



Series RRSS2/2



SET-2

प्रश्न-पत्र कोड
Q.P. Code

57/2/2

रोल नं.

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Roll No.

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

नोट

(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित (I) पृष्ठ 23 हैं।

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



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



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



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

NOTE

Please check that this question paper contains 23 printed pages.

Please check that this question paper contains 33 questions.

Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

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

15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

जीव विज्ञान (सैद्धान्तिक)

BIOLOGY (Theory)

निर्धारित समय : 3 घण्टे

अधिकतम अंक : 70

Time allowed : 3 hours

Maximum Marks : 70

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सामान्य निर्देश :

निम्नलिखित निर्देशों को ध्यानपूर्वक पढ़िए और उनका पालन कीजिए :

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

खण्ड क

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

16×1=16

1. समजात अंग इंगित करते हैं :

- (A) अभिसारी विकास
- (B) अपसारी विकास
- (C) अनुकूली विकिरण
- (D) प्राकृतिक वरण

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### **General Instructions :**

Read the following instructions carefully and follow them :

- (i) This question paper contains **33** questions. **All** questions are **compulsory**.
- (ii) Question paper is divided into **five** sections – Sections **A, B, C, D** and **E**.
- (iii) **Section A** – questions number **1** to **16** are multiple choice type questions. Each question carries **1** mark.
- (iv) **Section B** – questions number **17** to **21** are very short answer type questions. Each question carries **2** marks.
- (v) **Section C** – questions number **22** to **28** are short answer type questions. Each question carries **3** marks.
- (vi) **Section D** – questions number **29** and **30** are case-based questions. Each question carries **4** marks. Each question has subparts with internal choice in one of the subparts.
- (vii) **Section E** – questions number **31** to **33** are long answer type questions. Each question carries **5** marks.
- (viii) There is no overall choice. However, an internal choice has been provided in Sections **B, C** and **D** of the question paper. A candidate has to write answer for only **one** of the alternatives in such questions.
- (ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
- (x) Wherever necessary, neat and properly labelled diagrams should be drawn.

### **SECTION A**

Questions no. **1** to **16** are Multiple Choice type Questions, carrying **1** mark each.  $16 \times 1 = 16$

1. Homologous organs indicate :
  - (A) Convergent Evolution
  - (B) Divergent Evolution
  - (C) Adaptive Radiation
  - (D) Natural Selection

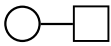

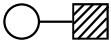
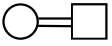
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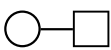
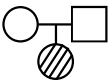
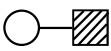
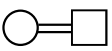
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2. 2 युग्मविकल्पी (दो विशेषकों) वाले जीन के लिए एक समष्टि आनुवंशिक संतुलन/हार्डी-वेनबर्ग संतुलन में होती है (प्रभावी ऐलील 'A' तथा अप्रभावी ऐलील 'a' है)। यदि ऐलील 'A' की आवृत्ति 0.6 है, तो जीनोटाइप 'Aa' की आवृत्ति होगी :
- (A) 0.21 (B) 0.42  
(C) 0.48 (D) 0.32
3. डीएनए अणु की द्विकुंडली संरचना में, रज्जुक होते हैं :
- (A) एकसमान तथा पूरक  
(B) एकसमान तथा अपूरक  
(C) प्रति-समानांतर तथा पूरक  
(D) प्रति-समानांतर तथा अपूरक
4. एक 'अनुलेखन इकाई' में, 'समापक' (टर्मिनेटर) इस ओर अवस्थित होता है :
- (A) टेम्पलेट रज्जुक के 3' किनारे पर  
(B) टेम्पलेट रज्जुक के 5' किनारे पर  
(C) कोडिंग रज्जुक के 5' किनारे पर  
(D) कोडिंग रज्जुक के 3' किनारे पर
5. निम्नलिखित में से कौन-सा विकल्प मानव वंशावली विश्लेषण में समरक्त मैथुन (रिश्तेदारों के बीच मैथुन) को दर्शाता है ?
- (A)  (B)   
(C)  (D) 
6. डेंगू ज्वर का संवाहक है :
- (A) मादा एडीज़ मच्छर  
(B) मादा ऐनोफेलीज़ मच्छर  
(C) नर एडीज़ मच्छर  
(D) मादा क्यूलेक्स मच्छर





2. A population is in genetic equilibrium/Hardy-Weinberg equilibrium for a gene with 2 alleles (dominant allele is 'A' and recessive allele 'a'). If the frequency of allele 'A' is 0.6, then the frequency of genotype 'Aa' is :
- (A) 0.21 (B) 0.42  
(C) 0.48 (D) 0.32
3. In the double helical structure of DNA molecule, the strands are :
- (A) identical and complementary  
(B) identical and non-complementary  
(C) anti-parallel and complementary  
(D) anti-parallel and non-complementary
4. In a 'transcription unit', the 'terminator' is located towards the :
- (A) 3' end of the template strand  
(B) 5' end of the template strand  
(C) 5' end of the coding strand  
(D) 3' end of the coding strand
5. Which one of the following option denotes mating between relatives in human pedigree analysis ?
- (A)  (B)   
(C)  (D) 
6. The vector for dengue fever is :
- (A) Female *Aedes* mosquito  
(B) Female *Anopheles* mosquito  
(C) Male *Aedes* mosquito  
(D) Female *Culex* mosquito





7. निम्नलिखित जोड़ों में से कौन-सा सही सुमेलित **नहीं** है ?
- (A) क्लोस्ट्रीडियम ब्युटायलिकम – ब्यूटिरिक अम्ल  
(B) ट्राइकोडर्मा पॉलीस्पोरम – साइक्लोस्पोरिन ए  
(C) मोनैस्कस परप्यूरीअस – सिट्रिक अम्ल  
(D) स्ट्रैप्टोकोकस – स्ट्रैप्टोकाइनेज़
8. पीसीआर के लिए निम्नलिखित में से किसकी आवश्यकता **नहीं** होती ?
- (A) प्रतिबंधन एंडोन्यूक्लिएज़ (B) टैक पॉलिमरेज़  
(C) उपक्रामक (प्राइमर) (D) डीएनए खंड
9. समुद्र में जैवमात्रा का पिरामिड सामान्यतः उल्टा होता है क्योंकि समुद्र में :
- (A) मछलियों की जैवमात्रा पादपप्लवकों की अपेक्षा अधिक होती है ।  
(B) पादपप्लवकों की संख्या अपेक्षाकृत अधिक होती है ।  
(C) पादपप्लवकों की संख्या अपेक्षाकृत कम होती है ।  
(D) बड़ी मछलियाँ छोटी मछलियों को खाती हैं ।
10. मानव में, द्वितीयक अंडक का अर्धसूत्री विभाजन तब पूर्ण होता है जब :
- (A) यह गर्भाशय के अंतःस्तर में अंतर्रोपित हो जाता है ।  
(B) यह परिपक्व ग्राफी पुटक से मोचित होता है ।  
(C) शुक्राणु इसमें प्रवेश करता है ।  
(D) अग्रपिंडक के एंजाइम ज़ोना पेलुसिडा (पारदर्शी अंडावरण) का भंजन करते हैं ।





7. Which one of the following pairs is **not** correctly matched ?
- (A) *Clostridium butylicum* – Butyric acid  
(B) *Trichoderma polysporum* – Cyclosporin A  
(C) *Monascus purpureus* – Citric Acid  
(D) *Streptococcus* – Streptokinase
8. Which of the following is **not** required for PCR ?
- (A) Restriction endonuclease (B) Taq Polymerase  
(C) Primer (D) DNA segment
9. The pyramid of biomass in sea is generally inverted because in sea :
- (A) Biomass of fishes exceeds that of phytoplankton.  
(B) Number of phytoplanktons is more.  
(C) Number of phytoplanktons is less.  
(D) Large fishes feed on small fishes.
10. In humans, the secondary oocyte completes meiotic division when :
- (A) it gets implanted in the uterine endometrium.  
(B) it is released from the matured Graafian follicle.  
(C) it is penetrated by the sperm cell.  
(D) acrosomal enzymes break down the zona pellucida.





11. स्तंभ I की मदों का मिलान स्तंभ II से कीजिए और नीचे दिए गए विकल्पों में से सही सुमेलित विकल्प का चयन कीजिए :

| स्तंभ I<br>क्रॉस                               |       | स्तंभ II<br>फीनोटाइप (दृश्यप्ररूप) अनुपात |
|------------------------------------------------|-------|-------------------------------------------|
| 1. मेंडलीय एकसंकर (मोनोहाइब्रिड)               | (i)   | 1 : 2 : 1 (F <sub>2</sub> )               |
| 2. मेंडलीय द्विसंकर                            | (ii)  | 1 : 1                                     |
| 3. अपूर्ण प्रभाविता (इंकंप्लीट डोमिनेंस)       | (iii) | 3 : 1 (F <sub>2</sub> )                   |
| 4. परीक्षार्थ संकरण (एकसंकर)<br>(मोनोहाइब्रिड) | (iv)  | 9 : 3 : 3 : 1 (F <sub>2</sub> )           |

विकल्प:

- (A) 1–(ii), 2–(iv), 3–(i), 4–(iii)  
(B) 1–(iii), 2–(i), 3–(iv), 4–(ii)  
(C) 1–(iii), 2–(iv), 3–(i), 4–(ii)  
(D) 1–(ii), 2–(i), 3–(iv), 4–(iii)
12. एक आवृतबीजी में कार्यशील गुरुबीजाणु विकसित होता है :

- (A) भ्रूणकोश में (B) भ्रूणपोष में  
(C) भ्रूण में (D) बीजाण्ड में

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

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









13. **अभिकथन (A) :** संसाधनों (प्राकृतिक संपदा) के अतिदोहन के कारण जैव-विविधता को क्षति पहुँच सकती है ।  
**कारण (R) :** भारतीय नदियों में *क्लैरियस गैरीपाइनस* मछली को प्रविष्ट कराने के कारण भारतीय मूल की मछलियों की संख्या में कमी आ गई है ।
14. **अभिकथन (A) :** आनुवंशिक इंजीनियरिंग में, प्रतिजैविक जीनों का वरण-योग्य चिह्नक के रूप में उपयोग किया जाता है ।  
**कारण (R) :** वरण-योग्य चिह्नक रूपांतरजों की अरूपांतरजों से पहचान करने में हमारी सहायता करते हैं ।
15. **अभिकथन (A) :** विषाणु-संक्रमित कोशिकाएँ इन्टरफेरॉन उत्पन्न करती हैं ।  
**कारण (R) :** इन्टरफेरॉन विषाणु-संक्रमित कोशिकाओं में शोथ (जलन) उत्पन्न कर सकते हैं ।
16. **अभिकथन (A) :** आरएनए अस्थायी है तथा तीव्र गति से उत्परिवर्तित हो सकता है ।  
**कारण (R) :** आरएनए के प्रत्येक न्यूक्लियोटाइड में 2' – OH समूह की उपस्थिति इसे अस्थायी तथा सरलता से विघटित होने वाला बनाती है ।

### खण्ड ख

17. अपरद की प्रकृति तथा ताप, अपघटन की दर को किस प्रकार प्रभावित करते हैं ? 2
18. प्रतिबंधन एंडोन्यूक्लिएज़ का नामकरण कैसे किया जाता है ? एक समुचित उदाहरण की सहायता से इसकी व्याख्या कीजिए । 2
19. (क) कॉपर मोचित करने वाली किन्हीं दो अंतःगर्भाशयी युक्तियों के नाम लिखिए । ऐसे दो कारण लिखिए जो उन्हें प्रभावी गर्भनिरोधक बनाते हैं । 2

### अथवा

- (ख) पुष्पीय पादपों द्वारा विकसित किन्हीं दो बहिःप्रजनन युक्तियों के नाम लिखिए तथा व्याख्या कीजिए कि परपरागण को प्रोत्साहित करने में वे किस प्रकार सहायक हैं । 2





13. *Assertion (A)* : Loss of biodiversity can occur due to overexploitation of resources.  
*Reason (R)* : Introduction of *Clarias gariepinus* in Indian rivers has led to a decline in native Indian fishes.
14. *Assertion (A)* : In genetic engineering, antibiotic genes are used as selectable markers.  
*Reason (R)* : Selectable markers help us to identify transformants from non-transformants.
15. *Assertion (A)* : Virus-infected cells produce interferons.  
*Reason (R)* : Interferons can cause inflammation of virus-infected cells.
16. *Assertion (A)* : RNA is unstable and can mutate at a faster rate.  
*Reason (R)* : The presence of 2' – OH group in every nucleotide of RNA makes it labile and easily degradable.

### SECTION B

17. How is the rate of decomposition affected by the nature of detritus and temperature ? 2
18. How is a restriction endonuclease named ? Explain with the help of a suitable example. 2
19. (a) Name any two copper releasing intra-uterine devices. State two reasons that make them effective contraceptives. 2

**OR**

- (b) Name any two outbreeding devices that flowering plants have developed and explain how they help in encouraging cross-pollination. 2





20. यद्यपि हीमोफीलिया तथा दात्र कोशिका अरक्तता (सिकल सेल एनिमिया) दो रक्त संबंधी मेंडलीय विकार हैं, फिर भी, वे वंशागति के प्रतिरूप में एक-दूसरे से विलग हैं। कोई दो अंतर लिखिए।

2

21. निम्नलिखित तालिका में A, B, C तथा D की पहचान कीजिए :

2

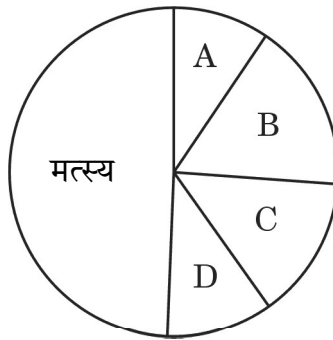
|     | पादप का वैज्ञानिक नाम | ड्रग         | मानव शरीर/मानव तंत्र पर प्रभाव                         |
|-----|-----------------------|--------------|--------------------------------------------------------|
| (a) | पैपेवर सोम्नीफेरम     | A            | अवसादक (डिप्रेसेंट)/शरीर के प्रकार्यों को धीमा करती है |
| (b) | कैनेबिस सैटाइवा       | कैनेबिनाइड्स | B                                                      |
| (c) | ऐरिथ्रोज़ाइलम कोका    | C            | D                                                      |

### खण्ड ग

22. परभक्षण को हानिकारक पारस्परिक-क्रिया कहा जाता है। पारितंत्र में परभक्षी की किन्हीं तीन सकारात्मक भूमिकाओं की व्याख्या कीजिए। प्रत्येक के समर्थन में एक-एक उदाहरण भी लिखिए।

3

23. नीचे दिए गए एक पाई चार्ट की सहायता से कशेरुकियों की वैश्विक जैव-विविधता का निरूपण किया गया है।



(क) वर्गों 'A', 'B', 'C' तथा 'D' की पहचान कर उनको सही स्थान पर दर्शाते हुए पाई चार्ट का पुनर्चित्रण कीजिए।

(ख) विगत कुछ समय (आधुनिक काल) में विलुप्त होने वाली दो जंतुओं के उदाहरण का उल्लेख कीजिए।

3





20. Although Haemophilia and sickle cell anemia are two blood related Mendelian disorders, yet, they differ in their pattern of inheritance. State any two differences. 2

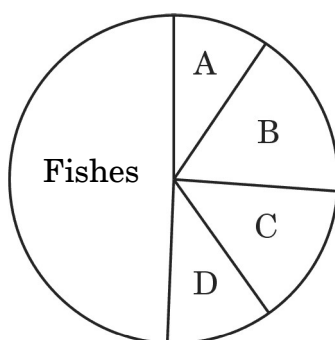
21. Identify A, B, C and D in the following table : 2

|     | Scientific name of the plant | Drug         | Effect on the human body/human system |
|-----|------------------------------|--------------|---------------------------------------|
| (a) | <i>Papaver somniferum</i>    | A            | Depressant/slows down body function   |
| (b) | <i>Cannabis sativa</i>       | Cannabinoids | B                                     |
| (c) | <i>Erythroxylum coca</i>     | C            | D                                     |

### SECTION C

22. Predation is referred to as a detrimental interaction. Explain any three positive roles, supported by an example each, that a predator plays in an ecosystem. 3

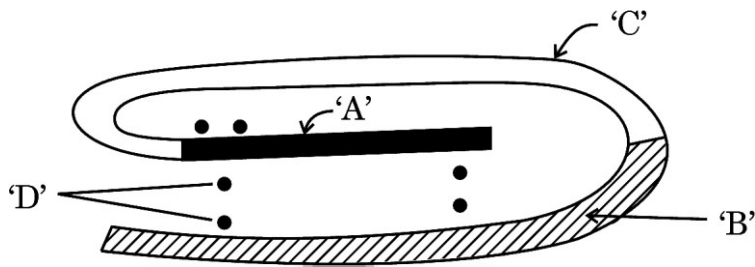
23. Given below is a pie chart representing global diversity of vertebrates.



- (a) Redraw the pie chart identifying the groups 'A', 'B', 'C' and 'D' in their respective positions.
- (b) Mention two examples of recently extinct animals. 3



24. (क) तरल प्रतिरक्षा अनुक्रिया (ह्यूमोरल इम्यून रिस्पॉन्स) तथा कोशिका-माध्यित प्रतिरक्षा अनुक्रिया के बीच विभेद कीजिए ।  
(ख) एक प्रतिरक्षी अणु का व्यवस्थात्मक आरेख बना कर इसके किन्हीं चार भागों को नामांकित कीजिए । 3
25. (क) एक समुचित उदाहरण की सहायता से अगुणित-द्विगुणित लिंग निर्धारण प्रतिरूप (पैटर्न) की क्रियाविधि की व्याख्या कीजिए । इस प्रतिरूप (पैटर्न) को इस प्रकार क्यों पुकारा जाता है ? 3
- अथवा**
- (ख) टी.एस. मॉर्गन तथा उनके साथियों ने अपने प्रयोगों के लिए *ड्रोसोफिला मेलानोगैस्टर* पर काम किया । वे जिन परिणामों पर पहुँचे उनका उल्लेख कीजिए और समझाइए, कैसे । 3
26. “मानव रुधिर वर्ग (ABO वर्ग) की वंशागति बहुऐलीलता तथा सह-प्रभाविता (को-डोमिनेंस) का एक अच्छा उदाहरण है ।” कथन की न्यायसंगतता सिद्ध कीजिए । 3
27. (क) “पात्रे निषेचन (आईवीएफ)” को यह नाम क्यों दिया गया है ? इसका महत्त्व लिखिए ।  
(ख) जी आई एफ टी तथा ज़ेड आई एफ टी के बीच विभेद कीजिए । 3
28. मानव में शर्करा उपापचय के लिए आवश्यक एक जैव-अणु का आरेख नीचे दिया गया है ।



- (क) इस जैव-अणु का नाम लिखिए तथा उल्लेख कीजिए कि यह सक्रिय अवस्था में है अथवा निष्क्रिय अवस्था में ।  
(ख) नामांकित भाग 'A', 'B', 'C' तथा 'D' की पहचान कीजिए । 3





24. (a) Differentiate between humoral immune response and cell-mediated immune response.
- (b) Draw a schematic diagram of an antibody molecule and label any four parts. 3

25. Explain the mechanism of haplo-diploid pattern of sex determination with the help of a suitable example. Why is this pattern so called ? 3

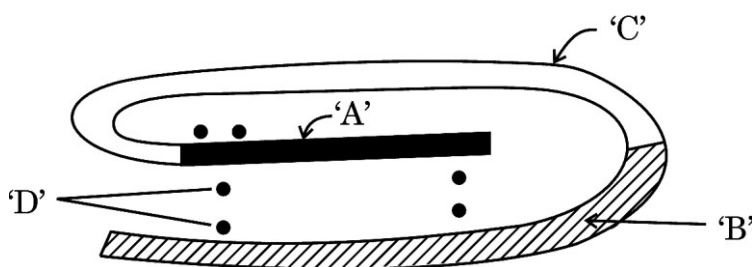
**OR**

T.S. Morgan and his colleagues worked with *Drosophila melanogaster* for their experiments. State the findings they arrived at and explain how. 3

26. “Human blood group (ABO group) inheritance is a good example of multiple allelism and co-dominance.” Justify the statement. 3

27. (a) Why is “in vitro fertilization (IVF)” so named ? State its importance.
- (b) Distinguish between GIFT and ZIFT. 3

28. The diagram given below is a biomolecule needed for sugar metabolism in human beings.



- (a) Name this biomolecule and mention whether it is in active state or inactive state.
- (b) Identify the parts marked as 'A', 'B', 'C' and 'D'. 3

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## खण्ड घ

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

29. निम्नलिखित परिच्छेद को पढ़कर नीचे दिए गए प्रश्नों के उत्तर दीजिए। 4

1981 में, संयुक्त राज्य अमेरिका के स्वास्थ्य कर्मचारियों को कापोसी सारकोमा, त्वचा के कैंसर तथा रुधिर वाहिनियों के कैंसर की दर में वृद्धि का पता चला। इसी प्रकार प्रोटोज़ोआ द्वारा होने वाले एक श्वसनी संक्रमण न्यूमोसिस्टिस न्यूमोनिया के फैलने का भान हुआ। ये दोनों रोग सामान्य जनसंख्या में तो बहुत ही दुर्लभ थे, परन्तु “प्रतिरक्षा संदमन युक्त” व्यक्तियों में अधिक व्यापक थे। इसके कारण प्रतिरक्षा तंत्र के विकार की पहचान हुई जिसे उपार्जित प्रतिरक्षा न्यूनता संलक्षण (एड्स) का नाम दिया गया।

1983 में, संयुक्त राज्य अमेरिका तथा फ्रांस में कार्यरत विषाणुविज्ञों ने ‘एड्स’ के रोगकारक की पहचान की जिसे अब हम ह्यूमन इम्यूनोडेफिशिएंसी वायरस (एचआईवी) के नाम से जानते हैं। रोग उत्पन्न करने के लिए ‘एचआईवी’ मानव शरीर पर हमला करने हेतु एक निर्धारित पथ को अपनाते हैं।

- (क) मानव शरीर में प्रवेश करने के पश्चात् एचआईवी जिस कोशिका समूह पर आक्रमण करता है, उसका नाम लिखिए। इस कोशिका में होने वाली विभिन्न परिघटनाओं को लिखिए। 1
- (ख) एड्स की पहचान करने वाले नैदानिक परीक्षण का विस्तृत रूप लिखिए। रोग के उपचार हेतु वर्तमान में उपलब्ध संभावित उपचार लिखिए। 1
- (ग) इस रोग को फैलने से रोकने के लिए डब्ल्यूएचओ (WHO) द्वारा सुझाए गए किन्हीं दो उपायों का उल्लेख कीजिए। 2

### अथवा

- (ग) “एड्स से पीड़ित रोगी इस रोग के कारण नहीं मरता परन्तु किसी अन्य संक्रमण के कारण उसकी मृत्यु होती है।” कथन की न्यायसंगतता सिद्ध कीजिए। 2







## SECTION D

Questions No. 29 and 30 are case-based questions. Each question has 3 subparts with internal choice in one subpart.

29. Read the following passage and answer the questions that follow. 4

In 1981, the health workers of United States of America had become aware of the increased frequency of Kaposi's sarcoma, cancer of the skin and blood vessels and another disease pneumocystis pneumonia, a respiratory infection caused by a protozoan. Both these diseases were very rare in the general population, but occurred frequently in more severely "immunosuppressed" individuals. This led to the recognition of the immune system disorder that was named Acquired Immune Deficiency Syndrome (AIDS).

In 1983, virologists working in the USA and France had identified a causative agent for 'AIDS', now known as Human Immunodeficiency Virus (HIV). 'HIV' follows a set path to attack the human body to cause the disease.

- (a) Name the group of cells the HIV attacks after gaining entry into the human body and write the various events that occur within this cell. 1
- (b) Write the expanded form of the diagnostic test used for detecting AIDS. Write the possible treatment available for the disease at present. 1
- (c) Mention any two steps suggested by WHO for preventing the spread of this disease. 2

OR

- (c) "A patient suffering from AIDS does not die of this disease but from some other infection." Justify the statement. 2

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30. निम्नलिखित परिच्छेद को पढ़कर नीचे दिए गए प्रश्नों के उत्तर दीजिए । 4

मानव तथा अन्य सभी कशेरुकियों में शुक्रजनन एक महत्वपूर्ण मूल लैंगिक अभिलक्षण है । इस प्रक्रम का समन्वय तथा नियंत्रण हॉर्मोनों के प्रभाव द्वारा किया जाता है । मनुष्यों में यह किशोरावस्था/यौवनारंभ से प्रारंभ होता है तथा सतत चलता रहता है । भ्रूणीय वृषण में आदि (मौलिक) जनन (जर्म) कोशिकाएँ शुक्राणुजन (स्पर्मैटोगोनिया) में विभेदित हो जाती हैं । शुक्राणुजन (स्पर्मैटोगोनिया) शुक्राणुओं की पूर्ववर्ती हैं । यह शुक्रजनक नलिकाओं की बाह्य स्तर (भित्ति) पर अवस्थित होती हैं जहाँ शुक्रजनन का प्रक्रम संपन्न होता है ।

(क) वृषण में एफएसएच के प्रकार्य/क्रिया स्थल तथा बाद में इसके क्रियाकलाप का वर्णन कीजिए । 2

#### अथवा

(क) शुक्रजनन प्रक्रम में एलएच की भूमिका का वर्णन कीजिए । 2

(ख) उन कोशिकाओं के नाम तथा उनके उत्पाद लिखिए जो शुक्रजनन के दौरान निम्न प्रक्रम करते हैं : 1

(i) समसूत्री विभाजन तथा विभेदन

(ii) अर्धसूत्री विभाजन I तथा अर्धसूत्री विभाजन II

(ग) शुक्रजनक नलिकाओं से मोचित होने के उपरांत शुक्राणुओं को अधिवृषण तक ले जाने वाली सहायक नलिकाओं के नाम लिखिए । 1

#### खण्ड ड

31. (क) (i) किसी कोशिका को विजातीय (बाहरी) डीएनए लेने हेतु सक्षम क्यों बनाना चाहिए ? कैल्शियम आयन के उपयोग द्वारा किसी जीवाणु कोशिका को कैसे सक्षम बनाया जा सकता है ? व्याख्या कीजिए । 2





30. Read the following passage and answer the questions that follow. 4

Spermatogenesis is an important primary sex characteristic in humans and all other vertebrates. The process is coordinated and controlled under the influence of hormones. It starts with the onset of puberty in humans and thereafter continues. The primordial cells within the embryonic testis which differentiate into spermatogonia are the precursors of the sperms. These are located at the outer walls of the seminiferous tubules where the process of spermatogenesis proceeds.

(a) State the site of action of FSH in the testes and describe its action thereafter. 2

**OR**

(a) Describe the role of LH in the process of spermatogenesis. 2

(b) Name the cells and their products which undergo : 1

(i) Mitosis and Differentiation

(ii) Meiosis I and Meiosis II

during the process of spermatogenesis.

(c) Name the accessory ducts that the sperms travel through from seminiferous tubules to reach the epididymis. 1

### SECTION E

31. (a) (i) Why should a cell be made competent to take up an alien DNA ?  
How can a bacterial cell be made competent using calcium ions ?  
Explain. 2

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- (ii) (1) जैव-प्रौद्योगिकी में जेल वैद्युत कण-संचलन (इलेक्ट्रोफोरेसिस) का महत्त्व लिखिए ।
- (2) उस सिद्धान्त की व्याख्या कीजिए जिस पर यह तकनीक कार्य करती है ।
- (3) इस तकनीक में इथीडियम ब्रोमाइड का उपयोग क्यों किया जाता है ? उल्लेख कीजिए ।

3

#### अथवा

(ख) आनुवंशिकता: रूपांतरित फ़सल 'बीटी (Bt) कपास' ने उपज (उर्वरता) बढ़ाने में कपास किसानों की बहुत सहायता की है ।

- (i) बीटी (Bt) कपास के पौधे को गोलक शलभ कृमि के लिए प्रतिरोधी किस प्रकार बनाया गया ? व्याख्या कीजिए ।
- (ii) बीटी (Bt) कपास के पौधों को खाने वाले गोलक शलभ कृमियों के मरने की क्रियाविधि का वर्णन कीजिए ।

2

3

32. (क) (i) एक आवृतबीजी में वर्तिकाग्र पर परागकण के जनित होने से लेकर द्विनिषेचन तक के प्रक्रम की व्याख्या कीजिए तथा अंतिम उत्पादों की सूत्रगुणता (प्लॉइडी) का उल्लेख कीजिए । इस प्रक्रम में सहाय कोशिकाओं की भूमिका का वर्णन कीजिए ।

4

- (ii) भ्रूणपोष का विकास भ्रूण के विकास से पहले होता है, क्यों ?

1

#### अथवा

(ख) (i) उस स्थल का उल्लेख कीजिए जहाँ स्त्री (मानव मादा) में अंडाणु का निषेचन होता है । निषेचन प्रक्रम की व्याख्या कीजिए और उल्लेख कीजिए कि इस प्रक्रम में अनेक शुक्राणुओं के प्रवेश को कैसे रोका जाता है ।

3

- (ii) भ्रूण की उस अवस्था का नाम लिखिए जिसमें उसका गर्भाशय में अंतर्रोपण होता है । स्त्री (मानव मादा) में अंतर्रोपण प्रक्रम की व्याख्या कीजिए ।

2





- (ii) (1) State the importance of gel electrophoresis in biotechnology.
- (2) Explain the principle on which this technique works.
- (3) Mention why ethidium bromide is used in this technique. 3

**OR**

- (b) 'Bt cotton', the genetically modified crop, has greatly helped the cotton farmers to increase their crop yield.
- (i) How was Bt cotton plant made resistant to bollworm ? Explain. 2
- (ii) Describe the mechanism that leads to the death of bollworms feeding on Bt cotton plants. 3

32. (a) (i) Explain the process of double fertilization in an angiosperm starting from the germination of pollen grains on the stigma, mentioning the ploidy of the end products formed at the end. State the role of synergids during the course of the process. 4
- (ii) Why does the development of endosperm precede that of the embryo ? 1

**OR**

- (b) (i) Mention the site where fertilisation of the ovum occurs in a human female. Explain the process of fertilization and mention how polyspermy is prevented. 3
- (ii) Name the embryonic stage that gets implanted in the uterus. Explain the process of implantation in a human female. 2



33. (क) (i) मेंडल के स्वतंत्र अपव्यूहन का नियम लिखिए ।
- (ii) इस नियम की व्याख्या मटर के पुष्प के रंग तथा पुष्प की पौधे पर स्थिति के संदर्भ में दो विषमयुग्मजी जनक पौधों के बीच क्रॉस/संकरण के उदाहरण द्वारा पनेट वर्ग बना कर कीजिए ।

5

अथवा

- (ख) आनुवंशिक पदार्थ की खोज के लिए ग्रीफिथ द्वारा किए गए प्रयोग की व्याख्या कीजिए । इसके परिणामस्वरूप वह जिस निष्कर्ष पर पहुँचे उसे लिखिए । एवेरी, मैकलिओड एवं मैककार्टी ने ग्रीफिथ के “आनुवंशिक पदार्थ” की जीव-रासायनिक प्रकृति को स्थापित (का निर्धारण) कैसे किया ?

5





33. (a) (i) State Mendel's law of independent assortment.
- (ii) Explain this law by taking the example of a cross between two heterozygous parents of pea plants with respect to flower colour and flower position using Punnett Square. 5

**OR**

- (b) Explain Griffith's experiment conducted in search of genetic material and write the conclusion he arrived at. How did Avery, MacLeod and McCarty establish the biochemical nature of the "Genetic Material" identified by Griffith ? 5



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

**General Instructions: -**

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



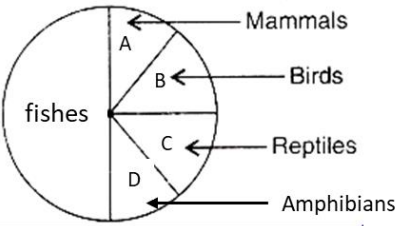
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9  | If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note “ <b>Extra Question</b> ”.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 10 | No marks to be deducted for the cumulative effect of an error. It should be penalized only once.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 11 | A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 12 | Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 13 | <p>Ensure that you do not make the following common types of errors committed by the Examiner in the past:-</p> <ul style="list-style-type: none"> <li>● Leaving answer or part thereof unassessed in an answer book.</li> <li>● Giving more marks for an answer than assigned to it.</li> <li>● Wrong totaling of marks awarded on an answer.</li> <li>● Wrong transfer of marks from the inside pages of the answer book to the title page.</li> <li>● Wrong question wise totaling on the title page.</li> <li>● Wrong totaling of marks of the two columns on the title page.</li> <li>● Wrong grand total.</li> <li>● Marks in words and figures not tallying/not same.</li> <li>● Wrong transfer of marks from the answer book to online award list.</li> <li>● 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.)</li> <li>● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.</li> </ul> |
| 14 | While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 15 | Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 16 | The Examiners should acquaint themselves with the guidelines given in the “ <b>Guidelines for Spot Evaluation</b> ” before starting the actual evaluation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 17 | Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 18 | The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

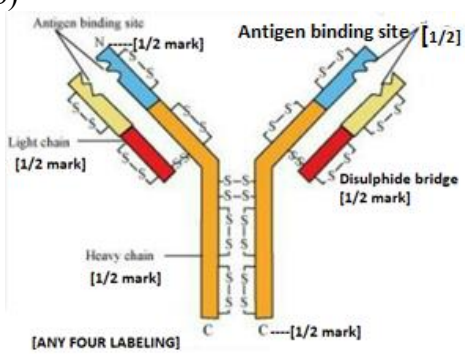
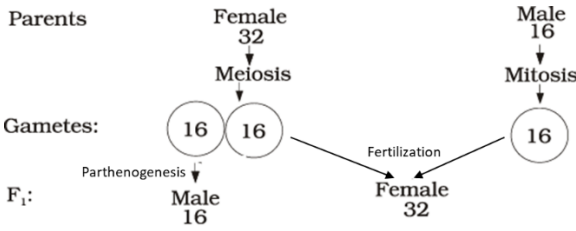


**MARKING SCHEME**  
**Senior Secondary School Examination, 2024**  
**BIOLOGY (Subject Code-044)**  
**[ Paper Code: 57/2/2]**

|                    |                                                                                                                                                                                                                                                                                                   |                                                            |   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---|
| 1                  | (B)/ Divergent Evolution                                                                                                                                                                                                                                                                          | 1                                                          | 1 |
| 2.                 | (C) /0.48                                                                                                                                                                                                                                                                                         | 1                                                          | 1 |
| 3.                 | (C) /anti-parallel and complementary                                                                                                                                                                                                                                                              | 1                                                          | 1 |
| 4.                 | (D)/ 3' end of the coding strand.                                                                                                                                                                                                                                                                 | 1                                                          | 1 |
| 5.                 | (D) / □=○                                                                                                                                                                                                                                                                                         | 1                                                          | 1 |
| 6.                 | (A) /Female <i>Aedes</i> mosquito                                                                                                                                                                                                                                                                 | 1                                                          | 1 |
| 7.                 | (C)/ <i>Monascus purpureus</i> – Citric Acid                                                                                                                                                                                                                                                      | 1                                                          | 1 |
| 8.                 | (A) /Restriction endonuclease                                                                                                                                                                                                                                                                     | 1                                                          | 1 |
| 9.                 | (A)/ Biomass of fish exceeds that of phytoplankton                                                                                                                                                                                                                                                | 1                                                          | 1 |
| 10.                | (C)/ it is penetrated by the sperm cell.                                                                                                                                                                                                                                                          | 1                                                          | 1 |
| 11.                | (C)/ 1-(iii), 2-(iv), 3-(i), 4-(ii)                                                                                                                                                                                                                                                               | 1                                                          | 1 |
| 12.                | (A)/ Embryo sac.                                                                                                                                                                                                                                                                                  | 1                                                          | 1 |
| 13.                | (B)/ Both Assertion (A) and Reason (R) are true, but Reason (R) is <b>not</b> the correct explanation of the Assertion (A).                                                                                                                                                                       | 1                                                          | 1 |
| 14.                | (A)/ Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).                                                                                                                                                                                   | 1                                                          | 1 |
| 15.                | (C) /Assertion (A) is true, but Reason (R) is false                                                                                                                                                                                                                                               | 1                                                          | 1 |
| 16.                | (A)/ Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).                                                                                                                                                                                   | 1                                                          | 1 |
| <b>SECTION – B</b> |                                                                                                                                                                                                                                                                                                   |                                                            |   |
| 17.                | <ul style="list-style-type: none"> <li>• Detritus rich in lignin and chitin– slow decomposition, rich in nitrogen and water soluble substances like sugar - decomposition rate is faster,</li> <li>• Warm environment – favour decomposition, low temperature – inhibit decomposition.</li> </ul> | $\frac{1}{2} \times 4$                                     | 2 |
| 18                 | In EcoRI<br>First letter 'E' comes from the genus,<br>the second two 'co' letters from the species,<br>letter 'R' – is derived from the name of strain,<br>Roman number 'I' - indicates the order in which the enzyme is isolated.                                                                | $\frac{1}{2} \times 4$                                     | 2 |
| 19.                | <p>(a) Copper releasing IUDS – CuT, Cu-7, Multiload – 375      <b>(Any two)</b></p> <p>Cu<sup>+</sup> released from IUDs suppress sperm motility, reduces fertilising capacity of sperms, increase phagocytosis of sperms      <b>(Any two)</b></p> <p style="text-align: center;"><b>OR</b></p>  | $\frac{1}{2} + \frac{1}{2}$<br>$\frac{1}{2} + \frac{1}{2}$ |   |

|                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                     |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------|-----------------------------------------|------------------------------|---------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----|---|
|                                                                                | <p>(b) - Unisexuality- production of unisexual flowers,</p> <ul style="list-style-type: none"> <li>- Release and receptivity of stigma are not synchronized, either pollen is released before the stigma becomes receptive or stigma becomes receptive much before the release of pollen,</li> <li>- Anther and stigma are placed at different positions, so that the pollen cannot come in contact with stigma,</li> <li>- Self-incompatibility/genetic incompatibility, genetic mechanism and prevents self-pollen from fertilizing the ovule by inhibiting pollen germination or pollen tube growth in the pistil.</li> </ul> <p style="text-align: center;"><b>(Any two devices with explanation)</b></p>                                                                                                                                | $\frac{1}{2} \times 4$      | 2                   |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
| 20.                                                                            | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Haemophilia</td> <td style="text-align: center;">Sickle cell anaemia</td> </tr> <tr> <td style="text-align: center;">Sex linked/X- linked recessive disorder</td> <td style="text-align: center;">Autosomal recessive disorder</td> </tr> <tr> <td style="text-align: center;">More males than females are affected.</td> <td style="text-align: center;">Affects both males and females equally.</td> </tr> <tr> <td style="text-align: center;">Carrier/unaffected female transmits the disease to some of her male offspring.</td> <td style="text-align: center;">When both the parents are carriers, the disease is transmitted to the offspring.</td> </tr> </table> <p style="text-align: right;"><b>(Any two points)</b></p> | Haemophilia                 | Sickle cell anaemia | Sex linked/X- linked recessive disorder | Autosomal recessive disorder | More males than females are affected. | Affects both males and females equally. | Carrier/unaffected female transmits the disease to some of her male offspring. | When both the parents are carriers, the disease is transmitted to the offspring. | 1+1 | 2 |
| Haemophilia                                                                    | Sickle cell anaemia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |                     |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
| Sex linked/X- linked recessive disorder                                        | Autosomal recessive disorder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                     |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
| More males than females are affected.                                          | Affects both males and females equally.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |                     |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
| Carrier/unaffected female transmits the disease to some of her male offspring. | When both the parents are carriers, the disease is transmitted to the offspring.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |                     |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
| 21.                                                                            | <p>(A) – Heroin/smack/diacetylmorphine</p> <p>(B) – Cardiovascular system</p> <p>(C) – Cocaine/coca alkaloid/coke/crack</p> <p>(D)–Stimulates central nervous system /produces a sense of euphoria and increased energy/hallucination.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $\frac{1}{2} \times 4$      | 2                   |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
| <b>SECTION - C</b>                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                     |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |
| 22.                                                                            | <ul style="list-style-type: none"> <li>- Predators act as conduits for energy transfer across trophic levels.</li> <li>- for example→</li> </ul> <p style="text-align: center;">Grass → Goat → Lion / Lion (Predator) transfers the energy fixed by plants and the Ecosystem.      <b>(or any other correct example)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $\frac{1}{2} + \frac{1}{2}$ |                     |                                         |                              |                                       |                                         |                                                                                |                                                                                  |     |   |

|       | <p>- Predators keep prey populations under control.</p> <p>e.g. Cactus feeding predator (moth) control the spreading of the prickly pear cactus. <b>(or any other correct example)</b></p> <p>- Predators help in maintaining species diversity by reducing the intensity of competition among competing prey species.</p> <p>e.g. extinction of more than 10 species of invertebrates due to removal of starfish <i>Pisaster</i> (predator) <b>(or any other correct example)</b></p>                                                                                                                                                                             | <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p> | 3                       |                               |     |                           |                            |      |                                                        |                                                                      |       |                                              |                                              |                                               |  |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------|-------------------------------|-----|---------------------------|----------------------------|------|--------------------------------------------------------|----------------------------------------------------------------------|-------|----------------------------------------------|----------------------------------------------|-----------------------------------------------|--|
| 23.   | <p>(a)</p>  <p>(b) Dodo, Quagga, Thylacine, Steller's Sea Cow, 3 subspecies (Bali, Javan, Caspian) of tiger</p> <p><b>(or any other correct example - any two)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                            | <p><math>\frac{1}{2} \times 4</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p>      | 3                       |                               |     |                           |                            |      |                                                        |                                                                      |       |                                              |                                              |                                               |  |
| 24.   | <p>(a)</p> <table border="1" data-bbox="296 1236 1265 1621"> <thead> <tr> <th></th> <th>Humoral immune response</th> <th>Cell-Mediated immune response</th> </tr> </thead> <tbody> <tr> <td>(i)</td> <td>Mediated by B-lymphocytes</td> <td>Mediated by T- lymphocytes</td> </tr> <tr> <td>(ii)</td> <td>Antibodies are produced by B-lymphocytes in the blood.</td> <td>T- cells do not secrete antibodies but help B-cells to produce them.</td> </tr> <tr> <td>(iii)</td> <td>This is not responsible for graft rejection.</td> <td>This is responsible for the graft rejection.</td> </tr> </tbody> </table> <p><b>(any two corresponding differences)</b></p> |                                                                                             | Humoral immune response | Cell-Mediated immune response | (i) | Mediated by B-lymphocytes | Mediated by T- lymphocytes | (ii) | Antibodies are produced by B-lymphocytes in the blood. | T- cells do not secrete antibodies but help B-cells to produce them. | (iii) | This is not responsible for graft rejection. | This is responsible for the graft rejection. | <p><math>\frac{1}{2} + \frac{1}{2}</math></p> |  |
|       | Humoral immune response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Cell-Mediated immune response                                                               |                         |                               |     |                           |                            |      |                                                        |                                                                      |       |                                              |                                              |                                               |  |
| (i)   | Mediated by B-lymphocytes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Mediated by T- lymphocytes                                                                  |                         |                               |     |                           |                            |      |                                                        |                                                                      |       |                                              |                                              |                                               |  |
| (ii)  | Antibodies are produced by B-lymphocytes in the blood.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | T- cells do not secrete antibodies but help B-cells to produce them.                        |                         |                               |     |                           |                            |      |                                                        |                                                                      |       |                                              |                                              |                                               |  |
| (iii) | This is not responsible for graft rejection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | This is responsible for the graft rejection.                                                |                         |                               |     |                           |                            |      |                                                        |                                                                      |       |                                              |                                              |                                               |  |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |   |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---|
|     | <p>(b)</p>  <p style="text-align: right;"><b>(any correct four labels)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $\frac{1}{2} \times 4$ | 3 |
| 25. | <p>Honey bee shows mechanism of haplo-diploid pattern of sex-determination, female (queen or worker) develops from fertilized egg, so are diploid, males (drones) develop from unfertilized egg by parthenogenesis, so are haploid, Females are diploid having 32 chromosomes and the males are haploid having 16 chromosomes this is haplo-diploid sex determination</p> <p style="text-align: center;">//</p>  <p style="text-align: center;"><b>OR</b></p> <p>In a dihybrid cross the F<sub>2</sub> phenotypic ration deviated very significantly from 9:3:3:1, the proportion of the parental gene combination was much higher than the non-parental type, the parental combinations were due to linkage of genes (physical association) and the non-parental types were due to distant genes (recombination/ crossing over)<br/> <b>(Explanation of the same if provided through cross should be considered)</b></p> | $\frac{1}{2} \times 6$ | 3 |
| 26. | <p>- Human blood group inheritance is regulated by the gene 'I' which is present in more than two allelic forms – I<sup>A</sup>, I<sup>B</sup>, i/Hence human blood group inheritance is controlled by more than two alleles that is called multiple allelism.</p> <p>- When I<sup>A</sup> and I<sup>B</sup> are present together in blood group AB they both express their own types of sugars, because both the dominant alleles hence show co-dominance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1<br><br>1+1           | 3 |
| 27. | <p>(a)</p> <ul style="list-style-type: none"> <li>• IVF – Fertilisation outside the human body in almost similar conditions as that of the body.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                      |   |

|                                                                                                                                                                     | <ul style="list-style-type: none"> <li>Helps infertile couples to enjoy parenthood</li> </ul> <p>(b)</p> <table border="1"> <thead> <tr> <th>GIFT</th> <th>ZIFT</th> </tr> </thead> <tbody> <tr> <td>Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one but can provide suitable environment for fertilization.</td> <td>Transfer of zygote or early embryos (with upto 8 blastomeres) into the fallopian tube.</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | GIFT                                                                                                                                                                                              | ZIFT | Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one but can provide suitable environment for fertilization. | Transfer of zygote or early embryos (with upto 8 blastomeres) into the fallopian tube. | 1 |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|---|--|
| GIFT                                                                                                                                                                | ZIFT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                   |      |                                                                                                                                                                     |                                                                                        |   |  |
| Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one but can provide suitable environment for fertilization. | Transfer of zygote or early embryos (with upto 8 blastomeres) into the fallopian tube.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                   |      |                                                                                                                                                                     |                                                                                        |   |  |
|                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                                                                                                                                                                                                 | 3    |                                                                                                                                                                     |                                                                                        |   |  |
| 28.                                                                                                                                                                 | <p>a) It is 'pro-insulin' produced, in an inactive state.</p> <p>(b) A – A peptide, B – B peptide, C – C peptide, D – disulphide bonds.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} \times 4</math></p>                                                                                                            | 3    |                                                                                                                                                                     |                                                                                        |   |  |
| <b>SECTION - D</b>                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                   |      |                                                                                                                                                                     |                                                                                        |   |  |
| 29.                                                                                                                                                                 | <p>(a)</p> <ul style="list-style-type: none"> <li>Macrophages,</li> <li>virus replication (RNA genome)</li> </ul> <p>(b)</p> <ul style="list-style-type: none"> <li>Enzyme-linked immuno-sorbent assay (ELISA) /Polymerase Chain Reaction (PCR)</li> <li>Treatment available – Antiviral drugs that are only partially effective as they only prolong the life of the patient.</li> </ul> <p>(c) Making blood HIV safe in blood banks, use of only disposable needles and syringes in hospitals, free distribution of condoms, controlling drug abuse, advocating safe sex, regular check-ups for HIV susceptible population. <b>(Any two)</b></p> <p style="text-align: center;"><b>OR</b></p> <p>(c) This is because of drastic reduction of helper T-lymphocytes that are responsible to fight infections,<br/>         -person become immune-deficient,<br/>         -unable to protect oneself from other bacterial or viral or fungal or parasitic infection.</p> | <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1+1</p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> | 4    |                                                                                                                                                                     |                                                                                        |   |  |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                           |          |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------|
| 30.                | <p>(a) Sertoli cells in seminiferous tubule, induces release of some factors which induce spermiogenesis.</p> <p style="text-align: center;"><b>OR</b></p> <p>(a) LH acts on Leydig cells, and stimulates the synthesis and secretion of androgens for spermatogenesis.</p> <p>(b) (i) Spermatogonia <math>\xrightarrow{\text{mitosis/differentiation}}</math> Primary Spermatocyte</p> <p style="padding-left: 40px;">(ii) Primary Spermatocyte <math>\xrightarrow{\text{meiosis I}}</math> Secondary Spermatocyte</p> <p style="padding-left: 80px;"><math>\xrightarrow{\text{meiosis II}}</math> Spermatid</p> <p>(c) Rete testis, vasa efferentia</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>1+1</p> <p>1+1</p> <p>½</p> <p>½</p> <p>½ +½</p>                       | <p>4</p> |
| <b>SECTION - E</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                           |          |
| 31.                | <p>(a) (i)</p> <ul style="list-style-type: none"> <li>• DNA is a hydrophilic molecule and cannot pass through the cell membrane.</li> <li>• A bacterial cell is made competent by treating the bacterial cell with a specific concentration of a divalent cation such as calcium, which increases efficiency with which the DNA enters through pores in its cell wall/This creates certain transient pores in its cell and increases the efficiency of the cell to take up DNA.</li> </ul> <p>(ii) (1) Separation of DNA fragments .</p> <p style="padding-left: 40px;">(2) DNA fragments are negatively charged molecules, they can be separated according to their size by forcing them to move toward the anode under an electric field through agarose gel.</p> <p style="padding-left: 40px;">(3) To stain the DNA to visualize by exposure to UV radiation.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) (i) Specific Bt toxin gene <i>cry IAc/cry II Ab</i>, isolated from <i>Bacillus thuringiensis</i> bacteria and incorporated into the cotton plant to provide resistance to bollworm.</p> <p>(ii) <i>Bacillus thuringiensis</i> forms toxic insecticidal protein or Bt toxin protein during a particular growth phase, Bt toxin protein exist as inactive pro-toxin, on ingestion by the bollworm inactive toxin is converted into active form due to alkaline pH of the gut, activated</p> | <p>1</p> <p>½ +½</p> <p>1</p> <p>½ +½</p> <p>1</p> <p>1+1</p> <p>½ x6</p> |          |



|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                      |   |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|     | toxin binds to the surface of the mid-gut epithelial cells, create pores and causes cell swelling, lysis and death of the insect.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                      | 5 |
| 32. | <p>(a) (i)</p> <ul style="list-style-type: none"> <li>Pollen tube passes down the style, generative cell divides mitotically into two male gametes and male gametes are discharged into the embryo sac through the micropyle,</li> </ul> <p>One of the male gamete + Egg/ovum <math>\rightarrow</math> Zygote (2n)/zygote is diploid, Process is known as syngamy.</p> <p>Other male nucleus (n) + secondary nucleus (2n) <math>\rightarrow</math> PEN/Primary Endosperm Nucleus(3n)/PEN is triploid, this is known as triple fusion,<br/> <b>(Ploidy of zygote and PEN)</b></p> <p>Since two types of fusion (syngamy and triple fusion) in an embryo sac called double fertilization.</p> <ul style="list-style-type: none"> <li>Filiform apparatus of synergids guide entry of the pollen tube (at the micropylar end).</li> </ul> <p>(ii) To provide assured nutrition to the developing embryo.</p> <p style="text-align: center;"><b>OR</b></p> <p>(a) (i)</p> <ul style="list-style-type: none"> <li>Ampullary-isthmic junction/ampulla of fallopian tube ,</li> <li>A sperm comes in contact with zona pellucida (layer of ovum), the secretion of the acrosome of the sperm helps the sperm to enter into the cytoplasm of the ovum, this induces completion of meiosis II to form haploid ovum (ootid), haploid nucleus of the sperm and of the ovum fuse together to form the diploid zygote.</li> </ul> <p>On contact of sperm with zona pellucida induces changes in the membrane of the ovum that blocks the entry of the additional sperms.</p> <p>(ii)</p> <ul style="list-style-type: none"> <li>Blastocyst</li> <li>Trophoblast layer of the blastocyst gets attached to the endometrium, inner cell mass gets differentiated into an embryo, the uterine cells divide rapidly and blastocyst gets embedded in the endometrium of the uterus.</li> </ul> | <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2} \times 4</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2} \times 3</math></p> | 5 |
| 33. | <p>(a) Law of independent assortment : It states that when two pairs of traits are combined in a hybrid segregation of one pair of characters is independent of the other pair of characters</p> <p>Parents phenotype - Axial violet flower X Axial violet flower</p> <p>Parents Genotype -      AaVv                      X                      AaVv</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>                                                                                                                                                                                                                                                                                                                             |   |



|       |                      |                      |                            |                            |
|-------|----------------------|----------------------|----------------------------|----------------------------|
| ♀ \ ♂ | AV                   | Av                   | aV                         | av                         |
| AV    | AAVV<br>Axial Violet | AAVv<br>Axial Violet | AaVV<br>Axial Violet       | AaVv<br>Axial Violet       |
| Av    | AAVv<br>Axial Violet | AAvv<br>Axial white  | AaVv<br>Axial Violet       | Aavv<br>Axial White        |
| aV    | AaVV<br>Axial Violet | AaVv<br>Axial Violet | aaVV<br>Terminal<br>violet | aaVv<br>Terminal<br>Violet |
| av    | AaVv<br>Axial Violet | Aavv<br>Axial White  | aaVv<br>Terminal<br>Violet | aaavv<br>Terminal<br>White |

(Gametes and punnet square)

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

Axial violet – 9

Axial white – 3

Terminal violet – 3

Terminal white – 1

(Ratio and phenotypes)

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

Non-parental recombination in the F2 progeny shows independent assortment of characters.

$\frac{1}{2}$

OR

- Griffith selected 'S' strain and 'R' strain bacteria *Streptococcus pneumoniae*, 'S' strain – Virulent causes pneumonia, 'R' strain – Non-virulent does not cause pneumonia

$\frac{1}{2}$

'S' strain  $\xrightarrow{\text{Inject into mice}}$  mice die

'R' strain  $\xrightarrow{\text{Inject into mice}}$  mice live.

'S' strain (heat-killed)  $\xrightarrow{\text{Inject into mice}}$  → mice live

Heat killed 'S' strain + 'R' strain (live)  $\xrightarrow{\text{Inject into mice}}$  → mice die.

Griffith concluded that the 'R' strain bacteria had somehow been transformed by the heat killed 'S' strain bacteria.

1

1

$\frac{1}{2}$

- They purified biochemicals (Proteins, DNA, RNA etc.) from the heat killed 'S' cells and the fractions were added individually to the culture of the live 'R' cells,

1



|  |                                                                                                                                                                                                                                                                                                                                                          |                                                                 |          |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------|
|  | <p>DNA was able to cause transformation of 'R' cells into 'S' cells/they found that protein digesting enzyme or RNA digesting enzymes did not affect transformation or digestion with DNase did inhibit transformation indicating that the transforming substance is not a protein or RNA,<br/>This suggests that the DNA is the "genetic material".</p> | <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> | <p>5</p> |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------|

