

系所(組)別：生物科技研究所

M6-2

考試科目：生物化學

(一) 單選題 (每小題 2%，共 40%)

1. In a highly acidic solution, pH=2, the dominant form of glycine is (a) $\text{NH}_2\text{-CH}_2\text{-COOH}$ (b) $\text{NH}_2\text{-CH}_2\text{-COO}^-$ (c) $\text{NH}_3^+\text{-CH}_2\text{-COOH}$ (d) $\text{NH}_3^+\text{-CH}_2\text{-COO}^-$
2. Amino acids are ampholytes because they can function as either a(n) (a) acid or a base (b) neutral molecule or an ion (c) polar or a nonpolar molecule (d) transport or a light-absorbing compound.
3. The fundamental cause of sickle-cell disease is a change in the structure of (a) blood (b) red cells (c) hemoglobin (d) the heart.
4. By adding SDS (sodium dodecyl sulfate) during the electrophoresis of proteins, it is possible to (a) separate proteins exclusively on the basis of molecular weight (b) preserve a protein's native structure (c) determine a protein's isoelectric point (d) determine the amino acid composition of the protein.
5. Which of the following statements about allosteric control of enzymatic activity is false? (a) Allosteric effectors give rise to sigmoidal V_0 vs. $[S]$ kinetic plots. (b) Allosteric proteins are generally composed of several subunits. (c) An effector may either inhibit or activate an enzyme. (d) Heterotropic allosteric effectors compete with substrate for binding sites.
6. V_{max} for an enzyme-catalyzed reaction (a) generally increases when pH increases (b) is twice the rate observed when the concentration of substrate is equal to the K_m (c) is unchanged in the presence of a uncompetitive inhibitor (d) increases in the presence of a competitive inhibitor
7. Which of the following statements is true of enzyme catalysts? (a) They can increase the equilibrium constant for a given reaction by a thousand fold or more. (b) They can increase the reaction rate for a given reaction by a thousand fold or more. (c) To be effective, they must be present at the same concentration as their substrate. (d) Their catalytic activity is independent of pH.
8. Which of the following is not a reducing sugar (a) fructose (b) glucose (c) ribose (d) sucrose.
9. Which of the following is not an intermediate of the citric acid cycle? (a) acetyl-co A (b) citrate (c) oxaloacetate (d) α -ketoglutarate
10. The binding of CRP (cAMP receptor protein of *E. coli*) to DNA in the *lac* operon (a) assists RNA polymerase binding to the *lac* promoter (b) is inhibited by a high level of cAMP. (c) occurs in the *lac* repressor region. (d) occurs only when glucose is present in the growth medium.
11. An Okazaki fragment is a (a) fragment of DNA resulting from endonuclease action (b) fragment of RNA that is a subunit of the 30 S ribosome (c) segment of DNA that is an intermediate in the synthesis of the lagging strand (d) segment of mRNA synthesized by RNA polymerase.
12. In the laboratory, several factors are known to cause alteration of the chemical structure of DNA. The factor(s) likely to be important in a living cell is (are) (a) heat (b) low pH (c) oxygen (d) UV light. (e) Both C and D.
13. When double-stranded DNA is heated at neutral pH, which change does not occur? (a) The absorption of UV (260 nm) light increases. (b) The covalent N-glycosidic bond between the base and the pentose breaks. (c) The helical structure unwinds. (d) the hydrogen bonds between A and T break.
14. Which one of the following analytical techniques does not help illuminate a gene's cellular function? (a) DNA microarray analysis. (b) Southern blotting (c) Two-dimensional gel electrophoresis (d) Two-hybrid analysis.
15. Which of the following statements concerning fatty acids is correct? (a) they all contain one or two double

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- bond (b) they are a constituent of sterols. (c) they are strongly hydrophilic (d) one is the precursor of prostaglandins..
16. Facilitated diffusion through a biological membrane is (a) driven by a difference of solute concentration (b) driven by ATP (c) generally irreversible. (d) not specific with respect to the substrate.
17. Conversion of 1 mol of acetyl-CoA to 2 mol of CO₂ and CoA via the citric acid cycle results in the net production of (a) 1 mol of NADH (b) 1 mol of citrate (c) 7 mol of ATP (d) 1 mol of FADH₂.
18. The proofreading function of DNA polymerase involves all of the following except (a) base pairing (b) detection of mismatched based pairs. (c) reversal of the polymerization (d) phosphodiester bond hydrolysis.
19. Bacterial plasmids (a) are always covalently joined to the bacterial chromosome. (b) are never circular. (c) cannot replicate when cells divide. (d) often encode proteins not normally essential to the bacterium's survival.
20. Compared with DNA polymerase, reverse transcriptase (a) does not require a primer to initiate synthesis (b) introduce no errors into genetic material because it synthesizes RNA, not DNA. (c) Makes fewer errors in synthesizing a complementary polynucleotide. (d) makes more errors because it lacks the 3' → 5' proofreading exonuclease activity.

(二) 請說明下列技術：(每小題4%，共16%)

- (1) SDS-PAGE (2) DNA microarray (3) ELISA (4) gel filtration

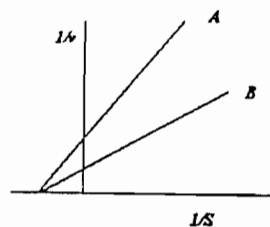
(三) 請說明在下列細胞中葡萄糖的最終代謝產物為何？請寫出反應之代謝方程式。(每小題3%，共9%)

- (1) 在厭氧狀況下的酵母細胞 (2) 氧氣充足的代謝細胞 (3) 激烈運動後的肌肉細胞

(四) 在某一個 organism 中，其 peroxidase 的基因有 18,000 個鹼基。此 peroxidase 的分子量大約是 110,000。請問這個 organism 是 prokaryote 或是 eukaryote？請說明你的判斷依據。(amino acid 的平均分子量=110；鹼基的平均分子量=450) (6%)

(五) 請舉出三種有關 RNA 的 postsynthetic processing。(9%)

(六) 某酵素的雙倒數作圖如下圖曲線 A，另有一化合物對此酵素的動力學影響如曲線 B。請說明此化合物與酵素為何種關係？(5%)



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第 2 頁 共 2 頁

(八) 何謂 Zymogen？何謂 Ribozyme？請各給一個例子。(10%)

(九) 當「s」= 4 K_m時，v/V_{max}的比例為何？(5%)