LIFE SCIENCES

Name & Signature of the Invigilator

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PAPER – II

CODE-04

OMR Answer Sheet No. :

Roll No. :

(in figures as in Hall Ticket)

Roll Number in words : .....

.....

Question Booklet Sl. No.

041010

Time : 2 Hours] **No. of Printed Pages : 24** **[Maximum Marks : 200**

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page.
2. This paper consists of **one hundred (100)** multiple choice type of questions. **All** questions are compulsory.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker seal and do not accept an open booklet.
   (ii) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   (iii) After this verification is over, the Test Booklet Number should be entered on the OMR Answer Sheet and the OMR Answer Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the oval as indicated below on the correct response against each item.
   Example: (A) ● (C) (D) where (B) is the correct response.
5. Your responses to the items are to be indicated on the OMR Answer Sheet under Paper – II only. If you mark your response at any place other than in the oval in the OMR Answer Sheet, it will not be evaluated.
6. Rough Work is to be done in the end of this booklet.
7. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
8. You have to return the original OMR Answer Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet and duplicate copy of OMR Answer Sheet on conclusion of examination.
9. Use only Blue/Black Ball point pen.
10. Use of any calculator or any electronic devices or log table etc., are prohibited.
11. There shall be no negative marking.

પરીક્ષાર્થીઓ માટે સૂચનાઓ

1. આ પાનાની ટોચ પર દર્શાવેલી જગ્યામાં તમારો રોલ નંબર લખો.
2. આ પ્રશ્નપત્રમાં બહુવૈકલ્પિક ઉત્તરો ધરાવતા સો (૧૦૦) પ્રશ્નો આપેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.
3. પરીક્ષાની શરૂઆતમાં આપને પ્રશ્નપુસ્તિકા આપવામાં આવશે. પ્રથમ પાંચ (૫) મિનિટ દરમ્યાન તમારે પ્રશ્નપુસ્તિકા ખોલી અને ફરજિયાતપણે નીચે મુજબ પરીક્ષણ કરવું :
   (i) પ્રશ્નપુસ્તિકાનો વપરાશ કરવા માટે આ કવર પૃષ્ઠની ધાર પર આપેલ સીલ સ્ટીકર ફાડી નાખો. કોઈપણ સંજોગોમાં સીલ સ્ટીકર વગરની કે ખુલ્લી પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં.
   (ii) કવર પૃષ્ઠ પર છપાયેલ નિર્દેશાનુસાર પ્રશ્નપુસ્તિકાના પ્રશ્નો, પૃષ્ઠો અને સંખ્યાને બરાબર ચકાસી લો. ખામીયુક્ત પ્રશ્નપુસ્તિકા કે જેમાં પ્રશ્નો/ પૃષ્ઠો ઓછાં હોય, બે વાર છપાયા હોય, અનુક્રમમાં અથવા અન્ય કોઈ ફરક હોય અર્થાત કોઈપણ સંજોગોમાં ખામીયુક્ત પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં. અને જો ખામીયુક્ત પ્રશ્નપુસ્તિકા મળી હોય તો નિરીક્ષક પાસેથી તુરંત જ બીજી સારી પ્રશ્નપુસ્તિકા મેળવી લેવી. આ માટે ઉમેદવારને પાંચ (૫) મિનિટનો સમયગાળો આપવામાં આવશે. પછીથી, પ્રશ્નપુસ્તિકા બદલવામાં આવશે નહીં કે કોઈ વધારાનો સમયગાળો આપવામાં આવશે નહીં.
   (iii) આ ચકાસણી સમાપ્ત થાય પછી, પ્રશ્નપુસ્તિકાનો નંબર OMR જવાબ પત્રક પર લખવો અને OMR જવાબ પત્રકનો નંબર પ્રશ્નપુસ્તિકા પર લખવો.
4. પ્રત્યેક પ્રશ્ન માટે ચાર જવાબ વિકલ્પ (A), (B), (C) અને (D) આપવામાં આવેલ છે. તમારે સાચા જવાબના ઓવલ (oval) ને નીચે આપેલ ઉદાહરણ મુજબ પેનથી ભરીને સંપૂર્ણ કાળું કરવાનું રહેશે.
   ઉદાહરણ : (A) ● (C) (D) કે જ્યાં (B) સાચો જવાબ છે.
5. આ પ્રશ્નપુસ્તિકાના પ્રશ્નોના જવાબ અલગથી આપવામાં આવેલ OMR જવાબ પત્રકમાં પેપર-II લખેલ વિભાગમાં જ અંકિત કરવા. જો આપ OMR જવાબ પત્રકમાં આપેલ ઓવલ (oval) સિવાય અન્ય સ્થાને જવાબ અંકિત કરશો તો તે જવાબનું મૂલ્યાંકન કરવામાં આવશે નહીં.
6. કાચું કામ (Rough work) પ્રશ્નપુસ્તિકાના અંતિમ પૃષ્ઠ પર કરવું.
7. જો આપ OMR જવાબ પત્રક નિયત જગ્યા સિવાય અન્ય કોઈપણ સ્થાને, આપનું નામ, રોલ નંબર, ફોન નંબર અથવા એવું કોઈ ચિહ્નકે જેનાથી તમારી ઓળખ થઈ શકે, અંકિત કરશો અથવા અભદ્ર ભાષાનો પ્રયોગ કરો, અથવા અન્ય કોઈ અનુચિત સાધનોનો ઉપયોગ કરો, જેમકે અંકિત કરી દીધેલ જવાબ ભૂંસી નાખવો કે સફેદ શાહીનો ઉપયોગ કરી બદલશો તો આપને પરીક્ષા માટે અયોગ્ય જાહેર કરવામાં આવશે.
8. પરીક્ષા સમય પૂરો થઈ ગયા બાદ ઓરીજીનલ OMR જવાબ પત્રક જે તે નિરીક્ષકને ફરજિયાત સોંપી દેવું અને કોઈ પણ સંજોગોમાં તે પરીક્ષા ખંડની બહાર લઈ જવું નહીં. પરીક્ષા પૂર્ણ થયા બાદ ઉમેદવાર ઓરીજીનલ પ્રશ્નપુસ્તિકા અને OMR જવાબ પત્રકની ડુપ્લિકેટ કોપી પોતાની સાથે લઈ જઈ શકે છે.
9. માત્ર કાળી / ભૂરી બોલ પોઈન્ટ પેન વાપરવી.
10. કેલ્કયુલેટર,લોગ ટેબલ અને અન્ય ઈલેક્ટ્રોનિક યંત્રોનો ઉપયોગ કરવાની મનાઈ છે.
11. ખોટા જવાબ માટે નકારાત્મક ગુણાંકન પ્રથા નથી.

LIFE SCIENCES

Paper – II

1. Which amino acid is a precursor for the neurotransmitter serotonin ?

   (A) Phenylalanine
   (B) Tryptophan
   (C) Tyrosine
   (D) Histidine

2. Which one of the following statements is correct ?

   (A) RNA is stable in alkaline solution.
   (B) DNA is susceptible to alkaline hydrolysis because of the presence of the 2'–hydroxyl group.
   (C) Under alkaline conditions, RNA is hydrolyzed to generate a mixture of 2'–and 3'–nucleoside monophosphates.
   (D) Under alkaline conditions, DNA is hydrolyzed to generate a mixture of 2'–and 3'–nucleoside monophosphates.

3. Which of the following vitamins is also known as Vitamin B3 and plays a key role in NAD^+ biosynthesis ?

   (A) Pantothenic acid
   (B) Niacin
   (C) Nicotin
   (D) Riboflavin

4. Which among the following is an unsaturated fatty acid ?

   (A) Lauric acid
   (B) Myristic acid
   (C) Palmitic acid
   (D) Palmitoleic acid

5. Which disaccharide contains the structure Galactose ($\beta 1 \rightarrow 4$) Glucose ?

   (A) Sucrose
   (B) Maltose
   (C) Lactose
   (D) Cellobiose

6. Bradford, Biuret and Folin methods are used to detect which biomolecule ?

   (A) RNA
   (B) DNA
   (C) Lipids
   (D) Proteins

7. Which peptide bond will be broken when the following oligopeptide is treated with trypsin at pH 7.0 ?
Lys---1---Arg---2---Pro---3---Lys---4---Arg---5---Gly
(A) Bond 1
(B) Bond 2, 3, 4, 5
(C) Bond 4
(D) Bond 5

8. Which of the following is formed during the β-oxidation of odd-chain fatty acids that is NOT generated during even-chain oxidation ?
(A) Propionyl-CoA
(B) Acetyl-CoA
(C) NADH
(D) $FADH_2$

9. The site of ribosomal RNA (rRNA) synthesis and ribosome assembly in eukaryotic cells is known as
(A) Nucleolus
(B) Centromere
(C) Centrosome
(D) Mitochondria

10. In the Wnt signaling pathway, which molecule is stabilized to activate target gene transcription ?
(A) Shh
(B) TGFβ
(C) β Catenin
(D) Ihh

11. Which one of the following organelles is responsible for breaking down damaged organelles and macromolecules using hydrolytic enzymes ?
(A) Peroxisome
(B) Lysosome
(C) Golgi apparatus
(D) Endosome

12. Which coat protein complex is involved in transport from the ER to the Golgi apparatus ?
(A) COPI
(B) COPII
(C) Clathrin
(D) Caveolin

13. Which sterol is primarily found in the plasma membranes of fungi ?
(A) Sitosterol
(B) Stigmasterol
(C) Cholesterol
(D) Ergosterol

14. Which of the following is the start codon in eukaryotic translation ?
(A) UAG
(B) UGA
(C) AUG
(D) UAA

15. Which of the following histone modifications is most commonly associated with activation of gene transcription ?

(A) Methylation at H3K9
(B) Ubiquitination at H2A
(C) Acetylation at lysine residues
(D) Phosphorylation at H2AX

16. Which of the following proteins facilitates homologous recombination in prokaryotes by promoting strand invasion ?

(A) RecA
(B) Ku70/Ku80
(C) DNA ligase
(D) MutS

17. In the lac operon of *E.coli*, what happens when lactose is present but glucose is absent ?

(A) The lac repressor binds to the operator, preventing transcription
(B) RNA polymerase binds to the promoter, but transcription is blocked by the repressor
(C) The repressor is inactivated and transcription of the operon is enhanced by CAP-cAMP binding
(D) Both the repressor and CAP-cAMP bind, blocking transcription

18. Which of the following RNA molecules is primarily involved in silencing transposable elements in germ cells ?

(A) miRNA
(B) siRNA
(C) piRNA
(D) snRNA

19. Which of the following is NOT involved in post-transcriptional modification of mRNA in eukaryotes ?

(A) Splicing
(B) 5' capping
(C) Polyadenylation
(D) Reverse transcription

20. Which of the following factors is required specifically for the initiation of translation in prokaryotes ?

(A) RF – 1
(B) EF – G
(C) IF – 2
(D) EF – Tu

21. Upon activation by a ligand-bound GPCR, which enzyme is directly stimulated by the Gαs subunit to amplify the signal via second messenger production ?

(A) Phospholipase C

(B) Adenylyl cyclase

(C) Protein kinase C

(D) Mitogen-activated protein kinase

22. Cleavage of phosphatidylinositol 4,5-bisphosphate (PIP_2) by phospholipase C results in the generation of which two pivotal second messengers ?

(A) cAMP and AMP

(B) Inositol 1,4,5-trisphosphate (IP_3) and diacylglycerol (DAG)

(C) ATP and ADP

(D) NAD^+ and $FADH_2$

23. What is the functional role of calmodulin in calcium-dependent intracellular signaling cascades ?

(A) Facilitates calcium efflux from the cytoplasm

(B) Hydrolyzes intracellular calcium ions

(C) Serves as a calcium sensor that activates downstream target proteins

(D) Blocks ER membrane calcium channels

24. Within Receptor Tyrosine Kinases (RTKs), which specific domain mediates phosphorylation events following ligand-induced dimerization ?

(A) Extracellular ligand recognition domain

(B) Cytoplasmic tyrosine kinase domain

(C) Transmembrane helix

(D) SH2 adaptor-binding domain

25. Termination of GPCR signaling via the Gα subunit involves which intrinsic molecular mechanism ?

(A) Receptor endocytosis

(B) GTP hydrolysis to GDP by intrinsic GTPase activity

(C) Ligand dissociation

(D) Activation of Ras-MAPK pathway

26. In the Transforming Growth Factor-beta (TGF-β) signaling pathway, which transcriptional regulators are activated downstream to mediate cellular responses ?

(A) ERK family kinases

(B) Signal transducers and activators of transcription (STATs)

(C) SMAD proteins

(D) β-catenin

27. During vertebrate embryogenesis, which morphogenetic event delineates the establishment of the trilaminar germ disc ?

(A) Cleavage

(B) Gastrulation

(C) Neurulation

(D) Organogenesis

28. The transcriptional regulators that determine segmental identity in *Drosophila* possess which conserved DNA-binding motif ?

(A) SH2 domain

(B) Zinc finger domain

(C) Homeobox domain

(D) PAS domain

29. The Spemann-Mangold organizer exerts its embryonic influence in amphibians primarily through

(A) Establishment of anterior-posterior polarity

(B) Induction of dorsal mesoderm and neural ectoderm via signaling inhibition

(C) Suppression of ventral mesodermal fate

(D) Activation of apoptotic pathways during morphogenesis

30. In a developmental context, "competence" of a responding tissue is defined as its

(A) Ability to migrate in response to morphogens

(B) Propensity for lineage-specific differentiation

(C) Receptivity to inductive cues from neighboring tissues

(D) Capacity for cell cycle re-entry post-commitment

31. Sequential patterning of *Drosophila* segments is orchestrated by

(A) Homeotic genes → Gap genes → Pair-rule genes

(B) Maternal effect genes → Gap genes → Pair-rule genes → Segment polarity genes

(C) Pair-rule genes → Homeotic genes → Gap genes

(D) Maternal effect genes → Homeobox genes → Segment polarity genes

32. The chick embryonic structure Hensen's node is developmentally homologous to

(A) Amphibian blastopore lip

(B) Spemann's organizer

(C) Mammalian primitive groove

(D) Neural fold crest

33. During tetrapod limb morphogenesis, the Apical Ectodermal Ridge (AER) is primarily associated with

(A) Axial rotation of limb structures

(B) Maintenance of proximal-distal outgrowth via FGF signaling

(C) Establishment of anterior-posterior identity via Shh

(D) Induction of vasculature within the limb bud

34. The CLAVATA3 (CLV3)-WUSCHEL (WUS) signalling pathway has evolved as the central regulatory pathway that

(A) Maintains the adaxial identity in the developing leaf primordia

(B) Coordinates stem cell proliferation with differentiation in shoot apical meristem

(C) Maintain development of vascular system in plants

(D) Coordinates the secondary growth

35. The primary photoreceptor mediating phototropic curvature in higher plants under unilateral blue light is

(A) Phytochrome B
(B) Phototropin
(C) Cryptochrome
(D) UVR8

36. In NADP-Malic Enzyme type C4 photosynthesis, the initial carboxylation step occurs

(A) In mesophyll cells via Rubisco
(B) In mesophyll cells via PEP carboxylase
(C) In bundle sheath cells via Rubisco
(D) In bundle sheath cells via NADP-ME

37. Which hormone predominantly governs stomatal closure through modulation of ion fluxes under water deficit conditions ?

(A) Auxin
(B) Cytokinin
(C) Abscisic acid (ABA)
(D) Ethylene

38. The acid growth theory explaining cell wall extensibility is most closely linked to the physiological action of

(A) Auxin
(B) Gibberellins
(C) Cytokinins
(D) Ethylene

39. Photoperiodic induction of flowering in long-day plants involves

(A) Diurnal degradation of CONSTANS (CO) protein
(B) CO stabilization in light and activation of FLOWERING LOCUS T (FT)
(C) Vernalization-dependent FT activation
(D) Phytochrome A-mediated repression of FT expression

40. The functional role of the Casparian strip in root endodermis is to

(A) Permit unregulated apoplastic transport

(B) Enable direct nutrient uptake into xylem

(C) Establish selective barrier by restricting apoplastic movement into the stele

(D) Facilitate root hair elongation under osmotic stress

41. The light-harvesting complexes are located in the

(A) stroma

(B) thylakoid membrane

(C) intermembrane space of chloroplast

(D) Outer membrane of chloroplast

42. The primary mechanism of water ascent in xylem is described by the

(A) ATP-driven transmembrane water pumps

(B) Root pressure-mediated bulk flow

(C) Cohesion-tension mechanism driven by transpiration

(D) Guttation-induced hydrostatic push

43. Which one of the following is true for Florigen ?

(A) Produced in the leaves and control the leaf development

(B) Produced in the leaves and is induce for flowering

(C) Produced in the stem and control the leaf development

(D) Produced in the stem and is responsible for controlling fruiting

44. Which of the following best describes CO_2 assimilation in CAM plants ?

(A) Simultaneous fixation and Calvin cycle operation in daylight

(B) Temporal separation with nocturnal malate storage

(C) Spatial separation in mesophyll and bundle sheath cells

(D) CO_2 fixation via Rubisco only at night

45. Which hormone increases water reabsorption in the collecting ducts of the kidney ?

(A) Aldosterone

(B) Renin

(C) Vasopressin (ADH)

(D) Atrial natriuretic peptide (ANP)

46. Which physiological effect describes the decrease in oxygen affinity of hemoglobin at low pH and high CO_2 levels ?

(A) Haldane effect

(B) Bohr effect

(C) Root effect

(D) Pasteur effect

47. The amount of carbon dioxide that can be transported in the blood is influenced by the percent saturation of hemoglobin with oxygen. Hence, the lower the amount of oxyhemoglobin, the higher the carbon dioxide carrying capacity of the blood. This relationship is called

(A) Bohr effect

(B) Chloride shift

(C) Haldane effect

(D) Hamburg effect

48. What does the T wave in an ECG represent ?

(A) Ventricular depolarization

(B) Atrial depolarization

(C) Ventricular repolarization

(D) Atrial repolarization

49. A 25-year-old male athlete was brought to the emergency room with complaints of severe dehydration, low blood pressure and generalized fatigue. On examination, his skin appeared unusually pigmented (bronze-like) and blood tests revealed low sodium, high potassium and low cortisol levels. His ACTH levels were significantly elevated. Based on this clinical presentation, which of the following best explains the physiological condition of this patient ?

(A) Overproduction of cortisol due to a pituitary adenoma resulting in Cushing's disease.

(B) Autoimmune destruction of adrenal cortex leading to Addison's disease and secondary adrenal insufficiency.

(C) Autoimmune destruction of adrenal cortex leading to Addison's disease and primary adrenal insufficiency.

(D) Excessive ACTH production due to hypothalamic CRH hypersecretion causing adrenal hyperplasia.

50. Match the following gastrointestinal hormones (Column A) with their primary functions (Column B).

Column A	Column B
I. Gastrin	1. Stimulates gallbladder contraction and pancreatic enzyme secretion
II. Secretin	2. Stimulates secretion of HCl in the stomach
III. Cholecystokinin (CCK)	3. Inhibits gastric emptying and acid secretion
IV. Somatostatin	4. Stimulates secretion of bicarbonate from pancreas

Select the options with the correct matches :

(A) I – 2, II – 4, III – 1, IV – 3

(B) I – 2, II – 1, III – 4, IV – 3

(C) I – 3, II – 2, III – 1, IV – 4

(D) I – 1, II – 3, III – 2, IV – 4

51. Which enzyme is secreted by the pancreas and continues the digestion of proteins in the small intestine ?

(A) Pepsin
(B) Amylase
(C) Lipase
(D) Trypsin

52. Which of the following is an example of an autosomal recessive disorder ?

(A) Hemophilia A
(B) Huntington's disease
(C) Cystic fibrosis
(D) Turner syndrome

53. In an X-linked recessive disorder, what is the probability that a carrier mother and an unaffected father will have a carrier daughter ?

(A) 0%
(B) 25%
(C) 50%
(D) 100%

54. Which of the following is an example of codominance in humans ?

(A) Skin color
(B) ABO blood group – AB genotype
(C) Eye color
(D) Cystic fibrosis

55. If a trait is passed from an affected mother to all of her children, but affected fathers never transmit the trait, what is the most likely mode of inheritance ?

(A) Autosomal dominant
(B) Y-linked inheritance
(C) X-linked recessive
(D) Mitochondrial inheritance

56. In a population, the frequency of the recessive allele (a) is 0.3. According to Hardy-Weinberg equilibrium, what is the expected frequency of individuals homozygous for the recessive allele (aa) ?

(A) 0.09 (B) 0.21

(C) 0.42 (D) 0.49

57. A male affected by an autosomal dominant disorder mates with a female who is unaffected. What is the probability that their offspring will inherit the disorder ?

(A) 0% (B) 25%

(C) 50% (D) 75%

58. Which of the following best exemplifies epistasis in animals ?

(A) ABO blood group in humans

(B) Eye color determined by a single gene

(C) Coat color in Labrador retrievers

(D) Sickle cell anemia

59. Which of the following best explains why mitochondrial diseases show maternal inheritance ?

(A) Mitochondrial DNA is present only in sperm and not in eggs.

(B) Mitochondrial DNA is inherited from both parents, but only maternal mtDNA is expressed.

(C) Mitochondria in the embryo are derived exclusively from the egg cytoplasm.

(D) Mitochondrial DNA undergoes recombination and is inherited randomly.

60. In a test cross, a heterozygous tall pea plant (Tt) is crossed with a homozygous recessive dwarf pea plant (tt). What is the expected phenotypic ratio in the offspring ?

(A) 1 tall : 1 dwarf (B) 3 tall : 1 dwarf

(C) All tall (D) All dwarf

61. Which of the following describes the inheritance controlled by cytoplasmic genes ?

(A) Extranuclear inheritance
(B) Heritability
(C) Environmental factors
(D) Complex trait

62. The purpose of test cross is to determine the

(A) Phenotype of the organism
(B) Genotype the organism
(C) Dominant characters of an organism
(D) Ploidy level of organism

63. Which one of the following involves the comparison of protein profiles of different plants to infer evolutionary relationships and their classification ?

(A) Cladistics
(B) Phenetics
(C) Cytotaxonomy
(D) Serotaxonomy

64. A scientist is studying the phylogenetic relationships among various species using molecular data. Which of the following methods would be most appropriate for constructing a phylogenetic tree ?

(A) Morphological comparisons
(B) DNA sequencing
(C) Biogeographic distribution
(D) Behavioral studies

65. Which of the following best describes an ecosystem with many different species, each represented by a small and roughly equal number of individuals ?

(A) Low biodiversity
(B) Low species richness
(C) High species richness and high evenness
(D) High species dominance

66. What does the ecological niche of a species refer to ?

(A) The geographic area where the species is found

(B) The set of resources and environmental conditions the species uses and the interactions it has

(C) The total number of individuals of that species in a habitat

(D) The taxonomic classification of the species

67. Which one is NOT true about the APG System of classification of plants ?

(A) This system relied heavily on morphological characteristics only

(B) It classifies plants based on evolutionary relationships, utilizing molecular data to determine these relationships

(C) It aims to define taxonomic groups that are monophyletic, meaning they include all descendants of a common ancestor.

(D) It represents a shift towards a more natural and evolutionarily informed classification of flowering plants

68. Monophyletic group

(A) Include all representatives of a clade but not most recent common ancestors

(B) Contain unrelated organisms

(C) Contain all representatives of clade and most recent common ancestors

(D) Include most recent ancestors (common) but not its decendents

69. In a recent study, researchers found that a certain plant species has a very limited geographic range. This is an example of

(A) Endemism

(B) Cosmopolitan distribution

(C) Habitat generalization

(D) Extinction risk

70. What defines a foundation species in an ecological community ?

(A) A species that contributes to the physical structure of a habitat and supports other organisms

(B) A predator that regulates prey populations

(C) A species that migrates seasonally and impacts nutrient cycling

(D) A species introduced by humans into a non-native habitat

71. Carrageenan is made from the various seaweeds of

(A) Rhodophyceae (B) Chlorophyceae

(C) Phaeophyceae (D) Xanthophyceae

72. Which of the following best defines an indicator species ?

(A) A species introduced into a new ecosystem by humans

(B) A species whose presence, absence or abundance reflects a specific environmental condition

(C) A species that forms the base of all food chains

(D) A species that competes with all other native species

73. Mycorrhizal fungi form mutualistic relationships with plant roots. What benefit do the fungi provide ?

(A) Increased photosynthetic capacity

(B) Enhanced seed dispersal

(C) Improved water and nutrient uptake

(D) Protection from herbivores

74. Which of the following best defines the carrying capacity of an environment ?

(A) The maximum number of organisms that an ecosystem can sustain indefinitely.

(B) The maximum number of species that can coexist in a given habitat.

(C) The total biomass that a food chain can support.

(D) The threshold level of predation an ecosystem can withstand.

75. Which of the following best exemplifies resource partitioning among coexisting species ?

(A) Two bird species feed on the same insects at the same time

(B) Two species of lizards use different parts of the same tree for basking

(C) One species outcompetes another and drives it to extinction

(D) A predator species hunts multiple prey species

76. Which statement best describes bottom-up control in an ecosystem ?

(A) Top predators influence the entire food web

(B) Nutrient availability and primary producer abundance regulate higher trophic levels

(C) Herbivores regulate plant diversity

(D) Decomposers are solely responsible for energy flow

77. Which of the following is a possible consequence of the Allee effect ?

(A) Increase in reproductive success due to cooperative behavior in large populations

(B) Inability of individuals in small populations to find mates, leading to further population decline

(C) Rapid recovery of populations after a bottleneck event

(D) Genetic drift causing more diversity in small populations

78. Which of the following statements is true about the Lotka-Volterra model of predator-prey interactions ?

(A) It suggests that predator and prey populations grow exponentially without limitations.

(B) It describes a stable equilibrium where predator and prey populations remain constant over time.

(C) It predicts oscillations in predator and prey populations, where increases in prey lead to increases in predators, followed by a decline in both.

(D) It assumes that prey populations are only limited by the presence of predators.

79. The exponential growth of a population is characterized by

(A) A linear increase in population size over time.

(B) An increase in population size that accelerates as population density increases.

(C) A population that stabilizes at the carrying capacity.

(D) Population growth limited by predation and competition.

80. What does the founder effect refer to in evolutionary biology ?

(A) Loss of genetic variation due to selective mating

(B) Genetic drift that occurs when a small group establishes a new population

(C) The original population's complete gene pool

(D) Random mutation in a large population

81. Which event marks the earliest step in the origin of life on Earth ?

(A) Formation of RNA molecules

(B) Appearance of oxygen in the atmosphere

(C) Evolution of photosynthetic prokaryotes

(D) Development of multicellular eukaryotes

82. Which type of natural selection favors both extreme phenotypes over intermediate ones ?

(A) Stabilizing selection

(B) Directional selection

(C) Disruptive selection

(D) Artificial selection

83. Which of the following is an example of intersexual selection ?

(A) Male lions fighting for pride dominance

(B) Male peacocks displaying large colorful tails to attract females

(C) Insects using camouflage to avoid predation

(D) Territorial defense by male penguins

84. Kin selection explains altruistic behavior because

(A) It increases genetic diversity in the population

(B) Helping relatives increases indirect fitness by passing shared genes

(C) It promotes mating success with non-relatives

(D) It reduces population density for resource conservation

85. Which of the following is an example of convergent evolution ?

(A) Human arms and bat wings sharing the same bone structure

(B) Flippers of dolphins and fins of sharks used for swimming

(C) Variations in beak shapes among Darwin's finches

(D) Eye color variation in humans

86. Which of the following is primarily used to detect specific DNA sequences in a sample ?

(A) TALENs

(B) CRISPR-Cas9

(C) Southern blotting

(D) ZFNs

87. Which of the following is NOT an in-situ bio-remediation strategy ?

(A) Bioaugmentation

(B) Biopiling

(C) Bioventing

(D) Biostimulation

88. Which method is based on the direct delivery of DNA into plant cells using gold or tungsten particles ?

(A) Electroporation

(B) Microinjection

(C) Biolistic particle delivery

(D) Transduction

89. Hybridoma technology, Phage display technology and Single B-cell technology are methods used for the production of which molecules ?

(A) Polyclonal antibodies

(B) Monoclonal antibodies

(C) Inhibitory drugs

(D) Penicillin

90. Which of the following methods is a biotechnological process where plant cells (protoplasts) from different species are fused to create a hybrid plant with combined traits from both parents ?

(A) Somatic hybridization

(B) Organogenesis

(C) Totipotency

(D) Somatic embryogenesis

91. Kanamycin resistance, glyphosate resistance and green fluorescent protein are marker genes used for detecting which of the following ?

(A) Gene modifications

(B) Metabolism alteration

(C) Enzyme activity

(D) ATP synthesis

92. Which of the processes are executed using Bioleaching ?

(A) Bioremediation

(B) Microfiltration

(C) Coal sulfurization

(D) Metal toxicity

93. In a fluorescence microscopy experiment, you want to visualize the distribution of two different proteins within the same cell. Which combination of dyes or labels would NOT allow you to observe both proteins simultaneously ?

(A) FITC and Alexa Fluor 488

(B) FITC and Rhodamine

(C) GFP and CFP

(D) DAPI and Hoechst dyes

94. You are studying the effect of a specific drug on the cell cycle in cancer cells. You use a flow cytometer to analyze the DNA content of cells. Which of the following steps are involved in analyzing the phases of the cell cycle ?

P. Staining the DNA with a fluorescent dye.

Q. Sample preparation of the isolate to be screened.

R. Plotting fluorescence intensity against cell count.

S. Sorting cells based on size and granularity.

(A) P and R only

(B) Q and S only

(C) P, Q and R only

(D) P, R and S only

95. When performing a real-time Polymerase Chain Reaction (PCR), you observe a delayed melt curve of your gene of interest with 30 amplification cycles. Which of the following modifications would most likely help improve specificity ?

(A) Increasing the annealing temperature

(B) Reducing the extension time

(C) Lowering the Mg^{2+} concentration

(D) Increasing the number of amplification cycles

96. FRET is most appropriate for detecting which of the following interactions ?

(A) Protein-protein interactions in live cells

(B) Protein-DNA interactions in live cells

(C) Protein-protein interactions in cryopreserved cells with damaged cellular integrity

(D) Protein-DNA interactions in cryopreserved cells with damaged cellular integrity

97. Which of the following techniques can NOT be used for determining the three-dimensional structure of a membrane protein at atomic resolution ?

(A) Cryo-electron microscopy (cryo-EM)

(B) X-ray crystallography

(C) NMR spectroscopy

(D) Confocal microscopy

98. Which of the following methods would be most suitable for detecting epigenetic modifications ?

(A) Real-time PCR

(B) Reporter gene assay using GFP

(C) ChIP-Seq

(D) RNA-Seq

99. Which of the following techniques is NOT suited for analyzing gene expression across the entire genome ?

(A) Real-time PCR

(B) DNA microarray

(C) Western blot

(D) RNA sequencing

100. Which condition is essential for sympatric speciation to occur ?

(A) Geographic isolation

(B) Temporal separation in mating periods

(C) Physical barriers like rivers or mountains

(D) Complete hybrid sterility

Space for Rough Work