LIFE SCIENCES

Question Booklet Sl. No.: 041160

Name & Signature of the Invigilator .....

.....

PAPER – II OMR Answer Sheet No. :

CODE-04 Roll No. :

(in figures as in Hall Ticket)

Roll Number in words : .....

.....

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.

SEAL

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-IIલખેલ વિભાગમાં જ અંકિત કરવા. જો આપ OMR જવાબ પત્રકમા 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 ચિહ્ન કે 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 સોપી 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.

DO NOT WRITE HERE

LIFE SCIENCES

Paper – II

1. Which of the following reactions in glycolysis is coupled with the production of NADH, contributing to the cell's reducing power ?

(A) Phosphoenolpyruvate to pyruvate

(B) Glucose to glucose-6-phosphate

(C) Fructose-6-phosphate to fructose-1,6-bisphosphate

(D) Glyceraldehyde-3-phosphate to 1,3-bisphosphoglycerate

2. What is the primary factor responsible for proliferation of blastemal cells during limb regeneration in salamanders ?

(A) Fgf8 from neurons only

(B) Fgf8 from AEC and newt Anterior Gradient protein from neurons

(C) newt Anterior Gradient protein from AEC and Fgf8 from neurons

(D) newt Anterior Gradient protein from neurons only

3. Match the items in Group – A with their corresponding functions in Group – B, and choose the correct option.

Group – A	**Group – B**
1. C, H, O and N	a. elements that activate or inhibit enzymes
2. Mg and P	b. elements of biomolecules and structural elements
3. Na and K	c. elements of energy related chemical compounds
4. Zn and Mg	d. alters the osmotic potential of cell

(A) 1-d; 2-c; 3-a; 4-b (B) 1-b; 2-c; 3-d; 4-a

(C) 1-d; 2-a; 3-c; 4-b (D) 1-a; 2-c; 3-d; 4-b

4. As compared to a healthy resident in the plains, the blood of age and sex matched healthy inhabitant residing in high mountain area (~16000 ft altitude) is likely to have

(A) increased RBC count and increased hemoglobin concentration

(B) decreased RBC count and decreased hemoglobin concentration

(C) increased RBC count but decreased hemoglobin concentration

(D) decreased RBC count but increased hemoglobin concentration

5. Which of the following factors is most likely to contribute to an "Allee effect" in a population ?

(A) High population density leading to increased competition for resources

(B) Low population density resulting difficulty in finding mates and lower reproductive success

(C) Rapid population growth exceeding the carrying capacity of the environment

(D) Increased predation pressure leading to a sharp decline in population size

6. The diploid chromosome number of a plant is 10. What will be the chromosome number in the endosperm ?

(A) 5 (B) 10 (C) 15 (D) 20

7. In vertebrates, progesterone

(A) is produced by the posterior hypothalamus and stored in the posterior pituitary before release

(B) is produced by the anterior hypothalamus and stored in the suprachiasmatic nucleus before release

(C) plays a major role in preparing the uterus for implantation

(D) is solely responsible for stimulation of FSH production and follicular growth

8. Which all peptide bond(s) will be broken when the following oligopeptide is treated with trypsin at pH 7.0 ? (The number between the amino acid represents the bond)

Lys---1---Ser---2---Val---3---Lys---4---Arg---5---Gly

(A) Bond 1 and Bond 2 (B) Bond 2 and Bond 5

(C) Bond 3 and Bond 4 (D) Bond 1, Bond 4 and Bond 5

9. _____ signaling pathway phosphorylates SMAD to regulate downstream gene expression.

(A) Wnt (B) TGF-β

(C) Notch (D) Hedgehog

10. Closest intra lysosomal pH is

(A) 8.0 (B) 7.0 (C) 6.5 (D) 5.0

11. Clathrin-coated vesicles are transported from

(A) Golgi to ER

(B) ER to Golgi

(C) ER to mitochondria

(D) trans-Golgi to late endosome

12. Which is the major sterol present in the plasma membrane of animal cells ?

(A) Cholesterol (B) Ergosterol

(C) Lanosterol (D) Stigmasterol

13. Spectrin and ankyrin are common examples of proteins found in the membranes of

(A) White Blood Cells (B) Red Blood Cells

(C) Thrombocytes (D) Melanocytes

14. _____ enzyme is involved in the direct repair of single-strand DNA breaks.

(A) DNA polymerase (B) DNA ligase

(C) Exonuclease (D) Primase

15. In the lac operon of *Escherichia 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

16. Which of the following is most likely to be involved in gene silencing in eukaryotes ?

(A) tRNA
(B) mRNA
(C) miRNA
(D) rRNA

17. Which of the following metal pairs is required for the function of Cytochrome C oxidase ?

(A) Copper and Iron
(B) Iron and Zinc
(C) Magnesium and Copper
(D) Sodium and Iron

18. 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

19. Which of the following sequences correctly represents the pathway for insulin receptor signaling leading to glucose uptake ?

(A) Insulin → PI3K → PDK1 → Akt → GLUT4 translocation
(B) Insulin → Ras → ERK → Akt → GLUT4 translocation
(C) Insulin → GPCR → cAMP → PKA → GLUT4 translocation
(D) Insulin → JAK → STAT → Akt → GLUT4 translocation

20. Which one of the following events will NOT usually lead to the transformation of a normal cell to a cancerous state ?

(A) Loss of function of tumor suppressor genes
(B) Gain of function of oncogenes
(C) Loss of function of pro-apoptosis related genes
(D) Gain of function of genes involved in nucleotide exchange repair

21. Choose the correct statement about Ca^{2+}.

(A) It favors both, blood clotting and Na-K ATPase activity

(B) It stimulates Na-K ATPase activity, but inhibits neurotransmitter release from synaptic terminals

(C) It inhibits both, Na-K ATPase activity, and muscle contraction

(D) It facilitates release of neurotransmitters at the pre-synaptic terminal, but inhibits Na-K ATPase activity

22. In which of the following zones do we find stem cells in *Arabidopsis* root ?

(A) Transition zone

(B) Meristematic zone

(C) Elongation zone

(D) Differentiation zone

23. Holoblastic cleavage

(A) is absent in invertebrates

(B) is restricted to a discoidal region of the egg

(C) occurs throughout the egg

(D) is exhibited in aves

24. Which of the following sequences best describes the process of water uptake and transport from roots to leaves in plants via the cohesion-tension mechanism ?

(A) Root pressure → Active transport in phloem → Transpiration pull → Xylem transport

(B) Transpiration → Cohesion of water molecules → Negative pressure in xylem → Water uptake by roots

(C) Osmosis in leaves → Guttation → Water transport via xylem → Evaporation from roots

(D) Active transport of water → Cohesion in phloem → Translocation → Transpiration

25. Which of the following is a modified monosaccharide that plays a crucial role in the structure of bacterial cell walls, specifically in peptidoglycan ?

(A) N-acetylmuramic acid
(B) N-acetylmannosamine
(C) N-acetylgalactosamine
(D) N-acetylneuraminic acid

26. What is the correct functional difference between hemoglobin and myoglobin ?

(A) Hemoglobin is not an allosteric protein but myoglobin is
(B) The Hill coefficient for hemoglobin is about 3 times than myoglobin
(C) Hemoglobin has a higher affinity for oxygen than myoglobin
(D) The affinity of hemoglobin for oxygen is independent of pH, while myoglobin's affinity for oxygen is dependent on pH

27. Bradford, Biuret and Folin methods are used to detect

(A) Proteins
(B) Lipids
(C) Nucleic acids
(D) Carbohydrates

28. Match the terms in Group – I with their definitions in Group – II.

Group – I	**Group – II**
P. Ammonification	1. Conversion of atmospheric nitrogen into ammonia
Q. Denitrification	2. Conversion of organic nitrogen into ammonia
R. Nitrification	3. Conversion of nitrite or nitrate into atmospheric nitrogen
S. Nitrogen fixation	4. Conversion of ammonia into nitrite and nitrate

(A) P – 2, Q – 3, R – 1, S – 4
(B) P – 3, Q – 2, R – 4, S – 1
(C) P – 3, Q – 2, R – 1, S – 4
(D) P – 2, Q – 3, R – 4, S – 1

29. The process of photophosphorylation during photosynthesis involves

(A) ATP synthesis using the proton gradient generated by the electron transport chain in the chloroplast

(B) Direct absorption of sunlight by Rubisco to produce ATP

(C) Transport of electrons from Photosystem I to Photosystem II

(D) Breakdown of ATP to release energy for the Calvin cycle

30. During water uptake in plants, if the free energy of cell water is lower than the free energy of external water, net flux will be

(A) into the cell

(B) out of the cell

(C) no net movement

(D) both (A) and (B)

31. Which of the following is required for the initiation of translation in prokaryotes ?

(A) RF-1 (B) EF-G

(C) IF-2 (D) EF-Tu

32. Match contents of Group – A with Group – B and choose the correct option.

Group – A	**Group – B**
1. Photoperiodism	a. *Mimosa pudica*
2. Phototropism	b. Diurnal light
3. Thigmonasty	c. Auxin
4. Nyctinasty	d. Florigen

(A) 1 – d, 2 – c, 3 - a, 4 – b

(B) 1 – c, 2 - a, 3 – d, 4 – b

(C) 1 – d, 2 – a, 3 - c, 4 – b

(D) 1 - a, 2 – c, 3 – d, 4 – b

33. Torus and Margo are the parts of

(A) Phloem elements of angiosperms

(B) Complex pit membrane of tracheids

(C) Simple pit membrane of vessels

(D) Xylem elements of angiosperms

34. In an electrocardiogram, P wave denotes

(A) Ventricular depolarisation

(B) Atrial depolarisation

(C) Ventricular repolarisation

(D) Atrial repolarisation

35. Choose the correct statement.

(A) Thyroid hormone diffuses through the plasma membrane of a target cell, binds to an intracellular receptor and changes gene expression.

(B) Epinephrine diffuses through the plasma membrane of a target cell, binds to an intracellular receptor and changes gene expression.

(C) Estrogen diffuses through the plasma membrane of a target cell, binds to an intracellular receptor and changes gene expression.

(D) Estrogen binds to a receptor within the plasma membrane and initiates an intracellular signaling cascade.

36. Which of the following groups is characterized by bilateral symmetry and a coelom ?

(A) Cnidaria

(B) Porifera

(C) Annelida

(D) Platyhelminthes

37. The P450 cytochromes are members of

(A) Hydrolase

(B) Lyase

(C) Oxidoreductase

(D) Transferase

38. The primary function of insulin is to

(A) Breakdown of glycogen to glucose

(B) Increasing blood glucose levels by promoting gluconeogenesis

(C) Inhibit protein synthesis in muscle cells

(D) Lower blood glucose levels by facilitating the uptake of glucose into cells

39. The different segments of the renal tubule (Column – A) and the mechanism of Na^+ transport in the apical membrane of tubular cells (Column – B) are tabulated below :

Column – A	Column – B
I. Proximal tubule	1. Na^+–Cl^- symporter
II. Thick ascending loop of Henle	2. Diffusion through Na^+ selective channels
III. Early distal tubule	3. Na^+– glucose symporter
IV. Late distal tubule and collecting duct	4. $1Na^+$ $1K^+$ $2Cl^-$ symporter

Select the options with the correct matches.

(A) I – 3, II – 4, III – 1, IV – 2

(B) I – 4, II – 3, III – 2, IV – 1

(C) I – 1, II – 2, III – 3, IV – 4

(D) I – 2, II – 1, III – 4, IV – 3

40. Choose the correct statement about the role of Calcium in cellular signaling.

(A) It is released from the nucleus during signal transduction.

(B) IP3 receptors in the plasma membrane release calcium into the extracellular matrix.

(C) Its binding to calmodulin leads to activation of downstream target proteins.

(D) Its concentration is higher in the cytosol compared to the endoplasmic reticulum at rest.

41. Which of the following enzymes catalyzes the hydrolysis of starch into maltose in the human digestive system ?

(A) Carboxypeptidase

(B) Pancreatic amylase

(C) Chymotrypsin

(D) Sucrase-isomaltase complex

42. In a population, the frequency of the recessive allele (a) is 0.3. According to Hardy-Weinberg equilibrium, what is the expected frequency of heterozygotes (Aa) in this population ?

(A) 0.09 (B) 0.21

(C) 0.42 (D) 0.49

43. In plants, meiosis takes place during sporogenesis and form four haploid spores. What is the significance of this division during reproduction ?

(A) It is responsible for the growth and development of an organism

(B) It helps in maintaining the same number of chromosomes in an organism

(C) It helps in repair of damaged chromosomes

(D) It helps the cell to maintain proper size

44. 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

45. Crassulacean Acid Metabolism in plants minimizes water loss in arid environments by

(A) Opening stomata during the day and closing them at night

(B) Fixing carbon dioxide at night and storing it as malic acid for use during the day

(C) Using the C3 pathway during the day and the C4 pathway at night

(D) Preventing photorespiration by directly converting CO_2 into glucose in mesophyll cells

46. The concept of ecological niche can be best described as the

(A) Physical habitat of an organism

(B) Role and position a species has in its environment

(C) Evolutionary history of a species

(D) Genetic diversity within a species

47. Which of the following characteristics is INCORRECT among the molecules Carboxypeptidase, Chymotrypsin, Elastase and Trypsin ?

(A) They are all proteolytic enzymes

(B) They are all synthesized as inactive precursors

(C) All are activated by proteolytic cleavage

(D) All require metal ion for function

48. Which of the following biomes is characterized by low temperatures and low precipitation with permafrost present ?

(A) Tropical rainforest

(B) Desert

(C) Tundra

(D) Grassland

49. 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

50. In a food web, trophic cascades

(A) Increase biodiversity by ensuring equal distribution of species across trophic levels

(B) Refer to the top-down effects that predators have on the populations of organisms at lower trophic levels

(C) Occur only in aquatic ecosystems and are driven by the presence of apex predators

(D) Are bottom-up processes controlled by primary producers and resource availability

51. Ubiquitin is a

(A) Heterocyclic compound that gets attached to the target protein by the enzyme ubiquitinase

(B) Quinine compound that gets attached to the target protein by ubiquitin ligase

(C) Polypeptide that gets attached to the target protein by ubiquitin ligase

(D) Derivative of CTP that gets attached to the target protein by ubiquitin ligase

52. Which of the following is the best example of stabilizing selection in evolution ?

(A) Longer necks in giraffes

(B) High survival rate of intermediate birth weights in humans

(C) Increase in the number of black-colored moths during the industrial revolution

(D) Speciation in Darwin's finches

53. Which of the following behavioral adaptations is most likely the result of sexual selection ?

(A) Camouflage in insects

(B) Bright plumage in male birds

(C) Cooperative hunting in wolves

(D) Migration of birds

54. Which of the following statements best describes the genetic phenomenon of epistasis ?

(A) It occurs when one gene influences the expression of multiple phenotypic traits.

(B) It occurs when one gene masks or suppresses the effect of a gene at another locus.

(C) It involves the expression of both alleles at a locus in a heterozygote.

(D) It refers to the blending of two phenotypes in a heterozygous organism.

55. One of the features of the mitochondrial inheritance is that the disorder

(A) Is passed from mother to all her offspring, regardless of sex

(B) Is passed from father to son, but not to daughters

(C) Is inherited only if both parents are affected

(D) Follows the same inheritance pattern as autosomal dominant traits

56. Which of the following best describes convergent evolution ?

(A) Mutations that introduce the same polymorphism into two species after they diverged from a common ancestor

(B) The evolution of similar phenotypes in distantly related species

(C) The finding that there are parallel gene duplications in two unrelated species

(D) Having only synonymous substitutions in their genes

57. Which of the following sets of statements is correct ?

P. Most speciation is thought to occur via allopatric speciation.

Q. Polyploidy is an example of sympatric speciation.

R. Geographic isolation can eventually lead to reproductive isolation.

S. Speciation cannot occur without geographic isolation.

(A) P and Q

(B) Q and R

(C) P, Q and R

(D) Q, R and S

58. The commonly used method for the production of monoclonal antibodies in large quantities is

(A) Western blotting

(B) Hybridoma technology

(C) RNA interference

(D) Polymerase chain reaction

59. Generating a whole plant from a single cell or group of cells in plant tissue culture is known as

(A) Somatic hybridisation
(B) Organogenesis
(C) Totipotency
(D) Somatic embryogenesis

60. Improvement of the human race by controlled selective breeding between individuals with desirable characteristics is known as

(A) Inbreeding
(B) Euthenics
(C) Eugenics
(D) Genetics

61. In environmental biotechnology, which of the following techniques is used to remove heavy metals from contaminated soil ?

(A) Phytoremediation
(B) Microfiltration
(C) Bioleaching
(D) Biostimulation

62. Which of the following methods is used to identify specific DNA sequences by hybridizing them with a complementary probe ?

(A) Northern blotting
(B) Western blotting
(C) Southern blotting
(D) Polymerase chain reaction

63. Which of the following best describes the Intermediate Disturbance Hypothesis (IDH) ?

(A) Ecosystems with no disturbance have the highest species diversity
(B) Moderate levels of disturbance can foster greater species diversity than low or high levels of disturbance
(C) Species diversity decreases as the frequency of disturbance increases
(D) Only ecosystems with high levels of disturbance will develop into complex communities

64. Cyanide poisoning will immediately deplete cells of

(A) NAD+
(B) Citrate synthase
(C) Aconite
(D) Acetyl-CoA

65. Protein-protein interactions in live cells can be detected most efficiently by

(A) Co-immunoprecipitation

(B) Western blotting

(C) Forster Resonance Energy Transfer

(D) Enzyme-Linked Immunosorbent Assay

66. Which of the following techniques would be most appropriate for determining the three dimensional structure of a membrane protein at atomic resolution ?

(A) Atomic force microscopy

(B) Cryo-electron microscopy

(C) NMR spectroscopy

(D) X-ray crystallography

67. Gene expression across the entire genome can be studied by

(A) Real-time PCR

(B) Northern blot

(C) Western blot

(D) RNA sequencing

68. In which of the following animal groups do you find organisms that are acoelomates ?

(A) Annelida

(B) Platyhelminthes

(C) Mollusca

(D) Echinodermata

69. Which of the following is an essential step in the CRISPR-Cas9 gene editing method ?

(A) Cloning a guide RNA that is complementary to the target DNA sequence

(B) Amplifying the DNA using PCR

(C) Using RNA interference (RNAi) to silence gene expression

(D) Using restriction enzymes to cut the DNA

70. Lotka-Volterra model of predator-prey interaction

(A) Suggests that predator and prey populations grow exponentially without limitations

(B) Describes a stable equilibrium where predator and prey populations remain constant over time

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

(D) Assumes that prey populations are only limited by the presence of predators

71. Differential ionic distribution across cell membrane in a living cell can be best explained by the

(A) Characteristics of lipid nature of the membrane

(B) Presence of double layer of the membrane

(C) Fluid mosaic nature of the membrane

(D) Donnan-membrane equilibrium

72. When large mammals walk in the forest and trample small plants, those plants die. This interspecies relationship is a form of

(A) Amensalism (B) Mutualism

(C) Commensalism (D) Parasitism

73. What is the primary consequence of Della binding to Notch receptor ?

(A) Activation of G-protein

(B) Release of the Notch intracellular domain

(C) Phosphorylation of the Notch receptor

(D) Activation of adenylyl cyclase

74. Which of the following is the correct sequence of events in the Wnt/β-catenin signaling pathway leading to gene transcription ?

(A) Wnt binds to Frizzled → Disheveled activation → β-catenin degradation → TCF transcription

(B) Wnt binds to Frizzled → LRP phosphorylation → β-catenin accumulation → TCF transcription

(C) Wnt binds to Frizzled → G-protein activation → β-catenin accumulation → TCF transcription

(D) Wnt binds to Frizzled → LRP phosphorylation → β-catenin degradation → TCF transcription

75. Which one of the following regions of the target gene is NOT used to make an RNAi construct to knock down its expression ?

(A) 5'UTR of the mature transcript (B) 3'UTR of the mature transcript

(C) Exonic region (D) Intronic region

76. Which one of the following characteristics of Fura-2 has been exploited to detect intracellular concentration of a desired ion ? The fluorescence intensity of Fura-2 at a specific wavelength

(A) Remains unaffected by small, rapid changes in the desired ion concentration

(B) Remains the same at a wider range of incident light frequencies

(C) Increases upon binding with the ion

(D) Decreases upon binding with the ion

77. A colour blind man marries a normal woman and together they have a daughter (D), who is not colour blind. The said daughter (D) marries a man (A) with normal vision (without colour blindness). What is the probability of their (D and A) first-born child, a son, becoming colour blind ?

(A) 50% (B) 25% (C) 100% (D) 75%

78. The main difference between active transport and facilitated diffusion is

(A) Only in active transport, the molecules move from areas of higher concentration to areas of lower concentration

(B) Carrier protein is involved only in the case of active transport

(C) In active transport, energy is consumed to move molecules against a concentration gradient but not in facilitated diffusion

(D) In active transport only water molecules are transported but not in facilitated diffusion

79. Which of the following regarding DNA replication is NOT applicable for both leading and lagging strands ?

(A) RNA primer is synthesized

(B) DNA polymerase III synthesizes DNA

(C) Nucleoside monophosphates are added in a 5′ to 3′ direction in growing DNA chain

(D) DNA ligase repeatedly joins the ends of DNA along the growing strand

80. Which of the following morphogenetic movements can be defined as the splitting of one cellular sheet into two sheets ?

(A) Involution (B) Ingression

(C) Epiboly (D) Delamination

81. Commonly used technique for paternity testing which is also used for forensic identification of a suspect is

(A) DNA sequencing (B) DNA fingerprinting

(C) CHIP analysis (D) RNA sequencing

82. Drug azidothymidine (AZT) is effective against AIDS. It acts by

(A) Inhibiting viral protein synthesis

(B) Inhibiting viral RNA polymerase

(C) Stimulating DNA provirus production

(D) Inhibiting viral reverse transcriptase

83. Through which receptor do follicle cells receive the Gurken signal in Drosophila ?

(A) Toll (B) Brat (C) Torpedo (D) Pumilio

84. A gene contains 2 exons that encode a protein of 100 amino acids. They are separated by an intron of 120 bp. The messenger RNA has 5′ and 3′ untranslated regions of 70 and 30 nucleotides, respectively. A complementary DNA (cDNA) made from mature RNA would have which of the following sizes ?

(A) 520 bp (B) 400 bp (C) 300 bp (D) 120 bp

85. Guanosine triphosphate (GTP) hydrolysis is required by which one or more of the following steps in protein synthesis ?

P. Activation of amino acids by Aminoacyl-tRNA synthetase

Q. Attachment of ribosomes to endoplasmic reticulum

R. Translocation of tRNA-nascent protein complex from A to P sites

S. Binding of aminoacyl-tRNA to A site

(A) P only (B) P and R only

(C) Q and R only (D) R and S only

86. The maximum buffering capacity at physiologic pH would be provided by a protein rich in

(A) Arginine
(B) Glutamic acid
(C) Valine
(D) Histidine

87. In scurvy, which of the following amino acids that is normally part of collagen is NOT synthesized ?

(A) Hydroxytryptophan
(B) Hydroxytyrosine
(C) Hydroxyhistidine
(D) Hydroxyproline

88. A researcher has to isolate a lysosomal membrane protein that recognizes mannose-6-phosphate groups in lysosomes. Which of the following chromatography techniques for the purification of proteins could be used to specifically isolate the protein of interest ?

(A) Size exclusion
(B) Affinity
(C) Gel filtration
(D) Ion exchange

89. Which motif in a protein strongly suggests that it is a DNA-binding, regulatory protein ?

(A) α helix
(B) β bend
(C) Triple helix
(D) Zinc finger

90. Contraction of cardiac and skeletal muscle is initiated by the binding of calcium to which of the following ?

(A) Actin
(B) Actomyosin
(C) Myosin
(D) Troponin

91. Which of the following is the important reactive group of glutathione in its role as an antioxidant ?

(A) Serine
(B) Sulfhydryl
(C) Tyrosine
(D) Carboxyl

92. Warfarin acts primarily as

(A) Ca^{++} channel blocker

(B) Anticoagulant

(C) Growth factor

(D) Anti-diabetic factor

93. A microorganism that uses inorganic compounds as source of energy and fixes carbon dioxide is best defined as

(A) Photoautotroph

(B) Chemoheterotroph

(C) Chemolithoautotroph

(D) Chemoorganotroph

94. Which of the following is true about metagenomics ?

(A) It is the analysis of genomes of individual organisms

(B) It is the analysis of genomes of the entire community

(C) It requires isolation and cultivation of diverse organisms from a sample

(D) It gives only phylogenetic information but not functional information

95. Environment A has about 100 species while environment B has about 600 species. Therefore, environment B has a greater species

(A) richness

(B) evenness

(C) equity

(D) abundance

96. A placid cell (ψ_w = −0.732 MPa; ψ_s = −0.732 MPa; ψ_p = 0 MPa) was dropped in 0.1 M sucrose solution ($\psi_w = \psi_s$ = −0.244 MPa). What will be the ψ_p of the cell at equilibrium ?

(A) −0.732 MPa

(B) 0.488 MPa

(C) −0.244 MPa

(D) 0.976 MPa

97. Which of the following activities is NOT present in Klenow fragment but is present in intact DNA Polymerase I ?

(A) 5′ to 3′ exonuclease

(B) 3′ to 5′ polymerase

(C) 3′ to 5′ exonuclease

(D) 5′ to 3′ polymerase

98. Which of the following sequences indicates the correct structural organization of chromosome constituents, going from smaller to the larger size of molecule ?

(A) Chromatin fibril, nucleosome, histone octamer, chromosome loop

(B) Nucleosome, chromatin fibril, chromosome loop, histone octamer

(C) Nucleosome, histone octamer, chromosome loop, chromosome fibril

(D) Histone octamer, nucleosome, chromatin fibril, chromosome loop

99. You are given two proteins in two tubes "A" and "B". Protein in "A" is a homodimer, while in "B" it is a homotetramer. They were run on SDS PAGE. Both the gels gave clean single bands at 100 KDa. The molecular weights of the proteins are

(A) A 200 KDa, while B 400 KDa

(B) A 400 KDa, while B 200 KDa

(C) A 100 KDa, while B 200 KDa

(D) A 100 KDa, while B 400 KDa

100. Under normal measuring conditions, you measured the absorbance of a solution in 1 ml (A) and 3 ml (B) cuvettes. You will expect the absorbance value in

(A) A to be triple than B

(B) A to be one-third than B

(C) Both to be identical

(D) B to be half than A

Space for Rough Work

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