



國立臺灣海洋大學 101 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。

壹、選擇題（單選題，每題1分，共20分）

1. Thermodynamic parameters (entropy, enthalpy, free energy, and internal energy) are given for an unknown enzyme. Explain which results would be expected for the breaking of hydrogen bonds and the exposure of hydrophobic groups from the interior during the unfolding process of a protein.
 - a. Entropy change, ΔS , is zero
 - b. Enthalpy change, ΔH , is positive
 - c. The reaction is spontaneous
 - d. Enthalpy change, ΔH , is negative
 - e. Entropy change, ΔS , is positive

2. _____ 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

3. The hyperchromic shift that occurs when dsDNA is _____ is a(n) _____ in absorption at _____ nm.
 - a. methylated; increase; 220
 - b. methylated; decrease; 260
 - c. denatured; decrease; 260
 - d. denatured; increase; 260
 - e. melted; decrease; 280

4. The UV absorption decrease associated with ssDNAs reannealing plotted on a _____ will indicate that more _____ DNAs take longer to renature.
- c_0t curve; complex
 - cat curve; double strand nature
 - c/c_0 curve; simple
 - c_0t curve; simple
 - cat curve; complex
5. All are correct statements comparing an intact 4 kb plasmid and a 4 kb fragment of E. coli chromosomal DNA. The plasmid has a 50% G+C content and the chromosomal DNA has a 55% G+C content EXCEPT:
- The T_m of the plasmid would be less than the T_m of the chromosomal DNA
 - The $c_0t_{1/2}$ value (time required to renature 50% of the DNA molecules) of the plasmid would be more than that of the chromosomal DNA
 - The plasmid DNA and chromosomal DNA would both show approximately a 30-40% increase in their absorption at 260 nm upon heating to 90°C
 - The plasmid DNA would contain more negative supercoiling than the chromosomal DNA fragments
 - All are true
6. Naturally occurring, self-replicating, extra-chromosomal DNA molecules found in bacteria that carry genes specifying novel metabolic capacity advantageous to the bacterium are called:
- probes
 - cruciform
 - toroidal DNA
 - plasmids
 - all of these choices

7. Carbon dioxide affects O_2 binding to Hb by:
- Hb competing with carbonic anhydride for CO_2
 - directly binding to heme-Fe in the oxygen binding site
 - forming iron carbonate with the heme-iron
 - forming $H^+ + HCO_3^-$ where the H^+ is an antagonist to oxygen binding to Hb
 - forming HCO_3^- that combines with H^+ to increase CO_2 binding
8. A method used to insert or transform cells with a plasmid is to:
- add the DNA to bacterial cells that have been lightly treated with lysozyme to produce "holes" in the cell wall
 - add the DNA to a heated suspension of cells at $42^\circ C$
 - treat the bacteria with Ca^{2+} , add the DNA, and briefly heat to $42^\circ C$
 - incubate the DNA with the cells overnight at $4^\circ C$
 - mixing plasmids with an extract of broken cells
9. The correct sequence for colony hybridization experiments is:
- A replica of the bacterial colonies is obtained on an absorbent disc
 - Autoradiography of the disc reveals probe complementary DNA
 - Host bacteria with plasmid are plated and allowed to grow overnight
 - The disc is treated with alkali
 - The disc is reacted with labeled probe
- A, C, E, B, D
 - C, A, E, D, B
 - C, E, A, B, D
 - C, A, E, B, D
 - C, A, D, E, B
10. The correct sequence of procedures in the Southern blotting (hybridization) technique is:
- hybridization with radioactive probe
 - agarose gel electrophoresis and visualize bands
 - 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

11. 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

12. 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

13. Prions are defined as:

- a. ions with an inappropriate number of protons
- b. ions about to form
- c. ionic proteins that bind DNA
- d. proteinaceous infectious particles
- e. particle ions that bind proteins

14. 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

15. _____ 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

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 initiation site binds a _____ nucleotide base pairing with the _____ base exposed within the _____ promoter complex, and then the second base is added to the _____ of the first base.

a. pyrimidine; -1; closed; 3'-O

b. pyrimidine; +1; closed; 5'-O

c. purine; +2; closed; 3'-O

d. purine; -1; open; 5'-O

e. purine; +1; open; 3'-O

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 _____.

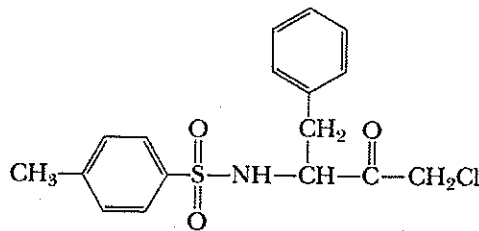
- a. autoregulation; regulatory; co-repressors; initiation
- b. co-induction; induction; co-repressors; initiation
- c. induction; co-inducer; co-repressors; repression
- d. induction; co-inducer; repressor; co-repression
- e. all are true

19. Heat shock element (HSE) is a(n) _____ found in the _____ region of genes whose transcription is activated in response to _____.
- a. silencer; enhancer; cold
 - b. response element; promoter; elevated temperature
 - c. promoter; enhancer; elevated temperature
 - d. enhancer; response element; elevated temperature
 - e. silencer; promoter; cold
20. The mechanism by which _____ are removed and multiple _____ are spliced together to generate a continuous, translatable mRNA must be both _____ and _____.
- a. introns; exons; precise; complex
 - b. exons; introns; precise; complex
 - c. exons; introns; continuous; simple
 - d. introns; exons; continuous; simple
 - e. none are true

貳、問答題

1. 請說明生物薄層 (biofilm) 的主要構成、形成步驟以及其對於水產養殖之影響。(5%)
2. 請舉出實際應用於水產養殖中的益生菌 (probiotics) 或益生物質，其組成種類、功能以及實際應用之方式與效果。(5%)
3. 請說明下列技術應用於水產養殖之現況與未來發展潛力：
 - (1) 基因轉殖技術與轉基因/基改生物(4%)
 - (2) 多倍體(3%)
 - (3) 多價疫苗(3%)

4. Please briefly describe six major "anterior pituitary hormones", their targets and representative actions. (12 %)
5. Please describe three metabolic stages of cellular (aerobic) respiration to harvest energy from glucose and their functions, respectively. (8 %)
6. The interferon protein is very valuable in antiviral usage. If your mentor asks you to produce the "functional" interferon for further study. What is your plan and how to perform it? (15%)
7. What is the basic principle for peptide vaccine? (5%)
8. Tosyl-L-phenylalanine chloromethyl ketone (TPCK) specifically inhibits chymotrypsin by covalently labeling His⁵⁷ (10%)
- (A) State why this inhibitor is specific for chymotrypsin
- (B) Propose a reagent based on the structure of TPCK that might be an effective inhibitor of trypsin



Tosyl-L-phenylalanine chloromethyl ketone (TPCK)

9. Describe the reactions of fatty acid oxidation (β -oxidation). (5 %)
10. If the complete metabolic oxidation of 1 molecule of alanine yields 16 ATPs in a mammal. Would the corresponding energy yield in a fish be higher or lower? Why? (5%)