考生注意事項：所有考題務必在答案卷上作答，在問題卷上作答者不計分。

I. 選擇題（1-19題，每題二分，答錯倒扣0.5分，均為單選）

1. Identify the molecules derived from sterols

   A. prostaglandins
   B. geraniol
   C. vitamin D
   D. gangliosides

2. Tay-Sachs disease results from

   A. the lack of a phospholipid-synthesizing enzyme.
   B. a deficiency of gangliioside residue due to the lack of a ganglioside-synthesizing enzymes.
   C. an accumulation of gangliioside due to the lack of a ganglioside-degrading enzymes.
   D. an accumulation of phospholipid-synthesizing enzyme.

3. Which of the following is true of sphingolipids?

   A. Phosphatidylcholine is a typical sphingolipid.
   B. They always contain glycerol and fatty acids
   C. They may be charged, but are never amphipathic.
   D. Cerebrosides and gangliosides are sphingolipids.

4. A lipid derived from isoprenoid precursors is:

   A. palmitate
   B. cholesterol
   C. arachidonate
   D. sphingosine

(背面仍有題目,請繼續作答)

5. Sphingosine is **NOT** a component of

A. cardiolipin
B. gangliosides
C. cerebrosides
D. ceramide

6. A glycosidic bond is the linkage in a(an)

A. ester
B. ether
C. aldehyde
D. ketone

7. Indicate the number of stereoisomers which are possible for a linear aldopentose.

A. 4
B. 8
C. 12
D. 16

8. How many enantiomeric pairs are found for a linear aldohexose?

A. 2
B. 4
C. 8
D. 16

9. Which of the following molecules **CANNOT** undergo mutarotation?

A. glucose
B. lactose
C. maltose
D. sucrose

10. The amino acid residues directly involved in the sugar-protein linkage in glycoproteins are

A. asn, ser, and thr
B. lys, his, and glu
C. tyr, ser, and thr
D. ser, tyr, and lys

11. Membrane lipids in a lipid bilayer are held together primarily by

A. hydrophobic forces
B. hydrogen bonds
C. electrostatic forces
D. covalent bonds

12. The fatty acid that is described as 20:4 is

A. palmitic acid
B. arachidonic acid
C. lauric acid
D. linoleic acid

13. Which of the following is a heteropolysaccharide?

A. glycogen
B. chitin
C. cellulose
D. hyaluronate

14. Which of the following statements is NOT correct?

A. Amylose is unbranched.
B. Amylopectin and glycogen contains many (1⟶6) branches.
C. In proteoglycans, the protein moiety dominates, constituting 95% of the mass.
D. Chondrotin sulfate is a glycosaminoglycan.

(背面仍有題目,請繼續作答)

15. The fluidity of a lipid bilayer will be increased by

A. decreasing the number of unsatured positions
B. increasing the length of the alkyl chains
C. increasing the temperature
D. more than one answer above

16. An integral membrane protein will commonly be solubilized by extraction with

A. a buffer of alkaline pH
B. a solution of high ionic strength
C. a chelating agent that removes divalent cations
D. a solution containing detergent

17. Glucose transport into erythrocytes is an example of

A. facilitated diffusion
B. active transport
C. symport
D. antiport

18. Facilitated diffusion through a biological membrane is

A. generally irreversible.
B. driven by ATP
C. driven by a difference of solute concentration
D. endergonic

19. Which of the following is a palindromic sequence

A. GGGGGG
B. GCATAT
C. GCATGC
D. CCTTCC

II. Essay question: (20-30 題)

20. Polymerase chain reaction is a powerful method to amplify any gene by the use of two oligo-primers and thermostable DNA polymerase. The length of the primer is usually longer than 16 bp. Explain why the length of the primer should be longer than 16 bp. (4%)

21. Two primers with the length of 20 bp each was used to amplify the following DNA fragment. The sequence of this DNA fragment is shown below:

AAGTCGATGCTAGTCGTCGTATGCTGCGTATGCGTATTATGCAGTCGTACG
TAAGTCGTCAGTCGTCGAAGGCGACGTGCGATGCGGATGCGTTGCGTGTT
CGGATCGTGTCGTGACTGACGTCGTGTCGTATGCTTAATGTCTTCTAGCTG
ACTGCGTCGTGCGTCGTCATGCGTCGTACGTC

Write the sequence of these two primers for PCR reaction. Remember that the DNA sequence must be written in a 5' to 3' order. (8%)

22. A 500-mL sample of a 0.1M formate buffer, pH 3.75, is treated with 5 ml of 1M KOH. What is the pH following this addition? (5%)

(pKa of formic acid is 3.75. log 2 = 0.301, log 3 = 0.477, log 9 = 0.95, log 11 = 1.041)

23. The decomposition reaction of crystalline N_2O_5 is as following:

N_2O_5 (s) ⟶ $2NO_2$ (g) + 1/2 O_2 (g) .

At 25°C we have the following values for the standard state enthalpy and free energy of the reaction: (5%)

ΔH° = +109.6 kJ/mol ΔG° = -30.5 kJ/mol

(a) Calculate ΔS° at 25°C

(b) Why the entropy change so favorable for this reaction?

(背面仍有題目,請繼續作答)

24. Given the following peptide

Ser-Glu-Pro-Ile-Met-Ala-Pro-Val-Glu-Tyr-Pro-Lys

(a) Estimate the net charge (1) at pH 7 and (2) at pH 12.

(b) How many peptides would result if this peptide was treated with (1) cyanogen bromide (2) trypsin, and (3) chymotrypsin (5%)

25. In the protein adenylate kinase, the C terminal region is α-helical, with the sequence

Val-Asp-Asp-**Val-Phe**-Ser-Gln-Val-Cys-Thr-His-**Leu**-Asp-Thr-**Leu**-Lys-

The hydrophobic residues in this sequence are presented in bold face type. Suggest a possible reason for the periodicity in their spacing. (5%).

26. What effect would you expect each of the following to have on the P_{50} of hemoglobin A (Hb A)? Where P_{50} is the oxygen partial pressure for half-saturation of Hb A in oxygen binding curve. (6%)

(a) Decrease in pH from 7.4 to 7.2.

(b) Increase of P_{CO_2} from 20 to 40 mmHg.

(c) Increase of 2,3-Bisphosphoglycerate from 1 mM to 10 mM

27. The following data describe the catalysis cleavage of peptide bonds in small peptides by the enzyme elastase.

Substrate	K_M(mM)	kcat (s^{-1})
(I) PAPA ↓ G	4.0	26
(II) PAPA ↓ A	1.5	37
(III) PAPA ↓ F	0.64	18

The arrow indicates the peptide bond cleaved in each case.(9%)

(a) if a mixture of these three substrates was presented to elastase with the concentration of each peptide equal to 0.5 mM, which would be digested most rapidly? which most slowly? (assume enzyme is present in excess.)

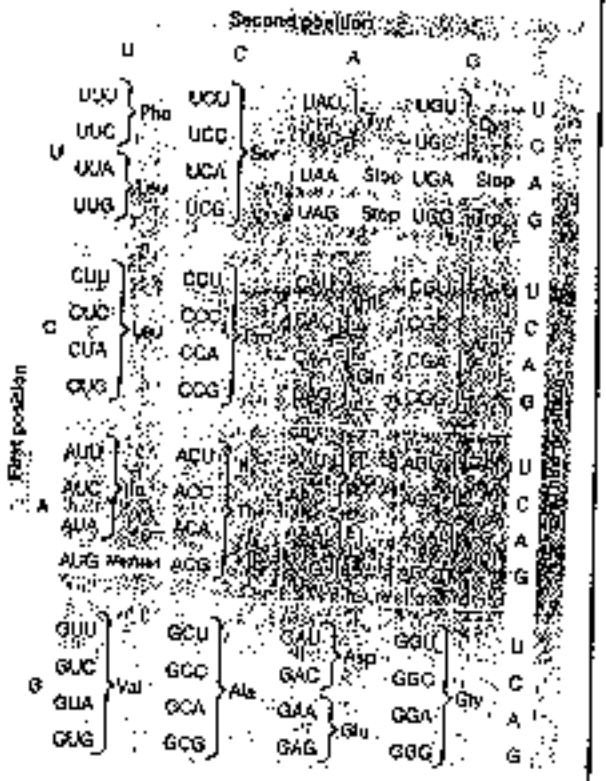
(b) On the bases of these data, suggest what features of amino acid sequence dictated the specificity of proteolytic cleavage by elastase.

(c) Elastase is closely related to chymotrypsin. Suggest three kinds of amino acid residues you might expect to find in the active site.

28. The 5' end sequence of the mRNA of seal myoglobin is as following:

5'-----ACUGCACCAUGGGGCUCAGCGACGGGGAA-----3'

What are the first five N-terminal amino acid residues in the matured myoglobin? (5%)



29. For a Michaelis-Menten reaction, $k_1 = 7 \times 10^7\ M^{-1}\ sec^{-1}$,

$k_{-1} = 1 \times 10^3\ sec^{-1}$ and $k_2 = 2 \times 10^4\ sec^{-1}$. (4%)

(a). What are the values of K_S and K_M ? (Where Ks is the dissociation constant)

(b) Does substrate binding approach equilibrium or does it behave more like a steady-state system?

30. (a) Draw the structure of γ-carboxyglutamic acid.

(b) Which fat-soluble vitamin is necessary for production of this modified amino acid?

(c) Suggest a biological role for this modified amino acid? (6%)