

系所組別： 生物科技研究所甲、乙組

考試科目： 生物化學

考試日期： 0308 · 節次： 2

※ 考生請注意：本試題 可 不可 使用計算機

I. 單選題 (Simple Choice Questions): 共 25 題, 每題 2 分

1. What can cause the increase of O_2 affinity of hemoglobin?
 - A. A pH increase from pH 7.2 to pH 7.4 in blood plasma.
 - B. An increase in the partial pressure of CO_2 in the lungs from 2 to 6 kPa.
 - C. An increase in the 2, 3-Bisphosphoglycerate level to high altitude.
 - D. A decrease in the partial pressure of O_2 in blood plasma.

2. Following statements which are correct regarding the formation of a peptide bond except _____?
 - A. Two amino acids are covalently joined through an amide linkage.
 - B. Peptide bond is consisted of C, N, O, H atoms.
 - C. H_2O is formed when two amino acids form a peptide bond.
 - D. Under standard biochemical condition, peptide formation is thermodynamically favorable.

3. Following which methods can be used to determine the structure of protein?
 - A. Edman degradation.
 - B. Tandem mass spectrometer (MS) or MS/MS.
 - C. Nuclear magnetic resonance (NMR).
 - D. SDS-PAGE.

4. Following which steroid hormones are derived from cholesterol except _____?
 - A. Testosterone.
 - B. Estradiol.
 - C. Cortisol.
 - D. Prednisone

5. There are at least three types of ion-transporting ATPase in living organism. Following which is not one of the features of P-type ATPase?
 - A. Its structure is similar to F-type ATPase.
 - B. It can pump heavy metal ions out of cell in bacteria.
 - C. It pump H^+ and K^+ across the plasma membrane, thereby acidifies contents of the mammalian stomach.
 - D. It can be inhibited by vanadate.

6. Following which molecules can serve as a second messenger in signal transduction except _____?

(背面仍有題目,請繼續作答)

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- A. cGMP.
B. Inositol 1, 4, 5-triphosphate.
C. Calcium.
D. Triacylglycerol.
7. What is the approximate molecular weight of a protein with 500 amino acid residues in a single polypeptide chain?
A. 35 kDa.
B. 45 kDa.
C. 55 kDa.
D. 75 kDa.
8. Following statements which are correct to illustrate the relationship between protein structure and biological function except _____?
A. The α -helix structure of α -keratin crossed linked by disulfide bonds is mainly contributed to the flexibility of hair.
B. The α -helix structure of α -keratin is mainly contributed to the tough, hardness of nails.
C. The β -conformation structure of fibroin is mainly contributed to the soft, flexible filaments in silks.
D. The β -conformation structure of collagen is mainly contributed to the high tensile strength in bone matrix.
9. Following which proteins might facilitate the process of protein folding except _____?
A. HSP70.
B. Chaperonins.
C. Protein disulfide isomerase (PDI).
D. Protein peptidase.
10. Following which coenzymes contain adenosine except _____?
A. Vitamin B₂.
B. Vitamin B₆.
C. Vitamin B₁₂.
D. Coenzyme A.
11. Following which molecule is the precursor used to synthesize L-Ascorbic acid (vitamin C)?

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- A. ADP-glucose.
 - B. UDP-glucose.
 - C. CDP-glucose.
 - D. Glucose 1-phosphate
12. Following which amino acids can be synthesized from α -ketoglutarate?
- A. Glutamate.
 - B. Isoleucine.
 - C. Arginine.
 - D. Proline.
13. Which techniques can separate proteins based on molecular size?
- A. Ion exchange chromatography.
 - B. X-ray crystallography.
 - C. Gel filtration.
 - D. Native PAGE (polyacrylamide gel electrophoresis).
14. Which enzyme is a type of reverse transcriptase?
- A. Polynucleotide phosphorylase.
 - B. Polyadenylate polymerase.
 - C. Telomerase.
 - D. RNA replicase.
15. Which is not correct regarding polymerase chain reaction (PCR)?
- A. Conceived by Kary Mullis in 1983.
 - B. PCR reaction need DNA template.
 - C. PCR reaction need a pair of specific primers.
 - D. PCR reaction needs polyadenlyate polymerase.
16. Which enzyme is involved in CO_2 fixation in photosynthesis?
- A. Ribulose 1,5-bisphosphate carboxylase/oxygenase.
 - B. Ribulose 1-phosphate carboxylase/oxygenase.
 - C. Ribulose 5-phosphate carboxylase/oxygenase.
 - D. Ribulose 1,5-bisphosphate transferase.
17. Which is not correct regarding the electron transport chain complex in mitochondria?
- A. Cytochrome oxidase carries electrons from cytochrome c to oxygen.

(背面仍有題目,請繼續作答)

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- B. Q cycle occurs through complex IV.
- C. Succinate dehydrogenase is a subunit of complex II.
- D. NADH:ubiquinone oxidoreductase is complex I.

18. Which genetically defective enzyme in urea synthesis can lead to disease in human?

- A. Arginase.
- B. Arginine aminotransferase.
- C. Argininsuccinate lyase.
- D. Carbamoyl phosphate synthetase I.

19. Which is an amphipathic molecule at pH 7 except _____?

- A. Phenylalanine.
- B. Phosphatidylcholine.
- C. Tyrosine.
- D. Phosphatidylglycerol.

20. Following which amino acid residue is the potential phosphorylation site of a protein?

- A. Glutamine.
- B. Glutamic acid.
- C. Lysine.
- D. Threonine.

21. Following statement which is not correct regarding the polysaccharide?

- A. Starch is consisted of amylose and amylopectin with only α (1 \rightarrow 4)glucose repeating unit.
- B. Glycogen is for energy storage in animal cells with α (1 \rightarrow 4)glucose repeating unit.
- C. Cellulose is homopolymer of (β 1 \rightarrow 4)glucose.
- D. Hyaluronate is an essential component of the extracellular matrix of cartilage and tendons.

22. Following which molecules are required for DNA sequencing by the Sanger method except _____?

- A. DNA.
- B. ATP.
- C. dATP.
- D. ddATP.

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23. Following which techniques is commonly used in lipid analysis except _____?

- A. Chloroform/methanol/water extraction.
- B. Thin-layer chromatography.
- C. Gas chromatography
- D. SDS-PAGE

24. Following which compound is a chemotherapeutic agent, involved in the inhibition of thymine synthesis in cells?

- A. Methotrexate.
- B. Azaserine.
- C. Acivicin
- D. Fluorouracil

25. Following which double strand DNA has highest melting point (t_m)?

- A. AAAGGGTTTCCC.
- B. AAAGGGTTTTC.
- C. AAAGGTTTTCCC
- D. AAAGGTTTTTCC

II. 簡答題 (Short Essay): 共 10 題, 每題 5 分

1. A peptide has the sequence as following: "Gly-Tyr-Ser-Ser-Gly-Lys-Asp-Gly". According to the properties of indicated amino acids in the table below, please answer following questions:

Amino acid	pKa values			pI
	pK ₁ (-COOH)	pK ₂ (-NH ₃)	pK _R (R group)	
Gly	2.3	9.6		6.0
Tyr	2.2	9.1	10.0	5.7
Ser	2.2	9.2		5.7
Lys	2.2	9.0	10.5	9.7
Asp	1.9	9.6	3.7	2.8

- (a). What is the net charge of this peptide at pH 8?
- (b). Please estimate the pI for this peptide?

2. Substrate concentration can affect the rate of enzyme-catalyzed reactions as the following table shown. Please calculate the kinetic parameters such as V_{max} and K_m for this enzyme by Lineweaver-Burk plot.

(背面仍有題目, 請繼續作答)

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Substrate concentration (mM)	Velocity (mmoles/min/ μ g)
0	0
0.25	10
0.50	20
1.00	50
2.00	80
4.00	85
8.00	85
10.00	85

- Please explain why replication is very accurate in *E. coli*?
- Please describe or draw the splicing mechanism of group I introns?
- Please explain the “wobble hypothesis”, which a set of 4 relationships was proposed by Crick!
- Please draw and explain the “operon” in prokaryotes!
- A biochemist discovers and purifies a new enzyme, generating the purification table below.

Procedure	Total protein (mg)	Activity (units)
1. Crude extract	2,000	40,000
2. Precipitation (salt)	1,000	30,000
3. Ion-exchange chromatography	200	20,000
4. Affinity chromatography	50	12,500
5. Gel filtration	30	9,000

Please explain and indicate which of the purification procedures used for this enzyme is most effective? Which is least effective?

- Please give at least five types of covalent modification of enzymes, which might play a role in the regulation of enzymatic activity.

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9. Please describe or draw the stage of "termination of protein synthesis" in bacteria.

10. Please explain and indicate following which polypeptide is more soluble in water at pH 6?

a. peptide: (Ala-Ser-Gly)₅ or b. peptide: (Asn-Ser-His)₅