

1. The amino acid lysine has an side-chain of ϵ -amino group ($pK_a \sim 10.5$). In an aqueous solution of pH 7.0, lysine would have:
 - (A) a net negative charge.
 - (B) a net positive charge.
 - (C) no charged groups.
 - (D) positive and negative charges in equal concentration.

2. In a mixture of proteins listed below, which should elute last in gel filtration chromatography?
 - (A) immunoglobulin G $M_r = 145,000$
 - (B) ribonuclease A $M_r = 13,700$
 - (C) RNA polymerase $M_r = 450,000$
 - (D) serum albumin $M_r = 68,500$

3. Which of the following methods is frequently used to prevent disulfide bond interference with protein sequencing procedure?
 - (A) cleaving proteins with proteases that specifically recognize disulfide bonds.
 - (B) protecting the disulfide bridge against spontaneous reduction to sulfhydryl groups.
 - (C) reducing disulfide bridges and preventing their re-formation by further modification.
 - (D) sequencing proteins that do not contain cysteinyl residues.

4. A sequence -Ser-Gly-Pro-Gly- found in a certain protein is most probably part of a(n):
 - (A) antiparallel β sheet.
 - (B) parallel β sheet.
 - (C) α helix.
 - (D) β turn.

5. The structural classification of proteins (based on motifs) is based primarily on their:
 - (A) amino acid sequence.
 - (B) evolutionary relationships.
 - (C) secondary structure content and arrangement.
 - (D) function.

6. Prosthetic groups in the class of proteins known as glycoproteins are composed of:

- (A) carbohydrates.
- (B) lipids.
- (C) metals.
- (D) phosphates.

7. Protein A will fold into its native conformation only when protein B is also present.

Therefore, protein B may function as a _____ for protein A.

- (A) ligand
- (B) molecular chaperone
- (C) protein precursor
- (D) structural motif

8. In the binding of oxygen to myoglobin and hemoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied can best be described as:

- (A) both are linear with a negative slope
- (B) both are linear with a positive slope
- (C) sigmoidal for myoglobin ; hyperbolic for hemoglobin
- (D) hyperbolic for myoglobin; sigmoidal for hemoglobin

9. Which of the following is *not* correct concerning 2,3-bisphosphoglycerate (BPG)?

- (A) It binds at a distance from the heme groups of hemoglobin.
- (B) It is an allosteric modulator.
- (C) It increases the affinity of hemoglobin for oxygen.
- (D) It binds with lower affinity to fetal hemoglobin than to adult hemoglobin.

10. Which of the following is *not* correct concerning molecules bound to hemoglobin (Hb)?

- (A) O₂ binds to the iron atom of the hemes in Hb.
- (B) H⁺ binds to specific amino acid residues.
- (C) CO₂ binds as a carbamate to the α-amino group at the N-terminal end of each chain.
- (D) BPG binds at a site in the vicinity of the O₂-binding site.

11. Which of the following parts of the IgG molecule are *not* involved in binding to an antigen?

- (A) Heavy chain
- (B) Light chain
- (C) Fab
- (D) Fc

12. Which of the following is not a covalent modification for enzyme regulation?

- (A) phosphorylation
- (B) glycosylation
- (C) reduction
- (D) methylation

13. Enzymes are potent catalysts because they

- (A) drive reactions to completion while other catalysts drive reactions to equilibrium
- (B) can prevent the conversion of products back to substrates
- (C) lower the activation energy for the reaction they catalyze
- (D) are consumed in the reaction they catalyze

14. Which of the following statements about a plot of V_0 vs. $[S]$ for an enzyme that follows Michaelis-Menten kinetics is *false*?

- (A) As $[S]$ increases, the initial velocity of reaction V_0 also increases.
- (B) At very high $[S]$, the curve becomes a horizontal line that intersects the y-axis at K_m .
- (C) K_m is the $[S]$ at which $V_0 = 1/2 V_{max}$.
- (D) A hyperbolic curve is observed.

15. To calculate the turnover number of an enzyme, you need to know:

- (A) the enzyme concentration.
- (B) the initial velocity of the catalyzed reaction at $[S] \gg K_m$.
- (C) the K_m for the substrate.
- (D) both (A) and (B).

16. V_{max} for an enzyme-catalyzed reaction:

- (A) generally increases when pH increases.
- (B) increases in the presence of a competitive inhibitor.

- (C) is twice the rate observed when the concentration of substrate is equal to the K_m .
- (D) is unchanged in the presence of a uncompetitive inhibitor.

17. Enzyme A exhibits maximum activity at pH = 6.9 and shows a sharp decrease in its activity when the pH goes much lower than 6.4. One likely interpretation of this pH activity is that:

- (A) a Glu residue on the enzyme is involved in the catalytic reaction.
- (B) a His residue on the enzyme is involved in the catalytic reaction.
- (C) the enzyme has a metallic cofactor.
- (D) the enzyme is found in gastric secretions.

18. Which of the following does *not* play a role in determining the specificity of protein kinases?

- (A) Disulfide bonds near the phosphorylation site
- (B) Primary sequence at phosphorylation site
- (C) Protein tertiary structure
- (D) Residues near the phosphorylation site

19. How is trypsinogen converted to trypsin?

- (A) A protein kinase-catalyzed phosphorylation converts trypsinogen to trypsin.
- (B) An increase in Ca^{2+} concentration promotes the conversion.
- (C) Proteolysis of trypsinogen forms trypsin.
- (D) Two inactive trypsinogen dimers pair to form an active trypsin tetramer.

20. Which of the following amino acids would be destroyed during 6N HCl hydrolysis?

- (A) Tryptophan
- (B) Phenylalanine
- (C) Leucine
- (D) Isoleucine

21. If the adenine content of duplex DNA is 30% of the total bases, the cytosine content would be

- (A) 10
- (B) 20
- (C) 30
- (D) 40

22. The structure of the double helix proposed by Watson and Crick is a
(A) A-DNA
(B) B-DNA
(C) C-DNA
(D) D-DNA
23. DNA gyrase introduced negative supercoils into DNA is
(A) class I topoisomerase
(B) class II topoisomerase
(C) reverse transcriptase
(D) ribozyme
24. The melting temperature (T_m) of DNA is
(A) directly proportional to the GC content
(B) not related to base content
(C) directly proportional to the length of DNA
(D) the same in all eukaryotes
25. Which RNA is the most recent discovery
(A) Messenger RNA
(B) Transfer RNA
(C) Micro RNA
(D) Small nuclear RNA
26. The anticodon for the a particular tRNA Serine is 5'-UGA-3'. What is the corresponding codon in mRNA
(A) 5'-TAC-3'.
(B) 5'-AGU-3'.
(C) 5'-UCA-3'
(D) 5'-CAU-3'
27. Ribozyme are
(A) RNA molecules which possess enzymatic or catalytic activity
(B) Proteins which confer enzymatic or catalytic activity to ribosomes
(C) Proteins which catalyze the formation of RNA molecules
(D) DNA which catalyze the formation of RNA molecules

28. DNA is more resistant to hydrolysis than RNA. Which feature of DNA is responsible for the characteristic?
- (A) The difference in base composition between DNA and RNA
 - (B) The difference in backbone linkages in DNA and RNA
 - (C) The absence of 2'-hydroxyl group in deoxyribose
 - (D) The absence of 4'-hydroxyl group in deoxyribose
29. Degeneracy of the genetic code contributes the existence of?
- (A) multiple codons for a single amino acid
 - (B) a single codons for each amino acid
 - (C) a single codons for multiple amino acid
 - (D) codons that contain one or more unusual bases
30. All of the following factors are required for initiation of translation in prokaryotes except ?
- (A) 70S ribosome
 - (B) *N*-formylmethionine-tRNA^{fmet}
 - (C) mRNA
 - (D) met-tRNA^{met}
31. Which following statement of plasmids are characterized best?
- (A) They are groups of bacterial genes that code for bacterial drug resistance
 - (B) They are organelles of the bacterial
 - (C) They are extrachromosomal, circular DNA molecules
 - (D) They are the specialized regions of bacterial chromosome.
32. Following digestion of a DNA sample with restriction enzyme and separation of the resulting fragments by electrophoresis, one often uses RNA probes and a blotting procedures to identify the fragment containing the gene of interest. The process is known as?
- (A) Southern blotting
 - (B) Northern blotting
 - (C) Eastern blotting
 - (D) Western blotting
33. Which one of the following statement of prokaryotes promoter is false?
- (A) the binding site for regulatory proteins that stimulate transcription
 - (B) the general region of DNA downstream from the start site
 - (C) Pribnow box was located in -10 region.

(D) upstream the start site for transcription in DNA

34. *E. coli* replication on the leading strand?

- (A) is synthesis continuously
- (B) DNA synthesis in a 3'-5' direction
- (C) is initially synthesis as Okazaki fragments
- (D) fragment are linked together by DNA ligase

35. The linkage number of a covalently closed circle DNA is 10, and the writhing number is +1. What is the twist?

- (A) +10
- (B) -9
- (C) -10
- (D) +9

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37. Plasmids containing antibiotics resistance genes are widely used in gene cloning. What is the major benefit of using plasmids containing genes for antibiotic resistance?

- (A) Protection against natural antibiotics produced by other bacteria in culture
- (B) Allowing cells to grow in the presence of antibiotics to kill competing bacteria
- (C) As a means of selection of those bacteria which have picked up the plasmid
- (D) Contamination prevention

38. Posttranslational control of gene expression is found?

- (A) only in prokaryotes
- (B) only in eukaryotes
- (C) both in prokaryotes and eukaryotes
- (D) only in plants and animals

39. Which organelle dose not contain genetic materials?

- (A) vacuole
- (B) mitochondria

- (C) chloroplast
- (D) nucleus

40. Which is the stop codon in protein translation?

- (A) AUG
- (B) GUG
- (C) UAG
- (D) UGG

41. What is the function of Shine-Dalgarno sequence?

- (A) recognized by ribosome
- (B) recognized by RNA polymerase
- (C) recognized by *lac* repressor
- (D) terminator signal for transcription

42. Which the following statement concerning MAPK signal transduction is *not* correct?

- (A) the process start when an growth factor binds to the receptor tyrosine kinase on cell membrane
- (B) binding growth factor result in each part of receptor autophosphorylation
- (C) the receptor tyrosine kinase activity is specific for tyrosine residues on the substrate proteins.
- (D) Intrinsic hydrolysis of ATP retures the Ras protein to its inactivate form

43. The conversion of one mole of fructose-1,6-bisphosphate to two moles of pyruvate by the glycolytic pathway results in a net formation of ?

- (A) one mole of NAD^+ and two moles of ATP
- (B) one mole of NAD^+ and one moles of ATP
- (C) two mole of NAD^+ and two moles of ATP
- (D) two mole of NAD^+ and four moles of ATP

44. The rate-limiting reaction in glycolysis is?

- (A) the phosphorylation of fructose-6-phosphate
- (B) the phosphorylation of glucose
- (C) the breakdown of glycogen
- (D) the isomerization of glucose-6-phosphate to fructose-6-phosphate

45. Which of the following is *not* required for the oxidative decarboxylation of pyruvate to form acetyl-CoA ?

- (A) NAD^+

- (B) lipoic acid
- (C) ATP
- (D) CoA-SH

46. The most importance source of reducing equivalent for fatty acid synthesis in the live is?

- (A) pentose phosphate pathway
- (B) oxidation of glucuronic acid
- (C) oxidation of acetyl CoA
- (D) glycolysis

47. How many carbon atoms dose palmitate have?

- (A) 16
- (B) 18
- (C) 20
- (D) 22

48. In gluconeogenesis, the initial reaction converts pyruvate to?

- (A) oxaloacetate
- (B) acetyl-CoA
- (C) Glyceraldehyde-3-phosphate
- (D) lactate

49. The rate-limiting step in cholesterol biosynthesis is catalyzed by?

- (A) HMG-CoA synthase
- (B) HMG-CoA reductase
- (C) Mevalonate kinase
- (D) None of above

50. A nonapeptide was determined to have the following amino acid composition: Ala, Phe, Gly, Ile, Lys, Met, Arg, Ser, Tyr. The peptide was incubated with 1-fluoro-2,4-dinitrobenzene (FDNB) and then hydrolyzed; 2,4-dinitrophenyl-serine was identified by HPLC. When the peptide was exposed to cyanogen bromide, an octapeptide and free glycine were recovered. Incubation of the peptide with trypsin gave a pentapeptide, a tripeptide, and free Arg. 2,4-Dinitrophenyl-serine was recovered from the pentapeptide, and 2,4-dinitrophenyltyrosine was recovered from the tripeptide. Digestion with chymotrypsin produced a dipeptide, a tripeptide, and a tetrapeptide. The tetrapeptide was composed of Ala, Arg, Lys, and Tyr. The sequence of this nonapeptide was determined to be:

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第 10 頁，共 10 頁

- (A) Gly–Met–Ile–Phe–Ala–Tyr–Ala–Lys–Arg.
- (B) Ser–Ile–Tyr–Ala–Lys–Arg–Phe–Met–Gly.
- (C) Ser–Phe–Ile–Ala–Lys–Arg–Tyr–Met–Gly.
- (D) Ser–Ile–Phe–Ala–Lys–Arg–Tyr–Met–Gly.