(一) 單選題 (每小題 2%，共 50%)

1. In a highly basic solution, pH=13, the dominant form of glycine is (a) NH_2-CH_2-COOH (b) NH_2-CH_2-COO^- (c) NH_3^+-CH_2-COOH (d) NH_3^+-CH_2-COO^-

2. Which of the following is correct with respect to the amino acid composition of proteins? (a) Larger proteins have a more uniform distribution of amino acids than smaller proteins. (b) Proteins contain at least one each of the 20 different standard amino acids. (c) Proteins with different functions usually differ significantly in their amino acid composition (d) Proteins with the same molecuIr weight have the same amino acid composition.

3. Which of the following refers to particularly stable arrangements of amino acid residues in a protein that give rise to recurring patterns? (a) primary structure (b) secondary structure (c) tertiary structure (d) quaternary structure.

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. Pauling and Corey's studies of the peptide bond showed that (a) at pH7, many different peptide bond conformations are equally probable. (b) primary structure of all proteins is similar. (c) peptide bond structure is complex. (d) peptide bonds are essentially planar, with no rotation about the C-N axis.

6. Which of the following is least likely to result in protein denaturation? (a) altering net charge by changing pH (b) changing the salt concentration (c) exposure to detergents (d) disruption of weak interactions by boiling.

7. Which of the following statements about protein-ligand binding is correct? (a) The K_a (association constant) is independent of such conditions as salt concentration and pH. (b) The larger the K_a, the weaker the affinity. (c) The larger the K_a, the faster is the binding. (d) The larger the K_a, the smaller the K_d. (dissociation constant)

8. In a plot of $1/V$ against $1/[S]$ for an enzyme-catalyzed reaction, the presence of a competitive inhibitor will alter the (a) intercept on the $1/[S]$ axis (b) pK of the plot. (c) Vmax. (d) intercept on the $1/V$ axis.

9. 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.

10. 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.

11. How is trypsinogen converted to trypsin? (a) An increase in Ca^{2+} concentration promotes the conversion. (b) Proteolysis of trypsinogen forms trypsin. (c) A protein kinase-catalyzed phosphorylation converts trypsinogen to trypsin. (d) Two inactivate trypsinogen dimmers pair to form an active trypsin tetramer.

12. Which of the following is not a reducing sugar (a) fructose (b) glucose (c) ribose (d) sucrose.

13. When two carbohydrates are epimers (a) One is pyranose, the other a furanose. (b) They differ only in the configuration around one carbon atom. (c) They differ in length by one carbon. (d) One is an aldose, the other a ketose.

14. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to (a) specific oligosaccharides. (b) specific peptides. (c) hydrophobic molecules. (d) amphipathic molecules.

15. Which one of the following is true of the pentoses found in nucleic acids (a) C-5 and C-1 of the pentose are joined to phosphate groups. (b) C-5 of the pentose is joined to a nitrogeneous base, and C-1 to a phosphate group. (c) The bond that

joins nitrogeneous based to pentose is an *O*-glycnsidic bond. (d) The pentoses are always in the β-furanose forms

16. The double helix of DNA in the B-form is stabilized by (a) Covalent bonds between the 3'end of one strand and the 5' end of the other. (b) Hydrogen bonds between riboses of each strand. (c) Nonspecific base-stacking interaction between two adjacent bases in the same stand. (d) Ribose interactions with the planar base pairs.

17. 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.

18. When double-stranded DNA is heated at neutral pH, which change dosed 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.

19 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.

20. Which of the following statements about sterols is true? (a) All sterols share a fuse-ring structure with four rings. (b) Sterols are found in the membrane of all living cells. (c) Stigmasterol is the principle sterol in fungi (d) The principle sterol of animal cells is ergosterol.

21. Facilitated diffusion through a biological membrane is (a) driven hy a difference of solute concentration (b) driven by ATP (c) generally irreversible. (d) not specific with respect to the substrate.

22. Glucose labeled with C^{14} in C-1 and C-6 gives rise in glycolysis to pyruvate labeled in (a) All three carbons. (b) Its carbonyl carbon. (c) Its carbonyl carbon (d) Its methyl carbon.

23. 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.

24. At replication forks in *E. coli* (a) DNA primers are degraded by exonucleases. (b) DNA topoisomerases make endonucleolytic cuts in DNA. (c) RNA primers are removed by primase. (d) RNA primers are synthesized by primase.

25. 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. 9d) 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) Isoelectric focusing electrophoresis (2) Gel filtration (3) Western blot (4) DNA microarray

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

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

(四) 在某一個 organism 中，其 hexokinase 的基因有21,000 個鹼基。Hexokinase 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) (8%)

(五) 有一抗生素會抑制原核蛋白質的合成，在此抗生素的存在下，蛋白質合成起始階段(initiation)會發生，但只有 dipeptide 被合成，且此 dipeptide 一直與 ribosome 結合。根據上述資訊，你認為此抗生素阻止了蛋白質合成的哪一個步驟？(8%)

(六) 15 μg of an enzyme of *Mr* 30,000 working at *V*max catalyzes the conversion of 60 μmol of substrate into product in 3 min What is the enzyme's turnover number? (9%)