國立臺南大學106學年度 **生物科技學系碩士班** 招生考試 生物科技概論 試題卷

一、選擇題 (每題 2.5 分，共 50 分)

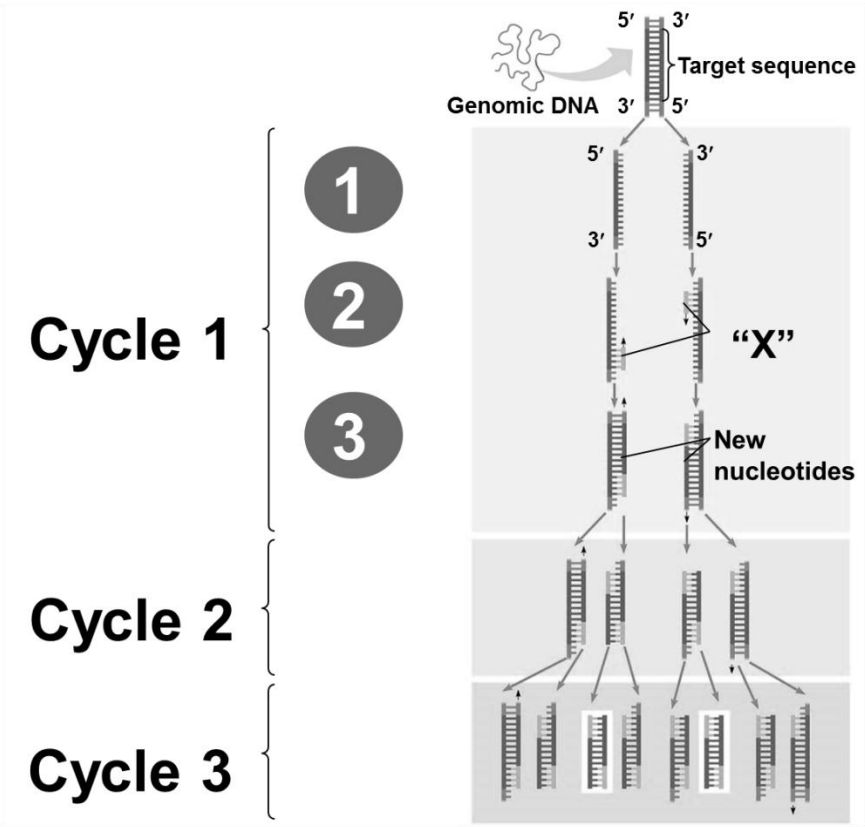
1. The main difference between prokaryotic and eukaryotic cells is the existence of ____ in eukaryotes.
   (A) the nucleus
   (B) ribosomes
   (C) DNA
   (D) RNA
   (E) cell walls
2. Which substance is not involved in the production of urea from $NH4^+$ via the urea cycle?
   (A) Aspartate
   (B) ATP
   (C) Carbamoyl phosphate
   (D) Malate
   (E) Ornithine
3. Which cell component is composed of RNA and protein?
   (A) Nucleus
   (B) Mitochondrion
   (C) Endoplasmic Reticulum
   (D) Chloroplast
   (E) Ribosome
4. Which organelle is involved in the synthesis of ATP?
   (A) Nucleus
   (B) Mitochondrion
   (C) Chloroplast
   (D) ATP is synthesized in both mitochondria and chloroplasts.
   (E) ATP is synthesized in all three organelles.
5. The process of ATP synthesis in chloroplasts is referred to as
   (A) oxidative phosphorylation
   (B) photophosphorylation
   (C) reductive phosphorylation
   (D) substrate-level phosphorylation
6. In the Three Domain classification system, *Escherichia coli* would be considered
   (A) Archaebacteria
   (B) Eubacteria
   (C) Eukarya
   (D) none of the above

7. A spontaneous reaction is
   (A) exergonic
   (B) endergonic
   (C) at equilibrium
   (D) none of the above
8. The side chain groups of amino acids are bonded to which carbon?
   (A) The α-carbon.
   (B) The β-carbon.
   (C) The carbonyl carbon.
   (D) Different amino acids have their side chains attached to different carbons.
9. The order in which amino acids are linked in peptides is given
   (A) from the C-terminal to the N-terminal end
   (B) from the N-terminal to the C-terminal end
   (C) in alphabetical order
   (D) in order of increasing molecular weights of the amino acid residues
10. Disulfide bonds are most important in this type of structure:
   (A) primary structure
   (B) secondary structure
   (C) tertiary structure
   (D) quaternary structure
11. Which would be best to separate a protein that binds strongly to its substrate?
   (A) Gel filtration
   (B) Affinity chromatography
   (C) Cation exchange
   (D) Anion exchange
   (E) Cation or anion exchange
12. Which of the following compounds yields the most energy per gram?
   (A) triacylglycerols
   (B) carbohydrates
   (C) proteins
   (D) They all yield about the same amount of energy per gram.
13. Glycolipids are particularly important in these structures:
   (A) Membranes.
   (B) Lipoproteins.
   (C) The brain and nervous system.
   (D) Membranes, the brain and the nervous system.
14. Which of the following nucleobases is a purine?
   (A) adenine
   (B) cytosine
   (C) thymine
   (D) uracil

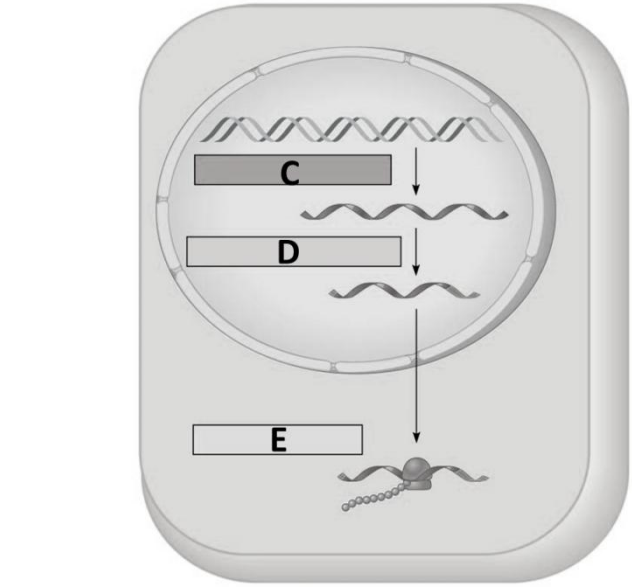
15. The backbone of nucleic acids consists of
    (A) a phosphodiester bond between the 2' and 5' hydroxyl groups of neighboring sugars
    (B) a phosphodiester bond between the 3' and 5' hydroxyl groups of neighboring sugars
    (C) a glycosidic bond between a pyrimidine and a sugar
    (D) a glycosidic bond between a purine and a sugar
16. The Tm for melting the double helix is:
    (A) The temperature at which the helix starts to open.
    (B) The midpoint of the range over which the helix denatures.
    (C) The temperature at which the helix is completely open.
    (D) The energy needed to melt the DNA.
    (E) None of these is correct.
17. The study of DNA changes that are not reflected in the base sequence is called:
    (A) Molecular biology
    (B) Histology
    (C) Epigenetics
    (D) Physical genetics
18. The standard state usually used in biochemistry ($\Delta G^{\circ'}$) includes
    (A) all concentrations at 1 M
    (B) all concentrations at 1 M, except for $[H^+]$, which is 10^{-7} M
    (C) same as (A), but at 25℃
    (D) same as (B), but at 25℃
19. The conversion of 1 mol of pyruvate to 3 mol of CO_2 via pyruvate dehydrogenase and the citric acid cycle also yields _____ mol of NADH, _____ mol of $FADH_2$, and _____ mol of ATP (or GTP).
    (A) 2; 2; 2
    (B) 3; 1; 1
    (C) 3; 2; 0
    (D) 4; 1; 1
    (E) 4; 2; 1
20. Which of the following best characterizes NADH and NADPH
    (A) NADH and NADPH are interchangeably used for both ATP generation and biosynthesis.
    (B) NADH is primarily used for ATP generation, whereas NADPH is primarily used for biosynthesis.
    (C) NADPH is primarily used for ATP generation, whereas NADH is primarily used for biosynthesis.
    (D) Both ATP generation and biosynthesis preferentially use NADH over NADPH.

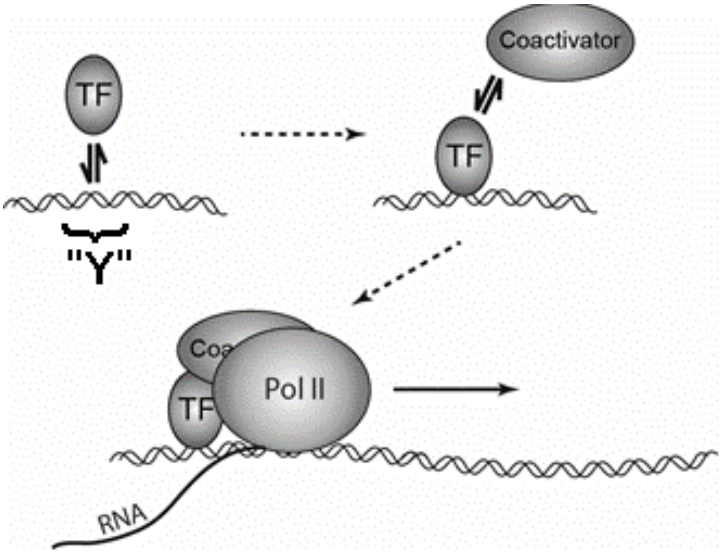
二、問答題 (共 50 分)

1. 附圖為一種重要的生物科技與分子生物學的實驗技術，請寫出：
   (1) 此技術的名稱（中文或英文均可）。(2 分)
   (2) 請參照附圖，解釋此項技術的關鍵步驟①②③分別為何（6 分）
   (3) 附圖中關鍵試劑“X”的名稱與用途分別為何？（4 分）
   (4) 該技術使用的主要酵素的名稱為何？該酵素有何特性？(4 分)

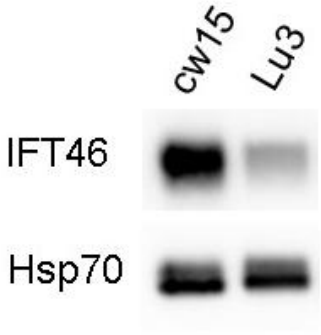


2. 附圖上半部為真核細胞基因表現的概觀，下半部為過程C的細部作用示意圖。
   (1) 請說明C至E的過程各為何？與原核生物主要有何不同？(6 分)
   (2) 附圖 TF 與“Y”區域各代表什麼？這兩者如何影響基因表現的專一性？（4 分）
   (3) 真核細胞的基因表現與蛋白質產物活性的調控，還可以作用在其他層面上。請任舉其他兩種調控方式，並且分別簡要說明。（6 分）





3. Western blotting 是一種常用的生化分析與檢測技術，附圖為利用該技術的實驗結果。
   (1) 請說明該技術的原理與主要步驟。(6 分)
   (2) 附圖的實驗為取用 cw15 與 Lu3 兩種細胞之等量的細胞萃取液樣品，分別利用能識別 IFT46 或 Hsp70 之實驗試劑的檢測實驗結果。請判讀後寫下該實驗的結論。（4 分）



4. 請從(A)至(F)中<u>任選一組</u>，盡可能地說明你對該組名詞的認知。你可以解釋該名詞的意思、舉例說明、描述其應用… 等各種觀點來展現你的瞭解與認識。請任挑一組名詞回答即可；回答多組的以最先答題的一組為準，超過的部分不計分。（8 分）

   (A) ubiquitin 與 proteasome
   (B) steroid hormone 與 steroid hormone receptor
   (C) micro RNA 與 small interference RNA
   (D) genetic model organism 與 mutant
   (E) sequence homology 與 conserved proteins
   (F) photosystem II 與 electron transport chain