51

QUESTION PAPER

51

ENTRANCE EXAMINATION, 2012

Pre-Ph.D./Ph.D. BIOTECHNOLOGY

[Field of Study Code : SBTP (168)]

Time Allowed : 3 hours   Maximum Marks : 70

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

(i)   Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.

(ii) **Please darken the appropriate circle of Question Paper Series Code on the Answer Sheet.**

(iii) The Question Paper is divided into two parts : Part—A and Part—B. Both parts have multiple-choice questions. All answers are to be entered in the Answer Sheet provided with the Question Paper for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with **BALLPOINT PEN** only against each question in the corresponding circle.

(iv) Part—A consists of 30 questions and all are compulsory.

(v)   Part—B contains 60 questions. **Answer any 40 questions.**

In case any candidate answers more than the required 40 questions, the first 40 questions attempted will be evaluated.

(vi) Each correct answer carries 1 mark. **There will be negative marking and ½ mark will be deducted for each wrong answer.**

(vii) Answer written by the candidates inside the Question Paper will not be evaluated.

(viii) Simple Calculators and Log Tables may be used.

(ix) Pages at the end have been provided for rough work.

(x)   Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination. **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

1. Use only Blue/Black Ballpoint Pen (Do not use pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken ONLY ONE CIRCLE for each question as shown in example below :

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ © ●	⊘ ⓑ © ⓓ	⊘ ⓑ © ⊘	⊙ ⓑ © ●	ⓐ ⓑ © ●⌄

4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please do not do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate circle of Question Paper Series Code on the Answer Sheet.**

1/51

PART—A

Answer **all** questions

1. Circular dichroism spectra of some proteins show a strong negative ellipticity band at 200 nm. Which of the following secondary structures is characterized by the presence of this band?

   (a) Random coil structure

   (b) Intrinsically disordered structure

   (c) α-Helical structure

   (d) β-Sheet structure

2. Which of the following wavelengths is most suitable for determining the concentration of polyalanine (a synthetic polypeptide composed solely of alanine residues) directly in aqueous solution without using any reagents in a UV-visible spectrometer?

   (a) 220 nm

   (b) 260 nm

   (c) 280 nm

   (d) 595 nm

3. Which of the following is the reason for urea to act as a strong denaturant of proteins?

   (a) Perturbs electrostatic interactions only

   (b) Perturbs hydrophobic interactions only

   (c) Perturbs hydrophobic interactions as well as binds to peptide groups

   (d) Perturbs hydrophobic interactions as well as binds to nonpolar side chains

4. From an isothermal titration calorimetric experiment, it was observed that the dissociation constant (K_d) for the binding of the HIV drug nelfinavir to HIV-1 protease at 25 °C was 3 nM. The corresponding free energy change for the binding would be nearly equal to

   (a) 12 kcal/mol

   (b) –12 kcal/mol

   (c) 5 kcal/mol

   (d) – 5 kcal/mol

2|5|

5. Several neurodegenerative diseases like Alzheimer's and Parkinson's are characterized by the presence of amyloid fibril structures of specific proteins in the brain. These structures have characteristic features of a

   (a) coiled-coil structure

   (b) polyproline II structure

   (c) cross-beta structure

   (d) Π-helical structure

6. We have a mixture of two proteins, one monomeric in nature with a molecular mass of 10 kDa, and the other one multimeric in nature, having four subunits, two of which have a monomer molecular mass of 10 kDa and the other two have a molecular mass of 15 kDa. It has also been observed that the oligomeric structure has one inter-subunit disulfide bond between the 10 kDa monomers only. The two proteins could be best separated by

   (a) nonreducing SDS-PAGE

   (b) reducing SDS-PAGE

   (c) native PAGE

   (d) All of the above

7. In a ^{1}H-NMR experiment of ethanol, a resonance frequency peak for the —OH proton was observed at 500 Hz, while the frequency of the spectrometer was 100 MHz. The corresponding 'chemical shift' would have a value of

   (a) 0·2 ppm

   (b) 1 ppm

   (c) 4 ppm

   (d) 5 ppm

8. Water has a high dielectric constant of 80 in contrast with many nonpolar solvents having very low dielectric constants. Due to this property, the electrostatic interactions between various side chains of amino acids in proteins after their transfer from nonpolar solvent to water would

   (a) decrease

   (b) increase

   (c) remain unaffected

   (d) attain a value of zero

9. The ionic strength of a 0.2 mol dm^{-3} $MgSO_4$ solution would be

   (a) 0.2 mol dm^{-3}

   (b) 0.4 mol dm^{-3}

   (c) 0.8 mol dm^{-3}

   (d) 1.0 mol dm^{-3}

10. In a mass spectrometry experiment for determining molecular mass of a protein, the property that is used for the determination of the molecular mass is

   (a)   mass/charge ratio

   (b)   charge/mass ratio

   (c)   total charge on the protein

   (d)   net charge on the protein

11. Concentration of a protein solution determined using UV spectrophotometer and the knowledge of its extinction coefficient in 'ml/mg-cm' units was found to be 1 mg/ml. Given that the molecular weight of the protein is 50 kDa, its concentration in molar units will be

   (a)   10 μM

   (b)   20 μM

   (c)   50 μM

   (d)   20 mM

12. Among solvents, water is known to have a high dielectric constant value of 80. Its selection by nature for sustenance of biological systems compared with low dielectric solvents, like hydrocarbons, should thus

   (a)   strengthen electrostatic interactions but weaken hydrophobic interactions

   (b)   weaken electrostatic interactions but strengthen hydrophobic interactions

   (c)   strengthen both electrostatic and hydrophobic interactions

   (d)   weaken both electrostatic as well as hydrophobic interactions

4/51

13. The pK_a of the side chain carboxyl group of aspartic acid is 4·6. Then at pH 2·0, the carboxyl group is likely

(a)   to be positively charged

(b)   to be negatively charged

(c)   having no charge

(d)   to be 50% dissociated

14. A centrifuge is run with a fixed angle rotor in it and gives 500 g at 1000 r.p.m. of the rotor. In order to attain a centrifugal force of 8000 g, the r.p.m. of the rotor should be

(a)   4000

(b)   8000

(c)   12000

(d)   16000

15. In NMR spectroscopy, the resonance phenomenon is observed by subjecting the magnetized nucleus to which one of the following electromagnetic radiations?

(a)   Radio waves

(b)   Microwaves

(c)   Infrared rays

(d)   X-rays

16. Collagen is rich in proline residues and adopts a polyproline–II type of secondary structure. This structure can only form in

(a)   aqueous environment with *cis*-peptide units

(b)   nonaqueous environment with *trans*-peptide units

(c)   aqueous environment with *trans*-peptide units

(d)   nonaqueous environment with *cis*-peptide units

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    (a) strengthen electrostatic interactions but weaken hydrophobic interactions

    (b) weaken electrostatic interactions but strengthen hydrophobic interactions

    (c) strengthen both electrostatic and hydrophobic interactions

    (d) weaken both electrostatic as well as hydrophobic interactions

17. When two nonpolar amino acid side chains interact with each other in the presence of water, the resulting hydrophobic interactions would lead to

    (a)   a decrease in the entropy of the system

    (b)   an increase in the entropy of the system

    (c)   no change in the entropy of the system

    (d)   Entropy change becomes indeterminate

18. A mixture contains three proteins A, B and C that have the same molecular mass but different amino acid compositions. As a result, their average hydrophobicity is of the order $A > B > C$. The mixture is subjected to reverse phase chromatography using C-18 chromatography column and the eluting solvent is $20 : 80$ mixture of water : acetonitrile. The elution profile of the three proteins would be

    (a) A will elute first followed by B and then C

    (b) B will elute first followed by C and then A

    (c) C will elute first followed by A and then B

    (d) C will elute first followed by B and then A

19. A $10N$ HCl solution was diluted 10-fold with water and the pH of the diluted solution was measured with a pH meter after calibration using standard solutions. Given that the activity coefficient for diluted HCl was 0.01, the pH of the solution would be

    (a)   0

    (b)   1

    (c)   2

    (d) 2.5

20. A carbohydrate ligand at a concentration of 100 µM was incrementally added to the protein concanavalin-A at a concentration of 1 mM at 25 °C. The binding curve plotted for the ligand-protein interaction resulted in a dissociation constant (K_d) value of 4.5 nM. The free energy change associated with the binding would be nearly equal to

    (a) -1 kcal/mol

    (b) -10 kcal/mol

    (c) $+1$ kcal/mol

    (d) $+10$ kcal/mol

21. Which one of the following is a correct definition of a pharmacophore?

    (a) A pharmacophore is the collective name for all compounds that have pharmacological importance

    (b) A pharmacophore is a hypothesis that proposes critical structural and physico-chemical characteristics that must be possessed by a set of compounds showing a particular pharmacological activity

    (c) A pharmacophore is the name of an application that needs to be submitted to the National Drug Control Authority before a pharmacologically active substance can be marketed

    (d) A pharmacophore is a person who mixes different drug formulations in a pharmacy

22. Which one of the following algorithms is commonly used to perform a local alignment of two sequences?

    (a) Smith–Waterman algorithm

    (b) Needleman–Wunsch algorithm

    (c) Altschul–Karlin–Pearson algorithm

    (d) Kabsh–Sander algorithm

23. Wild-type ribonuclease-A has four disulfide bonds between specific pairs of cysteines in its sequence. How many different types of disulfide-bonded configuration are possible involving the same four pairs of cysteine residues? [Assume that there are no free cysteine residues in the mature protein]

    (a) $7*6*5*4*3*2$

    (b) $7*5*3$

    (c) $4*3*2$

    (d) 2^4

24. Boiling a mixture of butter, water and eggs results in a homogenous colloidal suspension, however if the eggs are omitted, then the butter and the water separate out. Which component, present in the egg, is responsible for this behavior?

    (a) Proteins

    (b) DNA

    (c) Various salts of sodium and magnesium that are present in egg

    (d) Phosphatidylcholine

25. Cooking meat in presence of cut pieces of papaya fruit results in unusually tender meat. What enzyme, present in the papaya fruit, is responsible for this?

    (a) Pepsin

    (b) Papain

    (c) Papase

    (d) Papaverine

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   (b) Papain

   (c) Papase

   (d) Papaverine

26. Which of the following sugars can be safely consumed by a patient of Type-II diabetes?

(a) D-glucose

(b) L-sucrose

(c) D-fructose

(d) D-galactose

27. Eating excess of foods rich in nucleic acids is considered to be harmful for which of the following diseases?

(a) Cancer

(b) AIDS

(c) Gout

(d) Hansen's disease

28. Which among the following is a potent carcinogen and commonly found in cigarette smoke?

(a) Benzo[a]pyrene

(b) 2,4,6-Trichlorotriazine

(c) N-Nitrosourea

(d) Diazomethane

29. Which of the following functional groups is present in the side chain of tryptophan?

(a) Indole

(b) Imidazole

(c) Guanidino

(d) Azetidino

30. Which of the following modified bases is not present in normal tRNA?

(a) Pseudouridine

(b) Dihydroxyuridine

(c) Wyosine

(d) 8-Oxoguanine

8/51

PART—B

Answer *any* **forty** questions

31. Treatment that inhibits the complete expression of immediate early genes of T_4 bacteriophage with double-stranded DNA genome during infection of an *E. coli* host cell is

    (a) nalidixic acid that inhibits DNA replication

    (b) rifampicin that inhibits host RNA polymerase

    (c) mutation that inactivates phage DNA polymerase

    (d) chloramphenicol that inhibits protein synthesis

32. If you wish to produce a subunit vaccine for a positive sense RNA that will stimulate the production of neutralizing antibody in the recipient, which of the following proteins would be a logical candidate for such a vaccine?

    (a) Viral capsomere protein

    (b) Viral protein that binds to its RNA genome

    (c) Viral RNA polymerase

    (d) Viral matrix protein

33. Which one of the following viruses is known to transform normal cells to cancerous cells in culture, but does not induce cancer in its natural host?

    (a) Bovine papillomavirus

    (b) Adenovirus

    (c) Hepatitis C virus

    (d) Human herpesvirus–8

34. The blue color that results during protein estimation by Folin–Lowry method is due to the presence of

    (a) tyrosine residues in proteins

    (b) cysteine residues in proteins

    (c) aspartate residues in proteins

    (d) arginine residues in proteins

9/51

35. You have carried out the following chemical modifications on a serine protease like trypsin. Which one of them is likely to produce a completely inactivated protein? [Assume that your treatments do not cause any major conformational changes in the enzyme]

(a) Blocking of all aspartate and glutamate residues by esterification

(b) Blocking of all arginine and lysine residues by N-acetylation

(c) Blocking of all free cysteine residues by S-alkylation

(d) Blocking of all histidine residues by N-alkylation

36. Which of the following protein purification techniques would be most suitable for a glycoprotein?

(a) Lectin-affinity chromatography

(b) Gel-filtration chromatography

(c) Silica-gel chromatography

(d) Ion-exchange chromatography

37. Formation of which of the following will allow solubilization of an ionic substance in chloroform in the presence of SDS?

(a) Micelles

(b) Reverse micelles

(c) Liposomes

(d) Bilayers

38. How many nonbonded interactions are to be found in the united atom representation of cyclohexane?

(a) 0

(b) 2

(c) 3

(d) 6

39. For a cyclin-dependent kinase to be active, which of the following conditions are needed?

(a) Presence of its cyclin partner, dephosphorylation at the activating site and phosphorylation of inhibitory site

(b) Absence of its cyclin partner, phosphorylation at the activating site and dephosphorylation of inhibitory site

(c) Presence of its cyclin partner, phosphorylation at the activating site and dephosphorylation of inhibitory site and translocation to the cytosol

(d) Absence of its cyclin partner, dephosphorylation at the activating site and dephosphorylation of inhibitory site

40. Which of the following statements is true?

(a) Thickness of biological membranes is exactly 5 nm

(b) Average thickness of biological membranes is 10 nm

(c) Average thickness of biological membranes is 5 nm but can be different at certain localized regions of the membrane

(d) Thickness of biological membranes has not been determined so far

41. Cluster analysis in DNA microarray experiments refers to

(a) genes that are clustered together in the genome

(b) cluster of probes that are used to monitor gene expression

(c) genes that are likely to work in concert in the cell

(d) cluster of cDNAs printed on microarray chip

42. If lysosomes were the only proteolytic machinery in the cell, which of the following will not be expected?

(a) All unstable proteins will have the same half-life

(b) Changes in growth conditions will affect the half-life of proteins to the same extent

(c) Energy will be required for proteolysis since proteins will have to be transported into the lysosomes for degradation

(d) Cells defective in the vesicular transport will show stabilization of protein turnover

35. You have carried out the following chemical modifications on a serine protease like trypsin. Which one of them is likely to produce a completely inactivated protein? [Assume that your treatments do not cause any major conformational changes in the enzyme]

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43. Vitamin C deficiency is not expected to affect which of the following?

(a) Proline hydroxylation

(b) Stabilization of collagen triple helix

(c) Destabilization of collagen triple helix

(d) Thinning of blood vessels

44. Peroxisomes are not involved in which of the following metabolic processes?

(a) Photorespiration

(b) Glyoxylate cycle

(c) Reduction of various molecules

(d) β-Oxidation of fatty acids

45. The membrane permeability of dimethylurea is

(a) less compared to urea

(b) the same as urea

(c) more than urea

(d) dependent upon the membrane

46. An amphipathic phospholipid molecule is most likely to be found in which of the following locations in the cell?

(a) Cytoplasm

(b) ER membrane

(c) Mitochondrial matrix

(d) Peroxisome matrix

47. A biological membrane is likely to have the lowest rate of diffusion for which one of the following?

(a) Water

(b) Na^+

(c) CO_2

(d) Urea

48. When a person climbs the stairs, he/she is converting

(a) potential energy into kinetic energy

(b) kinetic energy into potential energy

(c) potential energy into chemical energy

(d) Energy cannot be converted from one to another form

49. Which of the following statements about allosteric regulation of an enzymatic activity is correct?

(a) It involves regulation of activity at one site by binding to the same site

(b) It involves regulation of activity at one site by binding to a separate site

(c) It always causes inhibition of the enzyme activity

(d) It always stimulates the enzyme activity

50. The following statements about the cell cycle in prokaryotes are correct, *except*

(a) the cell divides by mitosis

(b) the process of DNA replication starts at a single origin of replication

(c) the cell elongates while DNA replication is going on

(d) the origins of daughter chromosomes move to opposite ends of the cell

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51. Which of the following statements about transport across the nuclear pore complex (NPC) is correct?

(a) Active transport as well as diffusion occur across the NPC

(b) Same NPC cannot allow traffic in both directions

(c) Specificity of transported ions is determined by the proteins in the NPC

(d) Transport across NPC occurs co-translationally

52. If all proteins from a cell membrane are removed, which of the following can be expected to happen?

(a) Transport of ions across the membrane will be stimulated

(b) Transport of ions across the membrane will be inhibited

(c) Transport of ions across the membrane will not be affected

(d) Diffusion of solutes across the membrane will increase

53. Which of the following statements about peripheral membrane proteins is wrong?

(a) They are loosely attached to the membrane often by interaction with the integral membrane protein

(b) They can be extracted by washing with high salt

(c) All of them are glycosylated

(d) It is not necessary for them to pass through endoplasmic reticulum

54. The disulfide bonds in a protein

(a) can be formed in the cytosol

(b) can be formed in the endoplasmic reticulum and outside the cell in the atmosphere

(c) can be formed in the endoplasmic reticulum but not outside the cell

(d) start forming in the ER but the process continues in the Golgi

/4/51

55. The common pathway of entry of proteins into the endoplasmic reticulum, lysosomes and plasma membrane is characterized by

    (a) binding of their mRNA to special ribosome population attached to endoplasmic reticulum

    (b) addition of specific sorting sequences to these proteins after their synthesis

    (c) addition of N-linked oligosaccharide to these proteins

    (d) presence of a signal sequence that targets these proteins to endoplasmic reticulum during synthesis

56. All of the following organelles can be isolated in their intact form from the cell, *except*

    (a) lysosomes

    (b) endoplasmic reticulum

    (c) peroxisomes

    (d) nuclei

57. You are interested in studying the half-life of a protein A in an animal cell that can be cultured. To do this, you label all proteins being translated in a cell with a radioactive amino acid for a short duration followed by removal of radiolabel and growth of cell in normal medium. You then take out samples at different time points. You can now use which of the following techniques to study the half-life of protein A ?

    (a) SDS-PAGE followed by autoradiography

    (b) SDS-PAGE followed by Western blotting

    (c) Immunoprecipitation followed by autoradiography

    (d) Immunoprecipitation followed by SDS-PAGE and autoradiography

58. To complement a defect in cell cycle in a mutant yeast, your professor tells you to transform the yeast and pick the colonies that allow cell cycle progression and identify the gene that corrected the defect. The professor did not tell you what you can use to transform the yeast. Use your logic to select an appropriate source of DNA from the following.

    (a) Genomic DNA fragments from wild-type cells

    (b) cDNA library prepared from wild-type cells

    (c) Genomic DNA library prepared from wild-type cells

    (d) mRNA isolated from wild-type cells

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   (b) can be formed in the endoplasmic reticulum and outside the cell in the atmosphere

   (c) can be formed in the endoplasmic reticulum but not outside the cell

   (d) start forming in the ER but the process continues in the Golgi

59. Signaling from a plasma membrane receptor that starts signaling after binding to a ligand is usually shut off by which of the following mechanisms?

(a) Removal of the ligand from the receptor by an extracellular protease

(b) Endocytosis of the receptor

(c) Exocytosis of the receptor

(d) Removal of the cytoplasmic tail of the receptor by a cytosolic protease

60. Some bacteria can avoid contact with human antibodies and white blood cells by hiding in the cytoplasm and yet they are able to move from one host cell to the other. They can use which of the following in order to do this?

(a) Exocytosis from one cell and endocytosis by the neighboring cell

(b) Generating a microfilament powered by actin polymerization so that it is pushed to the plasma membrane and the finger-like projection fuses with the plasma membrane of the neighboring cell thus transferring the bacteria

(c) Phagocytosis of the infected cell by the neighboring cell

(d) Release of vesicles by the infected cell that contain the bacteria and these vesicles then are captured by SNARE proteins on the plasma membrane of the neighboring cells

61. In case of damage of a cell, it can be expected that

(a) it will be advantageous for both unicellular and multicellular organisms to let the cell die

(b) it will be advantageous for both unicellular and multicellular organisms to try and repair themselves

(c) it will be advantageous for unicellular organism to let the cell die and for multicellular organism to try and repair itself

(d) it will be advantageous for unicellular organism to try and repair itself and for multicellular organism to let the cell die

62. The features that distinguish the fMet-tRNAf initiator from Met-tRNAm and other tRNAs used during elongation are located

(a) at the 5' end of the tRNA

(b) at the 3' end of the tRNA

(c) in the anticodon loop

(d) in the anticodon stem

63. Which of the following statements is correct?

   (a) Maintenance of the lipid bilayer in the plasma membrane requires special enzymes and the hydrolysis of ATP

   (b) The temperature at which a eukaryotic membrane freezes is determined solely by how much cholesterol it contains

   (c) When read in the same direction (5′– 3′), the sequence of nucleotides in the newly synthesized DNA strand is the same as in the parental template strand

   (d) Each aminoacyl-tRNA linkage is activated for addition of the next amino acid to the growing polypeptide chain rather than for its own addition

64. Many diseases sometimes are caused due to Alu-mediated uneven recombination. Which of the following diseases does not result due to Alu-mediated uneven recombination?

   (a) Insulin-resistant diabetes Type II (InsReceptor)

   (b) Lesch–Nyhan syndrome (overproduction of uric acid leading to neurologic syndrome)

   (c) Cholinesterase deficiency (congenital myasthenic syndrome)

   (d) α-Thalassemia

65. Small nucleolar RNA (snoRNA) is involved in

   (a) inhibition of translation from mRNA

   (b) processing of mRNA

   (c) processing of pre-rRNA to mature rRNA species

   (d) site-specific base modifications in rRNA

66. Topoisomerases help in unwinding and rewinding of the DNA. Which of the following statements about these enzymes is correct?

   (a) Will not affect transcription in anyways as they are active only when DNA is replicating and positive supercoiling occurs

   (b) Will interfere with transcription by rewinding the DNA which has melted due to the binding of RNA polymerase

   (c) Will facilitate transcription because rewinding occurs only after unwinding. These enzymes help in unwinding of the DNA and thus facilitate initiation of transcription

   (d) The effect will vary depending upon the replication status of the DNA

63. Which of the following statements is correct?

(a) Maintenance of the lipid bilayer in the plasma membrane requires special enzymes and the hydrolysis of ATP

(b) The temperature at which a eukaryotic membrane freezes is determined solely by how much cholesterol it contains

(c) When read in the same direction (5'- 3'), the sequence of nucleotides in the newly synthesized DNA strand is the same as in the parental template strand

(d) Each aminoacyl-tRNA linkage is activated for addition of the next amino acid to the growing polypeptide chain rather than for its own addition

64. Many diseases sometimes are caused due to Alu-mediated uneven recombination. Which of the following diseases does not result due to Alu-mediated uneven recombination?

(a) Insulin-resistant diabetes Type II (InsReceptor)

(b) Lesch–Nyhan syndrome (overproduction of uric acid leading to neurologic syndrome)

(c) Cholinesterase deficiency (congenital myasthenic syndrome)

(d) α-Thalassemia

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17/5/

67. Mutation or deletion of which of the following will result in permanent lysogenic state of the bacteriophage lambda?

   (a) N

   (b) CII

   (c) CI

   (d) Cro

68. Which of the following is least likely to be true in relation to SCID (severe combined immunodeficiency), caused due to complete lack of adenosine deaminase?

   (a) Loss of the enzyme causes increased levels of dATP because there is less turnover of adenosine nucleosides in general

   (b) Increased dATP decreases the concentration of all rNTPs, blocking RNA synthesis

   (c) Increased dATP inhibits ribonucleotide reductase, such that de novo production of all dNDPs is inhibited

   (d) Adenosine deaminase loss causes SCID, because T cells are particularly sensitive to DNA replication inhibition

69. Influenza viruses require the presence of the nucleus in their host cells, because

   (a) they use reverse transcriptase to make a cDNA which is integrated into the host genome

   (b) they scavenge poly [A] tails from host mRNAs in the nucleus

   (c) they use the host RNA polymerase II to transcribe viral mRNAs

   (d) they use the host RNA splicing enzymes to process some viral mRNAs

70. An inducer is a protein that

   (a) combines with a repressor and prevents it from binding the promoter

   (b) combines with a repressor and prevents it from binding the operator

   (c) binds to the promoter and prevents the repressor from binding to the operator

   (d) binds to the operator and prevents the repressor from binding at this site

18/51

71. All of the following statements are correct with regard to chromatin, *except*

(a) core nucleosomes consist of 8 histone protein molecules and about 146 base pairs of DNAs

(b) histones have been highly conserved during evolution

(c) almost all of the DNAs in a eukaryotic cell are assembled into nucleosomes

(d) assembly of DNAs into nucleosomes compacts it about 100-fold in length

72. Which of the following proteins is functionally similar to the translation factor EF-Ts?

(a) G-protein-coupled receptor

(b) Phospholipase C

(c) Tyrosine kinase

(d) Heterotrimeric G-protein

73. Aminoacyl tRNA synthetases are enzymes that charge the amino acids to their cognate tRNA. They have proofreading activity and remove the wrongly attached amino acid. For this activity, the editing domain of the aminoacyl tRNA synthetases recognizes which of the following and uses as a substrate?

(a) Nascent polypeptide with incorrect amino acid

(b) Incorrect aminoacyl-ATP

(c) Incorrect aminoacyl-ADP

(d) Incorrect aminoacyl-AMP

74. The proteins synthesized early during infection from early mRNA of a lytic phage in a susceptible bacterial cell are required for

(a) attachment of the phage to its host cell

(b) entry of the phage nucleic acid into the host cell

(c) replication of the phage nucleic acid

(d) lysis of the host cell

75. Which of the following best describes the F and ColE1 plasmids, respectively?

(a) Conjugative, nontransmissible

(b) Conjugative, transmissible

(c) Self-transmissible, mobilizable

(d) Mobilizable, self-transmissible

19/51

81. Growing a bacterium in medium containing 15 N is likely to produce which of the following radiolabelled polysaccharides?

   (a) Starch

   (b) Glycogen

   (c) Sialic acids

   (d) Teichoic acids

82. A protein has 100 amino acids and two transmembrane domains from 35–46 and from 75–86 amino acids. Given only this information, which of the following statements is correct?

   (a) The N-terminal of the protein is extracellular

   (b) The C-terminal of the protein is extracellular

   (c) The protein is glycosylated between 1–35 amino acids

   (d) Both N- and C-terminal of the protein will be exposed to the same environment, either cytoplasmic or extracellular

83. An exponentially growing mammalian culture has a cell count of 6×10^5 which increases to 1×10^6 in 12 hours. The doubling time is approximately

   (a) 19·28 hours

   (b) 18·28 hours

   (c) 17·28 hours

   (d) 16·28 hours

84. A 50 ml TAE buffer consisting of 20 mM Tris, 5% acetic acid and 1 mM EDTA has to be made using stock solutions of 1 M Tris, 50% acetic acid and 0·5 M EDTA. This will have

   (a) 1 ml Tris, 0·5 ml acetic acid, 1 ml EDTA and 47·5 ml water

   (b) 1 ml Tris, 0·5 ml acetic acid, 100 µl EDTA and 43·9 ml water

   (c) 100 µl Tris, 5 ml acetic acid, 100 µl EDTA and 44·8 ml water

   (d) 1 ml Tris, 5 ml acetic acid, 1 ml EDTA and 43 ml water

85. A CHO cell line produces 10 picogram of antibody per cell per day. If the production phase is for 6 days and the cell count increases linearly from 10^6/ml to 10^7/ml during this period, the best approximation of the expected product titre is

   (a) 33 µg/ml

   (b) 330 µg/ml

   (c) ^ µg/ml

   (d .g/ml

81. Growing a bacterium in medium containing 15-N is likely to produce which of the following radiolabelled polysaccharides?

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(b) Glycogen

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(d) Teichoic acids

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(a) 33 µg/ml

(b) 330 µg/ml

(c) 100 µg/ml

(d) 1 mg/ml

86. A circular plasmid is digested with EcoRI which has 10 sites on the plasmid and the fragments are cloned in a library. To ensure that this library contains one specific fragment (which is important) with 99% confidence, we need to have at least

(a) 29 clones

(b) 31 clones

(c) 44 clones

(d) 51 clones

87. A polluted lake has a volume of 458×10^9 m^3 (this volume can be assumed to be a constant because of inflows and outflows; also assume that the lake is well-mixed). Freshwater flows into the lake @ 480×10^6 m^3/day. The time required for the pollution in the lake to decline to 5% of its original value is approximately

(a) 7·8 years

(b) 15·6 years

(c) 31·2 years

(d) 52 years

88. While studying 24 families with 3 children, the data showed 3 families with no girl child, 7 families with 1 girl child, 9 families with 2 girls and 5 families with all 3 girls. To test the hypothesis that male and female births occur with the same probability, we need to calculate the chi-square value which is

(a) 25/9

(b) 16/9

(c) 31/9

(d) 64/9

89. In a centrifuge, the velocity of settling for a particle, which is the terminal velocity, would

(a) be a constant depending upon particle size and density

(b) increase linearly with increasing distance from the axis of rotation

(c) increase as a square of the distance from the axis of rotation

(d) decrease with increasing distance from the axis of rotation

90. An 80% AT-rich DNA sequence is digested by a four-cutter restriction enzyme with the recognition site GGCC. The expected average length of the fragments obtained after digestion is

(a) 256 bp

(b) 320 bp

(c) 400 bp

(d) 10 Kbp

22/51