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(二)

系所名稱：生物科技研究所碩士班甲組

1.答案以橫式由左至右書寫。2.請依題號順序作答。

1. Why does DNA with a high A–T content have a lower transition temperature, *T*m, than DNA with a high G–C content? (5%)
2. Which would be more harmful to a cell, a mutation in DNA or a transcription mistake that leads to an incorrect mRNA? Why? (5%)
3. Compare and contrast the properties of the enzymes DNA polymerase I and polymerase III from *E. coli*. (5%)
4. Describe the discontinuous synthesis of the lagging strand in DNA replication. (5%)
5. Explain, with diagrams, how transcription attenuation works in the *trp* operon. (5%)
6. What is blue/white screening? What is the key feature of a plasmid that is used for it? (5%)
7. Explain the following questions.
   (1) β-oxidation (2%)
   (2) lipolysis (2%)
   (3) lipogenesis (2%)
   (4) esterification (in lipid metabolism) (2%)
   (5) How many ATP molecules can be consumed in urea cycle? (2%) Describe which reaction steps they are.(4%)
   (6) If you go to hospital to have blood examination, the value of your GOT and GPT is 0. What is the physiological significance of GOT and GPT? (2%) Whether the value of GOT and GPT is 0, it could occur in our body. Is it possible or impossible? Why? (2%)
   (7) How are fats mobilized from dietary intake and adipose tissue? (8%)
   (8) A lack of adenosine deaminase can cause severe combined immunodeficiency syndrome. Why? (3%)
   (9) Indicate which reactions of purine or pyrimidine metabolism are affected by the inhibitors (a) azaserine, (b) methotrexate, and (c) allopurinol. (6%)
8. TCA cycle 中的 TCA 代表哪三個英文字？(3%) 請寫出 TCA cycle 中自 succinyl-CoA 回到 oxaloacetate 的途徑 (包括酵素名，輔酶，反應物與產物)。(10%) 而這一小段代謝途徑一共可以產生多少 ATP? (4%)
9. 請仔細閱讀以下文章後回答下方問題

   Metabolomics is the scientific study of chemical processes involving metabolites. Specifically, metabolomics is the "systematic study of the unique chemical fingerprints that specific cellular processes leave behind", the study of their small-molecule metabolite profiles. The metabolome represents the collection of all metabolites in a biological cell, tissue, organ or organism, which are the end products of cellular processes. Thus, while mRNA gene expression data and

proteomic analyses do not tell the whole story of what might be happening in a cell, metabolic profiling can give an instantaneous snapshot of the physiology of that cell. One of the challenges of systems biology and functional genomics is to integrate proteomic, transcriptomic, and metabolomic information to give a more complete picture of living organisms.

(1) Proteomics 中文翻譯為『蛋白質體』，那你認為 Metabolomics 合適的中文翻譯應該是？(3%)

(2) Metabolomics 與蛋白質體、基因體、轉錄體等都屬於系統生物學。但由上方文字的內容提示，你認為 Metabolomics 的實驗數據可以提供什麼資訊是其他方法所無法提供的？而 Metabolomics 的重要性又在哪裡？(5%)

(3) 在進行相關的實驗時，通常會將樣品先以 methanol/chloroform 萃取，將樣品分成兩部分。請問 methanol/chloroform 處理的目的是在萃取什麼代謝物質？試舉兩例。(4%)

(4) 若將癌細胞與正常細胞一起進行 metabolomics 分析，結果顯示癌細胞較正常細胞累積較多的 lactate，請問你認為這是因為癌細胞中的哪些代謝途徑活化所造成的？(3%) 而你判斷在癌細胞中的 $[NAD^+]/[NADH]$ 比例比正常細胞高或低？為什麼？(3%)