PART I: 選擇題 (每題 1 分, 共 20 分)

1. Glucose 的第幾個碳決定它是 D- 或 L-stereoisomer (Carbon 1 含 carbonyl carbon)? (1) 1 (2) 4 (3) 5 (4) 6.
2. 構成 cellulose 長鏈的 bonds 是 (1) α-1,4 (2) α-1,6 (3) β-1,4 (4) β-1,6 glycosidic bond.
3. 在 cholesterol 的分子中，有一 8-10 carbons 構成的 alkyl side chain，它是接在分子的 (1) A (2) B (3) C (4) D ring 上.
4. 下列何者不屬於 phospholipids? (1) cardiolipin (2) phosphatidylinositol (3) phosphatidylserine (4) terpene.
5. Lipid bilayer 中的 lipids 主要是靠什麼力量聚集在一起?(1) hydrogen bonds (2) electrostatic forces (3) hydrophobic forces (4) covalent bonds.
6. Cytochalasin 是 facilitated glucose transport 的 competitive inhibitor，則它會使 (1) K_M 降低 (2) K_M 升高 (3) V_{max} 降低 (4) V_{max} 升高.
7. 下面哪一項不可能成爲 active transport 的 driving force? (1) ion gradient depletion (2) light capture (3) macromolecule synthesis (4) ATP hydrolysis.
8. DNA 中哪一部份負責 250-270 nm 的吸光? (1) only bases (2) only bases and pentoses (3) only pentoses and phosphates (4) whole molecule.
9. 下面哪一個分子具有 anhydride bond? (1) DNA (2) ATP (3) AMP (4) cAMP.
10. Cyclic AMP 形成環狀的鍵結是在 (1) 1'-3' (2) 2'-4' (3) 3'-5' (4) 4'-6' 之間.
11. 在粒線體中，下列何者沒有擔任電子傳遞的工作? (1) copper (2) cytochrome (3) ubiquinone (4) phosphate.
12. *Escherichia coli* F_1F_0 ATP synthase 的 F_1 含有 (1) 3 (2) 4 (3) 5 (4) 6 個 subunits.
13. 下列那一項不是 mitochondria 的 F_1F_0ATPase 的功能? (1) nucleotide binding (2) H^+ conducting (3) ATP hydrolysis (4) ATP translocating.
14. 光合作用的電子傳遞系統不能產生 (1) O_2 (2) NADPH (3) NADH (4) ATP.
15. 光合作用的 dark reaction 裡，CO_2 acceptor 是 (1) 3-phosphoglycerate (2) ribulose-1,5-bisphosphate (3) glyceraldehydes-3-phosophate (4) fructose-1,6-bisphosphare.
16. Pentose phosphate pathway 的主要功能爲 (1) 合成 pentose phosphates 和 NAD^+ (2) 合成 NADH (3) 將 pentose phosphates 轉換成 metabolic intermediates 以供 oxidative phosphorylation 所需 (4) 合成 NADPH 和 pentose phosphates.
17. 如果完全氧化成 CO_2，則下列哪一個 fatty acids 產生最多能量? (1) palmitic acid (16:0) (2) stearic acid (18:0) (3) oleic acid (18:1) (4) linoleic acid (18:2).
18. Ketone bodies 從 liver 運送到其他組織時，是經由 (1) complexed to serum albumin (2) complexed to binding protein (3) freely dissolved in serum (4) incorporated into chylomicrons.
19. Pyruvate 不能直接變成 (1) lactate (2) acetyl-CoA (3) oxaloacetate (4) citrate.

20. 下列何者是 gluconeogenesis 的性質，但不是 glycolysis 的性質? (1) 在 cytoplasm 中發生 (2) 是 exergonic pathway (3) 活性精細胞的 energy charge 而增加 (4) gluconeogenesis 使用較少的 enzymes.

PART II: 填充題 – General knowledge (每格 1 分, 共 10 分)

1. Please write the name of one reagent that can be used for the following purposes without denaturing any biomolecule:
   (1) disruption of hydrogen bonds
   (2) disruption of hydrophilic interactions
   (3) disruption of hydrophobic interactions
   (4) precipitation of cytosolic proteins
   (5) reduction of disulfide bond to sulfhydril
2. In Maxam-Gilbert DNA sequencing, (6) is used to modify the purine rings and (7) is used to modify the pyrimidine rings. In the next step, (8) is used to cleave the glycosidic bonds.
3. In Edman's protein degradation, (9) is used to modify the N-terminal and (10) is used to cleave the C-terminal.

PART III: 填充題 – Specific knowledge (每格 1 分, 共 25 分)

1. During DNA synthesis, a small portion of dsDNA is required; this part could be artificially generated by adding a (1). The enzyme carrying DNA synthesis is called DNA polymerase.
2. Which of the ABZ forms of DNA is left-handed helix? (2)
3. When DNA is "melted," the absorbance of DNA increases. This phenomenon is called (3).
4. In c_0t curves of DNA rehybridization, $c_0t_{1/2}$ = (4).
5. (5) is the enzyme to join two ends of DNA fragments.
6. (6) are vectors capable of propagating and transferring genes between two different organisms, one is typically prokaryotic while the other one is eukaryotic.
7. Probability of finding a particular fragment of DNA in some number of clones is (7), where, P is probability, N is number of clones, f is the fraction of the DNA interested.
8. (8) is the enzyme used to synthesize DNA from complementary RNA.
9. (9) is the domain of enzyme for binding of substrate(s).
10. Many enzymes require non-protein components for its activity; this component is called cofactor. If this component is organic molecule, then it is also called (10).
11. Arrhenius equation is (11).
12. Some RNAs are catalysts, they are termed (12).
13. (13) are enzymes with more than one quarternary form, differing in relative proportions of structurally equivalent but catalytically distinct polypeptide subunits.

14. The phosphorylation of phosphorylase *b* is carried out by (14). The dephosphorylation of phosphorylated phosphorylase *a* is carried out by phosphorprotein phosphatase
15. Sickle-cell anemia is due to the replacement of a glutamate residue at position 6 in the β–chain by a (15) residue.
16. Troponin complex consists of several different proteins, of which (16) is believed to bind to tropomyosin.
17. (17) is usually a coenzyme which serves as one-carbon carrier for all oxidation level of carbon except that of CO_2.
18. In glycolysis, in which steps ATP are generated from one mole of glucose to two moles of pyruvate? (18)
19. Among the six carbons of glucose, which one comes out first as CO_2 during respiration? (19)
20. Phosphoglycerate mutase requires small amount of (20) to phosphorylate the histidine residue before the rection can proceed.
21. Leloir pathway requires four enzymes (21) for galactose to enter into glycolysis.
22. In TCA cycle, in which three steps are NADH generated? (22).
23. Pyruvate dehydrogenase complex contains (23) as coenzymes.
24. When the level of acetyl-CoA increases, (24) then synthesize(s) oxaloacetate to provide the need of TCA cycle.
25. In glyoxylate cycle, two specific enzymes, (25), are required to bypass oxidative decarboxylation of TCA cycle.

PART IV: 問答題 (共 45 分)

1. Chlorophyll mainly absorbs light in red and blue regions. Which color of light supports photosynthesis with higher efficiency? Why? (5 分)

2. Suppose an enzyme reacts with a substrate in a simple kinetics that can be defined as,

$$dC/dt = -kC$$

where C is the concentration of the substrate, k is a constant.

(1) In the above equation, there is a "negative sign" on the right-hand side. What does it mean? (2 分)

(2) Please write an equation which describes the variation of C as a function of time t. (3 分)

3. Please design a series of experimental procedures that can be used to purify two chemical components X and Y in the cytosolic part of mammalian cells. Assume component X is positively charged and Y is neutral. Apply necessary reagent(s) and instrument(s) to achieve the separation and purification of components X and Y in less than ten steps. (10 分)

Hint: Start from step one: "To disrupt the intact mammalian cells by adding (chemical name) to the incubation flask at ice temperature….."

4. A certain first-order reaction is 34.5% complete in 4.9 min at 298°K. What is its rate constant? (5 分)

5. The table below gives initial rates of an enzyme-catalyzed reaction along with the corresponding substrate concentration. Determine the K_m and V_{max} values (you can use any method) (5 分)

$[S]_o$	65	23	7.9	3.9	1.3	0.37	($\times 10^{-5}$ mole/liter)
v_o	130	116	87	63	30	10	(mole/min)

6. What are the differences between a competitive and a non-competitive inhibition. (5 分)

7. Sketch the expected results when you perform SDS gel electrophoresis with 15% acrylamide for the following proteins: (i) glycerol kinase (terameric, M_r = 22,000), (ii) phosphorylase b (dimeric, M_r = 185,000), (iii) BSA (fatty acid free, M_r = 68,000), (iv) hemoglobin (tetrameric, M_r = 67,000) and myoglobin (M_r = 17,000). Assume that all the native proteins are spherical. (5 分)

8. Give the equation for the Beer-Lambert law. What amino acid residues contribute to the absorption of ultraviolet light of wavelength 280 nm by proteins? (5 分)