國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：生物化學【海資系碩士班甲組選考】　　題號：452005

※本科目依簡章規定「不可以」使用計算機(混合題)　　

I.單選題：(60%)

( ) 1. Which of the following amino acids have side chains that are negatively charged under physiological conditions (i.e.,near pH7)?
(A) Glu (B) His (C) Trp (D) Lys (E) Cys

( ) 2. Which amino acid can stabilize protein structures by forming covalent cross-links between polypeptide chains?
(A)Met (B) Ser (C) Glu (D) Cys (E) Asp

( ) 3. Which of the following amino acid residue is likely to be found on the inside of a water-soluble protein?
(A) Val (B) Lys (C) Glu (D) Arg (E) Asp

( ) 4. Which of the following carbohydrate is a ketose
(A) ribose (B) fructose (C) glucose (D) glyceraldehyde (E) mannose

( ) 5. Which of the following carbohydrate is **not** a hexose?
(A) ribose (B) glucose (C) galactose (D) mannose (E) fructose

( ) 6. The amino acid with a side-chain pKa near neutrality and which therefore plays an important role as proton donor and acceptor in many enzyme catalyzed reactions is:
(A) histidine. (B) cysteine. (C)proline. (D) serine. (E)methionine.

( ) 7. All of the statements about the following pairs of sugars are correct **EXCEPT**:
(A) Galactose and mannose are diastereomers.
(B) L-galactose and D-galactose are enatiomers.
(C) Glyceraldehyde and dihydroxyacetone are stereoisomers.
(D) Glucose and mannose are epimers.
(E) Glucose has fewer chiral centers than fructose.

( ) 8. At a pH of 7, what charged group(s) are present in glycine?
(A) $-NH_3^+$ (B) $-COO^-$ (C) $-NH_2^+$ (D) a and b (E) a, b, and c

( ) 9. Cellulose is homopolysaccharide composed of _____ linked together by _____ glycosidic bonds.
(A) galactose; β-(1→4)
(B) galactose; α-(1→4)
(C) glucose; β-(1→4)
(D) glucose; α-(1→4)
(E) none of the above

( ) 10. Complete hydrolysis of nucleic acids liberates all of the following **EXCEPT**:
(A) 2-deoxyribose from DNA.
(B) nitrogenous bases.
(C) amino acids.
(D) phosphoric acid.
(E) ribose from RNA.

( ) 11. Which is a six-membered heterocyclic aromatic ring?
(A) pyrimidine
(B) purine
(C) ribose
(D) sugar portion of DNA
(E) ribonucleotide

背面有題

試題隨卷繳回

( ) 12. Which of the following statements regarding the structure of DNA is correct?
(A) the two strands are parallel.
(B) the two strands are held together by intrachain hydrogen bonds.
(C) the two strands have complementary base pairing.
(D) the hydrogen bonding that holds the helix together is always between two purines or between two pyrimidines.
(E) the ratio of adenine to guanine is the same in all organisms.

( ) 13. What is the nucleotide sequence of the DNA strand that is complementary to 5'-ATCGCAACTGTCACTA-3'?
(A) 5'-TAGCGTTGACAGTGAT-3'
(B) 5'-UAGUGACAGUUGCGAU-3'
(C) 5'-TAGCGTTGACAGTGAT-3'
(D) 5'-TAGTGACAGTTGCGAT-3'
(E) 5'-ATCACTGTCAACGCTA-3'

( ) 14. RNA is ____ stable to alkaline hydrolysis than DNA because RNA's vicinal ____ group makes the 3'-phosphodiester bond susceptible to ____ cleavage.
(A) less; 3'-OH; nucleophilic
(B) less; 2'-OH; nucleophilic
(C) more; 2'-OH; electrophilic
(D) more; 2'-OH; nucleophilic
(E) more; 3'-OH; electrophilic

( ) 15. If a restriction site of 6 bases starts with 5'-TGG, what are the last three bases in the sequence?
(A) 5'-ACC-3'
(B) 5'-GGT-3'
(C) 5'-CCA-3'
(D) 5'-TGG-3'
(E) none of the above

( ) 16. Which of the following statements is true regarding the role an enzyme plays in catalysis?
(A) An enzyme increases the equilibrium constant.
(B) An enzyme increases the energy of the transition state so that it breaks down more rapidly.
(C) An enzyme decreases the free-energy change.
(D) An enzyme facilitate the formation of the transition state

( )17. In this type of inhibition, the inhibitor can only bind to the ES complex to form an ESI complex.
(A) competitive (D) uncompetitive
(B) noncompetitive (E) None of the above.
(C) mixed

( ) 18. The K_M of enzyme is
(A) equal to the product concentration at initial reaction conditions.
(B) equal to the substrate concentration when the reaction rate is half its maximal value.
(C) proportional to the standard free energy.
(D) All of the above.
(E) None of the above.

背面有題

( ) 19. Which of the following water-soluble vitamins forms part of the structure of CoA?
(A) Thiamine (D) Folate
(B) Riboflavin (E) Pantothenate
(C) Pyridoxine

( ) 20. Which of the following carbon-containing molecules is most fully oxidized?
(A) formaldehyde (C) methane
(B) carbon dioxide (D) methanol

( ) 21. The conversion of one mole of glucose-6-phosphate to two moles of lactate in glycolysis is accompanied by a net gain of:
(A) three moles of ATP. (D) one mole of NADH
(B) two moles of ATP (E) none of above
(C) one mole of ATP

( ) 22. Which of the following is metabolic product of pyruvate in higher organism?
(A) Glycerol (D) Ethanol
(B) Lactose (E) Lactic acid
(C) Acetone

( ) 23. The rate of flow of electrons through the electron-transport chain is regulated by
(A) the concentration of Acetyl CoA.
(B) the rate of oxidative phosphorylation
(C) feedback inhibition by H_2O
(D) the catalytic rate of cytochrome oxidase
(E) the ATP : ADP ratio

( ) 24. Of the electron transfer complexes associated with the inner mitochondrial membrane, which is **not** involved in generation of a proton gradient?
(A) Cytochrome c oxidase
(B) NADH-Q oxidoreductase
(C) Q-cytochrome c oxidoreductase
(D) Succinate-Q reductase
(E) None of above

( ) 25. Which of the following does **not** participate in, nor is a component of, the electron-transport chain?
(A) Lipoic acid
(B) non-heme, iron-sulfur proteins
(C) coenzyme Q
(D) cytochrome c_1
(E) NADH

( ) 26.The pathway of electron flow from H_2O to $NADP^+$ in photosynthesis is referred to as
(A) cooperative special pairs. (D) photophosphorylation.
(B) photorespiration. (E) None of the above.
(C) the Z scheme of photosynthesis.

( ) 27. The glycogen phosphorylase enzyme carries out a phosphorolysis reaction resulting the formation of (1). Glycogen synthase adds glucose units to growing glycogen molecules using what? (2)
(A) (1) glucose-6-phosphate, (2) glucose-1- phosphate
(B) (1) glucose-1- phosphate, (2) glucose-6-phosphate
(C) (1) UDP-glucose, (2) glucose-6-phosphate
(D) (1) glucose-1- phosphate, (2) UDP-glucose
(E) (1) glucose, (2) glucose-6-phsophate

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( ) 28. Conversion of glucose 1-phosphate to glucose 6-phosphate is carried out by the enzyme
(A) phosphoglucomutase.
(B) kinase 1-P.
(C) phosphoglycerate mutase.
(D) All of the above.
(E) None of the above.

( ) 29. Which of the following enzymes participates in fatty acid oxidation?
(A) Carnitine acyltransferase
(B) Malic enzyme
(C) Acetyl CoA carboxylase
(D) Glucose-6-phosphate dehydrogenase
(E) Pyruvate carboxylase

( ) 30. Acetyl CoA carboxylase is the rate-limiting enzyme in
(A) fatty acid oxidation
(B) fatty acid synthesis
(C) glycogen synthesis
(D) glucose uptake
(E) triacylglycerol metabolism

II.問答題：

1. Please describe the primary, secondary, tertiary and quaternary structure of protein. (4%)
2. For the peptide Glu-Lys-Met-Arg-Ala-Gly
   (a) give the net charge at pH=7: (explain your answer in detail) (2%)
   (b) give the net charge at pH=1: (explain your answer in detail) (2%)
3. What is "two-dimensional gel electrophoresis" ? Please explain this technique as much as you know. (4%)
4. Penicillin, the first antibiotic discovered. How does penicillin inhibit bacteria growth ? (4%)
5. What are two features of eukaryotic mRNA that are unique as compared to prokaryotic mRNA? (4%)
6. Briefly describe the cause of sickle-cell anemia.(4%)
7. You believe a substrate fits into a cleft like a key into a lock, but your roommate does not. Who is right? (explain your answer in detail) (4%)
8. What is the Michaelis-Menten equation? Define all parameters. (4%)
9. How to determine K_M and V_{max} of enzyme? (Hint: Lineweaver-Burk plot) (4%)
10. Explain why animals are unable to convert fatty acids to glucose? (4%)

背面有題

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【海資系碩士班甲組】　　題號：

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

問答題：（7題，共100分）

(1) 利用β-galactosidase的活性進行藍白篩選是分子生物學上被廣泛使用的技術，請說明這項篩選方法的原理。(10分)

(2) 請問真核細胞粒線體（mitochondrion）中的呼吸電子傳遞鏈（respiratory electron transport chain），有哪些細胞膜蛋白參與電子傳遞，請列舉兩個。如何製造出化學勢能（proton gradient），其生理意義為何？(20分)

(3) 請繪圖說明真核細胞蛋白質合成（transcription and translation）過程。(20分)

(4) 請解釋為何某些 tRNA上的anticodon可與多個 mRNA codon辨識? 目的為何? (10分)

(5) 酵素（enzyme）是什麼？功能為何？酵素活性如何被調控？可舉例說明。（15分）

(6) 請簡單敘述孟德爾遺傳定律中的分離律（law of segregation）以及獨立分配律（law of independent assortment)。(10分)

(7) NCBI (National Center for Biotechnology Information) 網站是生物學資料相當重要的網站，請舉例說明在NCBI上可以使用哪些工具去做資料搜尋，以及你曾經下載過的哪些資料？目的為何? (15分)

試題隨卷繳回

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【海資系碩士班乙組】　　題號：452007

※本科目依簡章規定「不可以」使用計算機（問答申論題）　　共1頁第1頁

簡答題

1. 請說明組成細胞（cell）的大分子有機化合物（6%），並以細胞膜（cell membrane）之 fluid mosaic mode 圖示說明細胞膜基本組成及功能（10%）。

2. 請圖示說明細胞分裂（5%）及減數分裂過程（5%），並說明孟德爾遺傳定律（10%）。

3. 請說明原核與真核細胞基因表現之基本步驟與差異（8%）。

4. 請說明病毒與細菌，及其生態意義（10%）。

5. 請說明光合作用電子傳遞鏈 及 Calvin cycle 過程（10%），及植物基礎生產力（6%）。

6. 請說明動物發育（5%），並以神經系統說明動物調控行為之機制（15%）。

7. 請說明生物多樣性與親緣關係（10%）。

試題隨卷繳回

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文【海資系碩士班乙組】　　題號：452002

※本科目依簡章規定「不可以」使用計算機(混合題)　　

Reading Comprehension 閱讀能力測驗

An increasing awareness of the vulnerability of sharks to exploitation by shark finning has contributed to a growing concern about an unsustainable shark fishery. Taiwan's fleet has the 4th largest shark catch in the world, accounting for almost 6% of the global figures. Revealing the diversity of sharks consumed by Taiwanese is important in designing conservation plans. However, fins make up less than 5% of the total body weight of a shark, and their bodies are sold as filets in the market, making it difficult or impossible to identify species using morphological traits.

In the present study, we adopted a DNA barcoding technique using a 391-bp fragment of the mitochondrial cytochrome oxidase I (COI) gene to examine the diversity of shark filets and fins collected from markets and restaurants island-wide in Taiwan.

Amongst the 548 tissue samples collected and sequenced, 20 major clusters were apparent by phylogenetic analyses, each of them containing individuals belonging to the same species (most with more than 95% bootstrap values), corresponding to 20 species of sharks. Additionally, *Alopias pelagicus, Carcharhinus falciformis*, *Isurus oxyrinchus,* and *Prionace glauca* consisted of 80% of the samples we collected, indicating that these species might be heavily consumed in Taiwan. Approximately 5% of the tissue samples used in this study were identified as species listed in CITES Appendix II, including two species of *Sphyrna*, *C. longimanus* and *Carcharodon carcharias*.

DNA barcoding provides an alternative method for understanding shark species composition when species-specific data is unavailable. Considering the global population decline, stock assessments of Appendix II species and highly consumed species are needed to accomplish the ultimate goal of shark conservation.

[Liu *et al.* 2013. PLOS ONE]

單選題（**30%**，每題六分。請於答案卡上作答）

1. Why is it important to study shark species consumed in Taiwan? (A) There are at least 20 shark species in Taiwan. (B) Shark catch in Taiwan accounts almost 6% of the world. (C) Shark fin and the remaining body are sold separately in Taiwan. (D) Shark is attacking people in Taiwan.

2. What is the purpose of DNA barcoding in this article? (A) Identify species. (B) Extract DNA. (C) Distinguish sharks from other fish species. (D) Confirm the vulnerability of sharks.

3. CITES Appendix II is likely a(n) (A) international conservation organization. (B) list of world shark species. (C) list of fishes consumed. (D) list of vulnerable species.

4. Which is not the top 4 species found among the 548 samples? (A) *Alopias pelagicus.* (B) *Prionace glauca.* (C) *Carcharodon carcharias.* (D) *Isurus oxyrinchus.*

5. Which part of the body is the most demanded for shark fishery thus driving local and global population extinction? (A) Meat. (B) Internal organs. (C) Eyes. (D) Fins.

試題隨卷繳回　背面有題

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文【海資系碩士班乙組】　　題號：452002

※本科目依簡章規定「不可以」使用計算機(混合題)　　

For each of the following articles, please (1) translate into Chinese 英翻中, and (2) write ONE summary sentence.

A.

"The Arctic Ocean still freezes over most of its surface every winter, but an increasing area of that ice is so thin that it melts again the following summer. Since the first satellite measurements in 1979, the extent of the ice in September, when it reaches its annual minimum, has shrunk by more than 11 percent per decade." (25%)

[Quoted from: Tim Folger, National Geographic]

B.

"There will be more plastic than fish in terms of weight in the world's oceans by 2050, the World Economic Forum（世界經濟論壇）warned Tuesday. Plastic has become one of the world's most popular materials, combining amazing functionality and very low production costs. Its use has increased 20-fold in the past 50 years and is expected to double again in the next 20 years. Almost everybody in the world comes into contact with it -- over a quarter of all plastic is used for packaging, the most popular use of the material. But only 14% of plastic packaging is collected for recycling. The reuse rate is terrible compared to other materials -- 58% of paper and up to 90% of iron and steel gets recycled." (25%)

[Quoted from: Ivana Kottasova, CNN]

Please translate the following paragraph into English 中翻英.

C.

全球大規模珊瑚白化的歷史紀錄僅兩次，分別是1998年和2010年。1998年的聖嬰現象引起了全球一連串的暖化事件，摧毀全世界16-19%的珊瑚礁。NOAA珊瑚礁觀察計畫協調人（Coordinator of NOAA's Coral Reef Watch program）Mark Eakin說，這次的大規模白化和今年的聖嬰現象也有關係，但可以確定的是，全球暖化仍是最關鍵的原因。珊瑚適應的溫度範圍很窄。水溫暖化1°C超過一週，就會白化。輕微的暖化還有機會讓珊瑚蟲恢復牠們的顏色。但如果是劇烈的暖化，珊瑚會死亡，只能期待長出新的珊瑚。(20%)

〔摘錄自環境資訊中心網站〕

背面有題

國立中山大學105學年度碩士暨碩士專班招生考試試題

科目名稱：分析化學【海資系碩士班丙組】　　題號：452004

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

請注意:(a)若涉及計算，請將演算過程列出，否則不予計分

(b)log2 = 0.30 log3 = 0.48

(c)原子量:H= 1, N=14, O = 16, Na = 23, Cl = 35.5

1. Match the lettered terms to the phrases below (15%)
   (A) Precision (B) Accuracy (C) Systematic errors (D) Random errors
   ____ Represents the reproducibility m data
   ____ Indeterminant type of error
   ____ Can be identified by analyzing reliable standards
   ____ Closeness of a measurement to the "true" value
   ____ In a series of measurements, represented by an standard deviation

2. Define each of the following：
   (a) Retention time (4%)
   (b) Chromatography (4%)
   (c) Absolute uncertainty (4%)
   (d) Precipitating Reagent (4%)
   (e) Eddy Diffusion (4%)

3. What is the density of 54.3 wt% aqueous NaOH (MW= 40.00) if 17.6 mL of the solution diluted to 2.00 L gives 0.196 *M* NaOH? (10%)

4. Consider the dissociation of iron(II) carbonate ($FeCO_3$; $K_{sp} = 2.1 \times 10^{-11}$)
   a) Calculate the molar solubility of $FeCO_3$ in water [HINT- assume $\gamma_i = 1$ for all ions in this solution. (5%)
   b) Calculate the concentration equilibrium constant for $FeCO_3$ in 0.0010 M NaCl. (5%)
   c) Calculate the molar solubility of $FeCO_3$ in 0.0010 M NaCl. (5%)

5. What is the difference between fluorescence and phosphorescence? (10%)

6. Consider the simultaneous determination of two components. Species X absorbs very strongly (ε = 12,500) at 335 nm and exhibits a weaker absorption (ε= 524) at 600 nm. Species Y absorbs strongly (ε= 9550) at 600 nm and does not absorb at 335 nm. A mixture of X and Y was determined to have a percent transmittance of24.3% at 335 nm, and a percent transmittance of 29.2% at 600 nm. What is the concentration of species X and Y in this mixture. [All measurements were made in a 1.00 cm cell.] (10%)

7. a) Calculate the pH and pOH of a 1.31×10^{-3}M solution of sodium hydroxide. (5%)
   b) Calculate the pH and pOH of a 1.21×10^{-7}M solution of nitric acid. (5%)

8. Why do some absorbing compounds fluoresce and others not? (5%)
   What structural features appear to favor fluorescence? (5%)

試題隨卷繳回

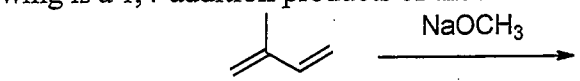
國立中山大學105學年度碩士暨碩士專班招生考試試題

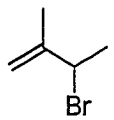
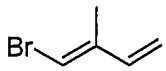
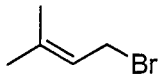
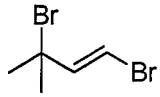
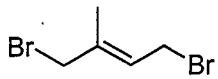
科目名稱：有機化學【海資系碩士班丙組】　　題號：452001

※本科目依簡章規定「不可以」使用計算機(混合題)　　

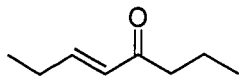
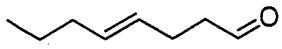
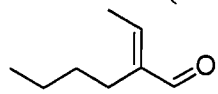
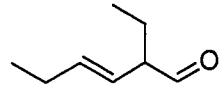
一、單選選擇題(10%, 2% for each)

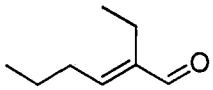
1. Which of the following is a 1,4-addition products of the reaction? (2%)



(a)  (b)  (c)  (d)  (e) 

2. Which of the following is the aldol condensation product of butanal ($CH_3CH_2CH_2CHO$)? (2%)

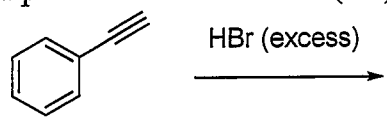
(a)  (b)  (c)  (d) 

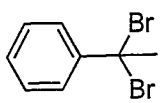
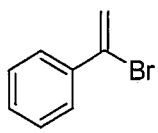
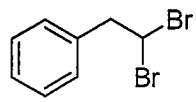
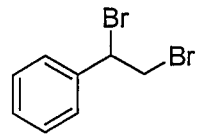
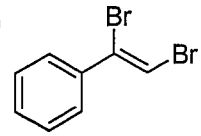
(e) 

3. Which of the following statements correctly applies Hückel's rule to the molecules shown above? (2%)

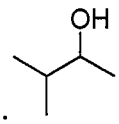
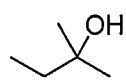
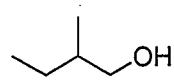
(a) Naphthalene is not monocyclic; therefore it cannot be aromatic.
(b) Pyrrole is not a hydrocarbon; therefore it cannot be aromatic.
(c) Cycloheptatriene is no completely conjugated; therefore it cannot be aromatic.
(d) Pyridine is weakly basic; therefore it cannot be aromatic.
(e) Styrene has 8 π electrons; therefore it cannot be aromatic.

4. Which of the following is the major product of the reaction? (2%)



(a)  (b)  (c)  (d)  (e) 

5. In which of the following are the compounds shown listed in order of increasing reactivity to acid-catalyzed dehydration?

1.  2.  3. 

(a) 1 < 2 < 3 (b) 1 < 3 < 2 (c) 2 < 3 < 1 (d) 3 < 1 < 2 (e) 3 < 2 < 1

二：問答題：(90%)

1. Provide a representative compound for each of the following functional groups. (15%, 3% for each)

a. hydrazone

b. cyanohydrin

c. lactone

d. mercaptan

e. aniline

2. Provide a structure for each of the following compounds. (15%, 3% for each)
a. Bicycle [4.1.0] heptane

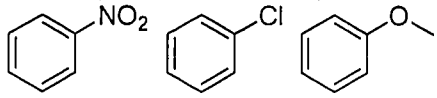
b. (*E*)-3-methyl-2-hexenoic acid

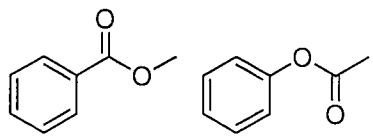
c. acetic anhydride

d. 4-methyl-5-oxoheptanal

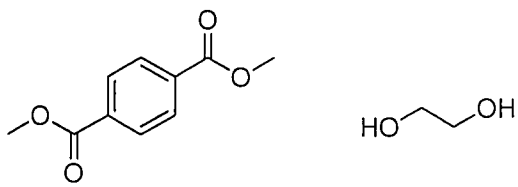
e. 4-ethyl-3,6-dimethylheptan-2-ol

3. For following reagents, circle the one that will react faster in an electrophilic aromatic substitution reaction. (6%, 3% for each)

a. 

b. 

4. Dimethyl terephthalate and ethylene glycol polymerize under acid conditions to form the polymer Dacron ™, also known as polyethylene terephthalate (PET.) Draw the repeating unit of the polymer. (4%)



5. Explain the following terms (15%)
a. Vicinal coupling

b. McLafferty rearrangement

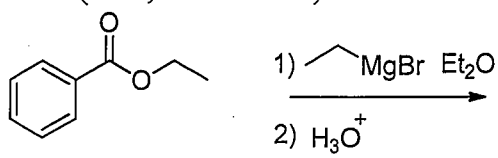
c. Aldol reaction

d. Diels-Alder reaction

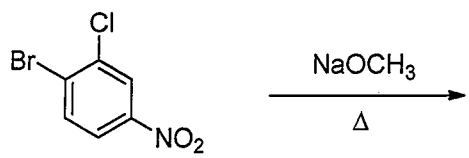
e. Suzuki reaction

6. Predict the main product in each of the following reaction. Be sure to show stereochemistry where it is known. (15%, 3% for each)

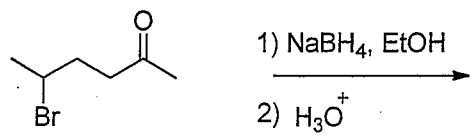
a.



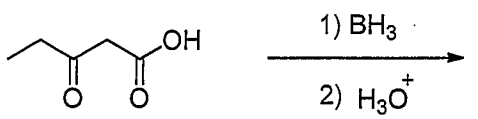
b.



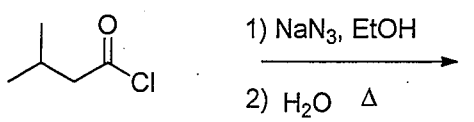
c.



d



e.



7. Please explain HOW to apply organic chemistry onto the development of marine resources. (10%)

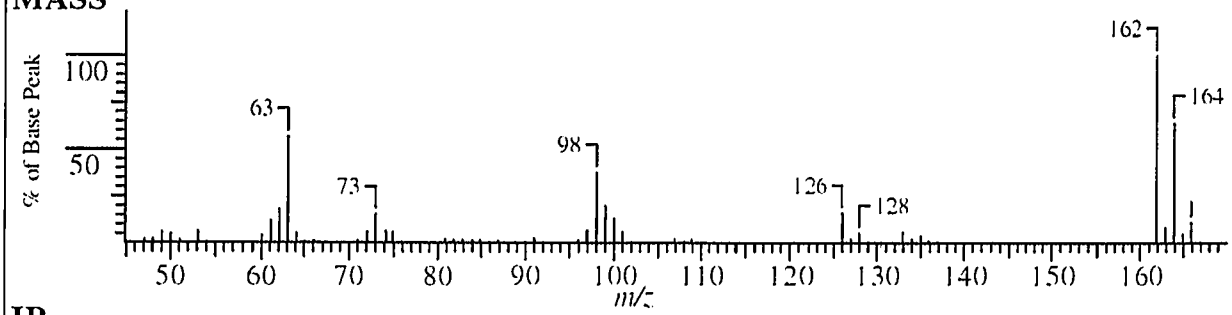
8. Determine the structure of the compound whose molecular formula is $C_6H_4Cl_2O$ for which the mass, IR, ^1H NMR, and ^{13}C/DEPT NMR spectra are given. (10%)

國立中山大學105學年度碩士暨碩士專班招生考試試題

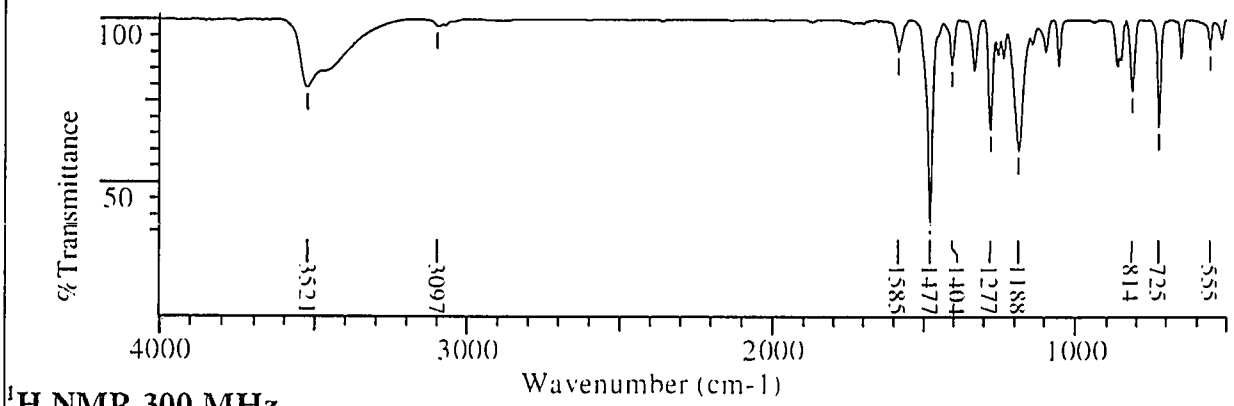
科目名稱：有機化學【海資系碩士班丙組】　　題號：452001

※本科目依簡章規定「不可以」使用計算機(混合題)　　

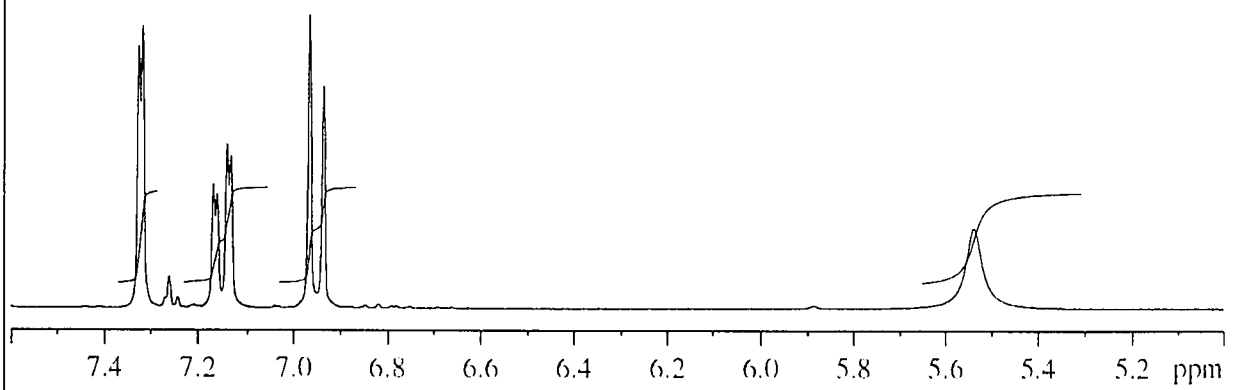
MASS



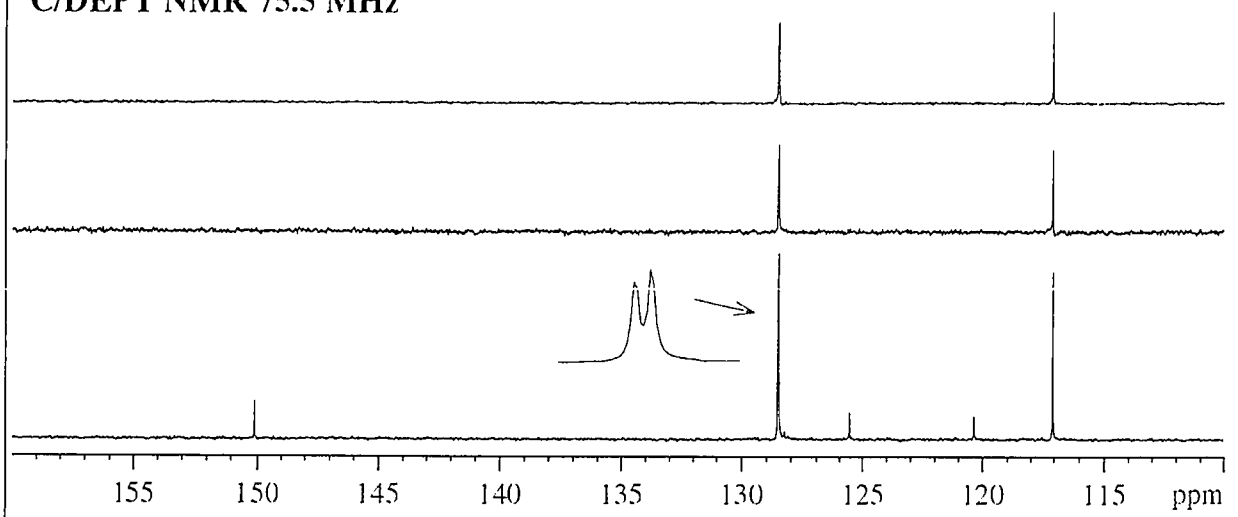
IR



^{1}H NMR 300 MHz



^{13}C/DEPT NMR 75.5 MHz



背面有題