

國立嘉義大學九十七學年度  
食品科學系碩士班（保健食品組）招生考試試題

科目：生物化學

一、單選題（40分，每題2分）

- Which of the following statements regarding cooperative binding is true? (A) Two or more proteins aid the binding of a ligand. (B) The binding of one ligand aids the binding of a second ligand. (C) The folding of part of a protein aids in the folding of the remainder of the protein. (D) All proteins engage in cooperative binding.
- Which of the following statements is true of the Bohr effect? (A) Oxygen is delivered to cells in proportion to their needs. (B) Binding of protons to hemoglobin molecules facilitates the binding of oxygen. (C) Metabolic waste products bond to oxyhemoglobin. (D) A and B are both true.
- A polypeptide has a high pH value. Which of the following amino acids are likely to be present? (A) Glycine (B) Serine (C) Arginine (D) Aspartic acid.
- In the DNA sequencing by the Sanger (dideoxy) method: (A) the role of ddATP is to occasionally terminate synthesis of DNA where dT occurs in the template strands. (B) enzymes are used to cut the DNA into small pieces, which are then separated by electrophoresis. (C) ddTTP is added to each of four reaction mixtures prior to synthesis of complementary strands. (D) the template strand of DNA is radioactive.
- Which of the following is the strongest reducing agent? (The standard reduction potential of each species is provided in parentheses.) (A)  $\text{FADH}_2$  (+ 0.22 V) (B)  $\text{H}_2$  (+ 0.424 V) (C) Cytochrome  $a \cdot \text{Fe}^{2+}$  (-0.29 V) (D)  $\text{H}_2\text{O}$  (-0.82 V).
- Give the proper reaction types in the order that they occur in the  $\beta$ -oxidation pathway. 1. oxidation 2. reduction 3. thiolysis 4. hydration 5. phosphorylation 6. rearrangement (A) 1, 6, 2, 2 (B) 6, 3, 4, 2 (C) 1, 4, 1, 3 (D) 1, 2, 3, 5.
- Which of the following is mismatched? (A) B-DNA: dehydrated (B) Z-DNA: left-handed helix (C) A-DNA: dehydrated (D) Z-DNA: no major or minor grooves.
- The recognition sites of some restriction enzymes are shown. Which will produce “sticky ends”? (A) *EcoRI*  $\text{G}^{\downarrow}\text{AATTC}$  (B) *SmaI*  $\text{CCC}^{\downarrow}\text{GCC}$  (C) *XhoI*  $\text{C}^{\downarrow}\text{TCGAG}$  (D) both *EcoRI* and *XhoI*.
- The assumptions made in calculating the Michaelis-Menten equation include (A) That the formation and decomposition of ES is the same for a period of time (B) That the concentration of the substrate is much greater than the concentration of E (C) That the value of  $k_{-2}$  can be ignored (D) A, B, and C.
- Which of the following has the (immediate) effect of increasing the rate of glycogen breakdown (A) Increased concentration of cAMP (B) Increase in the  $[\text{AMP}]/[\text{ATP}]$  ratio (C) Increase secretion of glucagon (D) All of the above.
- The synthesis of palmitate requires: (A) 8 acetyl-CoA (B) 14 NADPH (C) 7ATP (D) A and C.
- Which of the following does not provide a carbon skeleton for the synthesis of amino acids? (A) succinate (B) pyruvate (C) oxaloacetate (D) ribose 5-phosphate.
- In nucleotide metabolism, all of the following are true except: (A) The committed step in purine biosynthesis is the transfer of an amino group to PRPP. (B) De novo pyrimidine synthesis begins with a molecule of PRPP. (C) Nucleotides can be synthesized in a single reaction via salvage pathways. (D) Purine and pyrimidine biosynthesis are regulated by end-product inhibition.
- The purpose of the GTP cap on mRNA is (A) to prevent the formation of hairpin loops (B) to serve as a site for binding to the ribosome (C) to assist in the transport out of the nucleus (D) to prevent exonuclease attack.
- The degradation of arginine, histidine and proline all lead to the product (A) pyruvate (B) acetyl CoA (C) glutamate (D) acetoacetate.

- What is the pH of a solution prepared by mixing 150 mL of 0.1 M HCl with 300 mL of 0.1 M sodium acetate and diluting the mixture to 1L? (The  $\text{pK}_a$  of acetic acid is 4.76) (A) 4.36; (B) 4.76; (C) 5.06; (D) 8.16.
- Which one of the following inhibits the release of insulin from the  $\beta$ -cells? (A) Hyperglycemia; (B) Elevated levels of arginine; (C) Elevated levels of norepinephrine; (D) Secretin.
- Increased formation of ketone bodies during starvation is due to: (A) a decreased activity of hormone-sensitive lipase in adipose tissue. (B) increased levels of free fatty acids in serum. (C) decreased levels of circulating glucagon; (D) decreased formation of acetyl CoA in the liver.
- The presence of a noncompetitive inhibitor: (A) leads to both an increase in the  $V_{\text{max}}$  of a reaction and an increase in the  $K_m$ ; (B) leads to an increase in  $K_m$  without affecting  $V_{\text{max}}$ ; (C) leads to a decrease in  $K_m$  and  $V_{\text{max}}$ ; (D) leads to a decrease in the observed  $V_{\text{max}}$ .
- In the skeletal muscle, a sudden elevation of the  $\text{Ca}^{+2}$  concentration will cause: (A) conversion of glycogen phosphorylase b to phosphorylase a; (B) conversion of cyclic AMP to AMP by phosphodiesterase; (C) activation of cyclic AMP-dependent protein kinase; (D) inactivation of phosphorylase kinase due to the action of a protein phosphatase.

二、簡答題（30分）

- Identify each of the following:
  - An epimer of D-galactose that is also an epimer of D-mannose（2分）
  - Monosaccharide residues of cellulose, amylose, and glycogen.（2分）
- Name the amino acid(s) described.
  - Provides the least amount of steric hindrance in proteins.（2分）
  - Aromatic R group; hydrophobic and neutral at any pH（2分）
- Name the techniques described for separating cellular proteins
  - proteins are separated on the basis of their ability to migrate in an electric field, an indicator of relative size.（2分）
  - Proteins are chromatographically separated solely on the basis of size（2分）
- During glycolysis, what intermediate(s) accumulate(s) if an enolase inhibitor is present?（2分）
- Calculate the amount of metabolic energy produced from 8 mole of glucose at anaerobic conditions.（2分）
- Calculate the net ATP production for partial oxidation of palmitate (C16:0) to the ketone body acetoacetate.（2分）
- Place the components in their correct functional sequence and indicate the final electron acceptor for the following case:  
NADH as initial electron donor; Q and Complexes I, III, and IV in the liposomes; oxygen is present.（2分）
- Indicate the effect (increase, decrease, or no effect) of increasing concentration of fructose 2,6-bisphosphate on the rate of glycolysis.（2分）
- Describe the effect on the tricarboxylic acid cycle (TCA cycle) of
  - increasing the concentration of isocitrate.（2分）
  - increasing the concentration of  $\text{NAD}^+$ .（2分）
  - decreasing the concentration of ATP.（2分）
  - increasing the concentration of acetyl-CoA.（2分）

三、請說明下列名詞的功能及重要性。（每小題3分，共15分）

- Lipoprotein lipase; (2) Cholesteryl ester transfer protein; (3) Acetyl-CoA carboxylase; (4) Cyclic adenosine monophosphate; (5) Calmodulin.

四、請畫出下列物質的化學結構。（每小題3分，共15分）

- Glycine; (2) Urea; (3)  $\alpha$ -D-Glucose; (4) Sucrose; (5) Citrate.