

國立臺灣海洋大學 103 學年度研究所碩士班招生考試試題

考試科目：生物化學

系所名稱：生命科學暨生物科技學系碩士班甲組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

I. 單選題 (每題 3 分; 共 15 分)

1. Carbohydrate characteristic chemical features include all EXCEPT:
 - (a) the potential to form multiple hydrogen bonds.
 - (b) the existence of one or more asymmetric centers.
 - (c) the capacity to form polymeric structures.
 - (d) the ability to exist in either linear or ring structures.
 - (e) all are true.
2. The oxidation of one mole of glucose by anaerobic glycolysis yields a net of:
 - (a) two moles of lactate and two moles of ATP.
 - (b) two moles of lactate, two moles of NADH, and two moles of ATP.
 - (c) two moles of lactate and six moles of ATP.
 - (d) two moles of pyruvate and two moles of ATP.
 - (e) two moles of pyruvate, two moles of NADH, and four moles of ATP.
3. The isocitrate lyase catalyzed reaction cleaves isocitrate into:
 - (a) glyoxylate and fumarate.
 - (b) succinate and acetyl-CoA.
 - (c) malate and acetyl-CoA.
 - (d) succinate and glyoxylate.
 - (e) glyoxylate and acetyl-CoA.
4. Bacteria and other prokaryotic cells have the capacity to get more ATP/glucose oxidized than eukaryotic cells because _____, so they are more efficient.
 - (a) they are simpler and have less going on
 - (b) they don't have to use shuttles to reoxidize reduced nucleotides
 - (c) they do not have to translocate ATP-ADP across the mitochondrial membranes
 - (d) they use an electron transport chain that translocates more protons
 - (e) none of the above
5. Insulin in the bloodstream is a response to increased blood glucose, and:
 - (a) stimulates gluconeogenesis.
 - (b) inhibits glycolysis.
 - (c) stimulates glycogen synthesis in muscle and liver.

- (d) stimulates glycogen breakdown in liver.
- (e) inhibits phosphoprotein phosphatase-1.

II. 配合題: (共 20 分)

[I] 第一大題 (每題 1 分; 共 10 題)

Choose the correct answer from the list. Not all the answers will be used.

- | | | |
|-----------------------------|-------------------------|---------------------|
| A) amphiphilic | B) vitamin D | C) arachidonic acid |
| D) phosphatidylethanolamine | E) steroid | F) gangliosides |
| G) phosphatidylserine | H) glycerophospholipids | I) sphingomyelin |
| J) cholesterol | K) triacylglycerols | L) plasmalogen |
| M) nonpolar | | |

1. _____ are the fats and oils that constitute the lipids of the human diet.
2. The _____ are the major lipid components of the cell membrane.
3. The myelin sheath is particularly rich in _____.
4. A steroid-derived hormone, _____, regulates Ca^{2+} metabolism.
5. _____ is found exclusively in the cytosolic leaflet of the membrane.
6. Members of the _____ family have four fused, nonplanar rings.
7. A glycerophospholipid in which the C1 substituent is linked as an ether rather than an ester is called a _____.
8. Glycosphingolipids with complex carbohydrate head groups that often serve as cellular receptors are _____.
9. With respect to polarity, membrane lipids can be described as _____.
10. Eicosanoids are derived from _____.

[II] 第二大題 (每題 1 分; 共 10 題)

Choose the correct answer from the list. Not all the answers will be used.

- | | | | |
|----------------|------------------|------------------|-----------------------|
| a) HDL | b) propionyl-CoA | c) Claisen | d) DHAP |
| e) malonyl-CoA | f) ATP | g) chylomicrons | h) phosphopantetheine |
| i) flavin | j) albumin | k) ketone bodies | l) cholesterol |

1. Lipoproteins formed in the intestinal mucosal cells are _____.
2. Cholesterol and other lipids are transported from tissues to the liver by _____.
3. The glycerol backbone of triacylglycerols is converted to _____ in catabolic processes.
4. In the circulation, free fatty acids bind to _____.
5. The reaction catalyzed by thiolase is a _____ ester cleavage.
6. The β -oxidation of odd odd-numbered fatty acids forms _____.
7. The molecules acetoacetate, acetone, and D- β -hydroxybutyrate are metabolic fuels termed _____.

8. Acyl carrier protein (ACP) contains a _____ prosthetic group.
9. Fatty acid synthesis requires the initiating molecules acetyl-CoA and _____.
10. Isoprene units form the carbon skeleton of _____.

III. 簡答題:

1. The human tripeptide was discovered as an activity in human albumin that caused old human liver tissue to synthesize proteins like younger tissue. It has high affinity for copper ions and easily forms a copper complex (shown as the Figure 1). Please write down the amino acid sequence of tripeptide. (full name, one letter code and three code of amino acid) (10 分)

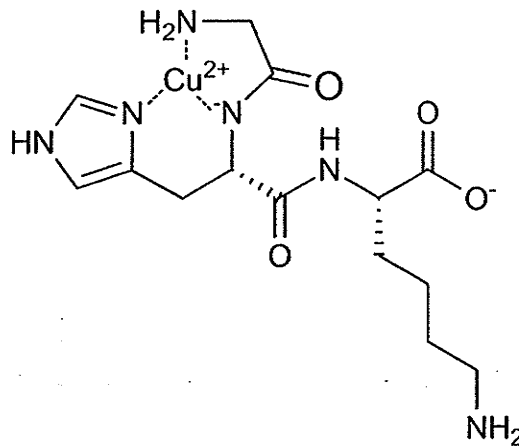


Figure 1. Copper complex

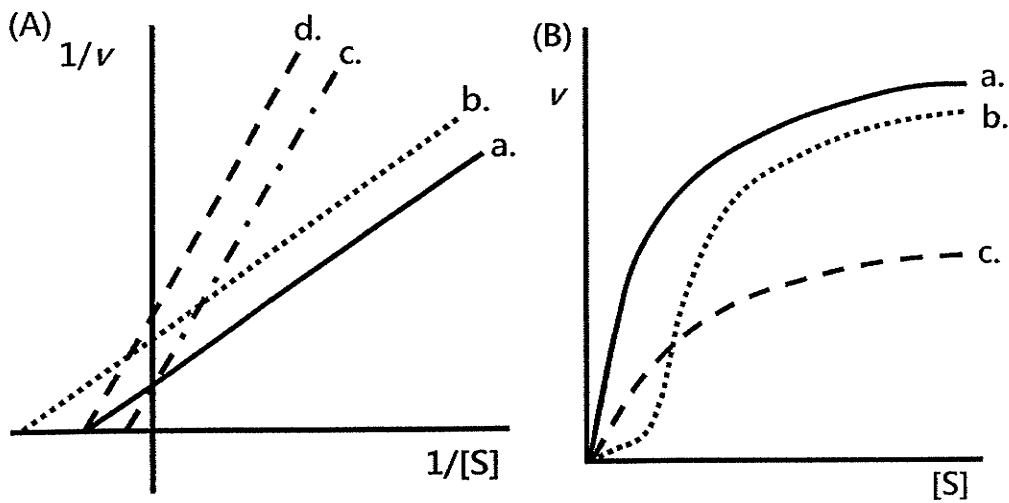
2. Buffer solutions are a big part of biochemistry, biological and chemical based work. In biochemistry, we use buffers in nearly all solutions that will be used with enzymes or where control of pH is important. How many moles of sodium acetate and acetic acid are required to prepare 1 liter of a buffer, pH 5.74, which is 0.11 M in total available acetate (dissociated and undissociated). Acetic acid has a pK of 4.74. (10 分)

Hint: Henderson-Hasselbalch equation:

$$\text{pH} = \text{pK}_a + \log \frac{[\text{conjugate base}]}{[\text{acid}]}$$

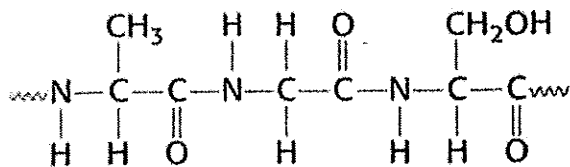
3. SDS-polyacrylamide gel electrophoresis (SDS-PAGE) is a standard laboratory technique used to separate proteins on the basis of molecular weight. Please briefly describe the principle of SDS-PAGE. (10 分)
4. (a) 三碳醛糖 (b) 三碳酮糖 (c) 六碳醛糖 (d) 六碳酮糖。以上糖類各舉一例，需寫出名稱並畫出 Fisher projection 的化學構造。(10 分)
5. 依照下圖的酵素動力學數據回答問題。圖 (A) 中的 a. 線條是單純酵素與基質的動力學結果，假設 b, c, d. 線條的實驗數據中也是使用相同的酵素，那麼這些實驗中可能各別是添

加了什麼樣的物質才造成這樣的實驗結果？圖 (B) 中的 a. 曲線是單純酵素與基質的動力學結果，假設 b, c 曲線的實驗數據中也是使用相同的酵素，那麼這些實驗中可能各別是添加了什麼樣的物質才造成這樣的實驗結果？(10 分)



6. Draw the structures of the amino acids phenylalanine and aspartate in the ionization state you would expect at pH 7.0. Why is aspartate very soluble in water, whereas phenylalanine is much less soluble? (5 分)

7. Name those components. Examine the segment of a protein shown here. (4 分)



- What three amino acids are present?
- Of the three, which is the N-terminal amino acid?
- Identify the peptide bonds
- Identify the α -carbon atoms.

8. Please write down the function for each protein. (6 分)

- (a) SIRT1 (b) acetyl Co A carboxylase (c) leptin (d) HMG-CoA reductase