

# 國立彰化師範大學 98 學年度碩士班招生考試試題

系所： 生物技術研究所

科目： 生物化學

☆☆請在答案紙上作答☆☆

共 4 頁，第 1 頁

## Section 1: Multiple choices.

Please choose **the best answer** for each question. (2.5 points for each question)

- In the operation of the sodium-potassium pump
  - conformational changes in membrane proteins are inhibited
  - the ions involved bind to the lipid portion of the membrane
  - a membrane protein is phosphorylated with ATP as the source of the phosphate group
  - a membrane protein is phosphorylated with ADP as the source of the phosphate group
  - a membrane protein is phosphorylated with tyrosine as the source of the phosphate group
- The vitamin pantothenic acid is involved in this type of reaction
  - carboxylation reactions
  - decarboxylation reactions
  - redox reactions
  - acyl transfer reactions
  - none of the above
- Which of the following can function as coenzymes?
  - lead ion, biotin, and lipoic acid
  - copper ion, *p*-hydroxymercuribenzoate, diisopropylphosphofluoridate
  - zinc ion, pyridoxal phosphate, and nicotinamide adenine nucleotides
  - lead ion, *p*-hydroxymercuribenzoate, diisopropylphosphofluoridate
  - a & c
- Redox reactions often use this cofactor
  - riboflavin
  - lipoic acid
  - pyridoxal
  - thiamine
  - a, b & c
- Nicotinamide adenine dinucleotide is
  - an enzyme inhibitor used in smoking cessation programs
  - an inhibitor of ATP production
  - a coenzyme in reactions that transfer acyl groups
  - a coenzyme in oxidation-reduction reactions
  - disaccharide name sucrose
- The serine in the active site of chymotrypsin functions as
  - a Lewis acid
  - a metal ion
  - an electrophile
  - a nucleophile
  - a DNase
- Which of the following amino acid side chains would best serve as a general acid, assuming the protein functions at a pH of 7?
  - alanine
  - aspartic acid
  - lysine
  - asparagines
  - none of the above
- Which groups of amino acids are likely to be found in the active site of an enzyme?
  - leucine, lysine, alanine
  - cysteine, isoleucine, phenylalanine
  - tyrosine, threonine, leucine
  - serine, histidine, aspartate
  - asparagines, aspartic acid, alanine

# 國立彰化師範大學 98 學年度碩士班招生考試試題

系所： 生物技術研究所

科目：生物化學

☆☆請在答案紙上作答☆☆

共 4 頁，第 2 頁

9. In the concerted model for allosteric enzymes
- (a) the relative affinities of substrate for the T and R conformations plays an important role in the cooperativity of the reaction
  - (b) the equilibrium between the T and R conformations plays a minor role
  - (c) the enzymatic activity of the T conformation is considerably higher than that of the R form
  - (d) it is possible to describe the reactions of all allosteric enzymes accurately
10. In a comparison of allosteric and non-allosteric enzymes
- (a) it is always possible to define a  $K_M$
  - (b) it is always possible to define a  $V_{max}$
  - (c) competitive inhibition is always a possibility
  - (d) much of the terminology is completely unchanged
  - (e) a & b
11. Which of the following DOES NOT bind to tRNA?
- (a) amino acid
  - (b) mRNA
  - (c) ribosome
  - (d) aminoacyl tRNA synthetase
  - (e) all of the above bind to tRNA
12. Small nuclear RNA forms part of:
- (a) replisomes
  - (b) spliceosomes
  - (c) nucleosomes
  - (d) ribosomes
  - (e) none of the above
13. Transcription activator proteins:
- (a) transcribe a messenger off a DNA template
  - (b) bind to ribosomes to activate the production of specific proteins
  - (c) bind regions near a eukaryotic gene and allow an RNA polymerase to transcribe a gene
  - (d) are essential to function of transfer RNAs during translation
  - (e) are produced during an infection of bacteria by a phage
14. During translation, which subunit of the prokaryotic ribosome attaches to the mRNA first?
- (a) small (30s)
  - (b) large (50s)
  - (c) both at the same time
  - (d) neither attach to the mRNA
15. The signal sequences that direct proteins to the nucleus are:
- (a) always at the amino terminus of the targeted protein.
  - (b) cleaved after the protein arrives in the nucleus.
  - (c) glycosyl moieties containing mannose 6-phosphate residues.
  - (d) not located at the ends of the peptide, but in its interior.
  - (e) the same as those that direct certain proteins to lysosomes.

# 國立彰化師範大學 98 學年度碩士班招生考試試題

系所： 生物技術研究所

科目：生物化學

☆☆請在答案紙上作答☆☆

共 4 頁，第 3 頁

16. The large structure consisting of a mRNA molecule being translated by multiple copies of the macromolecular complexes that carry out protein synthesis is called a  
(a) lysosome (b) polysome (c) proteosome  
(d) ribosome (e) synthosome
17. The “7-methyl-G” CAP found at the 5’ end of most Pol II transcripts:  
(a) defines the 3’ end of the last exon  
(b) helps to orient mRNAs into the translation pre-initiation complex  
(c) is required for the initiation of transcription  
(d) prevents endonucleolytic cleavage by ribonucleases  
(e) serves as a marker for polyadenylation
18. An example of a virus that causes an oncogenic infection is  
(a) Herpes Simplex I. (b) HIV  
(c) Human Papilloma Virus. (d) Rotavirus
19. Reverse transcription:  
(a) makes mRNA from cDNA (b) is used to amplify DNA  
(c) is important in transposition (d) is part of RT-PCR
20. How does a nucleotide differ from a nucleoside?  
(a) a nucleotide is a nucleoside with a phosphate ester linked to the sugar  
(b) purines are only found in nucleotides.  
(c) nucleosides contain only deoxyribose sugars  
(d) nucleosides are found in DNA, whereas nucleotides are found in RNA  
(e) none of the above
21. Which enzyme of glycolysis catalyses an oxidation reaction of the substrate?  
(a) hexokinase (b) aldolase (c) triose phosphate isomerase  
(d) glyceraldehyde-3-phosphate dehydrogenase (e) enolase
22. Which of the following hydrolytic reactions is the most exergonic?  
(a)  $ATP \rightarrow AMP + PPi$  (b)  $ATP \rightarrow ADP + Pi$  (c)  $glucose-6-phosphate \rightarrow glucose + Pi$   
(d)  $PPi \rightarrow 2 Pi$  (e)  $phosphoenol\ pyruvate \rightarrow pyruvate + Pi$
23. In gluconeogenesis, the intermediate oxaloacetate is produced by combining a pyruvate molecule with  
(a) the acetyl group from an acetyl-CoA molecule (b) a carbon dioxide molecule  
(c) another pyruvate molecule (d) a water molecule (e) a lactate molecule

# 國立彰化師範大學 98 學年度碩士班招生考試試題

系所： 生物技術研究所

科目： 生物化學

☆☆請在答案紙上作答☆☆

共 4 頁，第 4 頁

24. Which of the following enzymes is not shared by the pathways of glycolysis and gluconeogenesis?  
(a) glucose phosphate isomerase (b) aldolase (c) triose isomerase  
(d) glyceraldehyde-3-phosphate dehydrogenase (e) pyruvate kinase
25. Which of the following components of the mitochondrial electron transport chain carry BOTH electron and proton in their reduced forms?  
(a) ubiquinone (b) iron-sulfur proteins (c) cytochrome *c*  
(d) cytochrome *c* oxidase (e) none of the above
26. What yield of ATP can be expected from complete oxidation of one molecule of glyceraldehyde-3-phosphate by the reactions of glycolysis, the tricarboxylic acid cycle, and oxidative phosphorylation?  
(a) 34 (b) 32 (c) 17 (d) 13.5 (e) 2.5
27. How many cycles of  $\beta$ -oxidation are required for the complete degradation of palmitic acid (a 16-carbon fatty acid)?  
(a) 4 (b) 6 (c) 7 (d) 8 (e) 9
28. Which of the followings is the correct arrangement of the redox-active components of mitochondrial electron transport chain in order of increasing standard reduction potential?  
(a)  $\text{NAD}^+$ , FAD, Coenzyme Q, cytochrome *c*, cytochrome *a*  
(b) cytochrome *a*, cytochrome *c*, FAD, Coenzyme Q,  $\text{NAD}^+$   
(c)  $\text{NAD}^+$ , Coenzyme Q, FAD, cytochrome *c*, cytochrome *a*  
(d) cytochrome *a*, cytochrome *c*, Coenzyme Q, FAD,  $\text{NAD}^+$   
(e) cytochrome *c*, cytochrome *a*, Coenzyme Q, FAD,  $\text{NAD}^+$

## Section 2 : Short Answer (30 points in total)

1. How can you get a pure protein from cell? (5 points)
2. How can you define the active site of the protein? (5 points)
3. In addition to buffer, salts ( $\text{Mg}^{2+}$ ), dNTPs, and a PCR machine, what is/(are) required in a standard Polymerase Chain Reaction ? (forgive the redundancy of the reaction) (5 points)
4. Name and explain in one sentence the 2 functions of antibodies in the immune system. (5 points)
5. What is the difference between a synthase and a synthetase? (5 points)
6. What features of chloroplasts and mitochondria are consistent with the theory that they are descendents of endosymbiotic bacteria? (5 points)