試題卅一題共八頁，總分 100 分。請依題號順序於答案卷作答；未依序作答者不予計分。

一. 選擇題；1-18 題，每題二分，均為單選

Answer the following questions using the key outlined below:

(A) if 1, 2, and 3 are correct
(B) if 1 and 3 are correct
(C) if 2 and 4 are correct
(D) if only 4 is correct
(E) if all four are correct

1. 6-Phosphofructo-1-kinase activity can be decreased by
   1. decreased concentration of fructose-2,6-bisphosphate.
   2. low pH.
   3. ATP at high concentration.
   4. AMP.

2. Glyceraldehyde-3-phosphate dehydrogenase
   1. catalyzes the formation of the first high-energy compound during glycolysis.
   2. requires the coenzyme TPP.
   3. produces 2 moles of NADH per mole of glucose oxidized during glycolysis.
   4. does not require the participation of inorganic phosphate.

3. Which of the following statements about the chemiosmotic theory is correct?
   1. Key electron transport proteins are located on one side of the inner mitochondrial membrane.
   2. Energy is conserved as a transmembrane pH gradient.
   3. Oxidative phosphorylation does not require an intact mitochondrial membrane.
   4. The proton motive force is established as a result of electron transport.

4. Which of the following statements about the binding-change model of ATP synthase is correct?
   1. The β subunit of F_1 has three different conformations, β-ATP, β-ADP, and β-empty.
   2. The $\Delta G'^{o}$ for ATP synthesis on the enzyme surface is near zero.
   3. The γ subunit could rotate when F_0F_1 is synthesizing ATP.
   4. The F_1 complex has three equivalent adenine nucleotide-binding sites.

(背面仍有題目,請繼續作答)

5. The oxidative phase of pentose phosphate pathway includes

   1. the production of two molecules of NADPH.
   2. the conversion of ribulose-5-phosphate to xylulose-5-phosphate.
   3. the production of ribulose-5-phosphate by the enzyme 6-phosphogluconate dehydrogenase.
   4. the production of two molecules of CO_2.

6. Glucuronic acid

   1. is a charged molecule at physiological pH.
   2. can be converted to xylulose-5-phosphate and enter the pentose phosphate pathway.
   3. can be used in proteoglycan synthesis.
   4. is a precursor of ascorbic acid in humans.

7. Which of the following molecules is an allosteric effector in the pyruvate dehydrogenase complex and TCA cycle?

   1. ATP
   2. Acetyl-CoA
   3. NADH
   4. ADP

8. Ca^{2+} increases glycogenolysis by

   1. binding to phosphorylase b.
   2. activating phosphoprotein phosphatase.
   3. inhibiting phosphoprotein phosphatase.
   4. activating phosphorylase kinase b.

9. Which of the following statements concerning the effect of glucagon is correct?

   1. Glucagon initiates a cascade of reactions leading to the stimulation of glycogenolysis.
   2. Glucagon inhibits liver glycolysis at the level of 6-phosphofructo-1-kinase.
   3. Glucagon stimulates the phosphorylation of fructose-2,6-bisphosphatase.
   4. Glucagon stimulates the liver 6-phosphofructo-1-kinase activity via the formation of fructose-2,6-bisphosphate.

10. Phosphorylation activates

1. phosphorylase kinase.
2. glycogen synthase
3. glycogen phosphorylase.
4. pyruvate kinase.

11. Acetyl-CoA carboxylase

1. requires biotin as a coenzyme.
2. is inhibited by cAMP-mediated phosphorylation.
3. undergoes protomer-polymer interconversion during its physiological regulation.
4. is activated by palmitoyl CoA.

12. Citrate stimulates fatty acid synthesis by

1. participating in the production of ATP.
2. participating in a pathway that ultimately produces CO_2 and NADPH in the cytosol.
3. inhibiting acetyl-CoA carboxylase.
4. providing a mechanism to transport acetyl CoA from the mitochondria to cytosol.

13. Refsum's disease

1. is caused by an inability to carry out α-oxidation.
2. is caused by a failure to metabolize fatty acids to dicarboxylic acids.
3. results from an inability to metabolize methylated fatty acids.
4. leads to increased production of isobutyric acid.

14. Hormone-sensitive lipase

1. is stimulated by cAMP-mediated phosphorylation.
2. in an intracellular enzyme.
3. functions to mobilize stored triacylglycerols from adipose tissue.
4. is stimulated by one of the apoproteins present in VLDL.

15. β-oxidation of fatty acids

1. generates NADH and $FADH_2$, which can be reoxidized to generate ATP.
2. generates acetyl-CoA, which can not be reoxidized to generate ATP.
3. occurs by a repeated sequence of four reactions.
4. uses only even-chain fatty acids as substrates.

(背面仍有題目,請繼續作答)

16. During starvation a high glucagon/insulin ratio results in cAMP-mediated phosphorylations that

1. inhibit hormone-sensitive lipase in adipose tissue.
2. inhibit acetyl-CoA carboxylase in liver.
3. lead to decreased concentrations of ketone bodies in the blood.
4. lead to the decreased production of malonyl CoA in liver.

17. In the biosynthesis of cholesterol from acetyl-CoA

1. mevalonic acid is a precursor of farnesyl pyrophosphate.
2. HMG-CoA reductase has an absolute requirement for NAPDH as reductant.
3. the committed step is the formation of mevalonic acid from HMG-CoA.
4. HMG-CoA is synthesized by mitochondrial HMG-CoA reductase.

18. Arachidonic acid

1. is a precursor of thromboxane A_2.
2. can be derived from linoleic acid.
3. is a precursor of prostaglandins.
4. is a 20-carbon fatty acid with four double bonds.

二、選擇題：19-28 題，每題三分，均為單選

19. Which of the following statements concerning collagen is **CORRECT**?

A. The secondary structure of collagen helix is the same as the α helix.
B. The collagen helix is a right-handed helix.
C. Collagen is composed of about 35% Gly, 11% Ala and 21% of Pro and hydroxyPro.
D. The collagen molecules are cross-linked by Cys disulfide bonds.
E. Its polypeptide chains are predominantly in β conformation.

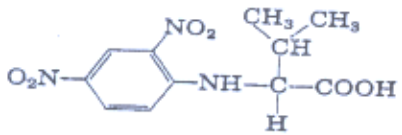
20. The most extended conformation of polypeptide chains is:

A. α helix
B. β conformation
C. β turns
D. collagen helix
E. random loop

21. The keratin of hair is composed of:

A. α helix
B. antiparallel β-sheets
C. parallel β sheets
D. β-turns
E. triple helix

22. A sample of 660 mg of an oligomeric protein of Mr 132,000 was treated with 1- fluoro-2,4 dinitrobenzene under slightly alkaline conditions until the chemical reaction was complete. The peptide bonds of the protein were then completely hydrolyzed by heating it with concentrated HCl. The hydrolysate was found to contain 5.5 mg of the following compound.



The compound is of Mr 283.
The number of the peptide chain in the protein is:

A. 2
B. 4
C. 6
D. 8
E. 12

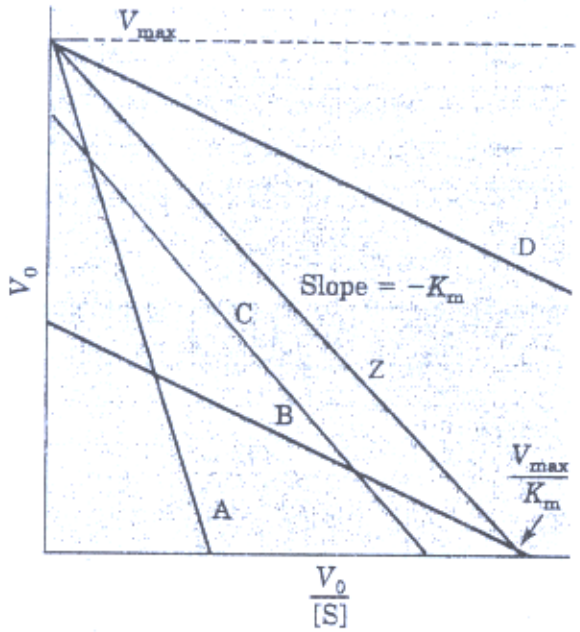
23. The following statements concerning the interaction of 2,3-bisphosphoglycerate (BPG) with hemoglobin, which one is the best answer:

A. BPG reduced the binding affinity of hemoglobin for oxygen
B. Only one molecule of BPG is bound to each of hemoglobin tetramer.
C. BPG concentration in the erythrocytes increased in the people suffering hypoxia.
D. The fetal hemoglobin (HbF) has lower affinity for BPG, and has higher affinity for oxygen than adult (HbA).
E. All the statements are correct.

(背面仍有題目,請繼續作答)

24. Eadie-Hofstee equation:

$V_0 = (-Km)\ V_0/[S] + Vmax$



A plot for an enzyme-catalyzed reaction is shown below.
The curve Z was obtained in the absence of inhibitor. Which of the other curves (A to D) shows the enzyme activity when a competitive inhibitor is added to the reaction mixture?

A. Line A
B. Line B
C. Line C
D. Line D
E. None of the above

25. The cholera toxin is an enzyme that catalyzed the inactivation of key cellular enzyme G-protein. Which of the following reaction is involved in the inactivation process?

A. Phosphorylation
B. Adenylylation
C. Uridylylation
D. ADP-ribosylation
E. Methylation

26. Diisopropylfluorophosphate (DIFP) is an irreversible inhibitor of acetylcholine esterase. Which of the following amino acid residues in the enzyme is covalently linked to DIFP?

A. His
B. Asp
C. Ser
D. Cys
E. Tyr

27. For the two-step enzyme reaction,

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} E + P$$

If the enzyme reaction follows Michaelis-Menten kinetics, the Km is reduced to the dissociation constant when

A. $k_2 << k_1$
B. $k_1 << k_2$
C. $k_2 << k_{-1}$
D. $k_{-1} << k_2$
E. $k_1 << k_{-1}$

28. Which amino acid residue in the active site of chymotrypsin functions as general acid and general base in catalyzing the substrate hydrolysis?

A. Ser
B. Cys
C. His
D. Asp
E. Tyr

三、問答題

29. Untreated phenylketonuria patients, in addition to mental retardation, have diminished production of catecholamines and light skin and hair. If the defect is in phenylalanine hydxoxylase itself, a diet lacking phenylalanine but including tyrosine alleviates these conditions. If the defect is in the ability to produce tetrahydrobiopterin, the same dietary treatment may alleviate the mental retardation and light hair but not the diminished catecholamine production. What is the rationale explaining these findings? (10%)

(背面仍有題目,請繼續作答)

30. Please compare all kinds of RNA and DNA in different organelles of mammalian cells. (10%)

31. Please describe in detail the mode of action for 5-fluorouracil and methotrexate as cancer chemotherapeutic agents. (14%)