

國立臺灣海洋大學 101 學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目：生物化學

系所名稱：食品科學系碩士班生技組、食品科學系碩士班食科組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

I. Multiple choice questions (only one answer is correct for each question!): total 32%, each 1%.

1. The amino and carboxyl groups of amino acids react in a head-to-tail fashion, eliminating water, and forming a covalent \_\_\_\_\_ linkage typically referred to as a \_\_\_\_\_ bond.
  - a. ester, aromatic
  - b. anhydride, phosphoanhydride
  - c. amide, peptide
  - d. dehydration, hydrogen
  - e. none of the above
2. Which of the peptides would absorb light at 280 nm?
  - a. ala-lys-his
  - b. ser-gly-asn
  - c. ala-ala-trp
  - d. val-pro-leu
  - e. ser-val-ile
3. Protein isolation and purification include all of the techniques EXCEPT:
  - a. gas-liquid chromatography.
  - b. ion exchange chromatography.
  - c. electrophoresis.
  - d. solubility ("salting in" and "salting out").
  - e. affinity chromatography.
4. The preponderance of protein sequence information is now derived from:
  - a. chemical sequencing (Edman method).
  - b. mass spectrometry.
  - c. mass spectrometry-mass spectrometry.
  - d. translating the nucleotide sequence of genes into codons, and thus amino acid sequence.
  - e. none of the above.
5. \_\_\_\_\_ amino acids are almost never found in the interior of a protein, but the protein surface may consist of \_\_\_\_\_ amino acids.
  - a. Nonpolar, both polar and nonpolar
  - b. Nonpolar, mostly nonpolar
  - c. Polar, both polar and nonpolar
  - d. Polar, only polar
  - e. Polar, only nonpolar
6. The "permanent" part of adding wave in hair is primarily due to:
  - a. rearrangement of hydrogen bonds between hair fibers.
  - b. reestablishment of new ionic interactions between hair fibers.
  - c. breaking and reforming peptide bonds in the hair polypeptides.
  - d. rearrangement of hydrophobic interactions in hair fibers.
  - e. reduction and re-oxidation of disulfide bonds in hair fibers.
7. Glucose most commonly forms which of the following structures?
  - a. a pyranose using the hydroxyl group on carbon 4
  - b. a pyranose using the hydroxyl group on carbon 5
  - c. a pyranose using the hydroxyl group on carbon 6

- d. a furanose using the hydroxyl group on carbon 3  
 e. a furanose using the hydroxyl group on carbon 4
8. Individuals with uncontrolled diabetes mellitus may have \_\_\_\_\_ levels of blood \_\_\_\_\_ so they test their blood for \_\_\_\_\_.
- a. elevated; fructose; gluconic acid    b. depressed; glucose; oxidizing sugars  
 c. elevated; glucose; fructose            d. depressed; gluconic acid; reducing sugars  
 e. elevated; glucose; reducing sugars
9. All of the following disaccharides are reducing sugars EXCEPT:  
 a. lactose.    b. maltose.    c. trehalose.    d. cellulose.    e. isomaltose.
10. In a sample of double-stranded DNA containing 32% cytosine, the percentage of adenine would be:  
 a. 32%    b. 34%    c. 18%    d. 68%    e. 16%
11. RNA is \_\_\_\_\_ stable to alkaline hydrolysis than DNA because RNA's vicinal \_\_\_\_\_ group makes the 3'-phosphodiester bond susceptible to \_\_\_\_\_ cleavage.
- a. less; 3'-OH; nucleophilic    b. less; 2'-OH; nucleophilic  
 c. less; 2'-OH; electrophilic    d. more; 2'-OH; nucleophilic  
 e. more; 3'-OH; electrophilic
12. All of the following are characteristics for *in vitro* DNA synthesis EXCEPT:  
 a. DNA polymerase adds nucleotides in a 5' → 3' direction.  
 b. The primer strand of DNA determines the nucleotides added.  
 c. Correct hydrogen bonding is the primary check of the newly synthesized DNA.  
 d. A primer strand must contain a free 3'-OH.  
 e. DNA polymerase copies the complementary strand of DNA.
13. 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 the above.
14. All are required to perform *in vitro* cloning to produce a library of eukaryotic genomic DNA EXCEPT:  
 a. DNA ligase.    b. a vector such as a plasmid.  
 c. restriction endonuclease.    d. mRNA.    e. none of the above.
15. Shuttle vectors have the property that they:  
 a. contain promoters for the expression of the gene.  
 b. have origins of replication for two different cell types, usually bacteria and yeast.  
 c. are capable of incorporating very large DNA fragments.  
 d. contain more than one antibiotic resistant gene.  
 e. none of the above

16. The correct sequence for colony hybridization experiments is:

- A. A replica of the bacterial colonies is obtained on an absorbent disc.
- B. Autoradiography of the disc reveals probe complementary DNA.
- C. Host bacteria with plasmid are plated and allowed to grow overnight.
- D. The disc is treated with alkali.
- E. The disc is reacted with labeled probe.

- a. A, C, E, B, D
- b. C, A, E, D, B
- c. C, E, A, B, D
- d. C, A, E, B, D
- e. C, A, D, E, B

17. An enzyme's specificity can be due to:

- a. the ratio of catalyzed rate to the uncatalyzed rate of reaction.
- b. molecular recognition based on structural complementarity.
- c. amount of enzyme produced by the cell.
- d. amount of substrate available.
- e. metabolic activators.

18. For an enzyme-catalyzed reaction, the initial velocity was determined at two different concentrations of the substrate. Which of the following would be closest to the value of  $K_m$ ?

[S] (mM)	$V_o$ (mM/min)
1.0	2.0
4.0	2.8

- a. 0.17 mM
- b. 5.7 mM
- c. 2.7 mM
- d. 0.60 mM
- e. 1.7 mM

19. Because the  $pK_a$  is near 7, \_\_\_\_\_ side-chains are often involved in general acid-base catalysis.

- a. cysteine
- b. aspartate
- c. glutamate
- d. lysine
- e. histidine

20. The good transition state analog is one which would serve also as an effective:

- a. noncompetitive inhibitor.
- b. competitive inhibitor.
- c. allosteric inhibitor.
- d. mixed-noncompetitive inhibitor.
- e. irreversible inhibitor.

21. Which of the following statements is correct regarding isozymes?

- a. they catalyze the same reaction but have vastly different structures
- b. their differences are based upon the type of tissue in which they are present
- c. they often respond to different inhibitors and activators
- d. both a and c are correct

- e. both b and c are correct
22. All are characteristic of allosteric enzymes EXCEPT:
- Effectors may show stimulatory or inhibitory activity.
  - They have multiple subunits.
  - They obey Michaelis-Menten kinetics.
  - The regulatory effect is by altering conformation and interaction of subunits.
  - Binding one subunit impacts binding of substrate to other subunits.
23. What is the common product of purine catabolism?
- xanthine
  - uric acid
  - inosine
  - hypoxanthine
  - xanthosine
24. Nitrate assimilation occurs in two steps: reduction of nitrate to \_\_\_\_\_ and further reduction to \_\_\_\_\_.
- ammonia; nitrogen
  - nitrogen; ammonia
  - nitrite; nitrogen
  - nitrite; ammonia
  - none are correct
25. All are characteristics of Okazaki fragments EXCEPT:
- newly synthesized short lagging strand fragments.
  - synthesis performed in the 5'→3' direction.
  - initiated with an RNA primer.
  - about 20-30 nucleotides in length.
  - binds anti-parallel to the template strand.
26. *E. coli* DNA polymerase I has all of the following characteristics EXCEPT:
- a 5'→3' exonuclease activity.
  - a 3'→5' exonuclease activity.
  - a 5'→3' DNA polymerase activity.
  - modest processivity (approximately 20 nucleotides).
  - does not require a primer for initiation.
27. Prions are defined as:
- ions with an inappropriate number of protons.
  - ions about to form.
  - ionic proteins that bind DNA.
  - proteinaceous infectious particles.
  - particle ions that bind proteins.
28. Which of the following is true of the *lac* operon?
- it is negatively controlled via the *lac* repressor
  - it is positively controlled via CAP
  - lactose represses the *lac* operon
  - a and b are true
  - a and c are true
29. The leucine zipper is a protein motif held together by:
- H-bonds.
  - hydrophobic interactions.
  - ionic interactions.

- d. metal ion binding.      e. protein:DNA interactions.

30. The initial event in the conversion of an hnRNA to the mature RNA which leaves the nucleus is:

- a. formation of ribonucleoprotein particles (RNPs).
- b. capping the 5'-end of the transcript with a guanylyl group by guanylyl transferase.
- c. addition of a poly(A) tail to the 3'-end of the transcript by poly(A) polymerase.
- d. splicing together of the exons.
- e. transesterification reactions in lariat formation.

31. Each of the following statements regarding ways in which eukaryotic protein synthesis differs from prokaryotic protein synthesis is true EXCEPT:

- a. prokaryote protein synthesis is initiated by f-Met, while eukaryotic is initiated by Met
- b. prokaryotes use a 30S small ribosomal subunit, while eukaryotes use a 40S small ribosomal subunit
- c. prokaryotic and eukaryotic translation initiation differ significantly in mechanism and process
- d. prokaryotic termination involves three release factors, while eukaryotic termination involves one
- e. all of the above are true statements

32. The termination signal complex transforms the ribosomal peptidyl transferase into a/an:

- a. lyase.    b. isomerase.    c. hydrolase.    d. transferase.    e. ligase.

**II. What are telomeres? What is telomere theory of aging? Why tumor cells are immortal? (9%)**

**III. A new protein of unknown structure has been purified. Gel filtration chromatography reveals that the native protein have a molecular weight of 240,000. Chromatography in the presence of 6 M guanidine hydrochloride yields only one peak for a protein of  $M_r$  80,000. Chromatography in the presence of 6 M guanidine hydrochloride and 10 mM  $\beta$ -mercaptoethanol yields peaks for proteins of  $M_r$  56,000 and 24,000. Explain what can be determined about the structure of this protein from these data. (9%)**

**IV. Terminology 30 points: (3 points for each)**

- |                                      |                              |
|--------------------------------------|------------------------------|
| 1. reducing sugar                    | 6. autophagy                 |
| 2. lipid raft                        | 7. carnitine acyltransferase |
| 3. nonsteroid anti-inflammatory drug | 8. dolichol                  |
| 4. ketogenesis                       | 9. proteasome                |
| 5. Prion                             | 10. ractopamine              |

V. Question 20 points: (5 points for each)

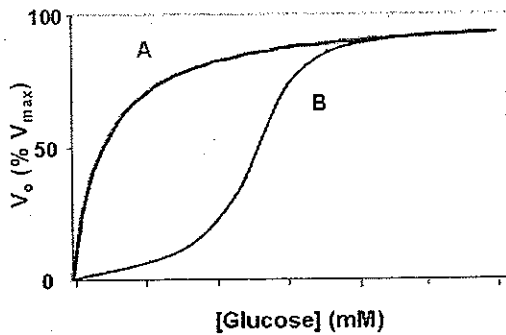
1. What different? Compare both biosynthesis and degradation of fatty acid.
2. Give an example of a glycosylphosphatidylinositol found in lipid-linked proteins.
3. The following are the chemical structures of hormones:

1). Amine, 2). Peptide/protein, 3). Steroid

Place the correct number (s) in the blanks below.

- a. water soluble
- b. main ingredient is tyrosine
- c. derived from cholesterol
- d. lipid-soluble.

4.



The above graph shows the initial velocities of the reaction catalyzed by hexokinase under conditions "A" and "B" in the presence of different concentrations of glucose. What do conditions "A" and "B" represent in both level of glucose 6-phosphate and ATP?

5. ① Interaction between the two cytoplasmic domains of the dimer is thought to stimulate autophosphorylation of \_\_\_\_\_ within the cytoplasmic tyrosine kinase domains of the RTKs causing their conformational changes.
- ② How many NADH are produced by Glycolysis per glucose?