



國立臺灣海洋大學九十九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、選擇題（每題 1 分，30%）

- 1、_____ and _____ are a small family of universal biomolecules mediating the flow of energy from exergonic reactions to the energy requiring processes of life.
- a. Reduced coenzymes, caffeine
 - b. High-energy phosphate compounds, caffeine
 - c. Chlorophyll, caffeine
 - d. Hemoglobin, chlorophyll
 - e. Reduced coenzymes, high-energy phosphate compounds
- 2、 Which of the listed amino acids is classified as a basic amino acid?
- a. leucine
 - b. phenylalanine
 - c. aspartate
 - d. asparagine
 - e. lysine
- 3、 The pK_a of the $\alpha\text{-NH}_3^+$ group is _____ by the presence on an amino acid by the a -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、 The correct sequence of procedures in the Southern blotting (hybridization) technique is:

- A. hybridization with radioactive probe
- B. agarose gel electrophoresis and visualize bands
- C. transfer (blot) to nitrocellulose filter
- D. digest DNA with restriction nucleases
- E. expose filter to X-ray film, develop and observe

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

5 · RT-PCR differs from basic PCR in that:

- a. reverse temperatures are used for annealing and transcription
- b. transcription is reversed from 5' to 3' ends
- c. reverse transcriptase is used to synthesize a cDNA strand complementary to an RNA strand
- d. reverse transcriptase is used to synthesize an RNA strand from the DNA strand
- e. none of these choices

6 · The enzyme that removes the RNA primer from the Okazaki fragment is:

- a. DNA polymerase I
- b. DNA ligase
- c. helicase
- d. DNA polymerase III
- e. DNA gyrase

7 · A pair of β -subunits of DNA polymerase III form a _____ to tether the polymerase to the template thus increasing the _____ of the polymerase.

- a. ligase; unwinding
- b. sliding clamp; processivity

- c. primer binding; primase activity
- d. loop of DNA; direction
- e. none are true

8. The termination of DNA replication in *E. coli* occurs when _____ protein binds the _____ locus on the DNA and acts as a _____.

- a. tag; oriC; helicase
- b. ter; tag; polymerase
- c. DnaC; DnaG; gyrase
- d. Tus; Ter; contrahelicase
- e. SSB; primer; RNA polymerase

9. The principal DNA polymerase in eukaryotic leading strand DNA replication is:

- a. DNA polymerase α (alpha)
- b. DNA polymerase β (beta)
- c. DNA polymerase γ (gamma)
- d. DNA polymerase δ (delta)
- e. DNA polymerase ϵ (epsilon)

10. An RNA-dependent DNA polymerase that carries the RNA template with it to synthesize repeats at the 3'-ends of chromosomes is called:

- a. DNA ligase
- b. telomerase
- c. DNA polymerase γ (gamma)
- d. topoisomerase
- e. DNA polymerase β (beta)

11. 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 β (beta)
- c. DNA polymerase α (alpha)
- d. reverse transcriptase
- e. none of these choices

12 · 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

13 · _____ promotes the formation of covalent bonds between _____ thymine residues in a DNA strand creating a _____ ring called a thymidine dimer.

- a. Visible light; adjacent; cyclohexyl
- b. Visible light; nearby; cyclobutyl
- c. UV light; adjacent; cyclobutyl
- d. UV light; nearby; cyclohexyl
- e. IR light; adjacent; cyclobutyl

14 · In base-excision repair, the first enzyme in the sequence is _____ creating a(n) _____ site.

- a. DNA polymerase III; ligase binding
- b. DNA glycosylase; apurinic or apyrimidinic
- c. DNA polymerase I; apurinic or apyrimidinic

- d. DNA ligase; polymerase III binding
- e. AP endonuclease; ligase binding

15 · A transition mutation would be replacing A by:

- a. T
- b. C
- c. U
- d. G
- e. none of these choices

16 · B-cells, T-cells, and macrophages are cell types capable of _____ as a mechanism of producing _____ essential to the immune response.

- a. replication rearrangement; antibodies
- b. complementarity modification; antigens
- c. DNA replication; genes
- d. DNA rearrangement; antibodies
- e. all are true

17 · The E. coli ribosome is made up of two subunits, a smaller _____S subunit with a _____ S ribosomal RNA and the larger _____S subunit with a _____S subunit and a _____S ribosomal RNA.

- a. 20; 16; 50; 25; 25
- b. 20; 12; 40; 25; 5
- c. 30; 12; 40; 23; 5
- d. 30; 16; 50; 23; 5
- e. 30; 20; 40; 23; 5

18 · The Shine-Dalgarno sequence found in prokaryotic systems resides on the _____ end of _____ and is the _____ site.

- a. 3'; peptidyl-tRNA; formyl transferase

- b. 5'; DNA; polymerase binding
- c. 3'; rRNA; initiation factor binding
- d. 5'; mRNA; ribosome binding
- e. 3'; aminoacyl-tRNA; formyl methionine binding

19 · 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_i^{fMet} 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

20 · Nucleotide sequences that identify the location of transcription start sites and regulate the level of transcription are called:

- a. sigma factors
- b. Pribnow boxes
- c. TATA boxes
- d. promoters
- e. enhancers

21. What maintains the secondary structure of a protein (A)peptide bond (B)hydrogen bond (C) disulfide bridge (D) ionic bond (E) electrostatic charge

22. What do both mitochondria and chloroplasts have in common? (A)ATP is produced (B)DNA is present (C)Ribosomes are present (D)Only B and C are correct (E)A, B and C are correct

23. Plasmodesmata in plant cells are similar in function to which structure in animal cells

(A)peroxisome (B)desmosome (C)gap junction (D)glycocalyx (E)tight junction

24. A cell has the following molecules and structures: enzymes, DNA, ribosomes, plasma membrane, and mitochondria. It could be a cell from (A) a bacterium (B) an animal, but not a plant (C) a plant, but not an animal (D) a plant or an animal (E) any kind of organism
25. Detoxifies alcohol in the liver (A) peroxisome (B) tonoplast (C) mitochondria (D) Golgi apparatus (E) lysosome
26. All of the following cellular activities require ATP energy EXCEPT (A) movement of O_2 into the cell (B) protein synthesis (C) pumping Na^+ ions out of the cell (D) cytoplasmic streaming (E) exocytosis
27. The sodium-potassium pump is called an electrogenic pump because it (A) pumps equal quantities of Na^+ and K^+ across the membrane (B) pumps hydrogen ions into the cell (C) contributes to the membrane potential (D) ionizes sodium and potassium (E) pumps hydrogen ions into the cell and contributes to the membrane potential
28. One of the function of cholesterol in plasma membranes is to (A) facilitate transport of ions (B) store energy (C) maintain membrane's fluidity (D) speed diffusion (E) phosphorylate ADP
29. Two similar-sized animal cells are placed in a 0.5% sucrose solution. Cell A enlarges in size for a while, then stops; Cell B continues to enlarge and finally ruptures. Which of the following was true at the beginning of the experiment (A) Cell A was hypoosmotic to the solution, and cell B was hyperosmotic (B) Cell A was hyperosmotic to the solution, and cell B was hypoosmotic (C) Cell A was hyperosmotic to cell B (D) Cell B was hyperosmotic to cell A (E) Cell A and cell B were isosmotic to each other
30. In plant cells, ATP is made in response to light. An electron transport chain is found in the (A) thylakoid membranes of chloroplasts (B) stroma of chloroplasts (C) inner membrane of mitochondria (D) matrix of mitochondria (E) cytoplasm

二、簡答題 (70%)

1. Please give the example and explain the "homeostasis". Also explain the significance of homeostasis in animal physiology and how to maintain homeostasis in body system. (7分)
2. Please give the good example to explain the "adaptation" in animals in order to meet the challenge and survive in the environment for many many generations. Also explain the difference between "adaptation" and "acclimation". (7分)
3. Please explain the importance of "endocrine system" or "nervous system" for the

communication and functional regulation in body life (just choose one to explain). (6 分)

- 4、請說明 water、Na⁺、estrogen 以及 LDL (low-density lipoprotein) 等物質如何通過細胞膜? (5 分)
- 5、細胞膜上水溶性和脂溶性激素受體有何不同? 同時請進一步說明 testosterone 這類小分子激素如何引發標的細胞的反應。(5 分)
- 6、Sequencing of the human genome has revealed much about the organization of genes. Please describe the differences between (1) solitary genes, (2) gene families, (3) pseudogenes, and (4) tandemly repeated genes. (每小題 2 分, 共 8 分)
- 7、Restriction enzymes and DNA ligase play essential roles in DNA cloning. (5) How is it that a bacterium that produces a restriction enzyme does not cut its own DNA? (6) Describe some general features of restriction enzyme sites. (7, 8, 9) What are the **three types** of DNA ends that can be generated after cutting DNA with restriction enzymes? (10) What reaction is catalyzed by DNA ligase? (每小題 2 分, 共 12 分)
- 8、Explain why a liver cell mitochondrion contains fewer cristae than a mitochondrion from a heart cell. (5 分)
- 9、How do long-chain fatty acids transport from cytoplasm into mitochondria? (5 分)
- 10、Which fatty acid is the precursor of prostaglandins (Eicosanoids)? And where is the fatty acid from? (4 分)
- 11、What are the precursors of pyrimidines biosynthesis (de novo pathway)? (2 分)
- 12、Describe the reactions of the urea cycle. (4 分)