一、選擇題（單選，共五題，每題二分，答錯倒扣 0.5 分）

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

1. α-D-Glucose

   1. is an anomer of β-D-galactose.
   2. is an epimer of α-D-galactose.
   3. is a constituent of cellulose.
   4. is an epimer of α-D-mannose.

2. Proteoglycans

   1. are negatively charged at neutral pH.
   2. are important components of the extracellular matrix of connective tissue.
   3. contain large segments of a repeating unit typically consisting of a hexosamine and a uronic acid.
   4. are largely composed of proteins.

3. Which of the following sugars can undergo mutarotation?

   1. Glycogen
   2. Lactose
   3. Sucrose
   4. Maltose

(背面仍有題目,請繼續作答)

4. Which of the following statements is correct concerning the free energy change?

   1. $\Delta G^{\circ\prime}$ and $\Delta G'$ mean the same thing.
   2. When $\Delta G^{\circ\prime}$ is positive, $K_{eq}'>1$.
   3. When $\Delta G^{\circ\prime}=1.0$ kJ/mol, $K_{eq}'=1$.
   4. In a reaction under standard conditions, both reactants and products are fixed at 1 M.

5. The free energy of a reaction (ΔG) is

   1. dependent on the activation energy.
   2. dependent on concentrations of reactants and products.
   3. dependent on the presence of an enzyme.
   4. dependent on the standard free energy change of this reaction.

二、選擇題（單選，共二十四題，每題二分，答錯倒扣 0.5 分）

6. Which one of the following is an anomeric pair?

   A. D-glucose and L-fructose.
   B. D-glucose and D-mannose.
   C. α-D-glucose and α-L-glucose.
   D. α-D-galactose and β-D-galactose.
   E. α-D-glucose and β-L-glucose.

7. Which of the following compounds is the product of glucose under oxidation by Cu^{2+}?

   A. D-Galactose
   B. D-Glucuronate
   C. D-Gluconate
   D. D-Ribose
   E. D-Mannose

8. Which of the following compounds is NOT a homopolysaccharide?

A. Starch
B. Glycogen
C. Chitin
D. Cellulose
E. Hyaluronate

9. Which of the following compounds is NOT a constituent of Gram-positive bacterial cell wall?

A. D-Isoglutamic acid
E. N-Acetylglucosamine
C. N-Acetylmuramic acid
D. Chitin
E. D-Alanine

10. Which of the following compounds does NOT contain sphingosine?

A. Cardiolipin
B. Gangliosides
C. Ceramide
D. Cerebrosides
E. None of the above

11. Which of the following vitamins is fat soluble?

A. Thiamine
B. B_6
C. C
D. D
E. Folate

12. Which of the following vitamins has a biological role in blood clotting?

A. A
B. B
C. D
D. E
E. K

(背面仍有題目,請繼續作答)

13. A lipid containing an ether-linked alkyl group is

A. sphingomyelin
B. platelet-activating factor
C. ganglioside
D. cholesterol
E. cerebroside

14. Lecithin is

A. phosphatidylethanolamine.
B. phosphatidylserine.
C. phosphatidylcholine.
D. phosphatidylinositol.
E. phosphatidic acid.

15. The integral membrane proteins

A. are water-soluble.
B. are easily extractable from the membrane lipid bilayer.
C. extend through the membrane.
D. are confined to one surface of the membrane.
E. none of the above.

16. Endergonic reactions are those which have a _____ value of ΔG and _____ spontaneous.

A. negative --------- are not
B. negative --------- are
C. positive --------- are not
D. positive --------- are
E. none of the above

17. The reaction pyruvate + NADH + $H^+ \rightleftharpoons$ lactate + NAD^+ has a $\Delta G^{\circ\prime}$ of -25 kJ/mol at 25°C. One can predict that

A. lactate will rapidly convert to pyruvate.
B. when pyruvate and NADH are mixed the reaction will proceed rapidly toward lactate formation.

C. the reaction is always at equilibrium.
D. at equilibrium $\Delta G = \Delta G^{\circ\prime}$.
E. none of the above.

18. Which of the following compounds is a high energy phosphate compound?

A. AMP
B. Pyruvate
C. 2,3-Bisphosphoglycerate
D. 1,3-Bisphosphoglycerate
E. Glucose-6-phosphate

19. The equilibrium constant of a reaction equals 10, the standard free energy change (ΔG°) is

A. -RT
B. +RT
C. -2.3 RT
D. +2.3 RT
E. 0

20. Consider the list of standard reduction potentials for biological half-reactions shown below.

	$E^{\circ\prime}$ (V)
$NAD^+ + 2H^+ + 2e^- \longrightarrow NADH + H^+$	-0.32
$Oxaloacetate + 2H^+ + 2e^- \longrightarrow malate$	-0.17

If you mixed oxaloacetate, malate, NAD^+, and NADH together, all at 1 M concentrations and in the presence of malate dehydrogenase, which of the following would happen initially?

A. Malate would become oxidized, NAD^+ would become reduced.
B. Oxaloacetate would become reduced, NADH would become oxidized.
C. Both oxaloacetate and malate would become oxidized.

(背面仍有題目,請繼續作答)

D. Oxaloacetate would become reduced, NADH would be unchanged.
E. No reaction would occur.

21. The amino acid which has a side chain with typical pKa range of 6.5-7.4 is

A. Alanine
B. Asparagine
C. Glutamine
D. Cysteine
E. Histidine

22. Which is the group of amino acids that all have branched aliphatic side chain?

A. Ala, Val, Ser
B. Val, Leu, Ile
C. Ser, Thr, Phe
D. His, Lys, Asp
E. Pro, Ile, Leu

23. The amino acid residue in chymotrypsin which is covalently modified in reaction with diisopropylfluorophosphate is?

A. Asp
B. Glu
C. His
D. Lys
E. Ser

24. Which of the following statements concerning collagen is **INCORRECT** ?

A. It contains repeat sequences of the form Gly-X-Y, where X is often proline and Y is proline or hydroxyproline.
B. It is consisted of four left-handed helices.
C. Hydroxylation of lysine as well as proline residues occur in collagen.

D. The polypeptide chains are cross-linked by covalent bonds between lysine residues.
E. Extreme vitamin C deficiency causes weakening of collagen fibers.

25. The correct statement is

A. Thalassemias are genetic defects involving hemoglobin mutation in which one or more genes are wholly or partially non-functional.
B. The fetus of human being has $\alpha_2\beta_2$ hemoglobin
C. Hemoglobin has higher affinity for oxygen than myoglobin.
D. The oxygen affinity of hemoglobin increases in the presence of CO_2.
E. Hemoglobin is only good for oxygen not for CO_2 transport.

26. The correct statement of sickle cell anemia is

A. Individuals heterozygous for sickle cell hemoglobin have a higher resistance to malaria than those who do not carry the sickle-cell mutation.
B. Sickle cell hemoglobin in its oxygenated state tends to aggregate into long, rod-like structures.
C. The glutamic acid residue at the position 6 in β chains of hemoglobin is replaced by a lysine residue in sickle cell hemoglobin.
D. Individuals who are homozygous for sickle cell mutation have normal life span.
E. Sickle cell hemoglobin can not form tetramer.

27. The correct statement of proteins

A. For all globular proteins hydrophobic residues are packed mostly on the outside surface.
B. Proline is found in the α helical structure.
C. β sheets and α helical structures do not exist in the same globular protein.
D. The secondary structures of a peptide can not be predicted from its amino acid sequence.
E. The burying of hydrophobic groups within a folded protein molecule produces an overall entropy increase.

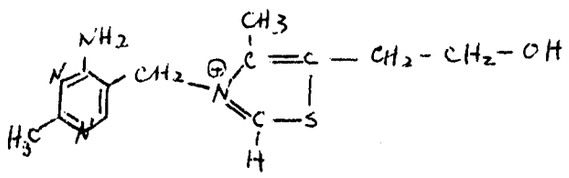
(背面仍有題目,請繼續作答)

28. The enzyme kinetic parameter that doesn't change in the presence of a competitive inhibitor is (are)?

A. K_M
B. V_{max} / K_M
C. V_{max}
D. the intercept of the Lineweaver-Burk plot with the 1/[S] axis
E. both K_M and V_{max}

29. The name of compound of the following chemical structure is:

A. niacin
B. riboflavin
C. thiamine
D. biotin
E. pyridoxal

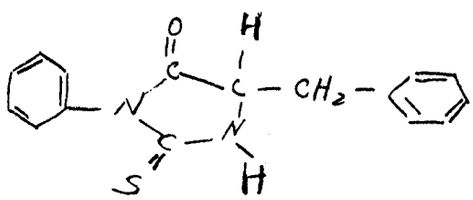


三、簡答題及問答題

30. Amino acid analysis of an oligopeptide of seven residues long gave

Asp Leu Lys Met Phe Tyr

The following facts were observed:
a. Trypsin treatment had no apparent effect.
b. The phenylthiohydantoin released by Edman degradation was



c. Brief chymotrypsin treatment yielded several products including a dipeptide and a tetrapeptide. The amino acid composition of the tetrapeptide was Leu, Lys, and Met

d. Cyanogen bromide treatment yielded a dipeptide, a tetrapeptide, and free lysine.

What is the amino acid sequence of this heptapeptide? (6%)

_____, _____, _____, _____, _____, _____, _____, _____.

31. A new protein of unknown structure has been purified. Gel filtration chromatography reveals that the native protein has a molecular weight of 240,000. Chromatography in the presence of 6M guanidine hydrochloride yields only a peak for a protein of Mr 40,000. Chromatography in the presence of 6M guanidine hydrochloride and 10 mM mercaptoethanol yields peaks for proteins of Mr 17,000 and 23,000. Explain what can be determined about the structure of this protein from the data. (4%)

32. The following kinetic data were obtained for an enzyme in the absence of any inhibitor (1) and in the presence of an inhibitor (2) at 5 mM concentration. Assume [Eo] is the same in each experiment. (7%)

[S] (mM)	(1) v(μmol/sec)	(2) v(μmol/sec)
1	12	4.3
2	20	8
4	29	14
8	35	21
12	40	26

a. Determine Vmax and Km for the enzyme.
b. Determine the type of inhibition.

(背面仍有題目,請繼續作答)

33. The pH profile of pepsin is bell-shaped, indicating the involvement of a general acid and a general base in the catalysis with pKas around 4.3 and 1.4, respectively. The two candidates for these roles are two aspartic acid residues, Asp-31 and Asp-25. However, the pKa of aspartic acid residues in polypeptides range from 4.2 to 4,6. How might the pKa of an aspartic acid residue be influenced by protein structure? (3%)

34. The central rod domain of a keratin protein is approximately 312 residues. What is the length (in Å) of the keratin rod domain? The α helix repeats every 3.6 residues and has a pitch of 0.54 nm. (2%)

35. Explain how methotrexate inhibits protein synthesis. (6%)

36. Explain the molecular basis of action of diphtheria toxin and aphidicolin toxin. (6%)

37. In the film "Jurassic park", they claimed to reconstruct dinosaur from the fossil of mosquitos which had sucked blood from dinosaurs in the Jurassic era. Do you think it is feasible to make dinosaurs using modern biotechnology? Use your scientific background and also your imagination to describe the possibilities and impossibilities. (8%)