

一、選擇題; 1-29 題, 每題一分, 均為單選

1. Disulfide bonds most often stabilize the native structure
 - A. extracellular proteins
 - B. dimeric proteins
 - C. hydrophobic proteins
 - D. intracellular proteins
 - E. multi-subunit proteins

2. A β -hairpin structure is
 - A. found in Protein G
 - B. consist of two β -strands
 - C. is stabilized by inter-strand hydrogen bonds
 - D. contains a tight turn
 - E. all of the above

3. The fact that the core of most globular proteins is composed of non-polar residues is because of
 - A. van der waals interactions.
 - B. hydrogen bonds.
 - C. an favorable increase in conformational entropy.
 - D. the hydrophobic effect.
 - E. favorable electrostatic interactions

4. The fact that the core of most globular proteins is tightly packed is due to:
 - A. the hydrophobic effect.
 - B. hydrogen bonding
 - C. electrostatic effects
 - D. van der Waals forces.
 - E. configurational entropy

5. A hydrogen bond to water that is broken during folding and not reformed
 - A. has not effect on the stability of the folded state.
 - B. decreases the stability of the folded state by 2 kJ/mol.
 - C. decreases the stability of the folded state by 20 kJ/mol.
 - D. decreases the stability of the unfolded state by 2 kJ/mol.
 - E. decreases the stability of the unfolded state by 20 kJ/mol.

(背面仍有題目, 請繼續作答)

6. Which of the following are "broad themes used in discussing enzyme reaction mechanisms"?
- A. Proximity stabilization
 - B. Transition state stabilization
 - C. Acid-base catalysis
 - D. Covalent catalysis
 - E. All of the above
7. Under physiological conditions, which of the following processes is not an important method for regulating the activity of enzymes?
- A. Phosphorylation.
 - B. Temperature changes.
 - C. Adenylation
 - D. Allosteric regulation.
 - E. Protein processing.
8. The conversion of glucose to pyruvate is a multistep process requiring ten enzymes. If a mutation occurs resulting in a lack of activity for one of these enzymes, which of the following happens?
- A. the concentration of the metabolic intermediate which is the substrate of the missing enzyme is likely to increase and accumulate
 - B. the concentration of pyruvate will increase
 - C. the cell will produce more of the other nine enzymes to maintain steady state
 - D. the concentration of the metabolic intermediate which is the product of the missing enzyme will decrease
 - E. A and D
9. Enzymes which catalyze introduction of carbon-carbon double bonds and carbon-oxygen double bonds are known as:
- A. Oxidoreductases
 - B. Transferases
 - C. Hydrolyases
 - D. Lyases
 - E. Ligases
10. Glucokinase is a major liver enzyme important for the initial step in glucose metabolism by that tissue. The rate of reaction of this enzyme determines how fast glucose is removed from the blood stream. The V_{max} for glucokinase is 100 units/min and the K_m is 5 mM. Normal glucose concentration in the blood is maintained at approximately 5 mM. What is the rate of glucokinase reaction at 5 mM glucose.
- A. 100 Units/min
 - B. 75 Units/min

- C. 50 Units/min
D. 25 Units/min
E. 10 Units/min
11. The efficiency of an enzyme to catalyze a reaction is expressed as the number of molecules of substrate converted to product per second. This activity of the enzyme is known as:
- A. The K_m
B. The Michaelis-Menton Constant
C. The equilibrium constant (K_{eq})
D. The turnover number.
E. The K_i
12. The pK_a of the side chain of aspartic acid is 4.3. At pH 7.0, what percentage of the side chain of aspartic acid exists in the ionized form.
- A. less than 10%
B. 40%
C. 50%
D. 60%
E. greater than 90%.
13. You would expect to find this amino acid side chain buried on the interior of a protein, away from water.
- A. Serine
B. Histidine
C. Lysine
D. Leucine
E. Arginine
14. Many enzymes, particularly those which carry out breakdown of normal cellular constituents, are synthesized as inactive precursors which become activated by proteolysis. These proenzymes are known as:
- A. Apoenzymes
B. Holoenzymes
C. Zymogens
D. Catalysts
E. Coenzyme

(背面仍有題目,請繼續作答)

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15. Which of the following has *no* effect on the energetics of protein folding?
- A. Conformational Entropy.
 - B. Hydrophobic Interactions.
 - C. Covalent bonds.
 - D. Hydrogen Bonds.
 - E. Electrostatic interactions.
16. The free energy change due to *unfolding* of a protein is positive, therefore
- A. the temperature is equal to T_M .
 - B. the enthalpy of the reaction is zero.
 - C. the temperature is above T_M .
 - D. the temperature is below T_M .
 - E. None of them
17. Unfolding of an single α -helix in a non-polar solvent (i.e. benzene, hexane, etc) would be less favorable than in water because
- A. of the formation of ordered benzene molecules around the non-polar sidechains.
 - B. of the inability to reform hydrogen bonds with the solvent.
 - C. of the formation of strong van der Waals interactions with the solvent.
 - D. of the instability of strong van der Waals interactions with the solvent.
 - E. reduction in the number of conformational states in the unfolded form.
18. Which of the following statements is *most* correct:
- A. Polar residues can be buried in the interior of a protein.
 - B. All hydrophobic amino acids are buried when a protein folds.
 - C. Charged amino acids are never buried in the interior of a protein.
 - D. Tryptophan is only found in the interior of proteins.
 - E. Lysine is only found in the exterior of proteins.
19. One ligand binds more tightly to a protein than another ligand if:
- A. its K_a is lower than the other ligand.
 - B. its K_d is lower than the other ligand.
 - C. its Hill coefficient is >1 .
 - D. its Hill coefficient is <1 .
 - E. its Hill coefficient is 1.

20. A ligand that binds more tightly to a protein than another ligand probably has
- a slower kinetic on-rate and a faster kinetic off-rate.
 - a slower kinetic on-rate and a slower kinetic-off rate.
 - a faster kinetic on-rate and a faster kinetic off-rate.
 - a faster kinetic on-rate and a slower kinetic off-rate.
 - no difference in kinetic on-rate and off-rate.
21. If protein binds two ligands in a *non-cooperative* manner, then:
- the dissociation constant is $[L]$ when $Y=0.5/2$
 - the dissociation constant is $[L]$ when $Y=0.5$
 - the dissociation constant is $[L]$ when $Y=0.5*2$
 - the dissociation constant is $[L]$ when $Y=0.5*3$
 - the dissociation constant cannot be determined from a binding curve in this case.
22. The oxygen bound to hemoglobin or myoglobin is directly attached to the
- helix-F in the protein.
 - the proximal histidine.
 - the iron atom.
 - the proto-porphyrin group.
 - sheet-F in the protein.
23. Enzymes increase the rate of chemical reactions by
- providing suitable catalytic groups.
 - decreasing the population of the transition state.
 - increasing the free energy difference ΔG_0 of the transition state.
 - all of the above.
 - none of the above.
24. HIV protease and Chymotrypsin are similar in that:
- both use Serine as the nucleophile.
 - both use Cysteine as the nucleophile.
 - both are monomeric proteins.
 - both cleave hydrophobic containing peptides.
 - both use Aspartate to activate the nucleophile.
25. SDS gel electrophoresis gives the _____ molecular weight and Gel filtration provides the _____ molecular weight.
- native, denatured.

- B. denatured, native.
C. native, native.
D. denatured, denatured.
E. none of them
26. The binding affinity of a ligand to a protein is affected by temperature if:
- A. the enthalpy of binding is zero.
B. the entropy of binding is zero.
C. the enthalpy of binding is not zero.
D. the entropy of binding is not zero.
E. none of them
27. In comparing the binding of two drugs to an enzyme, one would compare
- A. the Hill coefficient, n_h , of each drug.
B. the K_M of each drug.
C. the pKa of each drug.
D. the K_I values of each drug.
E. the k_{cat} values of each drug.
28. Myoglobin _____, while hemoglobin _____. (Make this true using the statements below)
- A. binds oxygen with positive cooperativity, does not
B. is an enzyme, is not
C. binds oxygen, binds oxygen with positive cooperativity
D. binds bisphosphoglycerate (BPG), does not.
E. binds oxygen with negative cooperativity, does not
29. The analysis of enzyme kinetics using steady-state methods
- A. assumes $d[ES]/dt = 0$.
B. provides an accurate description of the reactions at all times.
C. can only be used if the product does not inhibit the enzyme.
D. cannot be applied when inhibitors are present.
E. can only be used if the substrate does not inhibit the enzyme.

二、選擇題；30-47 題，每題二分，均為單選

Answer the following questions using the key outlined below:

- A. if 1, 2, and 3 are correct
 - B. if 1 and 3 are correct
 - C. if 2 and 4 are correct
 - D. if only 4 is correct
 - E. if all four are correct
30. The glycosaminoglycans are negatively charged at neutral pH. What components of these polymers confer the negative charge?
- 1. Glucuronic acid
 - 2. Iduronic acid
 - 3. Sulfated hydroxyl groups such as GalNAc4SO₃⁻ and GlcNAc6SO₃⁻
 - 4. Mannose
31. Which of the following statements about the pentose phosphate pathway is correct?
- 1. Its main function is to supply pentoses and NADPH.
 - 2. Its main function is to supply energy.
 - 3. It generates CO₂ from C-1 of glucose.
 - 4. It requires the participation of molecular oxygen.
32. Which one of the following compounds has a large negative free energy of hydrolysis?
- 1. 3-Bisphosphoglycerate
 - 2. ADP
 - 3. Phosphoenolpyruvate
 - 4. 3-Phosphoglycerate
33. The steps of glycolysis between 1,3-bisphosphoglycerate and 2-phosphoglycerate involve
- 1. oxidation of NADH to NAD⁺.
 - 2. ATP synthesis.
 - 3. utilization of P_i.
 - 4. catalysis by phosphoglycerate mutase
34. Which of the following compounds can serve as the starting material for the synthesis of glucose via gluconeogenesis?
- 1. glycerol

(背面仍有題目,請繼續作答)

2. lactate
3. oxaloacetate
4. acetate

35. Glycolytic reactions carried out by which of the following enzymes must be bypassed in the gluconeogenic pathway?

1. Hexokinase
2. Phosphoglycerate kinase
3. Pyruvate kinase
4. Triosephosphate isomerase

36. Glycogen synthase

1. adds glucose units to the nonreducing end of glycogen branches.
2. uses sugar nucleotide as the donor molecule.
3. is especially predominant in liver and muscle.
4. adds the initial glucose unit to a tyrosine residue in glycogenin.

37. Fructose-2,6-bisphosphate

1. activates fructose-1,6-bisphosphatase.
2. activates phosphofructokinase-1.
3. activates glycogen phosphorylase a.
4. inhibits fructose-1,6-bisphosphatase.

38. The citric acid cycle from isocitrate to fumarate includes the reactions catalyzed by

1. isocitrate dehydrogenase.
2. α -ketoglutarate dehydrogenase complex.
3. succinyl-CoA synthetase.
4. succinate dehydrogenase.

39. In tightly coupled mitochondria, the rate of NADH oxidation will:

1. decrease if mitochondrial ADP is depleted.
2. be very low if the inhibitor of ATP synthase is added.
3. increase if an uncoupler is added.
4. increase if cyanide is added.

40. Which of the following statements concerning the mitochondrial ATP synthase is correct?
1. It is actually an ATPase and only catalyzes the hydrolysis of ATP.
 2. It can synthesize ATP after it is extracted from broken mitochondria.
 3. It catalyzes the formation of ATP even though the reaction has a large positive ΔG° .
 4. When it catalyzes the ATP synthesis reaction, the ΔG° is actually close to zero.
41. In hepatocytes and adipocytes, cytosolic NADPH is largely generated by the
1. malate dehydrogenase
 2. malic enzyme
 3. glycolysis
 4. pentose phosphate pathway
42. Which of the following compounds is required in the synthesis of fatty acids?
1. Biotin
 2. Acetyl-CoA
 3. HCO_3^- (CO_2)
 4. NADH
43. In comparison of β oxidation of fatty acids with fatty acid biosynthesis, which of the following statements is correct?
1. Fatty acid degradation is catalyzed by cytosolic enzymes; fatty acid synthesis by mitochondrial enzymes.
 2. A thioester derivative of *trans*-2-butenic acid is an intermediate in the synthetic pathway, but not in the β oxidation pathway.
 3. Fatty acid biosynthesis uses NADH exclusively, whereas β oxidation uses NADP^+ exclusively.
 4. A thioester derivative of D- β -hydroxybutyrate is an intermediate in the synthetic pathway, not in the β oxidation pathway.
44. The enzyme system for adding double bonds to saturated fatty acids requires
1. cytochrome b_5 .
 2. molecular oxygen (O_2).
 3. NADPH.
 4. a mixed-function oxidase.
45. Which of following compounds is able to cross the inner mitochondrial membrane?
1. Acetyl-CoA
 2. Fatty acyl-CoA

(背面仍有題目,請繼續作答)

3. Malonyl-CoA
4. Fatty acyl-carnitine

46. Which of the following is true of the β oxidation of long-chain fatty acids?

1. FADH_2 serves as an electron carrier.
2. The enzyme complex that catalyzes the reaction contains biotin
3. NADH serves as an electron carrier.
4. Oxidation of a 16-carbon fatty acid produces at least one propionyl-CoA.

47. Ketone bodies

1. are acetoacetate, β -hydroxybutyrate, and acetone.
2. can be used as substrates for gluconeogenesis.
3. are overproduced in untreated diabetes mellitus and during prolonged fasting, when fatty acids become the principle energy source.
4. are primarily formed in the adipose tissue.

三、複選題；48-54 題，每題 5 分 (Each question may have more than one answer)

48. Which of the following are required for DNA transcription?

- A. promoter
- B. RNA polymerase II
- C. TATA box
- D. DNA polymerase I
- E. ribosome binding site

49. Which of the following statements about amino acid are *not* correct

- A. One amino acid can be encoded by six different codons
- B. There are three different codons for stop codon
- C. Lysine and Arginine are hydrophobic amino acid
- D. A mature protein may have four methionines.
- E. Most amino acids in signal peptide are hydrophobic amino acids

50. The following statements about eukaryotic mRNA are correct *except*

- A. It has a cap at its 5' end
- B. Mature mRNA are spliced from primary transcript
- C. Poly (A) tail was added to 3' end by terminal transferase

- D. It may undergo alternative splicing from primary transcript
E. It may be degraded or destroyed when expression is not necessary
51. Which of the following are *not* required for translation?
- A. ribosome
 - B. tRNA
 - C. elongation factor
 - D. reverse transcriptase
 - E. aminoacyl-tRNA synthetase
52. Which of the following are *not* involved in the destination (transport) of the protein?
- A. Signal peptide
 - B. Golgi complex
 - C. Endoplasmic reticulum
 - D. Transfer RNA
 - E. nuclear localization sequence
53. Which of the following activities may occur after the peptide is newly synthesized?
- A. removal of the 5' signal peptide
 - B. addition of carbohydrate to the peptide
 - C. Phosphorylation of the peptide
 - D. acetylation of the peptide
 - E. all the above are correct
54. Which of the following enzymes are used in DNA repair in *E. coli*?
- A. DNA polymerase I
 - B. DNA polymerase III
 - C. DNA ligase
 - D. DNA helicase
 - E. all the above are true