

選擇題，每題 2 分。

1. Biological catalysts are

- (A) proteins exclusively (B) RNA exclusively  
(C) DNA exclusively (D) most proteins and some RNA

2. Eukaryotic DNA

- (A) is found in the nucleus (B) is found in the mitochondrion  
(C) is found in the chloroplast (D) all of the above

3. The major building blocks for proteins are

- (A) nucleotides (B) amino acids (C) fatty acids (D) sugars

4. A buffer solution at pH 5.0 has a ratio of  $[HA]/[A^-]$  of 0.8. What is the pKa of the acid?

- (A) 4.1 (B) 4.5 (C) 4.8 (D) 4.9

5. The main intracellular buffer system is

- (A)  $H_3PO_4 / H_2PO_4^-$  (B)  $H_2PO_4^- / HPO_4^{2-}$  (C)  $HPO_4^{2-} / PO_4^{3-}$  (D)  $H_3PO_4 / PO_4^{3-}$

6. Which amino acids contain sulfur?

- (A) cysteine and lysine (B) cysteine and methionine  
(C) arginine and methionine (D) cysteine and isoleucine

7. The pKa values of the side chains of the common amino acids

- (A) are always at low pH (B) are always at high pH  
(C) depend on the chemical nature of the side chain (D) are not known

8. Two amino acids frequently found in reverse turns are

- (A) tyrosine and tryptophan (B) serine and threonine  
(C) glycine and proline (D) leucine and isoleucine

9. At pH below 7, arginine has a net charge of

- (A) +2 (B) +1 (C) -1 (D) -2

10. A peptide bond is formed by a reaction of two molecules of amino acids with the release of one molecule of

- (A)  $CO_2$  (B)  $NH_3$  (C)  $SO_2$  (D)  $H_2O$

11. The binding of oxygen to hemoglobin differs from the oxygen-binding behavior of myoglobin because

- (A) oxygen binding to hemoglobin is cooperative
- (B) oxygen binding to myoglobin is cooperative
- (C) hemoglobin is not an allosteric protein
- (D) the oxygen-binding curve of hemoglobin is hyperbolic

12. The amino acid sequence of a polypeptide chain is a

- (A) primary structure
- (B) secondary structure
- (C) tertiary structure
- (D) quaternary structure

13. How many polypeptide chain(s) is (are) in one molecule of the collagen helix?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

14. A protein has an isoelectric point (pI) of 7. The net charge of this protein will be

- (A) + at pH 5 and - at pH 9
- (B) - at pH 5 and + at pH 9
- (C) + at both pH 5 and 9
- (D) - at both pH 5 and 9

15. The fundamental difference between competitive and noncompetitive inhibition is

- (A) the degree of cooperativity of the reaction
- (B) the size of the active site of the enzyme
- (C) the manner of binding of substrate to the enzyme
- (D) the manner of binding of inhibitor to the enzyme

16. Many metabolic pathways involve multistep reactions. Consider the following pathway.



Feedback inhibition is usually associated with

- (A) the product of the final reaction, F, interacting with E1
- (B) F interacting with an allosteric site in E4
- (C) B interacting with an allosteric site in E1
- (D) all of the intermediates or products in the reaction interacting with the active site in E1

17. An enzyme can catalyze a reaction because it can

- (A) increase the standard free energy
- (B) decrease the standard free energy
- (C) increase the activation energy
- (D) decrease the activation energy

18. Formation of an enzyme-substrate complex in an enzyme reaction is the  
(A) first step                      (B) second step                      (C) third step                      (D) fourth step
19. When  $[S] = K_m$ , then  $V =$   
(A)  $V_{max}$                       (B)  $V_{max}/2$                       (C)  $V_{max}/3$                       (D)  $V_{max}/4$
20. The slope of the Lineweaver-Burk plot changes, but the y intercept does not (The x intercept also changes). What is this type of enzyme inhibition called?  
(A) Competitive      (B) non-competitive      (C) un-competitive      (D) mixed competitive
21. Membrane lipids in a lipid bilayer are held together by  
(A) hydrophobic interaction                      (B) hydrogen bonds  
(C) electrostatic forces                      (D) covalent bonds
22. In the sodium-potassium pump  
(A) sodium is transported out of the cell and potassium into the cell, both against concentration gradients  
(B) sodium is transported into the cell and potassium out of the cell, both against concentration gradients  
(C) sodium is transported out of the cell and potassium into the cell, both in the same direction as concentration gradients  
(D) sodium and potassium are both transported out of the cell against concentration gradient
23. How many carbon atoms does palmitate have?  
(A) 14                      (B) 16                      (C) 18                      (D) 20
24. *E. coli* replication on the lagging strand  
(A) is carried out by DNA polymerase I  
(B) is initially synthesized as Okazaki fragments  
(C) is synthesized continuously  
(D) has this DNA strand synthesized in a 3'-5' direction
25. The promoter site is  
(A) the start site for transcription in DNA  
(B) the binding site for regulatory proteins that stimulate transcription  
(C) the general region of DNA downstream from the start site  
(D) the site on DNA at which RNA polymerase binds to initiate transcription

26. The presence of reverse transcriptase in a cell is an indication of  
(A) DNA repair (B) presence of a retrovirus  
(C) primer synthesis (D) primer removal
27. Cytosine is a  
(A) base (B) nucleoside (C) nucleotide (D) nucleic acid
28. The structure of the double helix, proposed by Watson and Crick in 1953, is a  
(A) A-DNA (B) B-DNA (C) Y-DNA (D) Z-DNA
29. The formylation of methionine in prokaryotes  
(A) depends on two different tRNAs, where methionine can be formylated when bound to one form and not the other  
(B) depends on two different tRNAs, where methionine can be formylated when bound to either one  
(C) depends on one tRNA, where methionine is formylated after binding  
(D) takes place before methionine is bound to tRNA
30. Protein synthesis in prokaryotes always starts with  
(A) a methionine residue (B) a formylmethionine residue  
(C) a cysteine residue (D) no specific residue
31. The anticodon for a particular tRNA specific for tyrosine is 5'-GUA-3'. What is the corresponding codon in mRNA?  
(A) 5'-CAU-3' (B) 5'-UAC-3 (C) 5'-AUG-3 (D) 5'-TAC-3
32. The smallest of the biologically important RNA is  
(A) mRNA (B) tRNA (C) rRNA (D) snRNA
33. How many stereoisomers are possible for a linear aldopentose?  
(A) 4 (B) 8 (C) 12 (D) 16
34. Glucose normally exists as a cyclic molecule. The C-1 carbon atom becomes a new chiral center and is called an  
(A) aromatic atom (B) aliphatic atom (C) acidic atom (D) anomeric atom
35. The step that commits the cell to metabolize glucose is catalyzed by  
(A) hexokinase (B) phosphoglucosmutase (C) aldose (D) phosphofructokinase

36. Amino sugars have a functional group that does not occur in other sugars. This functional group has the structure of  
(A)  $-\text{NH}_2$                       (B)  $-\text{COOH}$                       (C)  $-\text{OH}$                       (D)  $-\text{CHO}$
37. Glycolysis  
(A) does not require oxygen to generate energy  
(B) requires oxygen to generate energy  
(C) is inhibited by oxygen  
(D) rate is increased in the presence of oxygen
38. Which of the following exercise(s) allosteric control in the reaction of phosphofructokinase?  
(A) ATP    (B) fructose 2,6-bisphosphate    (C) both of the above    (D) neither of the above
39. In gluconeogenesis, the initial reaction converts pyruvate to  
(A) oxaloacetate    (B) acetyl-CoA    (C) phosphoenolpyruvate    (D) lactate
40. In the Cori cycle  
(A) lactic acid is transported from the liver to muscle by the blood  
(B) lactic acid is transported from the liver to the kidneys by the blood  
(C) glycolysis takes place in muscle and gluconeogenesis in the liver  
(D) glycolysis takes place in the liver and gluconeogenesis in muscle
41. A cell in an active metabolic state has  
(A) a high (ATP/ADP) and a high (NADH/NAD<sup>+</sup>) ratio  
(B) a high (ATP/ADP) and a low (NADH/NAD<sup>+</sup>) ratio  
(C) a low (ATP/ADP) and a low (NADH/NAD<sup>+</sup>) ratio  
(D) a low (ATP/ADP) and a high (NADH/NAD<sup>+</sup>) ratio
42. Which of the following is a source of NADPH?  
(A) the pentose phosphate pathway  
(B) a series of reactions in which oxaloacetate is reduced to malate following by oxidative decarboxylation of the malate to pyruvate  
(C) both of the above  
(D) neither of the above
43. The cytochrome that passes electrons directly to oxygen is  
(A) the cytochrome *a/a3* complex                      (B) cytochrome *b*  
(C) cytochrome *c*                      (D) cytochrome *c1*

44. A characteristic of the glycerol phosphate shuttle is  
(A) it shuttles NADH across the mitochondrial membrane to yield 2.5 ATP / NADH.  
(B) it shuttles the electrons from NADH across the mitochondrial membrane to FADH<sub>2</sub>, yielding 1.5 ATP / NADH.  
(C) it only operates efficiently at high levels of NADH.  
(D) malate is a key component in the shuttle process.
45. Biosynthesis of lipids typically takes place  
(A) in the mitochondrial matrix                      (B) in the cytosol  
(C) on the endoplasmic reticulum                      (D) in the Golgi apparatus
46. A repeated sequence of reactions successively cleaves two-carbon units from the fatty acid, starting from the carboxyl end. This process is called  
(A)  $\alpha$  oxidation                      (B)  $\beta$  oxidation                      (C)  $\gamma$  oxidation                      (D)  $\theta$  oxidation
47. Ammonia is toxic and it must be incorporated into biologically useful compounds. Which two amino acids are of central importance in the process?  
(A) aspartate and asparagines                      (B) glutamate and glutamine  
(C) leucine and isoleucine                      (D) alanine and phenylalanine
48. Deoxyribonucleotids for DNA synthesis are mainly produced by the reduction of  
(A) ribonucleosides                      (B) ribonucleoside monophosphates  
(C) ribonucleoside diphosphates                      (D) ribonucleoside triphosphates
49. In the final stages of aerobic metabolism, electrons are transferred from NADH to  
(A) O<sub>2</sub>                      (B) CO<sub>2</sub>                      (C) H<sub>2</sub>                      (D) N<sub>2</sub>
50. A second messenger is  
(A) a substance that brings about a desired effect in a cell as a result of a hormone binding to its receptor on the cell surface.  
(B) a hormone that acts on a target cell, not one of the releasing factors or trophic hormones that act on specific endocrine glands.  
(C) a hormone that affects the DNA of the target cell.  
(D) a specialized form of mRNA.