國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【生科系碩士班甲組】
※本科目依簡章規定「不可以」使用計算機(問答申論題)

題號：421004

皆為問答題，共四題，一題25分。請留意答案文字表達的邏輯、結構、語詞彙的精準性。建議使用文字與繪圖表達你的科學概念。

1. 請解釋以下假說或定則所回應的問題，如何被檢驗，以及使用上的限制
   A. 內共生假說 (endosymbiosis hypothesis)
   B. 柏格曼定則 (Bergmann's rule)
   C. 紅皇后假說 (Red Queen hypothesis)

2. 若你打算回應與解決以下問題，請問有哪些技術或理論可使用？請詳細解釋
   A. 是否有越南茶混充在台灣茶中？
   B. 市售的鱈魚是否是假貨？
   C. 在開放性的水池放養大肚魚是否可有效滅蚊？

3. 請回應幾個有關數據分析的問題：
   A. 柱狀圖與折線圖的使用場合為何？
   B. 何時應該使用表？何時應使用圖？
   C. 如何判斷兩個參數之間有相關性？

4. 請自行畫出台灣地圖，並指出以下生態系的所在位置：
   A. 高位珊瑚礁林
   B. 高山草原
   C. 亞熱帶季風林
   D. 熱帶雨林
   E. 河口溼地

試題隨卷繳回

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：生態學【生科系碩士班甲組】　　題號：421002

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

一、 簡答題(共 100 分)

1. What is adaptive radiation? Give at least one example to explain. (10 points)
2. What is competitive exclusive principle? Give at least one example to explain. (10 points)
3. What is character displacement? Give at least one example to explain. (10 points)
4. Among three general ways to estimate population abundance, mark-recapture method is only used in mobile organisms. Why it is not suitable for sessile organisms? Is there any possible way to modify this method for surveying sessile organisms? Why? (10 points)
5. Describe and explain the distribution pattern of barnacle species *Chthamalus stellatus* and *Semibalanus balanoides* along the coast of Scotland. (10 points)
6. What is a community? Please give the definition and use one example to explain. (10 points)
7. Compare the differences between primary and secondary succession. (10 points)
8. Define the various spatial scales that are important to biogeography and describe how they are related to or interconnected with one another. (15 points)
9. Give one example to explain the equilibrium theories and nonequilibrium theories and compare the differences between the equilibrium theories and nonequilibrium theories. (15 points)

試題隨卷繳回

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：生物化學【生科系碩士班乙組】　　題號：421001

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

1. One technique commonly used in protein purification is chromatography.
a) Explain briefly the general principle of column chromatography
b) Name four types of chromatography and indicate for each of these types the basis for separation (match types of chromatography with the properties that form the basis for separation). **(20 分)**

2. a) Draw the following fatty acid: 18:3*c*Δ9,12,15 as it would appear at physiological pH. With reference to the omega carbon, what type of fatty acid is this? Draw the result if this fatty acid underwent partial hydrogenation to produce 18:1*t*Δ11. **(8分)**

b) Draw a molecule of phosphatidylserine with palmitic acid (16:0) and oleic acid (18:1*c*Δ9) present. Make sure to put the saturated and unsaturated fatty acids in their proper location. **(7分)**

3. Insulin activates glycogen synthase while glucagon inhibits glycogen synthase. Explain the intracellular mechanisms that are used to bring about this activity. **(15 分)**

4. It appears that the heme group in myoglobin binds the O_2. What is the function of the polypeptide? **(20 分)**

5. Metabolism serves two different purposes: the generation of energy and the synthesis of biological molecules. To achieve these purposes, metabolism consists largely of two contrasting processes: catabolism and anabolism. Compare and contrast catabolism and anabolism. **(15 分)**

6. Describe how epinephrine promotes the utilization of stored glycogen for glycolysis and ATP production in muscles. **(15 分)**

試題隨卷繳回

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：分子生物學【生科系碩士班乙組】　　題號：421003

※本科目依簡章規定「不可以」使用計算機(混合題)　　

一、選擇題每題2分(24%)單選

1.The bacterial Shine-Dalgarno mRNA sequence is:
A) a translation termination signal.　B) the ribosomal binding site.
C) a translational elongation factor.　D) a protein coding region.

2. Which one of the following statements is a feature of the wobble hypothesis?
A) An amino acid-specific tRNA molecule can recognize only one codon
B) The "wobble" occurs only in the third base of the anticodon
C) When inosine (I) is the first nucleotide of an anticodon, at least three different codons for the same amino acid can be recognized.
D) tRNA molecules can recognize codons that specify two different amino acids.

3. Which one of the following bacterial translational proteins is NOT a GTP-binding protein?
A) IF-2　B) EF-Tu　C) EF-G　D) RF-1

4. Which of the following is NOT an example of a regulatory DNA site?
A) Enhancer　B) Insulator　C) Repressor　D) Operator

5. Which of the following sequences contain a six-nucleotide inverted repeat?
A) GTCACGCGACGATACGGTCACG　B) GTCACGACTAGCCTAGTCGCTG
C) GTCACGACTAGCCATCAGCCTG　D) GTCACGACTAGCCCGACTAGTG

6. Which of the following events is least likely a result of protein phosphorylation?
A) Reduction in the activity of an enzyme　B) Transport of the protein to the nucleus
C) The specific binding of a regulatory protein　D) Targeting of the protein for degradation

7. The binding of tryptophan to the Trp repressor protein results in:
A) the dissociation of the repressor from the operator sequence.
B) a conformational change in the repressor that allows the repressor to bind the operator.
C) the recruitment of RNA polymerase.
D) an increase in the expression of tryptophan biosynthetic enzymes.

8. The integrase enzyme of bacteriophage λ is required to:
A) excise the prophage from the host genome.
B) degrade phage mRNA during lysogenic growth.
C) bypass terminator structures downstream from the N and Cro genes.
D) combine multiple DNA segments to make new genes.

9. Basal transcription factors are:
A) necessary only for initiation of transcription of house-keeping genes.
B) factors that bind to other proteins, not to DNA directly.
C) required at every Pol II promoter.
D) factors that bind to enhancers.

10. Which one of the following is least likely to affect the chromatin state in the vicinity of a gene?
A) HATs　B) HMG proteins　C) SWI/SNF complexes　D) Mediator protein

11. In which of the following biochemical reactions is it common to use ddNTPs (dideoxyribonucleoside triphosphates)?
A) citric acid cycle　B) DNA sequencing　C) restriction digestion
D) electron transport　E) plasmolysis

12. It has been recently determined that the gene for Duchenne muscular dystrophy (DMD) is more than 2000 kb (kilobases) in length; however, the mRNA produced by this gene is only about 14 kb long. What is a likely cause of this discrepancy?
A) The exons have been spliced out during mRNA processing.
B) The DNA represents a double-stranded structure, whereas the RNA is single-stranded.
C) There are more amino acids coded for by the DNA than by the mRNA.
D) The introns have been spliced out during mRNA processing.
E) When the mRNA is produced, it is highly folded and therefore less long.

二、解釋下列名詞 **(16 %)**

1. small nuclear RNAs (snRNAs),
2. Single-nucleotide polymorphism (SNPs)
3. fluorescence resonant energy transfer (FRET)
4. Fluorescent *in situ* hybridization (FISH)
5. ribozyme
6. transcriptomics or proteomics (choice one to answer)
7. nucleotide excision repair (NER)
8. telomere

三、問答題**(60%)**

1. Please describe how to use yeast two-hybrid system to identify protein-protein interaction? (hint: DNA binding domain (DBD), Activation domain (AD), reporter gene, such as *lacZ* or *Luciferase* gene) (5pts)

2. Describe how a dominant negative mutation can functionally inhibit the activity of a wild-type GTPase. (5pts)

3. Mobile DNA Sequences (or transposon) contain ~50% in the genome. Please describe the basic components and functions of a transposon? (5pts)

4. Please describe why oncogenes and tumor suppressor genes are related to cancer formation? (5pts)

5. Please describe the difference between variable number tandem repeats (VNTRs) and short tandem repeats (STRs)? How these sequences are used in medical applications? (5pts)

6. Two strategies to sequencing genomic DNA during the human genome project (HGP): clone-by-clone method and whole-genome shotgun method (shotgun cloning). Please describe the difference? (5pts)

7. Please describe how will you do to prove DNA replication is semiconservative. (5pts)

8. What is the structure and function of steroid receptors? [hint: There are 3 major components of steroid receptors] (5pts)

9. Three initiation factors (IF-1, IF-2 and IF-3) are required for initiation of bacterial translation. What are their roles? [hint: translation materials are ribosomal subunit 30S and 50S, template, tRNA, P/A sites] (10pts)

10. Describe the major mRNA degradation pathway in *E. coli*. (5pts) In eukaryotic cells, there has another mRNA degradation pathway mediated by microRNA (miRNA), what is miRNA? And please describe the miRNA-mediated pathway for degradation of eukaryotic mRNAs. (5pts)

背面有題