



國立臺灣海洋大學 100 學年度研究所碩士班甄試入學考試試題

考試科目： 生命科學概論

系所名稱： 水產養殖學系碩士班（生命科學組）

1.答案以橫式由左至右書寫。2.請依題號順序作答。

一、簡答題：

1. Please describe and provide examples of prezygotic and postzygotic reproductive barriers. (4%)
2. Please list the three major threats to biodiversity and give an example of each. (4%)

二、解釋名詞

1. negative feedback (2%)
2. homology (2%)
3. endosymbiosis (2%)
4. pheromone (2%)
5. antibiotic resistance (2%)
6. decomposer (2%)
7. endocrine signaling (2%)
8. paracrine factor (2%)

三、問答題

1. Please briefly describe three metabolic stages in cellular (aerobic) respiration to synthesize ATP. (6%)
2. Please explain how vertebrates maintain the blood glucose homeostasis by two antagonistic hormones secreted from different cell types of pancreas. (10%)
3. The winner of Nobel prize in medicine are Andrew Z. Fire and Craig C. Mello. Their major finding is RNA interfering mechanism. Please describe RNAi mechanism and their potential application. (12%)
4. What is cytokine. Please describe the function of interferon alpha, IL-1 and TNF alpha. (8%)

5. What characteristic features define enzymes? (5 %)
6. Why is the pyruvate reduced to lactate in working skeletal muscle under anaerobic condition? (5 %)
7. Describe the reactions of fatty acid oxidation ( $\beta$ -oxidation). (5%)
8. How are the specificity and catalytic activity of ribonucleotide reductase regulated by nucleotide binding (ATP, dATP, dTTP.....)? (5 %)

四、選擇題 20% (共 20 題，每題 1 分)

1. A widely used "consensus value" for  $G^{\circ}$  of ATP hydrolysis in biological systems is \_\_\_\_\_ kJ/mol.  
(a) -21 (b) -30.5 (c) -7 (d) 3 (e) 21
2. 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
3. The  $pK_a$  of the  $-NH_3^+$  group is \_\_\_\_\_ by the presence on an amino acid by the  $-COO^-$  group.  
(a) greatly increased (>2 pH units) (b) greatly decreased (> 2 pH units)  
(c) unchanged (d) slightly increased (~1.5 pH units)  
(e) slightly decreased (~ 1.5 pH units)
4. Insulin is a polypeptide hormone that contains two short polypeptide chains linked by two interstrand disulfide bonds. The most logical order of events to perform in order to sequence this protein would be:  
A— The peptides are reduced with mercaptoethanol.  
B— The peptides are sequenced using Edman chemistry.  
C— The peptides are separated by chromatography techniques.  
D— The peptides are alkylated with iodoacetamide.  
(a) A, D, C, B (b) C, A, D, B (c) C, B, A, D  
(d) A, B, C, D (e) A, C, D, B
5. Determine the amino acid sequence of the following oligopeptide from the experimental data below.  
— The amino acid composition is found to be [ala, lys, phe, met, cys, plus some decomposition products].  
— The peptide has a molecular weight around 700 Da and absorbs at 280 nm.

- Treatment with carboxypeptidase results in tryptophan and a peptide.
- CNBr treatment yields a tetrapeptide and a dipeptide.
- Trypsin digestion produces an amino acid and a pentapeptide with met on the amino end.
- Chymotrypsin digestion yields a dipeptide and a tetrapeptide.

- (a) trp-lys-met-cys-met-ala                      (b) lys-met-cys-phe-ala-trp  
 (c) trp-ala-phe-cys-met-lys                      (d) lys-ala-cys-phe-met-trp  
 (e) lys-met-cys-ala-phe-trp

6. 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.

7. Silk fibers consist of \_\_\_\_\_ proteins consisting of alternating \_\_\_\_\_ and \_\_\_\_\_ or \_\_\_\_\_ residues.

- (a) fibroin; glycine; proline; leucine  
 (b) -keratin; alanine; glycine; serine  
 (c) fibroin; glycine; alanine; threonine  
 (d) -keratin; cysteine; alanine; proline  
 (e) fibroin; glycine; alanine; serine

8. Arrange the steps involved in folding of globular proteins into a proper sequence.

- A — “Molten globule” formation of assembled domains.  
 B — Formation of domains through cooperative aggregation of folding nuclei.  
 C — Adjustment in the conformation of domains.  
 D — Rapid and reversible formation of local secondary structure.  
 E — Final protein monomer formation.

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

9. All of the following statements about cyclic sugars are true **EXCEPT**:

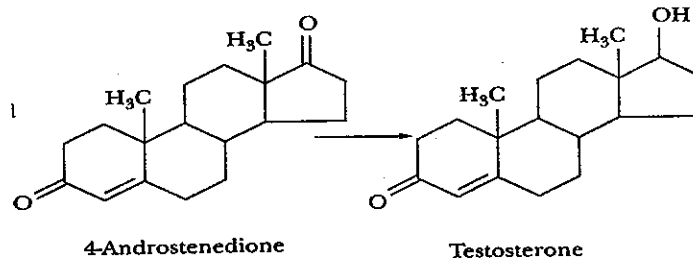
- (a) The  $\alpha$ -anomer has the -OH of the anomeric carbon positioned on the opposite side of the sugar ring from the -CH<sub>2</sub>OH.  
 (b) The five and six membered rings are more frequently observed due to stability.  
 (c) In a chair conformation, the predominant form has the bulkiest substituents occupying axial positions.  
 (d) The carbonyl carbon becomes a chiral center.

(e) They can be formed by the intramolecular reactions to hemiacetals or hemiketals.

10. Glycosphingolipids consist of a \_\_\_\_\_ with one or more \_\_\_\_\_ residues in a \_\_\_\_\_ linkage at the 1-hydroxyl moiety.

- (a) sugar; fatty acids; ester                      (b) ceramide; sugar; -glycosidic  
(c) ceramide; fatty acid; amide                      (d) glycerol; fatty acids; ester  
(e) none are true

11. The reaction below is catalyzed by:



- (a) desmolase.                      (b) 17-hydroxylase.                      (c) 17,20-lyase.  
(d) 17-hydroxysteroid dehydrogenase.                      (e) none, are true.

12. The two major phospholipids on the outer leaflet of erythrocytes are:

- (a) phosphatidylcholine and phosphatidylethanolamine.  
(b) phosphatidylcholine and sphingomyelin.  
(c) phosphatidylethanolamine and sphingomyelin.  
(d) phosphatidylserine and sphingomyelin.  
(e) phosphatidylcholine and phosphatidylserine.

13. In eukaryotic cells, a class of \_\_\_\_\_ - and \_\_\_\_\_ -rich proteins called \_\_\_\_\_ interact ionically with the anionic phosphate groups in the DNA backbone to form \_\_\_\_\_.

- (a) lysine; leucine; prions; ribosomes  
(b) arginine; lysine; histones; nucleosomes  
(c) arginine; alanine; histones; nucleosomes  
(d) arginine; lysine; prions; ribosomes  
(e) none are true.

14. All occur during DNA replication in *E. coli* **EXCEPT**:

- (a) helicase unwinds dsDNA at the replication fork.  
(b) DNA ligase catalyzes the formation of phosphoester bonds on the lagging strand.  
(c) DNA polymerase I hydrolyzes RNA from the 5' ends of Okazaki fragments.  
(d) primase (DnaG) binds to a GC rich region of dsDNA in *oriC*.  
(e) all are true.

15. Progression through the cell cycle for eukaryotic cells is regulated through a series of \_\_\_\_\_ that depend on \_\_\_\_\_, produced at one phase and degraded at another, that bind \_\_\_\_\_ which regulate specific proteins by phosphorylation.
- (a) checkpoints; cyclins; cyclin dependent protein kinases (CDKs)  
 (b) cyclins; phosphorylation; protein kinases  
 (c) phosphorylations; cyclins; protein kinases  
 (d) CDKs; cyclins; protein kinases  
 (e) none are true
16. AZT (3'-azido-2',3'-dideoxythymidine) is a drug that gets incorporated into growing viral DNA and blocks the activity of:
- (a) DNA ligase. (b) DNA polymerase (beta).  
 (c) DNA polymerase (alpha). (d) reverse transcriptase.  
 (e) none of the above.
17. The correct sequence for homologous recombination steps is:
- A – ligation.  
 B – branch migration and strand exchange.  
 C – nicking.  
 D – EW or NS cleavage, resolution and re-ligation.  
 E – strand invasion.
- (a) B, C, E, A, D (b) C, B, E, D, A (c) D, C, B, A, E  
 (d) C, E, A, B, D (e) C, A, B, E, D
18. In prokaryotes, gene expression is often responsive to small molecules where increasing synthesis of enzymes for metabolism of a certain substrate is termed \_\_\_\_\_ and the substrate is called \_\_\_\_\_. Likewise metabolic products that decrease synthesis of enzymes for their production are called \_\_\_\_\_ and carry out \_\_\_\_\_.
- (a) autoregulation; regulatory; co-repressors; initiation  
 (b) co-induction; induction; co-repressors; initiation  
 (c) induction; co-inducer; co-repressors; repression  
 (d) induction; co-inducer; repressor; co-repression  
 (e) all are true
19. The appropriate order for the basic steps of protein synthesis are:
- A – The elongation reaction transfers the peptide chain from the peptidyl-tRNA in the P site to the aminoacyl-tRNA in the A site.  
 B – The P site is occupied by peptidyl-tRNA carrying the growing polypeptide chain.

- C—Binding of mRNA by the small subunit followed by association of a particular initiator aminoacyl-tRNA that recognizes the first codon.  
 D—The large ribosomal subunit joins the initiation complex, preparing it for the elongation stage.  
 E—The new, longer peptidyl-tRNA moves from the A site into the P site as the ribosome moves one codon further along the mRNA.

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

20. The order of events in the initiation of protein synthesis is:

- A—GTP hydrolysis triggered by the 50 S subunit joining the 30 S subunit releasing IF-1, IF-2 and IF-3.  
 B—IF-2 delivers the initiator f-Met-tRNA<sub>i</sub><sup>fMet</sup> in a GTP-dependent process.  
 C—A-site of the 70 S initiation complex is ready to accept an incoming aminoacyl-tRNA.  
 D—IF-3 and IF-1 bind 30 S subunit.  
 E—mRNA binds to form the 30 S initiation complex.

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