臺中健康暨管理學院

九十四學年度碩士班暨碩士在職專班招生考試試題紙

系　所　別	組 別	考試科目	考試日期	時　　間	備　　註
生物科技與生物資訊學系碩士班	生物資訊組 生物科技組	生物化學	94.4.24	10:30-12:10	共五頁

一、選擇題（單選）：每題2分，共40分

1. _____ carries long-chain fatty acyl groups across the _____ membrane.
   a. Biotin; intestinal
   b. Carnitine; plasma
   c. CoA-SH; plasma
   d. Carnitine; inner mitochondrial
   e. TPP; outer mitochondrial

2. Electrostatic interactions among amino acid residues on proteins may be damped out by high concentrations of：
   a. water
   b. organic solvents
   c. salts
   d. heat
   e. all of these choices

3. Cellulose is a:
   a. (1→ 4) - $_{\alpha}$-D-mannopyranan
   b. (1→ 4) - $_{\beta}$-D-glucopyranan
   c. (1→ 6) - $_{\alpha}$-D-glucopyranan
   d. (1→ 4) - $_{\beta}$-D-galactopyranan
   e. (1→ 6) - $_{\alpha}$-D-mannopyranan

4. A fatty acid with eighteen carbons and one double bond could be designated all **EXCEPT**:
   a. linoleic acid
   b. 18:1
   c. *cis*-9-octadecenoic acid
   d. oleic acid
   e. all are true

5. Enzymes have active sites which have the greatest complementarity to the:
   a. substrate
   b. transition state
   c. product
   d. both substrate and product
   e. none of these choices

6. Hexokinase and glucokinase belong to the kinase subclass of what class of enzymes?
   a. oxidoreductase
   b. isomerase
   c. transferase
   d. hydrolase
   e. lyase

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7. How many NADH molecules are produced in the TCA cycle per molecule of acetyl-CoA oxidized?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5

8. All are true for the DNA double helix **EXCEPT**:
   a. the two strands are parallel
   b. the two strands are held together by interchain hydrogen bonds
   c. the two strands have complementary base pairing
   d. they are easily sheared into shorter fragments during isolation procedures
   e. all are true

9. What is the nucleotide sequence of the DNA strand that is complementary to 5'-ATCGCAACTGTCACTA-3'?
   a. 5'-TAGCGTTGACAGTGAT-3'
   b. 5'-UAGUGACAGUUGCGAU-3'
   c. 5'-TAGTGACAGTTGCGAT-3'
   d. 5'-ATCACTGTCAACGCTA-3'

10. The anticodon of a tRNA is 5'UUG. What codon(s) can be theoretically recognized by this tRNA?
   a. 5'CAA only
   b. 5'CAA & 5'CAG
   c. 5'AAC only
   d. 5'AAC & 5' GAC
   e. 5'CAC only

11. Edman degradation will:
   a. determine the C-terminal amino acid by using a carboxypeptidase
   b. cleave the protein into a multitude of smaller peptides
   c. compare overlapping sets of peptide fragments
   d. determine the N-terminal amino acid
   e. generate two different, but overlapping sets of peptide fragments

12. The C-terminal residue of a polypeptide can be determined by first cleaving the polypeptide with:
   a. chymotrypsin
   b. carboxypeptidase
   c. trypsin
   d. CNBr
   e. none of these choices

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13._____ is specific in hydrolyzing only peptide bonds in which the carboxyl function is contributed by an arginine or a lysine residue.
a. Chymotrypsin
b. Carboxypeptidase
c. Trypsin
d. CNBr
e. None of these choices

14. How do catalysts work to accelerate a chemical reaction?
a. They raise the average energy of the reactants
b. They provide a means of acceleration by being completely consumed in the reaction
c. They lower the energy of activation
d. They lower the overall free energy change of the reaction
e. They raise the overall free energy change of the reaction

15. Enzymes have active sites which have the greatest complementarity to the:
a. substrate
b. transition state
c. product
d. both substrate and product
e. none of these choices

16. All of the following are examples of a zymogen and its activating protease **EXCEPT**:
a. chymotrypsinogen and chymotrypsin
b. procarboxypeptidase and elastase
c. proelastase and elastase
d. pepsinogen and pepsin
e. trypsinogen and trypsin

17. All are characteristic of allosteric enzymes **EXCEPT**:
a. Effectors may show stimulatory or inhibitory activity
b. They have multiple subunits
c. They obey Michaelis-Menten kinetics
d. The regulatory effect is by altering conformation and interaction of subunits
e. Binding one subunit impacts binding of substrate to other subunits

18. Naturally occurring, self-replicating, extra-chromosomal DNA molecules found in bacteria that carry genes specifying novel metabolic capacity advantageous to the bacterium are called:
a. probes
b. cruciform
c. toroidal DNA
d. plasmids
e. all of these choices

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19. All are properties of DNA polymerase III **EXCEPT**:
    a. It is responsible for incorporating most of the nucleotides in the lagging strand
    b. It synthesizes most of the leading strand prior to aiding in the synthesis of the lagging strand
    c. It contains a 3' to 5' exonuclease activity
    d. It is a large protein complex containing more than five subunits
    e. Much greater processivity than DNA polymerase I

20. How many NAD^+ are reduced in the β-oxidation of stearoyl-CoA to form nine molecules of acetyl-CoA?
    a. 18
    b. 16
    c. 12
    d. 9
    e. 8

二、問答題：每題 10 分，共 60 分

1. The pKa values of alanine are 2.34 and 9.69, corresponding to the ionization of the carboxyl and the protonated amino groups, respectively. The di-, tri-, and larger oligopeptides of alanine also show the ionization of only two functional groups. The trend in pKa values is summarized in the table. **（10%）**

Amino acid or peptide	pK_1	pK_2
Ala	2.34	9.69
Ala- Ala	3.12	8.30
Ala- Ala- Ala	3.39	8.03
Ala-(Ala)$_n$- Ala, $n \geqq 4$	3.42	7.94

(a) Draw the structure of Ala- Ala- Ala. Identify the functional groups associated with pK_1 and pK_2
(b) Why does the values of pK_1 increase with each addition of an Ala residue to the Ala oligopeptide?
(c) Why does the values of pK_2 decrease with each addition of an Ala residue to the Ala oligopeptide?

2. Using the information below, determine the amino acid sequence of the opioid leucine enkephalin. Explain how your structure is consistent with each piece of information. **（10%）**
   (a) Complete hydrolysis by 6M HCl at 110℃ followed by amino acid analysis indicated the presence of Gly, Leu, Phe, and Tyr, in a 2:1:1:1 molar ratio.
   (b) Treatment of the peptide with 1-fluoro-2,4-dinitrobenzene followed by complete hydrolysis and chromatography indicated the presence of the 2,4-dinitrophenyl derivative of tyrosine, No free tyrosine could be found.
   (c) Complete digestion of the peptide with pepsin followed by chromatography yielded a peptide containing Phe and Leu, plus a tripeptide containing Tyr and Gly in a 1:2 ratio.

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3. Prepare a table that lists the names and compares the functions of the precursors, enzymes, and other proteins needed to make the leading versus lagging strands during DNA replication in *E. coli.* **（10%）**

4. Quantitative analysis of urine samples for a patient gave the results shown in the table. **（10%）**

Substance	Concentration (mM)	
	Patient's urine	Normal urine
Phenylalanine	7.0	0.01
Phenylpyruvate	4.8	0
Phenyllactate	10.3	0

(a) Why does phenylalanine appear in the urine in large amounts?
(b) What is the source of phenylpyruvate and phenyllactate? Why does this pathway (normally not functional) come into play when the concentration of phenylalanine rises?

5. The Michaelis-Menten equation for an enzyme is as follows: **（10%）**

$$v = \frac{V_{max}[S]}{K_m + [S]}$$

(a) Show, in which condition, that v is obeying zero-order kinetics, and in which condition, v is first order.
(b) If the value of K_m is decreasing , will the affinity of the enzyme for its substrate be going to decrease or increase?

6. The human immunodeficiency virus (HIV) that binds co-receptors on the surface of T cells belongs to retrovirus. **（10%）**
(a) What does retrovirus mean ?
(b) What are the names of co-receptors?
(c) The HIV protease is an aspartic protease, as you know, give more than two names of other aspartic proteases from different species.