國立中正大學
114 學年度碩士班招生考試
試 題

［第 3 節］

科目名稱	生物化學
系所組別	生物醫學科學系生物醫學

－作答注意事項－

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

國立中正大學 114 學年度碩士班招生考試試題

壹、單選題（50%，每題 2.5 分）

1. The reference compound for naming D and L isomers of sugars is:
(A) fructose.
(B) glucose.
(C) sucrose.
(D) ribose.
(E) glyceraldehyde.

2. B-form DNA in vivo is a _____-handed helix, _____ Å in diameter, with a rise of ____ Å per base pair.
(A) left; 20; 3.9
(B) right; 18; 3.4
(C) right; 18; 3.6
(D) right; 20; 3.4
(E) right; 20; 3.6

3. The oxidation of 3 mol of glucose by the pentose phosphate pathway may result in the production of:
(A) 2 mol of pentose, 4 mol of NADPH, and 8 mol of CO_2.
(B) 3 mol of pentose, 4 mol of NADPH, and 3 mol of CO_2.
(C) 3 mol of pentose, 6 mol of NADPH, and 3 mol of CO_2.
(D) 4 mol of pentose, 3 mol of NADPH, and 3 mol of CO_2.
(E) 4 mol of pentose, 6 mol of NADPH, and 6 mol of CO_2.

4. The main function of the pentose phosphate pathway is to:
(A) give the cell an alternative pathway should glycolysis fail.
(B) provide a mechanism for the utilization of the carbon skeletons of excess amino acids.
(C) supply energy.
(D) supply NADH.
(E) supply pentoses and NADPH.

5. Of the 20 standard amino acids, only _____ is not optically active. The reason is that its side chain _____.
(A) alanine; is a simple methyl group
(B) glycine; is a hydrogen atom
(C) glycine; is unbranched
(D) lysine; contains only nitrogen
(E) proline; forms a covalent bond with the amino group

6. All of the following are considered “weak” interactions in proteins, *except:*

(A) hydrogen bonds.

(B) hydrophobic interactions.

(C) ionic bonds.

(D) peptide bonds.

(E) van der Waals forces.

7. The formation of a peptide bond between two amino acids is an example of a(n) _____ reaction.

(A) cleavage

(B) condensation

(C) group transfer

(D) isomerization

(E) oxidation reduction

8. An α helix would be destabilized most by:

(A) an electric dipole spanning several peptide bonds throughout the α helix.

(B) interactions between neighboring Asp and Arg residues.

(C) interactions between two adjacent hydrophobic Val residues.

(D) the presence of an Arg residue near the carboxyl terminus of the α helix.

(E) the presence of two Lys residues near the amino terminus of the α helix.

9. A sequence of amino acids in a certain protein is found to be -Ser-Gly-Pro-Gly-. The sequence is most probably part of a(n):

(A) antiparallel β sheet.

(B) parallel β sheet.

(C) α helix.

(D) α sheet.

(E) β turn.

10. In hemoglobin, the transition from T state to R state (low to high affinity) is triggered by:

(A) Fe^{2+} binding.

(B) heme binding.

(C) oxygen binding.

(D) subunit association.

(E) subunit dissociation.

11. Which one of the following statements is true of enzyme catalysts?
(A) Their catalytic activity is independent of pH.
(B) They are generally equally active on D and L isomers of a given substrate.
(C) They can increase the equilibrium constant for a given reaction by a thousand fold or more.
(D) They can increase the reaction rate for a given reaction by a thousand fold or more.
(E) To be effective, they must be present at the same concentration as their substrate.

12. Membrane proteins:
(A) are sometimes covalently attached to lipid moieties.
(B) are sometimes covalently attached to carbohydrate moieties.
(C) are composed of the same 20 amino acids found in soluble proteins.
(D) diffuse laterally in the membrane unless they are anchored
(E) have all of the properties listed above.

13. The fluidity of a lipid bilayer will be increased by:
(A) decreasing the number of unsaturated fatty acids.
(B) decreasing the temperature.
(C) increasing the length of the alkyl chains.
(D) increasing the temperature.
(E) substituting 18:0 (stearic acid) in place of 18:2 (linoleic acid).

14.The ion channel that opens in response to acetylcholine is an example of a _____ signal transduction system.
(A) G protein
(B) ligand-gated
(C) receptor-enzyme
(D) serpentine receptor
(E) voltage-gated

15. Which of the following is true of glycogen synthase?
(A) Activation of the enzyme involves a phosphorylation.
(B) It catalyzes addition of glucose residues to the nonreducing end of a glycogen chain by formation of ($\alpha 1 \rightarrow 4$) bonds.
(C) It uses glucose-6-phosphate as donor of glucose units
(D) The conversion of an active to an inactive form of the enzyme is controlled by the concentration of cAMP.
(E) The enzyme has measurable activity only in liver.

16. Cellular isozymes of pyruvate kinase are allosterically inhibited by:
(A) high concentrations of AMP.
(B) high concentrations of ATP.
(C) high concentrations of citrate.
(D) low concentrations of acetyl-CoA.
(E) low concentrations of ATP.

17. Which combination of cofactors is involved in the conversion of pyruvate to acetyl-CoA?
(A) Biotin, FAD, and TPP
(B) Biotin, NAD^+, and FAD
(C) NAD^+, biotin, and TPP
(D) Pyridoxal phosphate, FAD, and lipoic acid
(E) TPP, lipoic acid, and NAD^+

18. Acetyl-CoA labeled with ^{14}C in both of its acetate carbon atoms is incubated with unlabeled oxaloacetate and a crude tissue preparation capable of carrying out the reactions of the citric acid cycle. After one turn of the cycle, oxaloacetate would have ^{14}C in:
(A) all four carbon atoms.
(B) no pattern that is predictable from the information provided.
(C) none of its carbon atoms.
(D) the keto carbon and one of the carboxyl carbons.
(E) the two carboxyl carbons.

19. The reaction of the citric acid cycle that is most similar to the pyruvate dehydrogenase complex catalyzed conversion of pyruvate to acetyl-CoA is the conversion of:
(A) citrate to isocitrate.
(B) fumarate to malate.
(C) malate to oxaloacetate.
(D) succinyl-CoA to succinate.
(E) α-ketoglutarate to succinyl-CoA.

20. Transport of fatty acids from the cytoplasm to the mitochondrial matrix requires:
(A) ATP, carnitine, and coenzyme A.
(B) ATP, carnitine, and pyruvate dehydrogenase.
(C) ATP, coenzyme A, and hexokinase.
(D) ATP, coenzyme A, and pyruvate dehydrogenase.
(E) carnitine, coenzyme A, and hexokinase.

貳、問答題（50%）

1. If G6P (Glucose-6-phosphate) is labeled by ^{14}C at its C1 position, where will the label appear in the product (Fructose-6-phosphate) of the pentose phosphate pathway? (3%)
2. Under aerobic conditions, pyruvate can be decarboxylated to yield acetyl-CoA and CO_2. Which carbons of glucose must be labeled with ^{14}C to yield $^{14}CO_2$? (3%)
3. Describe the mitochondrial electron-transport chain from NADH to oxygen. (5%)
4. The seed of plant contains the glyoxylate cycle, allowing it to be able to convert fatty acid to carbohydrate. Why? (5%)
5. How does the chemotherapeutic agent, fluorouracil, inhibit the synthesis of dTMP? (5%)
6. Give three cofactors required for one carbon transfer reaction in amino acid catabolism. (6%)
7. Which enzyme is defective in people with maple syrup urea disease? (2%) What kinds of amino acids cannot be degraded in patients that suffer maple syrup urea disease? (3%)
8. Describe two basic strategies for activating precursors in the biosynthesis of phospholipids. (6%)
9. Degradation of odd-chain fatty acids can boost the activity of the citric acid cycle. Why? (6%)
10. Draw the structures of the following compounds:

    (a) citrate (1%)　(b) lysine (1%)　(c) phenylalanine (1%)　(d) pyruvate (1%)
    (e) α-ketoglutarate (1%)　(f) succinate (1%)