

# 亞洲大學

## 96 學年度碩士班入學招生考試試題紙

學系別	考試科目	考試日期	時 間
生物科技學系、生物資訊學系	生物化學	96.4.21	10:30-12:10

### Part I. Multiple Choice Question: 35%

- To disrupt the cell membrane for protein extraction, which of the following material should be used?  
(A) dextran (B) triton X-100  
(C) diethylaminoethyl cellulose (D) carboxymethyl cellulose
- Which of the following is not a polysaccharide?  
(A) chitin (B) cellulose (C) pectin (D) lignin
- The enzymes that are responsible for three important control points in glycolysis are:  
(A) hexokinase, triose phosphate isomerase, and pyruvate kinase.  
(B) hexokinase, pyruvate dehydrogenase, and phosphoenolpyruvate carboxykinase.  
(C) hexokinase, phosphofructokinase, and pyruvate kinase.  
(D) hexokinase, glyceraldehyde 3-phosphate dehydrogenase, pyruvate kinase.
- The process of long chain fatty acid oxidation in liver is regulated in part by the interaction of:  
(A) acetyl-CoA with carnitine acyl transferase I.  
(B) acetyl-CoA with carnitine acyl transferase II.  
(C) malonyl-CoA with carnitine acyl transferase I.  
(D) malonyl-CoA with carnitine acyl transferase II.
- In the Cori cycle, the liver is primarily responsible for converting a substrate from muscle into glucose which is then returned to muscle. This substrate is:  
(A) acetyl CoA. (B) glucose. (C) alanine. (D) lactate
- NADPH necessary for de novo biosynthesis of fatty acids can be produced directly from:  
(A) pentose phosphate pathway.  
(B) glycolysis.  
(C) Krebs cycle.  
(D) oxidative phosphorylation.
- What is the abbreviation for  $\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CH}(\text{CH}_2)\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$ ?  
(A) 18:2  $\Delta$ 9,10,12,13 (B) 18:2  $\Delta$ 9,12  
(C) 18:2  $\Delta$ 6,7,9,10 (D) 18:2  $\Delta$ 6,9

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8. Which transport system is participated in glucose transport in vivo?  
 (A) active transport      (B) facilitated diffusion  
 (C) passive transport      (D) all of the above
9. The main purpose of glycoxylate cycle is to generate oxaloacetate from acetyl CoA for:  
 (A) TCA cycle in bacteria.      (B) gluconeogenesis in plant.  
 (C) TCA cycle in animal.      (D) gluconeogenesis in animal.
10. Which of the following is the shuttle mechanism for metabolite transport between mitochondria and cytosol during glycolysis in muscle?  
 (A) glycerol-phosphate shuttle      (B) pyruvate-oxaloacetate shuttle  
 (C) citrate-succinate shuttle      (D) malate-aspartate shuttle
11. Continuing from the above question, how many net ATPs will be generated after one maltose molecule was oxidized completely to CO<sub>2</sub> and H<sub>2</sub>O in muscle?  
 (A) 30      (B) 32      (C) 60      (D) 64
12. One RNA sequence is listed below.  
<sup>5'</sup>-AUGCCAUAUUCUAGUACCAUGGGUAGGCAUGAAUGUGA  
 CUGAUUUUAGUAACAUAUAAAAAAAAAAAAAAAAAAAA  
 AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA  
 AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA-<sup>3'</sup>
- Using the genetic code provided, which of the following is not included in any of the possible polypeptides translated from the above RNA sequence?  
 (A) proline      (B) histidine      (C) lysine      (D) phenylalanine

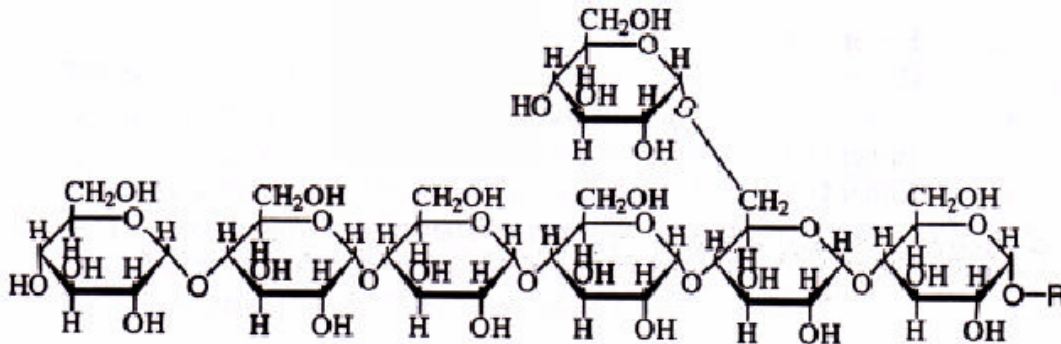
UUU Phe	UCU Ser	UAU Tyr	CGU Arg
UUC Phe	UCC Ser	UAC Tyr	CGC Arg
UUA Leu	UCA Ser	UGU Cys	CGA Arg
UUG Leu	UCG Ser	UGC Cys	CGG Arg
CUU Leu	CCU Pro	CAU His	AGU Ser
CUC Leu	CCC Pro	CAC His	AGC Ser
CUA Leu	CCA Pro	CAA Gln	AGA Arg
CUG Leu	CCG Pro	CAG Gln	AGG Arg
AUU Ile	ACU Thr	AAU Asn	GGU Gly
AUC Ile	ACC Thr	AAC Asn	GGC Gly
AUA Ile	ACA Thr	AAA Lys	GGA Gly
UGG Trp	ACG Thr	AAG Lys	GGG Gly
GUU Val	GCU Ala	GAU Asp	UGA SeCys
GUC Val	GCC Ala	GAC Asp	
GUA Val	GCA Ala	GAA Glu	
GUG Val	GCG Ala	GAG Glu	

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13. Which of the following glycosidic linkage is NOT shown in the molecule below?



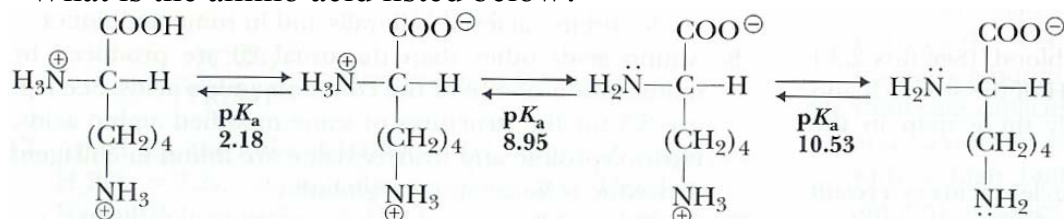
- (A)  $\alpha$ -1,4-glycosidic linkage  
 (B)  $\alpha$ -1,6-glycosidic linkage  
 (C)  $\beta$ -1,6-glycosidic linkage  
 (D) None of the above
14. Which factor is involved in the chain termination of RNA transcript?  
 (A)  $\alpha$  (B)  $\beta$  (C)  $\rho$  (D)  $\sigma$
15. Which of the following is not the enzyme action?  
 (A) increase the rate of a reaction.  
 (B) lower the activation energy of a reaction.  
 (C) act specifically on one substrate or a group of related substrates.  
 (D) alter the equilibrium constant of a reaction.
16. Three structures are listed below. Molecule A and B are:
- |                    |                    |                    |
|--------------------|--------------------|--------------------|
| CHO                | CHO                | CHO                |
|                    |                    |                    |
| HCOH               | HCOH               | HOCH               |
|                    |                    |                    |
| HOCH               | HCOH               | HCOH               |
|                    |                    |                    |
| HCOH               | HCOH               | HOCH               |
|                    |                    |                    |
| CH <sub>2</sub> OH | CH <sub>2</sub> OH | CH <sub>2</sub> OH |
| <b>A</b>           | <b>B</b>           | <b>C</b>           |
- (A) enantiomers (B) epimers  
 (C) mirror-image stereoisomers (D) none of the above
17. Which of the following can not be processed in prokaryotes?  
 (A) DNA replication (B) gene transcription  
 (C) mRNA translation (D) protein modification

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18. Which of the following statement about telomerase is NOT true?  
 (A) Telomerase contains DNA complementary to the tolemere.  
 (B) Telomerase uses its own RNA as the template to reverse-transcribe DNA.  
 (C) Telomerase is not active in most adult tissues/cells.  
 (D) Telomerase is active in rapidly growing tissues.
19. The non-competitive inhibitor:  
 (A) forms an irreversible complex with the active site of an enzyme.  
 (B) forms a complex with a site on an enzyme other than the active site.  
 (C) competes with the substrate for the active site of an enzyme.  
 (D) lowers the  $K_m$  for the substrate.
20. Which eukaryotic RNA polymerase is responsible for mRNA synthesis?  
 (A) RNA polymerase I (B) RNA polymerase II  
 (C) RNA polymerase III (D) RNA polymerase IV
21. Which of the following amino acids is incompatible with an alpha-helical structure?  
 (A) valine (B) glycine (C) proline (D) cysteine
22. Which of the following is not part of our current concept of biological membranes?  
 (A) a fluid lipid bilayer.  
 (B) proteins move laterally in the plane of the membrane.  
 (C) non-covalent association of protein with the lipid bilayer.  
 (D) proteins symmetrically distributed on both sides of the membrane.
23. The isoelectric point of alanine is 6.0. If alanine is dissolved in the pH 8.0 buffer and subjected to electrophoresis, it will:  
 (A) not migrate to either anode or cathode.  
 (B) migrate to the cathode (negative pole).  
 (C) migrate to the anode.  
 (D) some will migrate to the anode and some to the cathode.
24. What is the amino acid listed below?



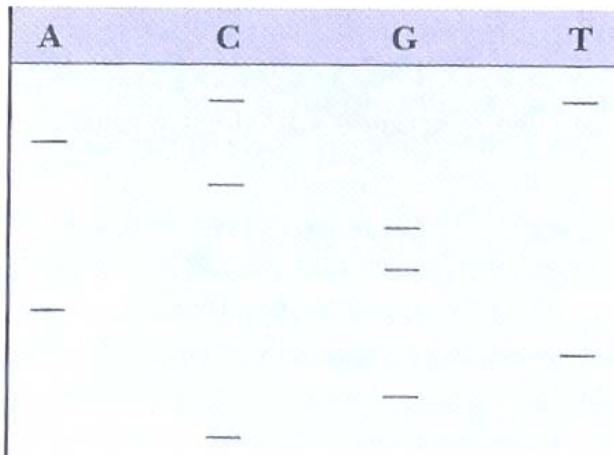
- (A) Lysine (B) Arginine (C) Isoleucine (D) Valine

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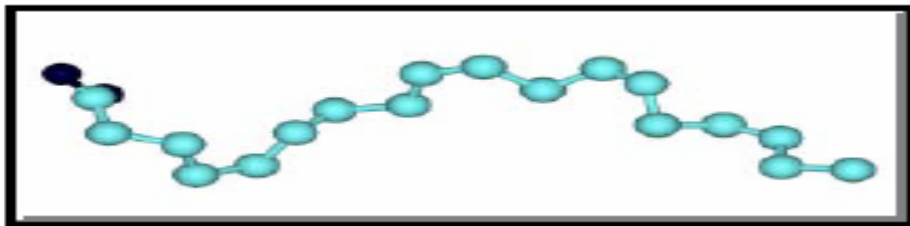
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25. Continuing from the above question, what is the PI value for this amino acid?  
 (A) 5.57 (B) 6.36 (C) 7.22 (D) 9.74
26. All of the carbon and nitrogen atoms of the pyrimidine ring are supplied by which of the groups of compounds listed below?  
 (A) glutamate, glycine (B) glycine, aspartate  
 (C) glutamine, N-10 formyl tetrahydrofolate  
 (D) carbamoyl phosphate, aspartate
27. The photo shown below is the result of a DNA sequence gel using the Sanger method. Which of the following is the correct DNA sequence of the template strand?  
 (A) 5' GATGCCTACG 3' (B) 5' GCATCCGTAG 3'  
 (C) 5' CGTAGGCATC 3' (D) 5' CTACGGATGC 3'



28. The figure shown below is a ball-and-stick representation of the crystal structure of a lipid (Note that the H atoms, which are often not evident in X-ray crystallography, are not shown). This lipid is:



- (A) linolenic acid (B) palmitic acid  
 (C) triacylglycerol (D) phosphatidylethanolamine

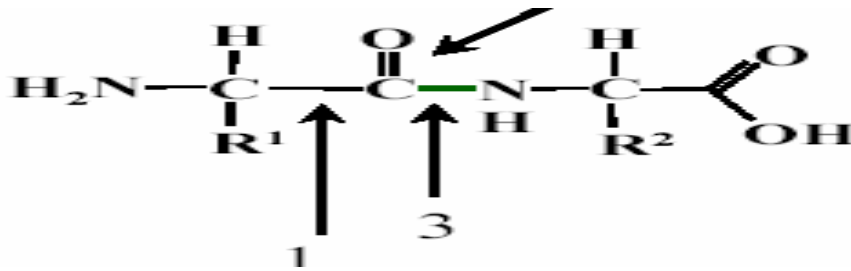
※ 試題請隨卷繳回

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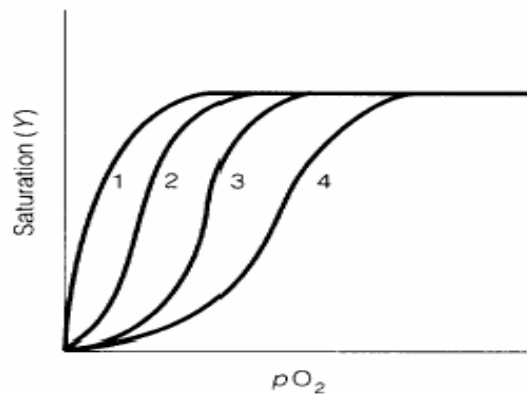
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29. The structure of a dipeptide is shown below. Which bond indicates the peptide bond?
- (A) 1                                      (B) 3  
 (C) 1 and 3                              (D) none of the above



30. Several oxygen dissociation curves are listed in the figure below.



- If curve #2 indicates the purified hemoglobin in a solution containing physiological concentration of  $\text{CO}_2$  and BPG at pH 7.0, then which curve should represent the oxygen dissociation curve when the pH increases?
- (A) 1                      (B) 2                      (C) 3                      (D) 4
31. The mRNA maturation from pre-mRNA does NOT need to go through:  
 (A) splicing      (B) glycosylation      (C) adenylation      (D) capping
32. The molecule needed for transport of palmitic acid from the cytosol into mitochondria for oxidation is:  
 (A) cobalamin (vitamin B12).      (B) coenzyme Q.  
 (C) acyl carrier protein.      (D) carnitine.
33. The acyl donor for cholesterol ester formation in blood is:  
 (A) phosphatidylcholine.      (B) palmitoyl-CoA.  
 (C) triglycerides.      (D) acyl carrier protein.

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34. Which statement regarding active transport of uncharged molecules through membranes is not true?
- (A) normally involves a carrier protein rather than a channel protein.
  - (B) proceeds against a concentration gradient.
  - (C) obeys saturation kinetics.
  - (D) always involves an  $\text{Na}^+$  gradient.
35. In the gene for a protein containing 300 amino acids, which of the following mutations would be the LEAST LIKELY to result in a non-functional protein?
- (A) an insertion of a single nucleotide in codon 23
  - (B) a single base change in the third position of codon 12
  - (C) a nonsense mutation in codon 37
  - (D) a 10 base-pair deletion in the first exon

### Part II. Short questions: 65%

1. Many enzymes are important in nucleic acid analysis, such as RNA-dependent DNA polymerase, DNA-dependent DNA polymerase, DNA-dependent RNA polymerase, Taq DNA polymerase, DNA ligase, T7 kinase, primase, helicase and EcoR1 restriction enzyme.
- (1) Describe briefly the main difference between DNA replication of the lagging strand and the leading strand. (5%)
  - (2) Which of the above enzymes are NOT involved in DNA replication of the lagging strand in animals? (5%)
  - (3) Specify briefly the function of the enzymes that you list in the above answer. (5%)
2. Dr. Whanger purified a new protein from animal tissues and made an antibody to identify this new protein.
- (1) Dr. Whanger would need to check on the titer of this antibody for initial screening. Describe the method he could use and explain your answer. (5%)
  - (2) Dr. Whanger would like to further confirm the specific protein this antibody recognizes. Which method he should use? Describe the method and explain your answer. (5%)

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### 3. Carbohydrate analysis problems:

- (1) You are given a polysaccharide from animal origin to analyze. After hydrolysis, you get a collection of disaccharides, trisaccharides, tetrasaccharides, *etc.* You find that all of the disaccharide fraction consists of only one kind of molecule---maltose. Based on these findings, what is the polysaccharide you analyzed? Explain your answer. (5%).
- (2) You are given a polysaccharide to analyze. After hydrolysis, you get a collection of disaccharides, trisaccharides, tetrasaccharides, *etc.* You find that all of the disaccharide fraction consists of only one kind of molecule---cellobiose. Based on these findings, list all the glycosidic linkage involved in this polysaccharide and explain your answer. (5%).
- (3) You are given a disaccharide to analyze. You treat this disaccharide with  $\alpha$ -glucosidase,  $\beta$ -galactosidase,  $\alpha$ -fructosidase and  $\beta$ -fructosidase and find that only  $\beta$ -galactosidase can hydrolyze this disaccharide. Based on these findings, what is the disaccharide you analyzed? Explain your answer. (5%)

### 4. Below are the peptide fragments generated after CNBR or pepsin treatment, respectively.

CNBR treatment: Arg-Thr  
Phe-Ser-Met  
Arg-Thr-Phe-Arg-Thr-Met

Pepsin treatment: Arg-Thr  
Phe-Ser-Met  
Phe-Arg-Thr-Met

What is the complete amino acid sequence of this polypeptide? (5%)

5. Describe the principle of "Edman degradation" method and the key compound for this method. (10%)
6. Describe the differential regulation for *lac* operon and *trp* operon in prokaryote (10%).