोजेक्ट से प्राप्त मानव जीनोम की कोई छ: विशेषताएँ लिखिए। 3

Write any six salient features of the human genome as drawn from the human genome project.

21. विषमयुग्मकता क्या है ? ड्रोसोफिला में लिंग निर्धारण प्रक्रम की व्याख्या कीजिए। 3

अथवा

सुकेंद्रकियों में विषमांगी केंद्रकीय आर.एन.ए. (hnRNA) से पूर्णतः क्रियाशील एम.आर.एन.ए. (mRNA) के निर्माण के प्रक्रम की व्याख्या कीजिए। कोशिका में यह प्रक्रम कहाँ सम्पन्न होता है ? 3

What is heterogamety ? Explain the mechanism of sex determination in *Drosophila*.

OR

Explain the process of making heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this process occur in the cell ?

22. (a) किन्हीं दो प्रकार के अंतःगर्भाशयी युक्तियों (आई.यू.डी.) के नाम लिखिए तथा उनकी क्रियाविधि की व्याख्या कीजिए।

(b) 'सहेली' नामक गोली का गर्भनिरोधक के रूप में उपयोग करने के लाभों की सूची बनाइए। 3

(a) Name and explain the mode of action of any two types of IUDs.

(b) List the advantages of using 'Saheli' as a contraceptive.

23. (a) एक जीवाणु को 'सक्षम' क्यों बनाया जाए ?

(b) जैव-प्रौद्योगिकी में 'सूक्ष्म-अंतःक्षेपण' (माइक्रोइंजेक्शन) तथा 'जीन गन' की भूमिका की व्याख्या कीजिए। 3

(a) Why should a bacterium be made 'competent' ?

(b) Explain the role of 'microinjection' and 'gene gun' in biotechnology.

24. एक आवृतबीजी पादप के अपरिपक्व परागकोश की अनुप्रस्थ-काट का आरेख बनाइए। इसकी भित्ति की विभिन्न परतों को नामांकित कीजिए तथा उनके कार्य लिखिए। 3

Draw a T.S. of a young anther of an angiosperm. Label the different layers of the wall and write their functions.

खण्ड द

SECTION D

25. (a) पराग-स्त्रीकेसर संकर्षण में वर्तिकाग्र की भूमिका की व्याख्या कीजिए।
 (b) आवृतबीजी पादपों में द्वि-कोशीय परागकणों से प्रारम्भ कर परागण-पश्च परिघटनाओं का वर्णन कीजिए जो दोहरा निषेचन तक अग्रसारित होती हैं। 5

अथवा

- (a) स्त्रियों में सगर्भता के दौरान उन परिघटनाओं का उल्लेख कीजिए जिनसे अपरा (प्लैसेंटा) का विकास होता है।
 (b) सगर्भता के दौरान अपरा (प्लैसेंटा) की भूमिका की व्याख्या कीजिए तथा इसके अंतःस्नावी अंग के रूप में कार्य करने की भी व्याख्या कीजिए। 5
 (a) Explain the role of stigma in pollen-pistil interactions.
 (b) Describe the post-pollination events leading to double fertilization in angiosperms, starting with a two-celled pollen grain.

OR

- (a) Mention the events that lead to the development of placenta during pregnancy in human females.
 (b) Explain the role of placenta during pregnancy including its action as an endocrine organ.

26. (a) आप कैसे पता लगाएंगे कि उद्यान मटर का दिया गया लंबा पौधा समयुग्मजी (होमोज़ाइगस) है अथवा विषमयुग्मजी (हेटरोज़ाइगस) ? पनेट वर्गों की सहायता से अपने उत्तर को प्रमाणित कीजिए।

- (b) स्वतंत्र रूप से कराए गए दो 'एक-संकर क्रॉस' के F_2 -लक्षणप्ररूपी अनुपात निम्नलिखित हैं :
- 1 : 2 : 1
 - 3 : 1
- प्रत्येक अनुपात क्या दर्शाता है ? उल्लेख कीजिए ।

अथवा

- (a) अपने प्रयोगों में हर्षे एवं चेस ने विकिरण-सक्रिय (रेडियोऐक्टिव) ^{32}P तथा ^{35}S का उपयोग क्यों किया ? व्याख्या कीजिए ।
- (b) अपने प्रयोगों से प्राप्त परिणामों के आधार पर उन्होंने क्या निष्कर्ष निकाले और कैसे ?
- (a) How would you find out whether a given tall garden pea plant is homozygous or heterozygous ? Substantiate your answer with the help of Punnett squares.
- (b) Given below are the F_2 -phenotypic ratios of two independently carried monohybrid crosses :
- 1 : 2 : 1
 - 3 : 1

5

Mention what does each ratio suggest.

OR

- (a) Why did Hershey and Chase use radioactive ^{32}P and ^{35}S in their experiments ? Explain.
- (b) Following the experiments conducted by them, write what conclusion did they arrive at and how.

27. (a) उस जीनस प्लैज्मोडियम का विशिष्ट नाम लिखिए जो मनुष्यों में अति गंभीर रोग का कारक है । रोग का नाम लिखिए ।
- (b) प्लैज्मोडियम के जीवन चक्र की उन परिघटनाओं का वर्णन कीजिए जो मादा एनोफेलीज में सम्पन्न होती हैं ।
- (c) जब प्लैज्मोडियम मानव की लाल रुधिर-कणिकाओं में प्रवेश करते हैं, तो उनमें क्या परिवर्तन होता है ? व्याख्या कीजिए । मनुष्य के शरीर पर इसका क्या प्रभाव पड़ता है ?

5

अथवा

- किन्हीं तीन समुचित उदाहरणों की सहायता से कार्बनिक-खेती तथा जैव-उर्वरकों के बीच पारस्परिक संबंध की व्याख्या कीजिए ।

5

- (a) Write the specific name of the genus *Plasmodium* that causes one of the most serious types of diseases in humans. Name the disease.
- (b) Describe the events in the life cycle of *Plasmodium* which take place in the female *Anopheles*.
- (c) Explain what happens in the RBCs of the humans when *Plasmodium* gains entry into them. How does the human body get affected ?

OR

Explain the interrelationship between organic farming and biofertilizers, with the help of any three suitable examples.



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. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. 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.**
3. 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.
4. 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.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. 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 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.
 - 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.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.
12. 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.
13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
14. 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.
15. 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.

Question Paper Code 57/3/1

SECTION – A

(Q. Nos. 1 - 5 are of one mark each)

- 1.** Why are no variations seen in clones ? State two reasons.

Ans. • Clones are produced from one parent / produced by mitosis / product of asexual reproduction
 $= \frac{1}{2}$

• No fusion of gametes / no syngamy/ no meiosis / no recombination = $\frac{1}{2}$

[1 Mark]

- 2.** Differentiate between a DNA and a RNA nucleotide.

| Ans. DNA NUCLEOTIDE | RNA NUCLEOTIDE |
|----------------------|---------------------|
| Deoxyribose sugar | Ribose sugar |
| Pyrimidine - Thymine | Pyrimidine - Uracil |

(Note - corresponding 2 differences)

$= \frac{1}{2} + \frac{1}{2}$

[1 Mark]

- 3.** What is 'Saltation' according to de Vries ?

Ans. Single step large mutation / random and directionless mutation / mutation related to speciation = 1

[1 Mark]

- 4.** Write the scientific name of the organism Alexander Fleming worked on and discovered the first antibiotic. Was the organism he worked on a fungus or a bacterium ?

Ans. *Staphylococci* = $\frac{1}{2}$

Bacteria = $\frac{1}{2}$

[1 Mark]

OR

Suggest a method to overcome excessive inbreeding depression.

Ans. Out cross // mating with unrelated superior animal of the same breed

[1 Mark]

5. Name the pollutant attributed to be the cause of 'ozone-hole' over the Antarctica region.

Ans. CFC / Chlorofluorocarbon

[1 Mark]

OR

List the greenhouse gases other than carbon dioxide.

Ans. CH_4 , CFC, N_2O / oxides of N_2 (*All three gases = 1 Mark*)

(*One / Two gases = ½ Mark*)

[1 Mark]

SECTION B

(Q. Nos. 6 -12 are of two marks each)

6. (a) List any two characteristic features of wheat flowers that make it a good example of wind pollination.
(b) It is observed that plant breeders carrying out wheat hybridisation often take pollen grains from the 'pollen banks'. Do you agree? Give one reason in support of your answer.

Ans. (a) Light pollen grains / pollen grains more in number / exposed stamen / feathery stigma / single ovule / numerous flowers packed into an inflorescence (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

(b) • Yes = $\frac{1}{2}$

• Viability of wheat pollen grain is only 30 minutes and so it can be stored in pollen bank for a long period of time = $\frac{1}{2}$

[1+1= 2 Marks]

7. Differentiate between Turner's syndrome and Down's syndrome.

| Ans. TURNER'S SYNDROME | DOWN'S SYNDROME |
|--|---|
| <ul style="list-style-type: none"> (i) Absence of one X chromosome / 44+X0 X0 condition / monosomy of sex chromosome in females / 45 withX0 (ii) Only females are affected (iii) females sterile / ovary rudimentary / lack of secondary sexual character / short stature | <ul style="list-style-type: none"> (i) Trisomy of 21st chromosome / Extra copy of 21st Chromosome = 1 (ii) Both Male and female are affected (iii) short stature with small round head / furrowed tongue and partially open mouth / palm is broad with characteristic palm crease |

Any one corresponding difference either from (ii) or from (iii) = 1

[2 Marks]

8. Explain the relationship between B-lymphocytes and T-lymphocytes in developing an immune response.

Ans. **B-lymphocytes**- produce antibodies to fight pathogen = 1

T - lymphocytes - do not produce antibodies but help B cells to produce them / can also destroy pathgen directly = 1

[2 Marks]

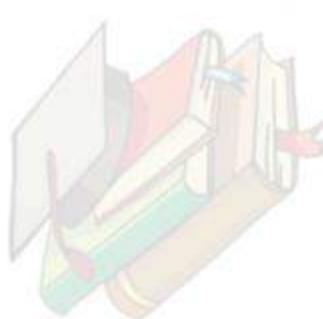
9. Why has the Indian Government set up the organisation named GEAC ? Give any two reasons.

Ans. To check the Validity of GM crops , safety of introduction of GM organism for public services

= 1 + 1

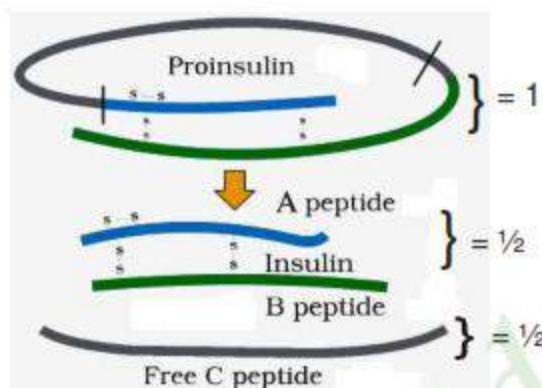
[2 Marks]

OR



Give a schematic representation of the transformation of a pro-insulin into insulin.

Ans.



[2 Marks]

10. What is 'Ori' ? State its importance during cloning of a vector.

- Ans.
- Specific sequences of DNA where replication starts = 1
 - Helps in the replication of alien DNA when attached to Ori = $\frac{1}{2}$
 - controls copy number = $\frac{1}{2}$

[2 Marks]

OR

Explain the importance of 'selectable marker', with the help of a suitable example.

Ans. It helps in identifying and eliminating non-transformants , selectively permitting the growth of transformants = $\frac{1}{2} + \frac{1}{2}$

Genes coding for antibiotic resistance such as ampicillin / tetracycline/kenamycin/chloramphenicol or (any other antibiotic) are used as selectable marker (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

11. What is 'carrying capacity' of a species in a habitat ? Why is logistic growth model considered more realistic ?

Ans. Maximum number of individuals a habitat can support (at given time) = 1

Since resources are limited / finite and sooner or later they become limiting (so logistic growth model is more realistic) = 1

[2 Marks]

12. Justify the statement, "Pyramid of energy is always upright, and can never be inverted."

Ans. Energy flow is always in one direction / Energy is always more at the producer level / Energy is lost at each successive trophic level in the form of heat (**Any two correct points**) = 1 + 1

[2 Marks]

SECTION -C

(Q. Nos. 13-24 are of three marks each)

13. Explain any three remedial measures to overcome the acute air pollution in our cities.

Ans. Electrostatic precipitators to remove particulate matter present in the exhaust from thermal power plant / Scrubber to remove SO_2 from the exhaust of thermal power plant / Alternative sources of energy in place of petrol / Lead free petrol or diesel / Catalytic converters - to reduce lead pollution / Use of CNG / Use of low sulphur petrol and diesel / Phasing out of old vehicles / Stringent enforcement of pollution level norms (**Any three**) = 1×3

[3 Marks]

OR

Write any three ways by which noise pollution affects the human body adversely. List any three steps that should be followed in order to reduce noise pollution.

Ans. Sleeplessness / Increased heart beat / Altered breathing pattern / Damage hearing ability / Damage ear drum (**Any three**) = $\frac{1}{2} \times 3$

Three steps to be followed to reduce noise pollution

Following of stringent laws laid down in relation to noise level / Delimitation of horn free zones around hospitals and schools / To adopt permissible sound level of crackers and loudspeakers / Adhering to time limit for loudspeakers beyond which it cannot be played / Use of sound absorbent material in industries / muffling of noise (**Any three**) = $\frac{1}{2} \times 3$

[3 Marks]

14. (a) What is the primary productivity of an ecosystem and how is it expressed ?

(b) Explain what does the equation given below show : $\text{NPP} = \text{GPP} - \text{R}$

Ans. (a) • Primary Productivity is defined as Rate of biomass production = 1

• Expressed as $\text{g}^{-2}\text{yr}^{-1} / (\text{kcal m}^{-2})\text{yr}^{-1} = \frac{1}{2}$

(b) • Gross primary productivity minus respiratory loss is the net primary productivity = 1
• Which is available to the next trophic level = $\frac{1}{2}$

[$\frac{1}{2} + \frac{1}{2} = 3$ Marks]

OR

- (a) Name the type of detritus that decomposes faster. List any two factors that enhance the rate of decomposition.
- (b) Write the different steps taken in humification and mineralisation during the process of decomposition.

Ans. (a) • Detritus rich in N_2 , water soluble substance like sugar = $\frac{1}{2} + \frac{1}{2}$

- **Factors -**

Warm temperature / moist environment / availability of oxygen (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

(b) **Humification** - Accumulation of dark coloured amorphous substance called humus which is resistant to microbial action and undergoes decomposition at a very slow rate = $\frac{1}{2}$

Mineralisation - humus is further degraded by microbes releasing inorganic nutrients = $\frac{1}{2}$

[2+1 = 3 Marks]

15. (a) Compare the characteristics of the following :

- (i) Eurythermal and Stenothermal organisms
- (ii) Euryhaline and Stenohaline organisms

(b) How does our body get acclimatized to 'altitude sickness' ?

Ans. (a) (i) Organism that tolerate wide range of temperature , Organism that are restricted to narrow range of temperature = $\frac{1}{2} + \frac{1}{2}$

(ii) Organism that tolerate wide range of salinity, Organism restricted to narrow range of salinity = $\frac{1}{2} + \frac{1}{2}$

(b) Increase of RBC production / decrease binding affinity of Hb to oxygen / increase of breathing rate (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[2+1 = 3 Marks]

16. Write any two biochemical/molecular diagnostic procedures for early detection of viral infection. Explain the principle of any one of them.

Ans. ELISA, PCR = 1 + 1

ELISA – antigen antibody interaction / PCR – amplification of nucleic acid for its identification (*Any one*) = 1

[3 Marks]

OR

Describe the steps that are followed during secondary treatment of sewage.

Ans. In Aeration tank effluent agitated mechanically , air pumped allows the growth of flocs , consumes organic matter , reduces BOD , Effluent pumped to settling tank to allow sedimentation of bacterial flocs called activated sludge , a small part of which is used as inoculum and the rest is pumped into anaerobic sludge digester for complete digestion of anaerobic bacteria and effluent is released into the natural water body (**steps should be in correct sequence**) = $\frac{1}{2} \times 6$

[3 Marks]

17. How did the plant breeders produce suitable varieties of sugarcane for cultivation in North India ? Why did they do it ?

Ans. • *Saccharum barberi* indigenous to North India with low sugar content and yield , crossed with South Indian *Saccharum officinarum* having thick stem and high sugar content= 1 + 1
• To improve the yield = 1

[3 Marks]

18. While on an excursion to a hill station, some of the children developed allergic symptoms.
(a) List any two allergic symptoms.

(b) Name any two allergens.

(c) List any two antiallergens.

Ans. (a) Sneezing / watery eyes / running nose / difficulty in breathing (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

(b) Dust / pollen / animal dander / mites (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

(c) Anti-histamine / adrenalin / steroids (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

[1+1+1= 3 Marks]

19. "Appearance of melanised moths post-industrialisation in England is a classic example of evolution by natural selection." Explain.

Ans. Before industrialisation more white winged moth than dark winged moth existed in England , post industrialisation tree trunks became dark as smoke and soot deposited , lichens could not grow due to pollution , due to higher predation of white winged moth on a darker background , dark winged moth survived , nature selected the fittest organism = $\frac{1}{2} \times 6$ (**correct sequence**)

[3 Marks]

20. Write any six salient features of the human genome as drawn from the human genome project.

- Ans. (i) The human genome contains 3164.7 million nucleotide bases
(ii) The average gene consists of 3000 bases but sizes vary greatly with the largest known human gene being dystrophin at 2.4 million bases
(iii) The total number of genes is estimated at 30,000 - much lower than previous estimates
(iv) Almost all (99.9 per cent) nucleotide bases are exactly the same in all people
(v) The functions are unknown for over 50 per cent of discovered genes
(vi) Less than 2 per cent of the genome codes for proteins
(vii) Repeated sequences make up very large portion of the human genome
(viii) Repetitive sequences are thought to have no direct coding function but they shed light on chromosome structure dynamics and evolution
(ix) Chromosome 1 has most genes (2968) and the Y has the fewest (231)
(x) Scientists have identified about 1.4 million locations where single base DNA difference (SNPs - single nucleotide polymorphism, pronounced as 'snips') occurs in humans and this information promises to revolutionise the processes of finding chromosomal locations for disease-associated sequences and tracing human history

Any six features (½× 6)

[3 Marks]

21. What is heterogamety? Explain the mechanism of sex determination in *Drosophila*.

- Ans. • Heterogamety is production of two different types of gametes (either in male / female) = 1
• Sex determination in *Drosophila* XX (female) / XY (male) type = $\frac{1}{2}$
Female (XX) produces only one type of gamete with X chromosome but the male produces two different types of gametes with either X or Y chromosome = $\frac{1}{2}$
When a male gamete with X fuses with the female gamete it produces a female progeny (XX) = $\frac{1}{2}$
When a male gamete with Y fuses with the female gamete it produces male progeny (XY) = $\frac{1}{2}$



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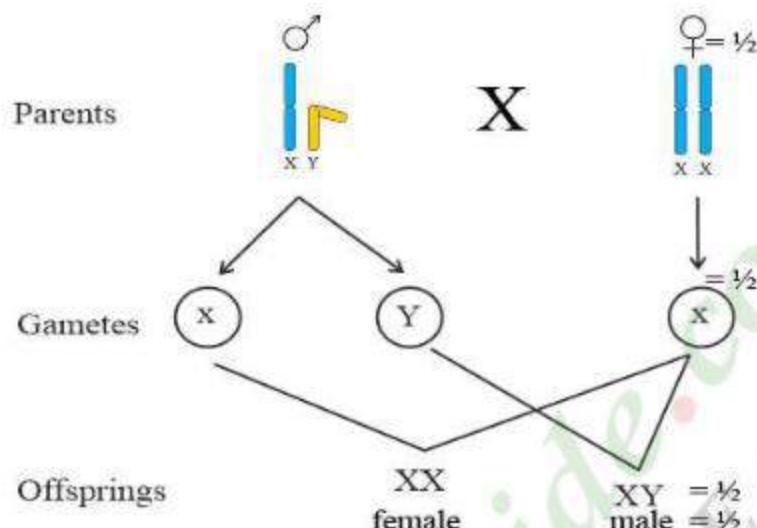


Diagram / Explanation = 2

[3 Marks]

OR

Explain the process of making heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this process occur in the cell ?

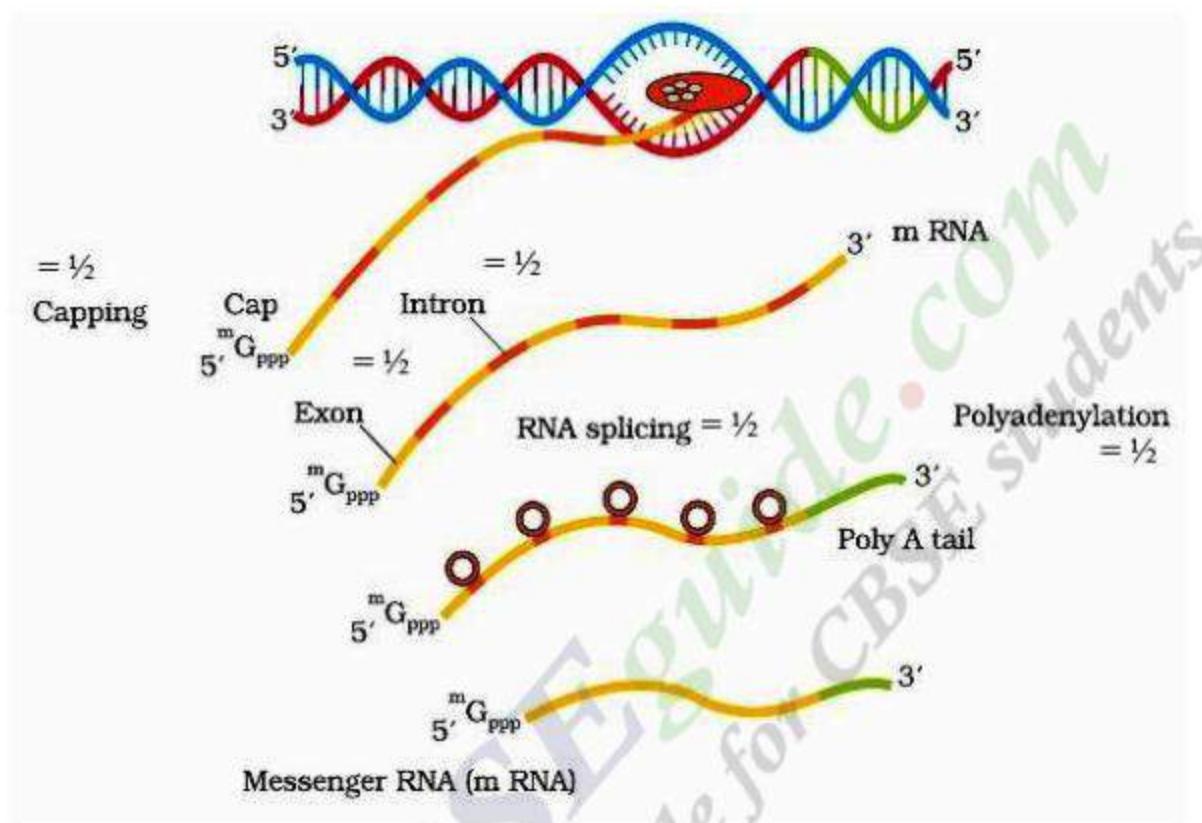
- Ans. • hnRNA undergoes capping at 5' end (methyl guanosine triphosphate) and tailing at 3' end (with poly A tail) = 1
- Further Splicing is carried out , where the non- coding sequences called introns are removed , and coding sequences called exons are joined together in a defined manner

= $\frac{1}{2} \times 3$

(either explanation or diagram)

//





Site of processing of hnRNA

- This process occurs in the Nucleus = ½

[3 Marks]

22. (a) Name and explain the mode of action of any two types of IUDs.

(b) List the advantages of using 'Saheli' as a contraceptive.

Ans. (a)

- Non-medicated (e.g. Lippes loop), phagocytosis of sperms = ½ + ½
- Copper releasing IUDs (CuT, Cu7, Multiload 375), suppress sperm motility / reduces fertilizing capacity of sperm = ½ + ½
- Hormone releasing IUDs (Progestasert, LNG - 20), makes uterus unsuitable for implantation / cervix hostile to sperms = ½ + ½

(Any two)

Advantages of Saheli

- (b) Non -steroidal /once a week / high contraceptive value / less side effects (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[2+1= 3 Marks]

- 23. (a) Why should a bacterium be made 'competent' ?**

- (b) Explain the role of 'microinjection' and 'gene gun' in biotechnology.**

Ans. (a) The bacterial cell must be made competent in order to receive the hydrophilic rDNA / plasmid , which cannot otherwise pass through the cell membrane = $\frac{1}{2} + \frac{1}{2}$

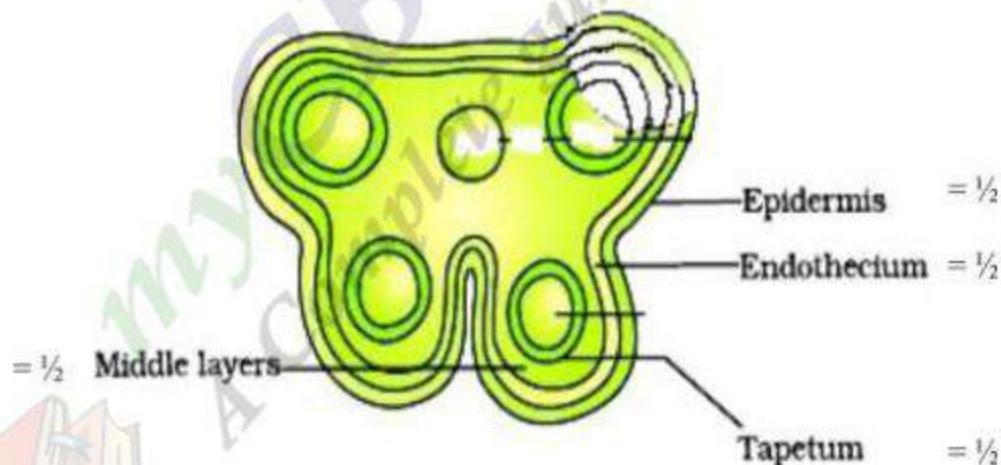
(b) Microinjection - rDNA is directly injected into the animal cell nucleus = 1

Biostatics (gene gun) - Plant cells are bombarded with high velocity microparticles of gold / tungsten coated with rDNA = 1

[1 + 2 = 3 Marks]

- 24. Draw a T.S. of a young anther of an angiosperm. Label the different layers of the wall and write their functions.**

Ans.



(Correct diagram with labelling of four wall layers)

Function

Epidermis , Endothecium, Middle layers – protection and dehiscence = $\frac{1}{2}$

Tapetum – nourishment of developing pollen grains = $\frac{1}{2}$

[3 Marks]

SECTION -D

(Q Nos. 25-27 are of five marks each)

25. (a) Explain the role of stigma in pollen-pistil interactions.
(b) Describe the post-pollination events leading to double fertilization in angiosperms, starting with a two-celled pollen grain.

Ans. (a) **Role of Stigma**

Landing platform for the pollen grain , enables continuous chemical dialogue between pollen and pistil , rejects incompatible pollen grain , promotes the growth of pollen tube of the compatible pollen grain leading to fertilization = $\frac{1}{2} \times 4$

(b) **Post Pollination Changes**

- Vegetative cell of pollen grain helps in the growth of pollen tube = $\frac{1}{2}$
- Nucleus of generative cell divides into two male gametes = $\frac{1}{2}$
- One male gamete fuses with the egg cell resulting in a zygote and the process is called syngamy = 1
- other male gamete fuses with the two polar nuclei to form primary endosperm nucleus and the process is called triple fusion = 1

[2+3 = 5 Marks]

OR

- (a) Mention the events that, lead to the development of placenta during pregnancy in human females.
(b) Explain the role of placenta during pregnancy including its action as an endocrine organ.

Ans. (a) After implantation, finger like projections appear on the trophoblast called chorionic villi , which are surrounded by the uterine tissue and maternal blood , chorionic villi interdigitate with uterine tissue to form the structural and functional unit between developing embryo and maternal body called placenta = $\frac{1}{2} \times 4$

(b) **Role of Placenta**

Supply oxygen and nutrients = 1

Removes carbon-di-oxide and excretory products = 1

Secretes hormones - estrogen / progesterone / hCG / hPL (*Any two*) = 1

[2+3 = 5 Marks]

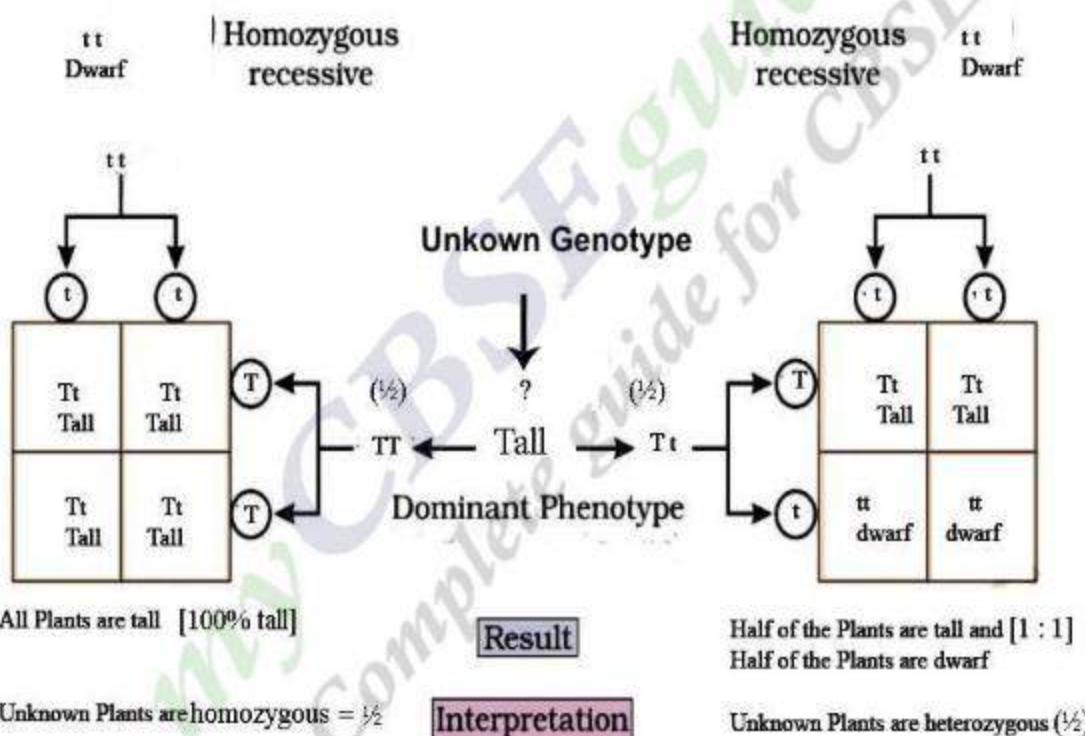
26. (a) How would you find out whether a given tall garden pea plant is homozygous or heterozygous? Substantiate your answer with the help of Punnett squares.
- (b) Given below are the F₂-phenotypic ratios of two independently carried monohybrid crosses :

(i) 1 : 2 : 1

(ii) 3 : 1

Mention what does each ratio suggest.

Ans. (a) By Test Cross / crossing the plant with unknown genotype with the recessive parent = 1



- (b) (i) Incomplete dominance = 1
- (ii) Dominance = 1

[3+2= 5 Marks]

OR

- (a) Why did Hershey and Chase use radioactive ^{32}P and ^{35}S in their experiments? Explain.

- (b) Following the experiments conducted by them, write what conclusion did they arrive at and how.

Ans. (a)

- Since bacteriophage contains only DNA and Protein the scientists wanted to identify whether it is DNA or the Protein from the Virus that entered the bacterium during infection = 1
- therefore they labelled DNA with ^{32}P and Protein coat with ^{35}S = 1

Conclusion

- (b) Conclusion - DNA is the genetic material = 1

Experiment

Bacteria which were infected with viruses having radioactive DNA [^{32}P] were found to be radioactive , indicating that DNA was the material that passed from the virus to bacterium

$$= \frac{1}{2} + \frac{1}{2}$$

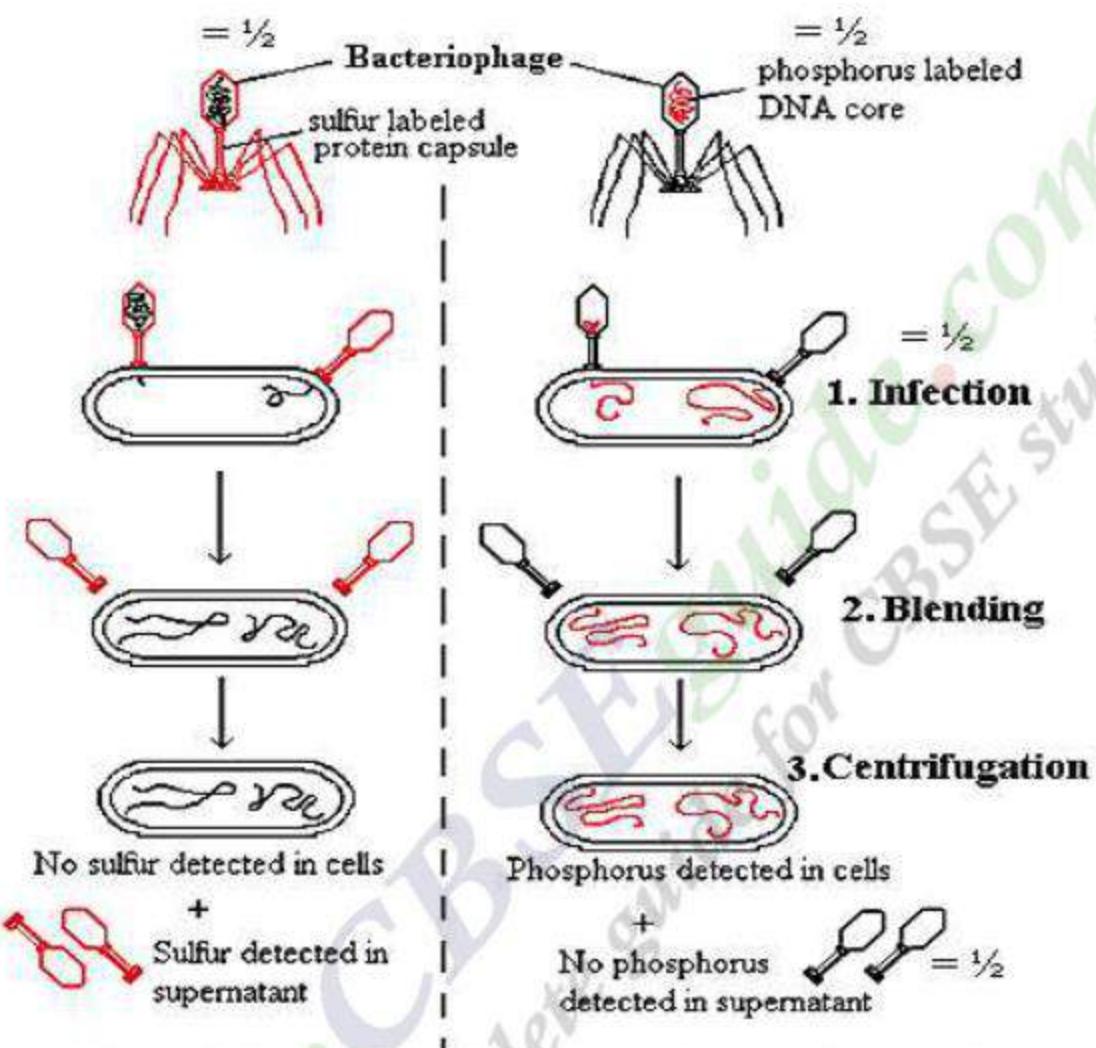
Bacteria which were infected with viruses having radioactive protein [^{35}S] were not found to be radioactive , indicating that protein did not enter bacterium from the virus

$$= \frac{1}{2} + \frac{1}{2}$$

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(diagram in lieu of experiment)





The Hershey-Chase Experiment

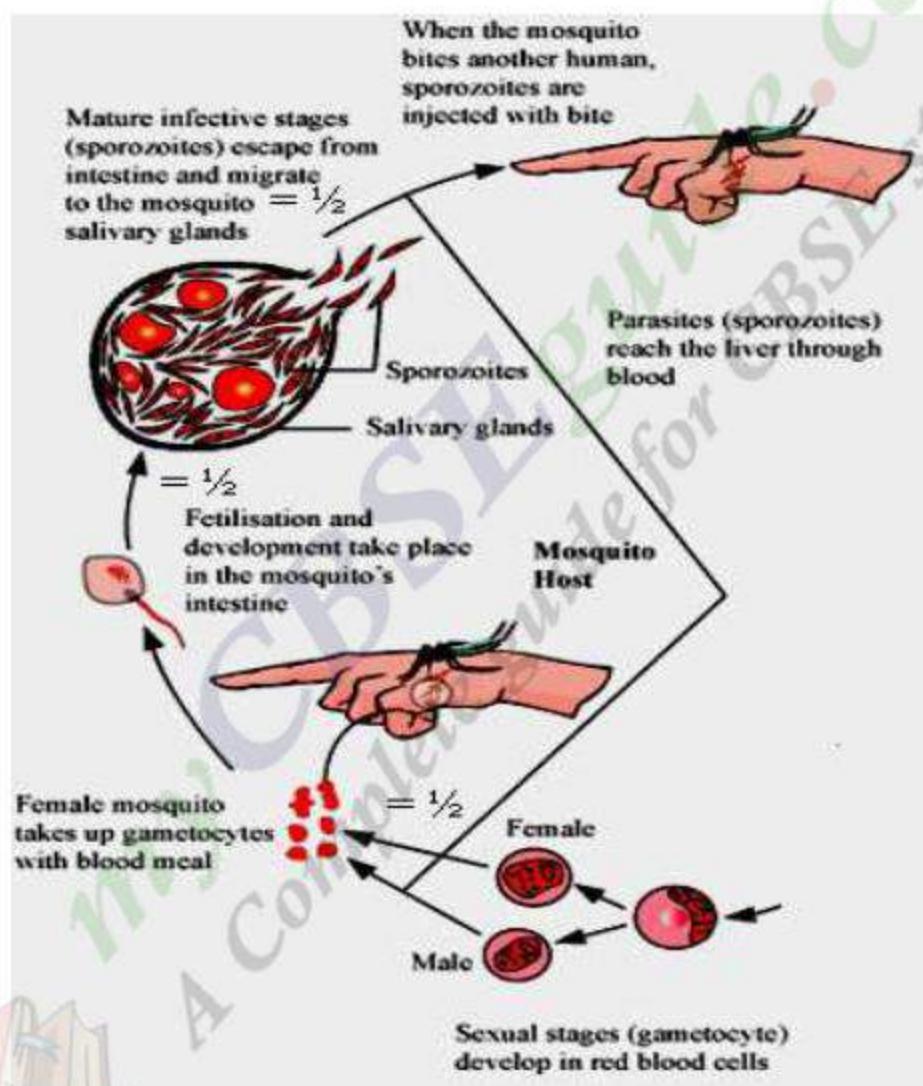
[2 + 3 = 5 Marks]

27. (a) Write the specific name of the genus *Plasmodium* that causes one of the most serious types of diseases in humans. Name the disease.
- (b) Describe the events in the life cycle of *Plasmodium* which take place in the female Anopheles.
- (c) Explain what happens in the RBCs of the humans when *Plasmodium* gains entry into them. How does the human body get affected?

Ans. (a) *Plasmodium falciparum*, malignant malaria = $\frac{1}{2} + \frac{1}{2}$

- (b) • Gametocytes / Male and Female gametes - enter female Anopheles mosquito = $\frac{1}{2}$
- fertilisatioin and development in the female mosquito gut / stomach = $\frac{1}{2}$
 - sporozoites are transported to salivary glands = $\frac{1}{2}$

//



- (c) • Parasite multiplies asexually in RBC = $\frac{1}{2}$
- RBC rupture = $\frac{1}{2}$
 - release toxic haemozoin = $\frac{1}{2}$
 - chill and fever recurring every 3 - 4 days = $\frac{1}{2}$
 - parasites enter fresh RBC and repeat the cycle = $\frac{1}{2}$

[1 + 1 $\frac{1}{2}$ + 2 $\frac{1}{2}$ = 5 Marks]

OR

Explain the interrelationship between organic farming and biofertilizers, with the help of any three suitable examples.

Ans. Organic farmers use organisms / biofertiliser instead of chemical fertilizer, to enrich the nutrient quality of the soil and increase the yield = 1 + 1

Examples

Rhizobium in the root nodules of leguminous plants (symbiotic) will fix atmospheric N₂ and enrich the soil / *Azotobacter* / *Azospirillum* (free living) fix atmospheric N₂ in the soil / Mycorrhiza is symbiotic association between fungus of genus *Glomus* and roots of higher plants , which absorb phosphorous from soil / they also make the plant resistant to root borne pathogens / *Cyanobacteria* fix atmospheric nitrogen / increases organic matter in the soil (*Anabaena* / *Nostoc* / *Oscillatoria*) (Any three examples) = 1 × 3

[2 + 3 = 5 Marks]



Question Paper Code 57/3/2

SECTION – A

(Q. Nos. 1 - 5 are of one mark each)

1. Why are cucurbit plants said to be monoecious?

Ans. Cucurbits have both male and female flowers on the same plant =1

[1 Marks]

2. Name the pollutant attributed to be the cause of 'ozone-hole' over the Antarctica region.

Ans. CFC / Chlorofluorocarbon

[1 Mark]

OR

List the greenhouse gases other than carbon dioxide.

Ans. CH_4 , CFC , N_2O / oxides of N_2 (All three gases = 1 Mark)

(One / Two gases = $\frac{1}{2}$ Mark)

[1 Mark]

3. Write the scientific name of the organism Alexander Fleming worked on and discovered the first antibiotic. Was the organism he worked on a fungus or a bacterium ?

Ans. *Staphylococci* = $\frac{1}{2}$

Bacteria = $\frac{1}{2}$

[1 Mark]

OR

Suggest a method to overcome excessive inbreeding depression.

Ans. Out cross // mating with unrelated superior animal of the same breed

[1 Mark]

4. What is 'Saltation' according to de Vries ?

Ans. Single step large mutation / random and directionless mutation / mutation related to speciation =1

[1 Mark]

5. Differentiate between a DNA and a RNA nucleotide.

| Ans. DNA NUCLEOTIDE | RNA NUCLEOTIDE |
|----------------------------|-----------------------|
| Deoxyribose sugar | Ribose sugar |
| Pyrimidine - Thymine | Pyrimidine - Uracil |

(Note - corresponding 2 differences)

= $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

SECTION -B

(Q. Nos. 6-12 are of two marks each)

6. Where exactly is the filiform apparatus present in the embryo-sac of an angiosperm ? State its function.

Ans. In synergids, it guides the entry of pollen tube into the synergid = 1 + 1

[2 Marks]

7. Explain the role of histones in forming a nucleosome.

- Ans. • Histones are positively charged proteins = $\frac{1}{2}$
 • they form a unit of eight molecules - Histone Octamer = $\frac{1}{2}$
 • negatively charged DNA, is wrapped around the octomer = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

8. What is 'Ori' ? State its importance during cloning of a vector.

- Ans. • Specific sequences of DNA where replication starts = 1
 • Helps in the replication of alien DNA when attached to Ori = $\frac{1}{2}$
 • controls copy number = $\frac{1}{2}$

[2 Marks]

OR

Explain the importance of 'selectable marker', with the help of a suitable example.

Ans. It helps in identifying and eliminating non-transformants , selectively permitting the growth of transformants = $\frac{1}{2} + \frac{1}{2}$

Genes coding for antibiotic resistance such as ampicillin / tetracycline/kenamycin/chloramphenicol or (any other antibiotic) are used as selectable marker (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

- 9.** What is 'carrying capacity' of a species in a habitat ? Why is logistic growth model considered more realistic ?

Ans. Maximum number of individuals a habitat can support (at given time) = 1

Since resources are limited / finite and sooner or later they become limiting (so logistic growth model is more realistic) = 1

[2 Marks]

- 10.** Why has the Indian Government set up the organisation named GEAC ? Give any two reasons.

Ans. To check the Validity of GM crops , safety of introduction of GM organism for public services

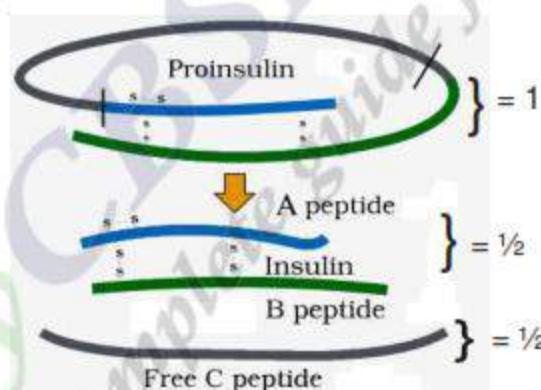
= 1 + 1

[2 Marks]

OR

Give a schematic representation of the transformation of a pro-insulin into insulin.

Ans.



[2 Marks]

- 11.** Explain the relationship between B-lymphocytes and T-lymphocytes in developing an immune response.

Ans. **B-lymphocytes**- produce antibodies to fight pathogen= 1

T - lymphocytes - do not produce antibodies but help B cells to produce them /

can also destroy pathgen directly = 1

[2 Marks]

- 12.** "The pyramid of biomass is not always upright." Explain the statement.

Ans. Pyramid of biomass is usually upright in terrestrial Ecosystem as the biomass keeps on decreasing from first Trophic level (producers) to the last trophic level (Top Carnivores) = 1
 Whereas in aquatic ecosystem, it is inverted as the Biomass of the Phytoplankton (Producers) is very little (because they are short lived) in comparison to that of fishes (consumers) = 1

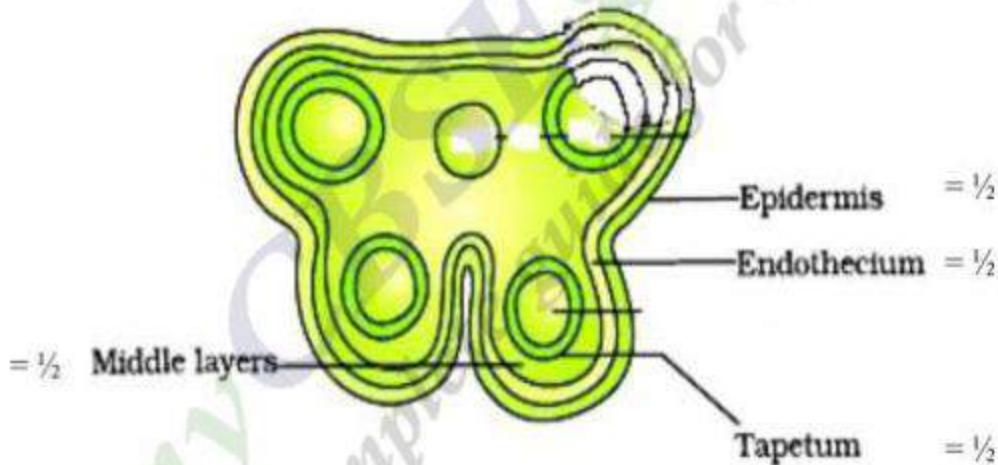
[2 Marks]

SECTION -C

(Q. Nos. 13-24 are of three marks each)

13. Draw a T.S. of a young anther of an angiosperm. Label the different layers of the wall and write their functions.

Ans.



(Correct diagram with labelling of four wall layers)

Function

Epidermis, Endothecium, Middle layers – protection and dehiscence = 1/2

Tapetum – nourishment of developing pollen grains = 1/2

[3 Marks]

14. (a) Why should a bacterium be made 'competent' ?

- (b) Explain the role of 'microinjection' and 'gene gun' in biotechnology.

Ans. (a) The bacterial cell must be made competent in order to receive the hydrophilic rDNA /

plasmid , which cannot otherwise pass through the cell membrane = $\frac{1}{2} + \frac{1}{2}$

- (b) **Microinjection** - rDNA is directly injected into the animal cell nucleus = 1

Biolistics (gene gun) - Plant cells are bombarded with high velocity microparticles of gold / tungsten coated with rDNA = 1

[1 + 2 = 3 Marks]

15. How do desert lizards cope with the variations in their environment ? Explain.

Ans. - They cope up with high temperature of desert by behavioural changes (manage to keep body temperature fairly constant) = 1

- they bask in sun and absorb heat when body temperature drops below the comfort zone / move to shade when ambience temperature rises / Some species burrow into the soil
(Any two points) = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

16. a) Name and explain the mode of action of any two types of IUDs.

- (b) **List the advantages of using 'Saheli' as a contraceptive.**

Ans. (a) • Non -medicated (e.g. lippes loop) , phagocytosis of sperms = $\frac{1}{2} + \frac{1}{2}$

- Copper releasing IUDs (CuT , Cu7, Multiload 375) , suppress sperm motility / reduces fertilizing capacity of sperm = $\frac{1}{2} + \frac{1}{2}$
- Hormone releasing IUDs (Progestasert , LNG - 20) , makes uterus unsuitable for implantation / cervix hostile to sperms = $\frac{1}{2} + \frac{1}{2}$

(Any two)

Advantages of Saheli

- (b) Non-steroidal /once a week / high contraceptive value / less side effects *(Any two)* = $\frac{1}{2} + \frac{1}{2}$

[2+1 = 3 Marks]

17. (a) Write the scientific name of the source plant and the part from which opioids are extracted. What is it commonly and chemically called ?

- (b) Where in the human body are its specific receptors located ? How do opioids affect the human body ?**

Ans. (a) *Papaver somniferum*, latex (from the fruit) = $\frac{1}{2} + \frac{1}{2}$

Common name:

Heroin / smack = $\frac{1}{2}$

Chemical name

diacetylmorphine = $\frac{1}{2}$

- (b) CNS / GI tract = $\frac{1}{2}$

Depressant / slows down body function= $\frac{1}{2}$

[2+1 = 3 Marks]

- 18. (a) How does the human body respond when vaccine is introduced into it ?**

- (b) It is said that vaccinations are a must for a healthy society. Justify.**

Ans. (a) B-cells assisted by T-cells produce antibodies against weakened antigens (Vaccine) and neutralise the pathogens (during actual infection), also generate memory B and T cells
= 1 + 1

- (b) These B & T memory cells recognise the pathogen (in case of actual infection/pathogen), and produce antibodies (to kill the pathogen) thus the population will remain healthy = $\frac{1}{2} \times 2$

[2 +1 = 3 Marks]

- 19. What is heterogamety ? Explain the mechanism of sex determination in Drosophila.**

Ans. • Heterogamety is production of two different types of gametes (either in male / female) = 1

- Sex determination in *Drosophila* X X / X Y type = $\frac{1}{2}$

Sex determination in *Drosophila* X X (female) / X Y (male) type = $\frac{1}{2}$

Female (XX) produces only one type of gamete with X chromosome but the male produces two different types of gametes with either X or Y chromosome = $\frac{1}{2}$

When a male gamete with X fuses with the female gamete it produces a female progeny (XX)
= $\frac{1}{2}$

When a male gamete with Y fuses with the female gamete it produces male progeny (XY)= $\frac{1}{2}$

//



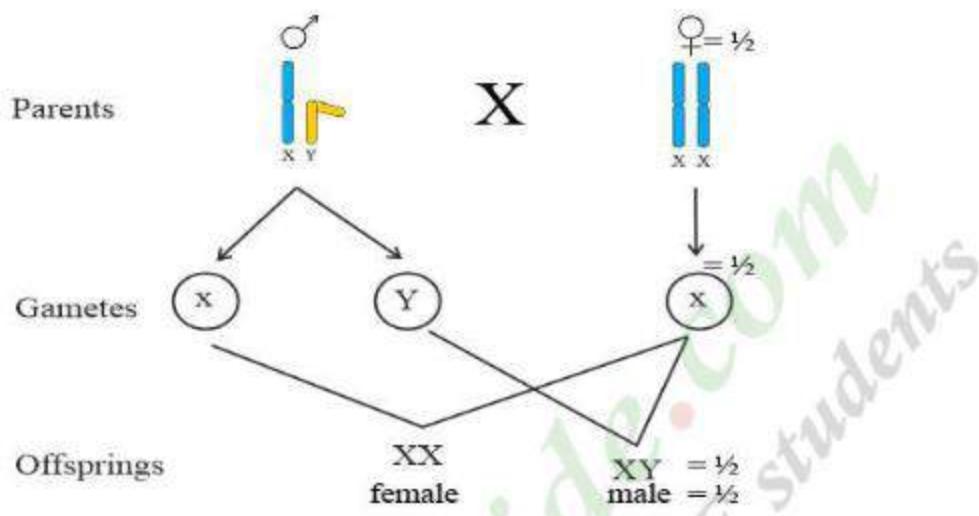


Diagram / explanation = 2

[3 Marks]

OR

Explain the process of making heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this process occur in the cell ?

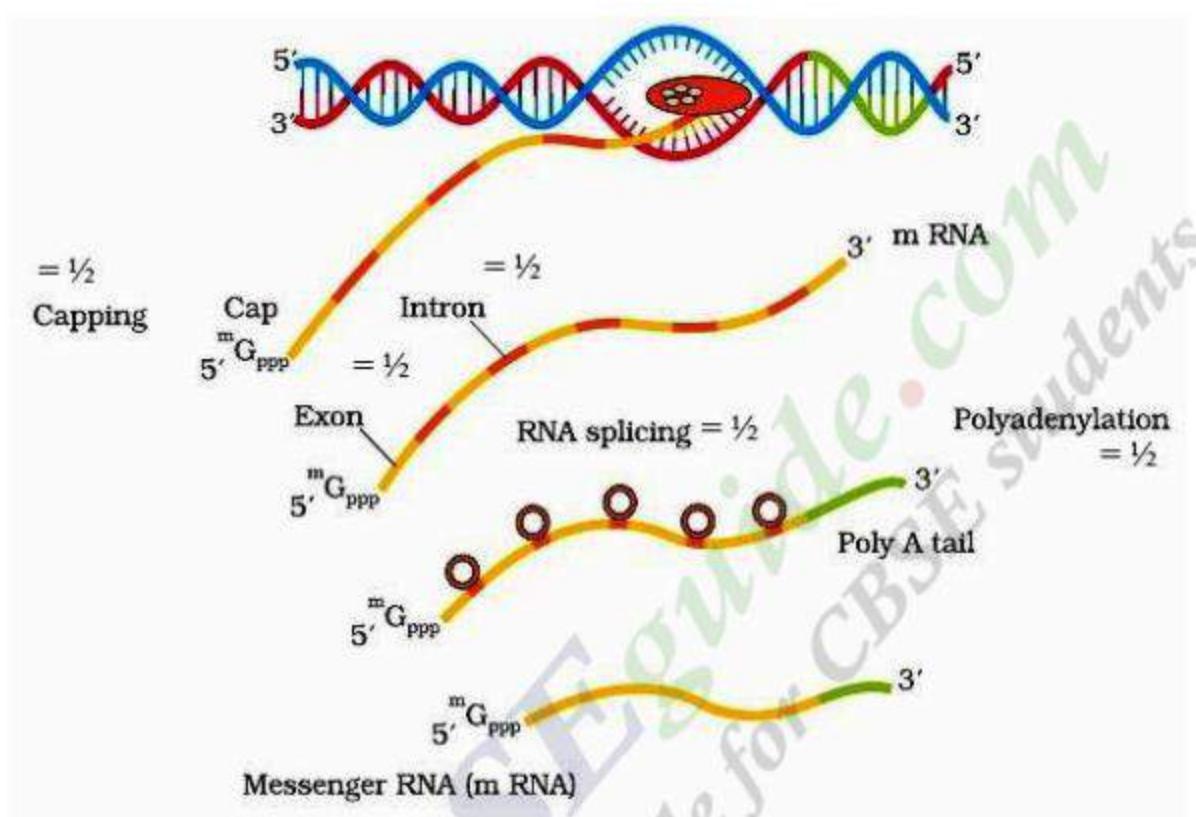
- Ans. • hnRNA undergoes capping at 5' end (methyl guanosine triphosphate) and tailing at 3' end (with poly A tail) = 1
- Further Splicing is carried out , where the non-coding sequences called introns are removed , and coding sequences called exons are joined together in a defined manner

= 1/2 × 3

(either explanation or diagram)

//





Site of processing of hnRNA

- This process occurs in the Nucleus $= \frac{1}{2}$

[3 Marks]

20. Write any six salient features of the human genome as drawn from the human genome project.

- Ans. (i) The human genome contains 3164.7 million nucleotide bases
- (ii) The average gene consists of 3000 bases but sizes vary greatly with the largest known human gene being dystrophin at 2.4 million bases
- (iii) The total number of genes is estimated at 30,000 - much lower than previous estimates
- (iv) Almost all (99.9 per cent) nucleotide bases are exactly the same in all people
- (v) The functions are unknown for over 50 per cent of discovered genes
- (vi) Less than 2 per cent of the genome codes for proteins

- (vii) Repeated sequences make up very large portion of the human genome
- (viii) Repetitive sequences are thought to have no direct coding function but they shed light on chromosome structure dynamics and evolution
- (ix) Chromosome 1 has most genes (2968) and the Y has the fewest (231)
- (x) Scientists have identified about 1.4 million locations where single base DNA difference (SNPs - single nucleotide polymorphism, pronounced as 'snips') occurs in humans and this information promises to revolutionise the processes of finding chromosomal locations for disease-associated sequences and tracing human history

Any six features (½ × 6)

[3 Marks]

- 21.** "Appearance of melanised moths post-industrialisation in England is a classic example of evolution by natural selection." Explain.

Ans. Before industrialisation more white winged moth than dark winged moth existed in England , post industrialisation tree trunks became dark as smoke and soot deposited , lichens could not grow due to pollution , due to higher predation of white winged moth on a darker background , dark winged moth survived , nature selected the fittest organism = $\frac{1}{2} \times 6$ (*Correct sequence*)

[3 Marks]

- 22.** Explain any three remedial measures to overcome the acute air pollution in our cities.

Ans. Electrostatic precipitators to remove particulate matter present in the exhaust from thermal power plant / Scrubber to remove SO_2 from the exhaust of thermal power plant/ Alternative sources of energy in place of petrol / Lead free petrol or diesel / Catalytic converters - to reduce lead pollution / Use of CNG / Use of low sulphur petrol and diesel / Phasing out of old vehicles / Stringent enforcement of pollution level norms (*Any three*)

[3 Marks]

OR

Write any three ways by which noise pollution affects the human body adversely. List any three steps that should be followed in order to reduce noise pollution.

Ans. Sleeplessness / Increased heart beat / Altered breathing pattern / Damage hearing ability / Damage ear drum (*Any three*) = $\frac{1}{2} \times 3$

Three steps to be followed to reduce noise pollution

Following of stringent laws laid down in relation to noise level / Delimitation of horn free zones around hospitals and schools / To adopt permissible sound level of crackers and loudspeakers /

Adhering to time limit for loudspeakers beyond which it cannot be played / Use of sound absorbent material in industries / muffling of noise (**Any three**) = $\frac{1}{2} \times 3$

[3 Marks]

23. (a) What is the primary productivity of an ecosystem and how is it expressed ?

(b) Explain what does the equation given below show : $NPP = GPP - R$

Ans. (a) • Primary Productivity is defined as Rate of biomass production = 1

• Expressed as $g^2 yr^{-1} / (kcal m^{-2}) yr^{-1} = \frac{1}{2}$

(b) • Gross primary productivity minus respiratory loss is the net primary productivity = 1
 • Which is available to the next trophic level = $\frac{1}{2}$

[$\frac{1}{2} + \frac{1}{2} = 3$ Marks]

OR

(a) Name the type of detritus that decomposes faster. List any two factors that enhance the rate of decomposition.

(b) Write the different steps taken in humification and mineralisation during the process of decomposition.

Ans. (a) • Detritus rich in N_2 , water soluble substance like sugar = $\frac{1}{2} + \frac{1}{2}$

• Factors -

Warm temperature / moist environment / availability of oxygen (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

(b) **Humification** - Accumulation of dark coloured amorphous substance called humus which is resistant to microbial action and undergoes decomposition at a very slow rate = $\frac{1}{2}$

Mineralisation - humus is further degraded by microbes releasing inorganic nutrients = $\frac{1}{2}$

[2+1 = 3 Marks]

24. Write any two biochemical/molecular diagnostic procedures for early detection of viral infection. Explain the principle of any one of them.

Ans. ELISA, PCR = 1 + 1

ELISA – antigen antibody interaction / PCR – amplification of nucleic acid for its identification (**Any one**) = 1

[3 Marks]

OR

Describe the steps that are followed during secondary treatment of sewage.

Ans. In Aeration tank effluent agitated mechanically , air pumped allows the growth of flocs , consumes organic matter , reduces BOD , Effluent pumped to settling tank to allow sedimentation of bacterial flocs called activated sludge , a small part of which is used as inoculum and the rest is pumped into anaerobic sludge digester for complete digestion of anaerobic bacteria and effluent is released into the natural water body (**steps should be in correct sequence**) = $\frac{1}{2} \times 6$

[3 Marks]

SECTION -D

(Q Nos. 25-27 are of five marks each)

- 25. Explain the changes that occur in the ovary and uterus during menstrual cycle in human females. Mention the influence of pituitary and ovarian hormones in bringing these changes.**

| Ans. | Phase | Ovary | Uterus |
|---------------------|----------------------------|---|--|
| | Menstrual | Corpus luteum regenerates and follicular development begins = $\frac{1}{2}$ | In absence of fertilisation menstrual flow occurs due to breakdown of endometrial lining of uterus = $\frac{1}{2}$ |
| | Follicular / Proliferative | Primary follicle grow and mature into Graafian follicle and rupture during middle phase of the cycle releasing ovum / secondary oocyte = $\frac{1}{2}$ | Endometrium regenerates through proliferation = $\frac{1}{2}$ |
| | Luteal / Secretory | Follicular cells of the ruptured Graafian follicle transform into corpus luteum which secretes progesterone = $\frac{1}{2}$ | Endometrium is maintained (by progesterone) to receive the fertilised egg for implantation = $\frac{1}{2}$ |
| Pituitary hormones- | | FSH and LH induces follicular growth (in the begining of the cycle) = $\frac{1}{2}$ LH induces ovulation (mid cycle) = $\frac{1}{2}$ | |
| Ovarian hormones- | | (i) Estrogen (from the growing follicle) repairs and induces proliferation of endometrium = $\frac{1}{2}$ (ii) Progesterone (released from corpus luteum) maintains endometrium to enable implantation = $\frac{1}{2}$ | |

[5 Marks]

OR

Compare the characteristic features of insect pollinated and wind pollinated flowers.

Explain how the respective features assist in pollination.

| Ans. | Insect Pollination | | Wind Pollination | |
|-------|--|---|---|---|
| | Feature | Role | Feature | Role |
| (i) | Flowers are large/ colourful/fragrant / foul odour = ½ | To attract pollinating agents = ½ | Flowers are small/ inconspicuous/ with no fragrance = ½ | The pollinating agent is abiotic so no extra adaptation = ½ |
| (ii) | Sticky pollen = ½ | To be carried by by the pollinator = ½ | Pollen light/non-sticky/ large in number = ½ | To be easily carried by wind = ½ |
| (iii) | Flowers provide nectar/pollen/safe place to lay eggs (for the pollinator) = ½ | as rewards to the pollinator = ½ | Well exposed stamens/ feathery stigma = ½ | Pollen can be easily dispersed into wind current can easily trap air borne pollen = ½ |

(Five characteristics with relevant explanation of roles)

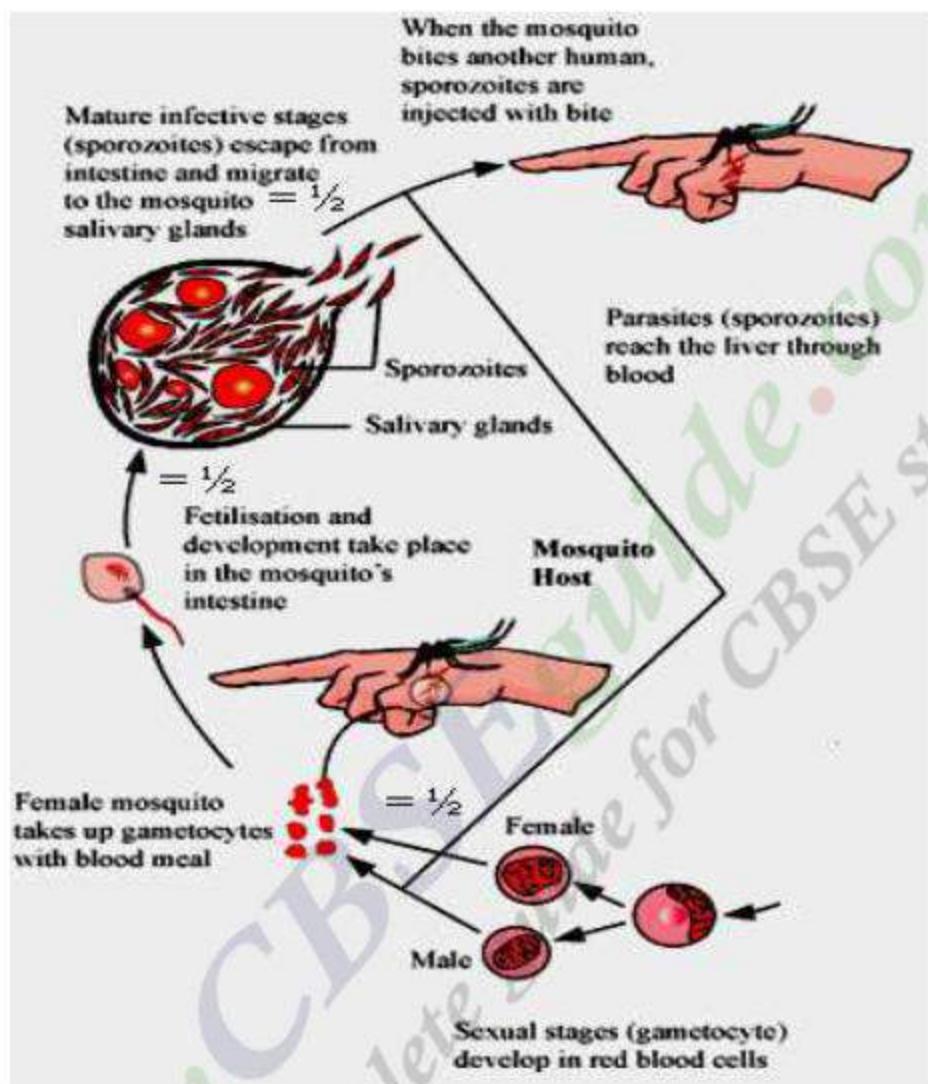
[5 Marks]

26. (a) Write the specific name of the genus *Plasmodium* that causes one of the most serious types of diseases in humans. Name the disease.
- (b) Describe the events in the life cycle of *Plasmodium* which take place in the female *Anopheles*.
- (c) Explain what happens in the RBCs of the humans when *Plasmodium* gains entry into them. How does the human body get affected ?

Ans. (a) *Plasmodium falciparum*, malignant malaria = ½ + ½

- (b) • Gametocytes / Male and Female gametes - enter female Anopheles mosquito = ½
- Fertilisation and development in the female mosquito gut / stomach = ½
 - Sporozoites are transported to salivary glands = ½

//



- (c) • Parasite multiplies asexually in RBC = $\frac{1}{2}$
- RBC rupture = $\frac{1}{2}$
- release toxic haemoglobin = $\frac{1}{2}$
- chill and fever recurring every 3 - 4 days = $\frac{1}{2}$
- parasites enter fresh RBC and repeat the cycle = $\frac{1}{2}$

[$1 + 1\frac{1}{2} + 2\frac{1}{2} = 5$ Marks]

OR

Explain the interrelationship between organic farming and biofertilizers, with the help of any three suitable examples.

Ans. Organic farmers use organisms / biofertiliser instead of chemical fertilizer, to enrich the nutrient quality of the soil and increase the yield = 1 + 1

Examples

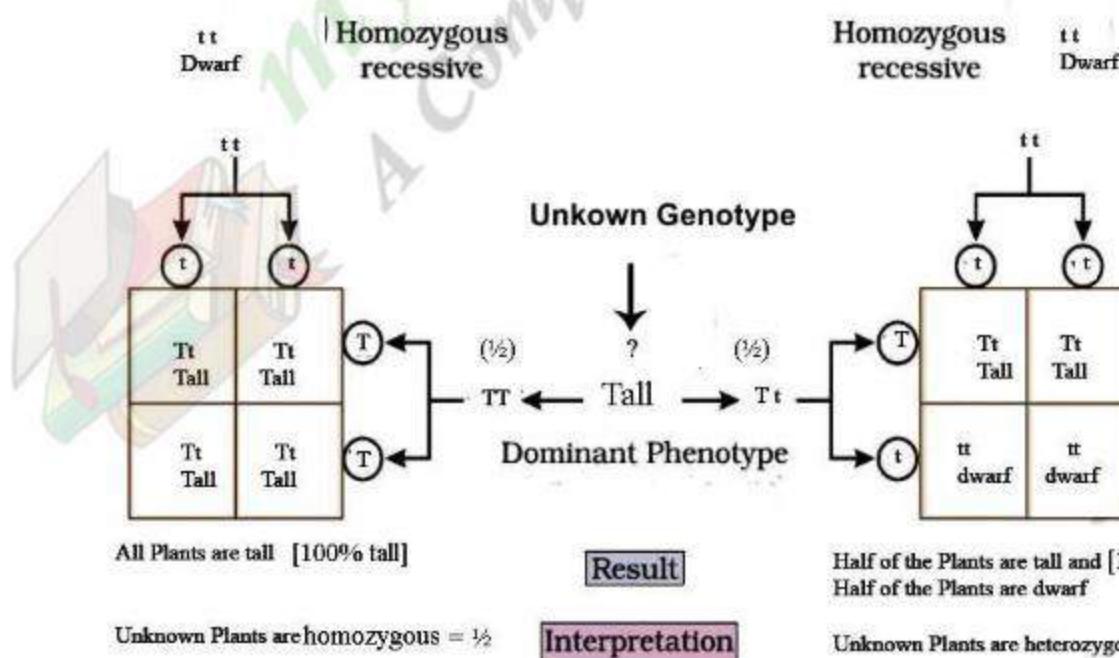
Rhizobium in the root nodules of leguminous plants (symbiotic) will fix atmospheric N₂ and enrich the soil / *Azotobacter* / *Azospirillum* (free living) fix atmospheric N₂ in the soil / Mycorrhiza is symbiotic association between fungus of genus *Glomus* and roots of higher plants , which absorb phosphorous from soil / they also make the plant resistant to root borne pathogens / *Cyanobacteria* fix atmospheric nitrogen / increases organic matter in the soil (*Anabaena* / *Nostoc* / *Oscillatoria*) (Any three examples) = 1 × 3

[2 + 3 = 5 Marks]

27. (a) How would you find out whether a given tall garden pea plant is homozygous or heterozygous ? Substantiate your answer with the help of Punnett squares.
- (b) Given below are the F₂-phenotypic ratios of two independently carried monohybrid crosses :
- 1 : 2 : 1
 - 3 : 1

Mention what does each ratio suggest.

Ans. (a) By Test Cross / crossing the plant with unknown genotype with the recessive parent = 1



(b) (i) Incomplete dominance = 1

(ii) Dominance = 1

[3+2= 5 Marks]

OR

(a) **Why did Hershey and Chase use radioactive ^{32}P and ^{35}S in their experiments ? Explain.**

(b) **Following the experiments conducted by them, write what conclusion did they arrive at and how.**

Ans. (a) • Since bacteriophage contains only DNA and Protein the scientists wanted to identify whether it is DNA or the Protein from the Virus that entered the bacterium during infection = 1
• therefore they labelled DNA with ^{32}P and Protein coat with ^{35}S = 1

Conclusion

(b) **Conclusion - DNA is the genetic material** = 1

Experiment

Bacteria which were infected with viruses having radioactive DNA [^{32}P] were found to be radioactive , indicating that DNA was the material that passed from the virus to bacterium

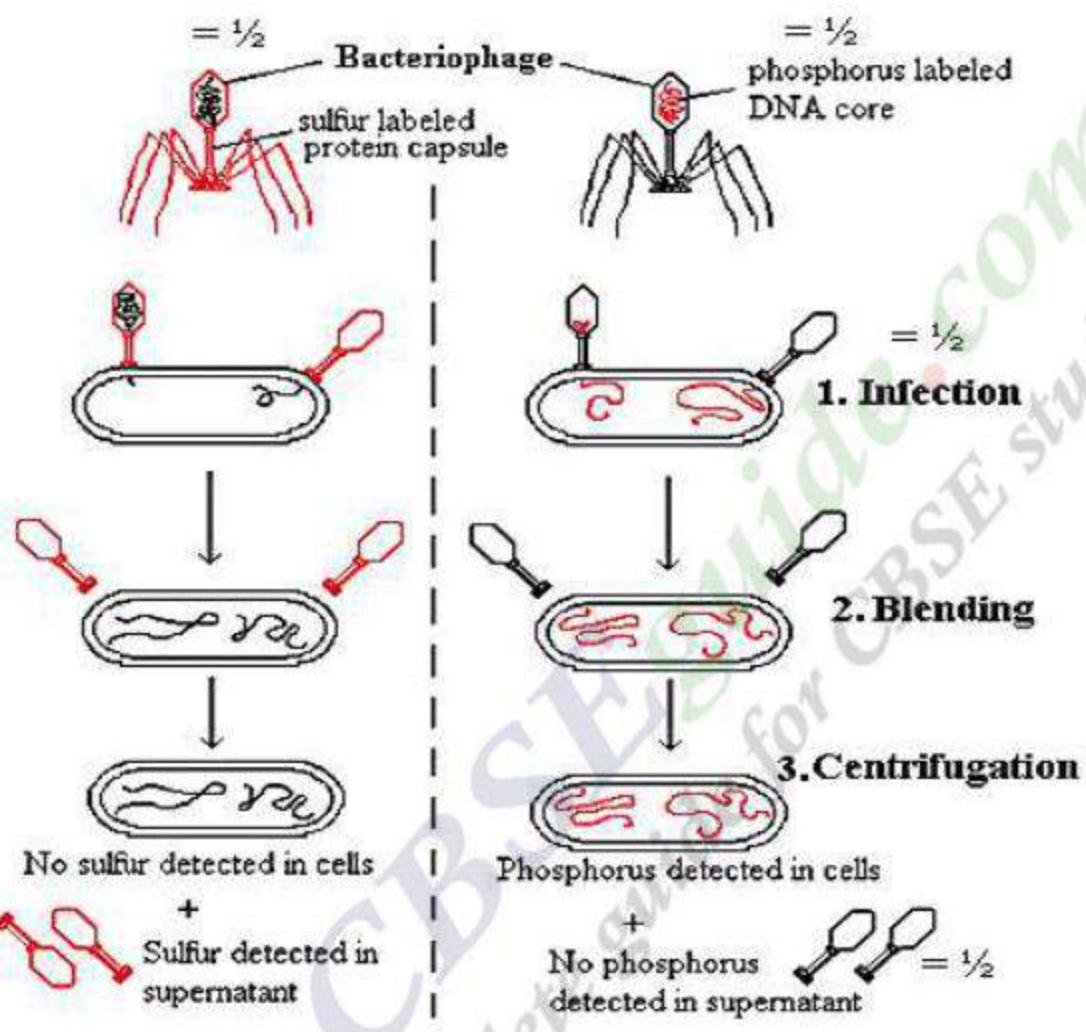
= $\frac{1}{2} + \frac{1}{2}$

Bacteria which were infected with viruses having radioactive protein [^{35}S] were not found to be radioactive , indicating that protein did not enter bacterium from the virus = $\frac{1}{2} + \frac{1}{2}$

//

(diagram in lieu of experiment)





The Hershey-Chase Experiment

[2 + 3 = 5 Marks]



Question Paper Code 57/3/3

SECTION – A

(Q. Nos. 1 - 5 are of one mark each)

1. Why are papaya plants said to be dioecious ?

Ans. Male and female plants are separate / bear male and female flowers on two separate plants

[1 Mark]

2. Name the pollutant attributed to be the cause of 'ozone-hole' over the Antarctica region.

Ans. CFC / Chlorofluorocarbon

[1 Mark]

OR

List the greenhouse gases other than carbon dioxide.

Ans. CH_4 , CFC , N_2O / oxides of N_2 (All three gases = 1 Mark)

(One / Two gases = $\frac{1}{2}$ Mark)

[1 Mark]

3. Write the scientific name of the organism Alexander Fleming worked on and discovered the first antibiotic. Was the organism he worked on a fungus or a bacterium ?

Ans. *Staphylococci* = $\frac{1}{2}$

Bacteria = $\frac{1}{2}$

[1 Mark]

OR

Suggest a method to overcome excessive inbreeding depression.

Ans. Out cross // mating with unrelated superior animal of the same breed

[1 Mark]

4. What is 'Saltation' according to de Vries ?

Ans. Single step large mutation / random and directionless mutation / mutation related to speciation

[1 Mark]

5. Differentiate between a DNA and a RNA nucleotide.

| Ans. DNA NUCLEOTIDE | RNA NUCLEOTIDE |
|----------------------------|-----------------------|
| Deoxyribose sugar | Ribose sugar |
| Pyrimidine - Thymine | Pyrimidine - Uracil |

(Note - corresponding 2 differences) = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

SECTION -B

(Q. Nos. 6 - 12 are of two marks each)

6. State the importance of emasculation and bagging in carrying out artificial hybridization.

Ans. Emasculation is needed to prevent self pollination and to promote cross pollination in bisexual flowers = 1

Bagging to prevent contamination of stigma from undesirable pollen = 1

[2 Marks]

7. Mention the causes of chromosomal disorders in humans. How do these disorders occur ?

- Ans
- Absence or excess or abnormal arrangement of one or more chromosomes = 1
 - Failure of segregation of chromatids during cell division/Aneuploidy / Nondisjunction = 1

[2 Marks]

8. What is 'carrying capacity' of a species in a habitat ? Why is logistic growth model considered more realistic ?

Ans. Maximum number of individuals a habitat can support (at given time) = 1

Since resources are limited / finite and sooner or later they become limiting (so logistic growth model is more realistic) = 1

[2 Marks]

9. What is 'Ori' ? State its importance during cloning of a vector.

- Ans.
- Specific sequences of DNA where replication starts = 1
 - Helps in the replication of alien DNA when attached to Ori = $\frac{1}{2}$
 - controls copy number = $\frac{1}{2}$

[2 Marks]

OR

Explain the importance of 'selectable marker', with the help of a suitable example.

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Genes coding for antibiotic resistance such as ampicillin / tetracycline/kenamycin/chloramphenicol or (any other antibiotic) are used as selectable marker (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

10. Why has the Indian Government set up the organisation named GEAC ? Give any two reasons.

Ans. To check the Validity of GM crops , safety of introduction of GM organism for public services

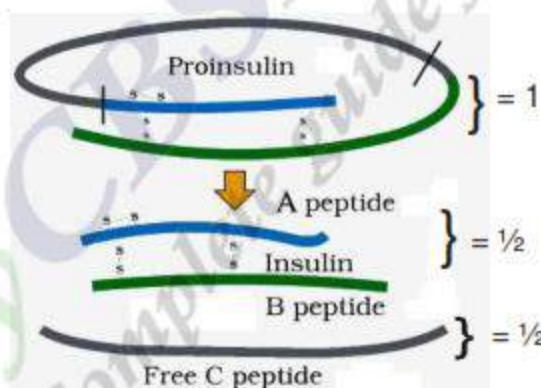
= 1 + 1

[2 Marks]

OR

Give a schematic representation of the transformation of a pro-insulin into insulin.

Ans.



[2 Marks]

11. Explain the relationship between B-lymphocytes and T-lymphocytes in developing an immune response.

Ans. **B-lymphocytes**- produce antibodies to fight pathogen = 1

T - lymphocytes - do not produce antibodies but help B cells to produce them /

can also destroy pathgen directly = 1

[2 Marks]

- 12. Why is the pyramid of biomass upright in most of the ecosystems ? Compare it with the pyramid of biomass in sea.**

Ans. Biomass of producers is more than that of the herbivores and the biomass of herbivores is more than that of carnivores (hence the pyramid of biomass is erect in most ecosystems) = 1

Pyramid of biomass in sea is generally inverted because the biomass of fishes (consumers) far exceeds that of phytoplankton (producers) = 1

[2 Marks]

SECTION -C

(Q. Nos. 13-24 are of three marks each)

- 13. "Appearance of melanised moths post-industrialisation in England is a classic example of evolution by natural selection." Explain.**

Ans. Before industrialisation more white winged moth than dark winged moth existed in England , post industrialisation tree trunks became dark as smoke and soot deposited , lichens could not grow due to pollution , due to higher predation of white winged moth on a darker background , dark winged moth survived , nature selected the fittest organism = $\frac{1}{2} \times 6$ (*Correct sequence*)

[3 Marks]

- 14. Write any six salient features of the human genome as drawn from the human genome project.**

- Ans. (i) The human genome contains 3164.7 million nucleotide bases
(ii) The average gene consists of 3000 bases but sizes vary greatly with the largest known human gene being dystrophin at 2.4 million bases
(iii) The total number of genes is estimated at 30,000 - much lower than previous estimates
(iv) Almost all (99.9 per cent) nucleotide bases are exactly the same in all people
(v) The functions are unknown for over 50 per cent of discovered genes
(vi) Less than 2 per cent of the genome codes for proteins
(vii) Repeated sequences make up very large portion of the human genome
(viii) Repetitive sequences are thought to have no direct coding function but they shed light on chromosome structure dynamics and evolution
(ix) Chromosome 1 has most genes (2968) and the Y has the fewest (231)
(x) Scientists have identified about 1.4 million locations where single base DNA difference (SNPs - single nucleotide polymorphism, pronounced as 'snips') occurs in humans and this information promises to revolutionise the processes of finding chromosomal locations for disease - associated sequences and tracing human history

Any six features ($\frac{1}{2} \times 6$)

2019-57/51,2,3 40 [3 Marks]

15. Explain with the help of an example each, any two ways by which the animals cope with the stressful conditions lasting for a short period in their habitat.

Ans. - Migrate = $\frac{1}{2}$

Example - Migratory birds from Siberia come to Keolado National Park (Bharatpur) in Rajasthan to avoid extreme cold climate in the northern regions = 1

(any other correct example)

- Suspend = $\frac{1}{2}$

Example

Bacteria, fungi and lower plants form various kinds of thick walled spores to survive the unfavourable condition and germinate on availability of suitable environment / Higher plants form seeds and some other vegetative reproductive structures to tide over stressful period by reducing their metabolic activity and going into state of dormancy / In some animals the organism avoid stress by escaping in time - bear goes into hibernation during winter / Snails and fish go into aestivation to avoid summer related problem - heat and dessication / Zooplankton species enter diapause a state of suspended development under unfavourable conditions (*Any one example*) = 1

[3 Marks]

16. What is heterogamety ? Explain the mechanism of sex determination in Drosophila.

Ans. • Heterogamety is production of two different types of gametes (either in male / female) = 1
• Sex determination in *Drosophila* XX (female) / XY (male) type = $\frac{1}{2}$
Female (XX) produces only one type of gamete with X chromosome but the male produces two different types of gametes with either X or Y chromosome = $\frac{1}{2}$
When a male gamete with X fuses with the female gamete it produces a female progeny (XX) = $\frac{1}{2}$
When a male gamete with Y fuses with the female gamete it produces male progeny (XY) = $\frac{1}{2}$

//



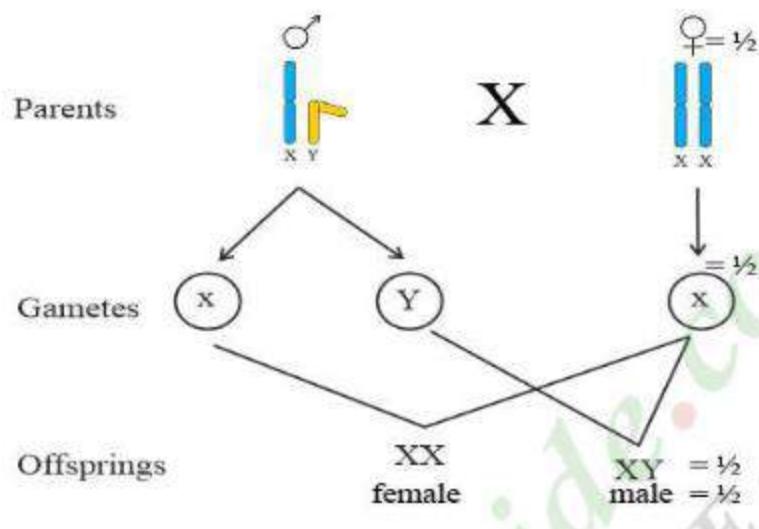


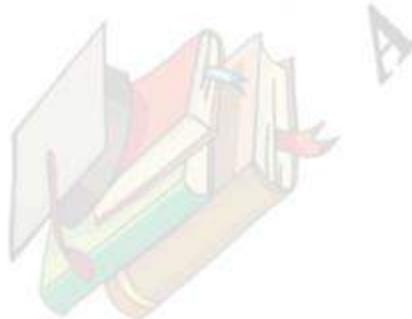
Diagram / explanation = 2

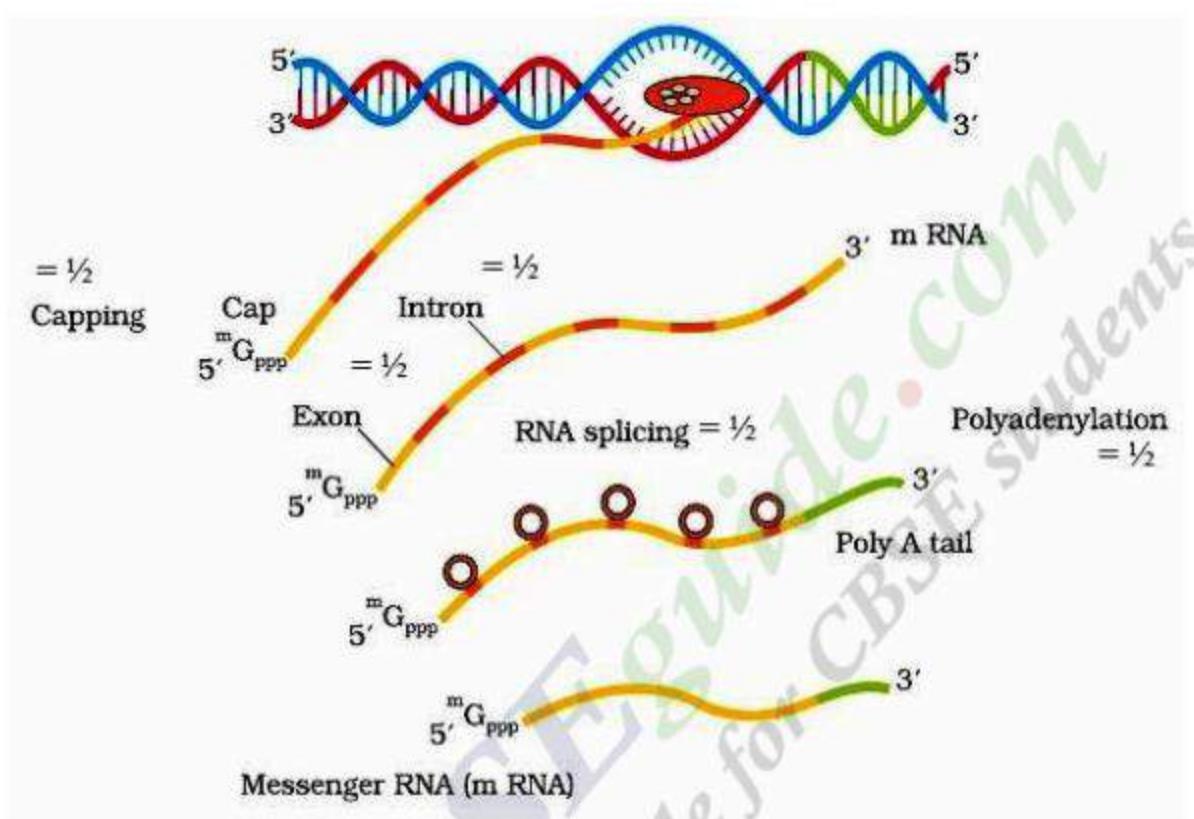
[3 Marks]

OR

Explain the process of making heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this process occur in the cell ?

- Ans.
- hnRNA undergoes capping at 5' end (methyl guanosine triphosphate) and tailing at 3' end (with poly A tail) = 1
 - Further Splicing is carried out , where the non- coding sequences called introns are removed , and coding sequences called exons are joined together in a defined manner = $\frac{1}{2} \times 3$
 (either explanation or diagram)
 //





Site of processing of hnRNA

- This process occurs in the Nucleus = $\frac{1}{2}$

[3 Marks]

17. (a) What is inbreeding?

- (b) Inbreeding of cattle is carried with a purpose, but is not continued for many generations. Do you agree ? Give reasons in support of your answer.

Ans. (a) Inbreeding is mating of more closely related individuals with the same breed for 4-6 generations to produce pure line / increase Homozygosity = 1

- (b)
- Yes = $\frac{1}{2}$
 - Results in inbreeding depression = $\frac{1}{2}$
 - Reduces fertility , and productivity = $\frac{1}{2} + \frac{1}{2}$

[1+2=3 Marks]

18. (a) Differentiate between humoral and cell mediated immune response.
- (b) Why is a patient who has undergone organ transplant put on immunosuppressants ? Explain.

Ans. (a) **Humoral Immune response**

Elicited / Carried out by B-lymphocytes , which produce antibodies in the blood in response to a pathogen = $\frac{1}{2} + \frac{1}{2}$

Cell mediated immune response

Elicited / Carried out by T-lymphocytes , which help the B-cells to produce antibodies/or destroy pathogen by themselves = $\frac{1}{2} + \frac{1}{2}$

- (b) To prevent T-cells from recognising foreign tissue / graft as 'non self' and prevent rejection = 1

[2+1=3 Marks]

19. (a) Name and explain the mode of action of any two types of IUDs.

- (b) List the advantages of using 'Saheli' as a contraceptive.

- Ans. (a)
- Non -medicated (e.g. lippes loop) , phagocytosis of sperms = $\frac{1}{2} + \frac{1}{2}$
 - Copper releasing IUDs (CuT , Cu7, Multiload 375) , suppress sperm motility / reduces fertilizing capacity of sperm = $\frac{1}{2} + \frac{1}{2}$
 - Hormone releasing IUDs (Progestasert , LNG - 20) , makes uterus unsuitable for implantation / cervix hostile to sperms = $\frac{1}{2} + \frac{1}{2}$

(Any two)

Advantages of Saheli

- (b) Non -steroidal /once a week / high contraceptive value / less side effects **(Any two)** = $\frac{1}{2} + \frac{1}{2}$

[2+1 = 3 Marks]

20. (a) Why should a bacterium be made 'competent' ?

- (b) Explain the role of ' microinjection' and 'gene gun' in biotechnology.

- Ans. (a) The bacterial cell must be made competent in order to receive the hydrophilic rDNA / plasmid , which cannot otherwise pass through the cell membrane = $\frac{1}{2} + \frac{1}{2}$

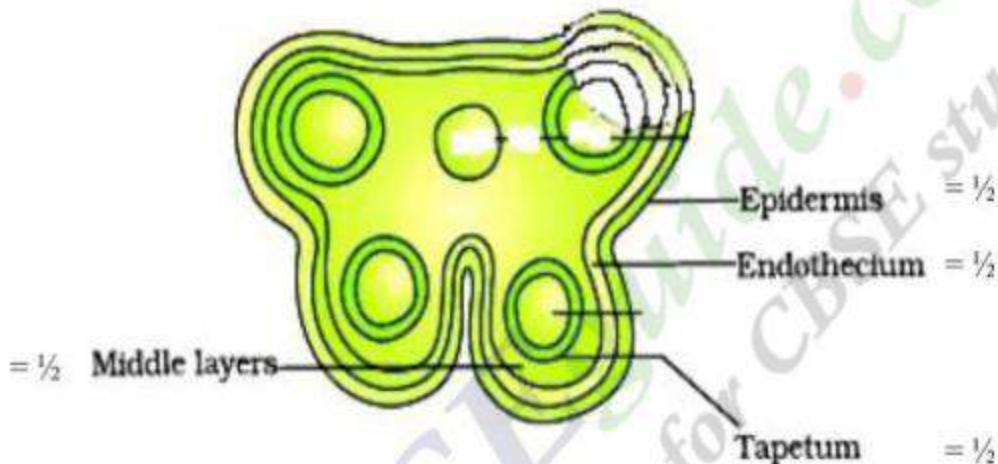
- (b) **Microinjection** - rDNA is directly injected into the animal cell nucleus = 1

Biolistics (gene gun) - Plant cells are bombarded with high velocity microparticles of gold / tungsten coated with rDNA = 1

[1 + 2 = 3 Marks]

21. Draw a T.S. of a young anther of an angiosperm. Label the different layers of the wall and write their functions.

Ans.



(Correct diagram with labelling of four wall layers)

Function

Epidermis, Endothecium, Middle layers – protection and dehiscence = $\frac{1}{2}$

Tapetum – nourishment of developing pollen grains = $\frac{1}{2}$

[3 Marks]

22. Write any two biochemical/molecular diagnostic procedures for early detection of viral infection. Explain the principle of any one of them.

Ans. ELISA, PCR = 1 + 1

ELISA – antigen antibody interaction / PCR – amplification of nucleic acid for its identification
(Any one) = 1

[3 Marks]

OR

Describe the steps that are followed during secondary treatment of sewage.

Ans. In Aeration tank effluent agitated mechanically , air pumped allows the growth of flocs , consumes organic matter , reduces BOD , Effluent pumped to settling tank to allow sedimentation of bacterial flocs called activated sludge , a small part of which is used as inoculum and the rest is pumped into anaerobic sludge digester for complete digestion of anaerobic bacteria and effluent is released into the natural water body (**Steps should be in correct sequence**) = $\frac{1}{2} \times 6$

[3 Marks]

23. (a) What is the primary productivity of an ecosystem and how is it expressed ?

(b) Explain what does the equation given below show : $NPP = GPP - R$

Ans. (a) • Primary Productivity is defined as Rate of biomass production = 1

• Expressed as $g^{-2}yr^{-1} / (kcal m^{-2})yr^{-1} = \frac{1}{2}$

(b) • Gross primary productivity minus respiratory loss is the net primary productivity = 1
 • Which is available to the next trophic level = $\frac{1}{2}$

[$\frac{1}{2} + \frac{1}{2} = 3$ Marks]

OR

- (a) Name the type of detritus that decomposes faster. List any two factors that enhance the rate of decomposition.
- (b) Write the different steps taken in humification and mineralisation during the process of decomposition.

Ans. (a) • Detritus rich in N_2 , water soluble substance like sugar = $\frac{1}{2} + \frac{1}{2}$

• **Factors -**

Warm temperature / moist environment / availability of oxygen (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

(b) **Humification** - Accumulation of dark coloured amorphous substance called humus which is resistant to microbial action and undergoes decomposition at a very slow rate = $\frac{1}{2}$

Mineralisation - humus is further degraded by microbes releasing inorganic nutrients = $\frac{1}{2}$

[$2+1 = 3$ Marks]

24. Explain any three remedial measures to overcome the acute air pollution in our cities.

Ans. Electrostatic precipitators to remove particulate matter present in the exhaust from thermal power plant / Scrubber to remove SO_2 from the exhaust of thermal power plant / Alternative sources of

energy in place of petrol / Lead free petrol or diesel / Catalytic convertors - to reduce lead pollution / Use of CNG / Use of low sulphur petrol and diesel / Phasing out of old vehicles / Stringent enforcement of pollution level norms (Any three)

[3 Marks]

OR

Write any three ways by which noise pollution affects the human body adversely. List any three steps that should be followed in order to reduce noise pollution.

Ans. Sleeplessness / Increased heart beat / Altered breathing pattern / Damage hearing ability / Damage ear drum (Any three) = $\frac{1}{2} \times 3$

Three steps to be followed to reduce noise pollution

Following of stringent laws laid down in relation to noise level / Delimitation of horn free zones around hospitals and schools / To adopt permissible sound level of crackers and loudspeakers / Adhering to time limit for loudspeakers beyond which it cannot be played / Use of sound absorbent material in industries / muffling of noise (Any three) = $\frac{1}{2} \times 3$

[3 Marks]

SECTION -D

(Q Nos. 25-27 are of five marks each)

25. (a) Where is microsporangium located in an angiosperm ? State the functions of tapetum and the other three layers of microsporangium?
- (b) Describe the structure of the male gametophyte produced as a result of microsporogenesis.
- (c) State the functions of each part of the male gametophyte.

Ans. (a) Microsporangium located in the anther lobe = $\frac{1}{2}$

Tapetum - nourishes the developing pollen grain = $\frac{1}{2}$

Epidermis , Endothecium , middle layers - protection and dehiscence (of microsporangium) = $\frac{1}{2}$

(b) **Structure of Pollen grain / male gametophyte**

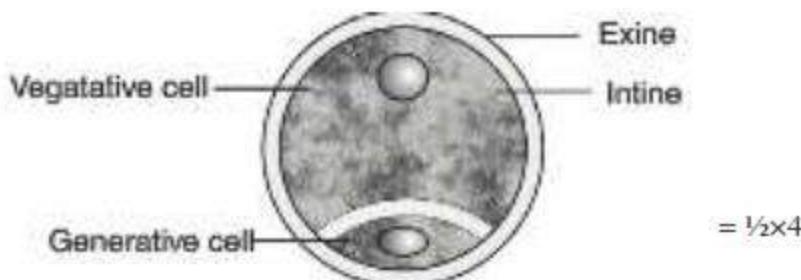
(i) Outer wall layer - Exine = $\frac{1}{2}$

(ii) Inner wall layer - Intine = $\frac{1}{2}$

(iii) Vegetative cell = $\frac{1}{2}$

(iv) Generative cell = $\frac{1}{2}$

//



(c) Function

- (i) Exine and Intine - Protection = $\frac{1}{2}$
- (ii) Vegetative cell - reserve food material / formation of pollen tube = $\frac{1}{2}$
- (iii) Generative cell - formation of two male gametes = $\frac{1}{2}$

[$1\frac{1}{2} + 3\frac{1}{2} = 5$ Marks]

OR

When and how do the following get to form in human females ? State their functions.

(a) Corpus luteum

(b) Placenta

Ans. (a) **Corpus luteum** -

- In the luteal phase / immediately after ovulation / secretory / phase = $\frac{1}{2}$
- Follicular cells of the ruptured Graafian follicle form the corpus luteum = 1
- Releases progesterone to maintain the endometrium = 1

(b) Placenta

- Formed after implantation of the embryo (Uterine wall) = $\frac{1}{2}$
- Chorionic villi (of the blastocyst / embryo) and uterine tissue interdigitate together to form the placenta = 1
- It supplies oxygen and nutrient and removes carbon dioxide and excretory material , also acts as an endocrine tissue (produces several hormones) - hCG , hPL etc = $\frac{1}{2} + \frac{1}{2}$

[$2\frac{1}{2} + 2\frac{1}{2} = 5$ Marks]

26. (a) Write the specific name of the genus Plasmodium that causes one of the most serious types of diseases in humans. Name the disease.

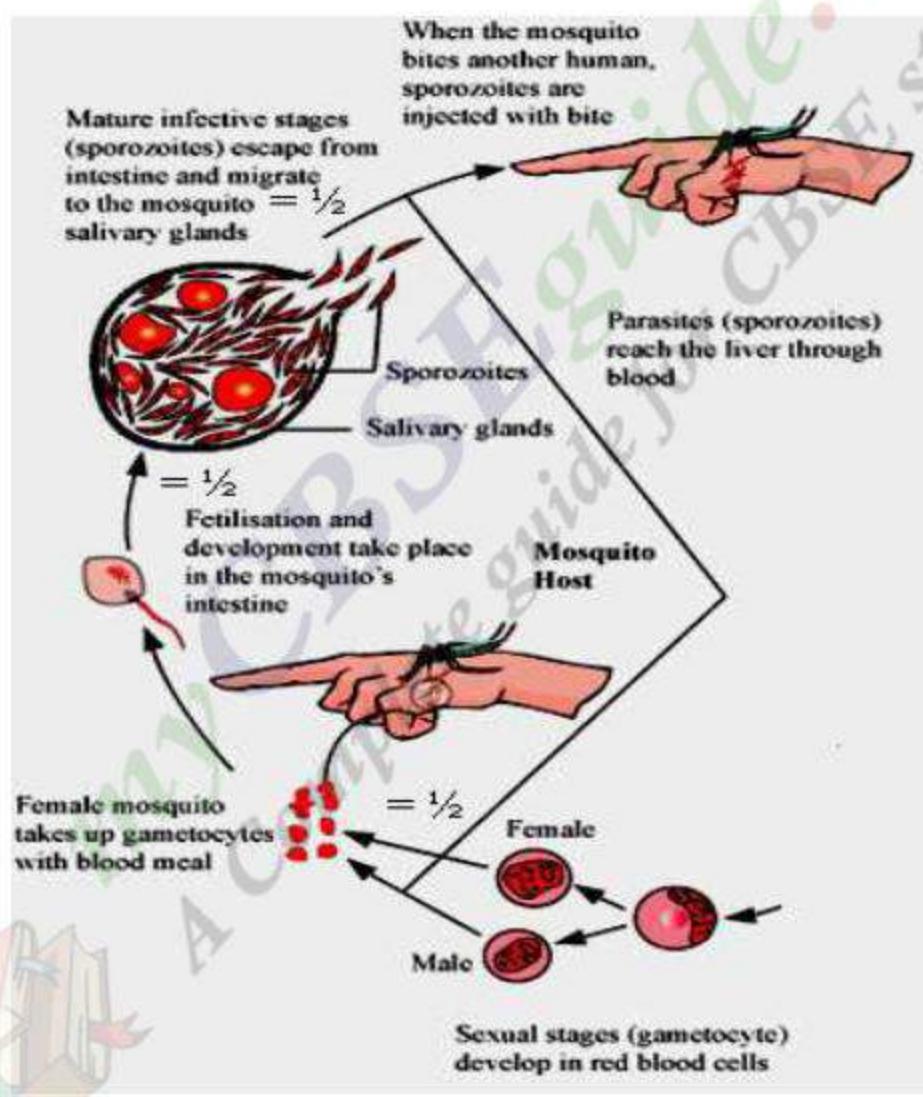
(b) Describe the events in the life cycle of Plasmodium which take place in the female Anopheles.

(c) Explain what happens in the RBCs of the humans when Plasmodium gains entry into them. How does the human body get affected ?

Ans. (a) *Plasmodium falciparum*, malignant malaria = $\frac{1}{2} + \frac{1}{2}$

- (b) • Gametocytes / Male and Female gametes - enter female Anopheles mosquito = $\frac{1}{2}$
- fertilisation and development in the female mosquito gut / stomach = $\frac{1}{2}$
 - sporozoites are transported to salivary glands = $\frac{1}{2}$

//



- (c) • Parasite multiplies asexually in RBC = $\frac{1}{2}$
- RBC rupture = $\frac{1}{2}$
 - release toxic haemoglobin = $\frac{1}{2}$

- chill and fever recurring every 3 - 4 days = $\frac{1}{2}$
- parasites enter fresh RBC and repeat the cycle = $\frac{1}{2}$

[1 + 1½ + 2½ = 5 Marks]

OR

Explain the interrelationship between organic farming and biofertilizers, with the help of any three suitable examples.

Ans. Organic farmers use organisms / biofertiliser instead of chemical fertilizer, to enrich the nutrient quality of the soil and increase the yield = 1 + 1

Examples

Rhizobium in the root nodules of leguminous plants (symbiotic) will fix atmospheric N₂ and enrich the soil / *Azotobacter* / *Azospirillum* (free living) fix atmospheric N₂ in the soil / Mycorrhiza is symbiotic association between fungus of genus *Glomus* and roots of higher plants , which absorb phosphorous from soil / they also make the plant resistant to root borne pathogens / *Cyanobacteria* fix atmospheric nitrogen / increases organic matter in the soil (*Anabaena* / *Nostoc* / *Oscillatoria*) (Any three examples) = 1 × 3

[2 + 3 = 5 Marks]

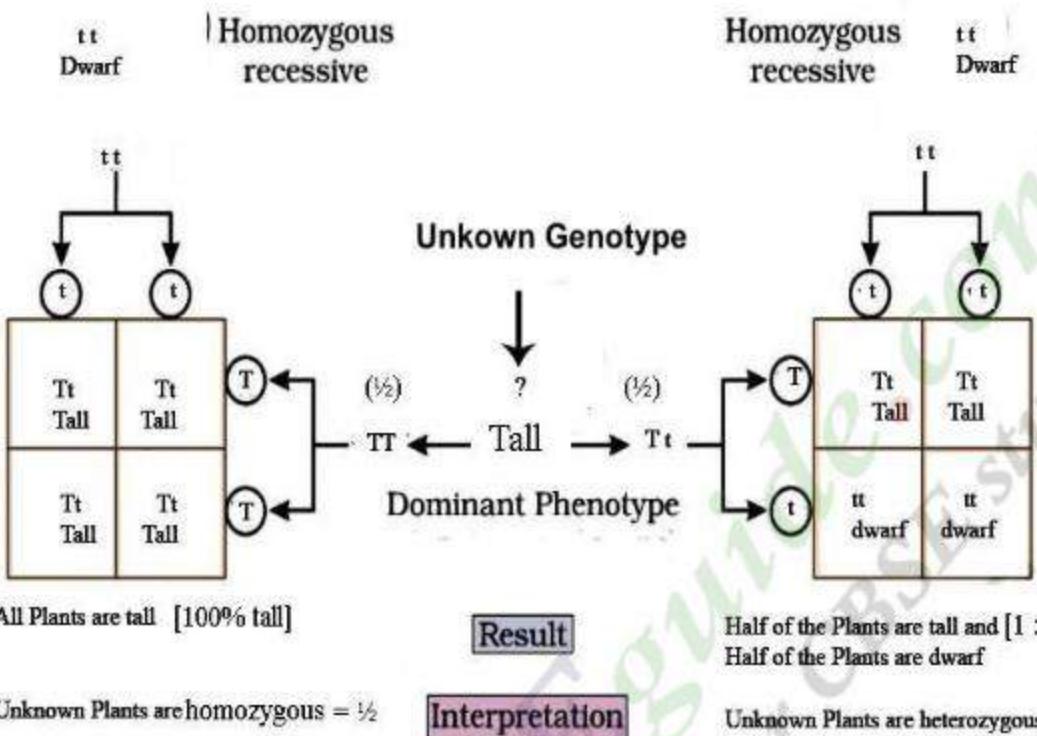
- 27. (a) How would you find out whether a given tall garden pea plant is homozygous or heterozygous ? Substantiate your answer with the help of Punnett squares.**
- (b) Given below are the F₂-phenotypic ratios of two independently carried monohybrid crosses :**

(i) 1 : 2 : 1

(ii) 3 : 1

Mention what does each ratio suggest.

Ans. (a) By Test Cross / crossing the plant with unknown genotype with the recessive parent = 1



(b) (i) Incomplete dominance = 1

(ii) Dominance = 1

[3 + 2 = 5 Marks]

OR

- (a) Why did Hershey and Chase use radioactive ^{32}P and ^{35}S in their experiments ? Explain.
- (b) Following the experiments conducted by them, write what conclusion did they arrive at and how.

- Ans. (a)
- Since bacteriophage contains only DNA and Protein the scientists wanted to identify whether it is DNA or the Protein from the Virus that entered the bacterium during infection = 1
 - therefore they labelled DNA with ^{32}P and Protein coat with ^{35}S = 1

Conclusion

(b) Conclusion - DNA is the genetic material = 1

Experiment

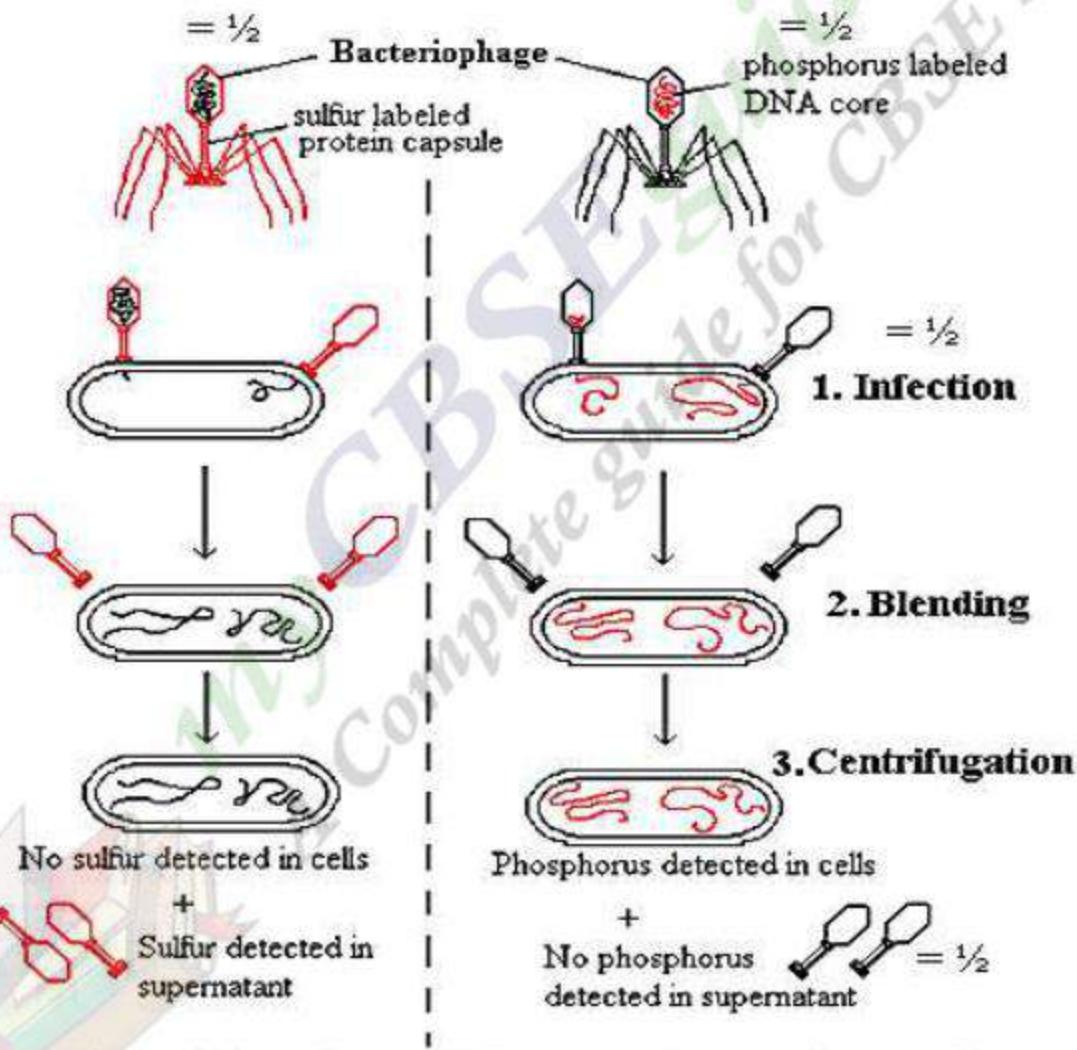
Bacteria which were infected with viruses having radioactive DNA [^{32}P] were found to be radioactive , indicating that DNA was the material that passed from the virus to bacterium

$$= \frac{1}{2} + \frac{1}{2}$$

Bacteria which were infected with viruses having radioactive protein [^{35}S] were not found to be radioactive , indicating that protein did not enter bacterium from the virus = $\frac{1}{2} + \frac{1}{2}$

//

(diagram in lieu of experiment)



The Hershey-Chase Experiment

[2 + 3 = 5 Marks]