注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。

國立清華大學 112 學年度碩士班考試入學試題

系所班組別：分析與環境科學研究所

科 目 代 碼 ：2905

考 試 科 目 ：有機化學

—作答注意事項—

1. 請核對答案卷（卡）上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「 由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「**國立清華大學試場規則及違規處理辦法**」，無法因本試題封面作答注意事項中未列明而稱未知悉。

國立清華大學 112 學年度碩士班考試入學試題

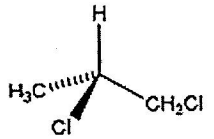
系所班組別：分析與環境科學研究所

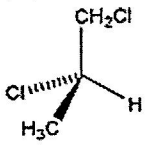
考試科目（代碼）：有機化學(2905)

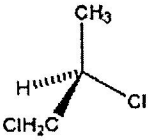
　*請在【答案卡】作答

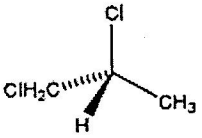
一、單選題（每題 4 分共 100 分）

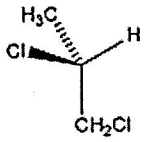
1. Which is the enantiomer of the compound shown below?

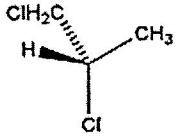


(A)


(B)


(C)


(D)


(E)


2. The biological importance of enantiomers arises from?

(A) Biological reactions involve receptor molecules.

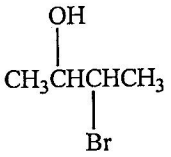
(B) Biological receptors are chiral.

(C) Biological receptors require a specific enantiomer for reaction.

(D) Each enantiomer has different biological properties.

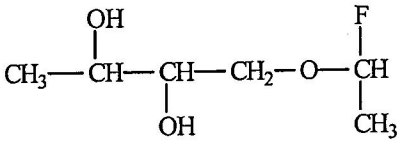
(E) All of the above

3. How many stereoisomers of 3-bromo-2-butanol exist?



(A) 1　(B) 2　(C) 3　(D) 4　(E) 6

4. Which is the most polar bond for the molecule shown below?



(A) C–F　(B) O–H　(C) C–H　(D) C–O　(E) C–C

5. Which of the following describes accurately the noncovalent interactions between the like molecules below?

$CH_3CH_2NH_2$	CH_3CH_2OH	$CH_3CH_2CH_3$
1	2	3

(A) Only 1 exhibits hydrogen bonding.

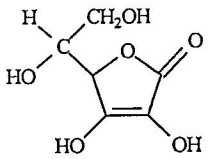
(B) Only 2 exhibits hydrogen bonding.

(C) Only 3 exhibits hydrogen bonding.

(D) Only 1 and 2 exhibit hydrogen bonding.

(E) All exhibit hydrogen bonding.

6. Which of the following statement correctly describes Vitamin C (shown below)?



(A) is hydrophilic.

(B) exhibits dispersion forces.

(C) exhibits hydrogen bonding.

(D) would be soluble in water.

(E) all of the above.

7. Which of the following functional group does not have oxygen?

(A) ether　(B) thiol　(C) aldehyde　(D) ester　(E) amide

8. Which of the following functional group is characterized by the presence of an sp^2 hybridized carbon atom?

(A) alkyl halide　(B) sulfide　(C) alcohol　(D) aldehyde　(E) alkyne

9. What is the most likely major product if ethane is reacted with a large excess of chlorine over a long period of time?

(A) CCl_3CCl_3

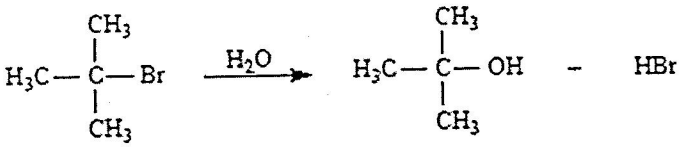
(B) CH_3CH_3

(C) CH_2ClCH_2Cl

(D) CH_2ClCH_3

(E) Ethane does not react with the halogens.

10. The following reaction is an example of:



(A) a substitution reaction.

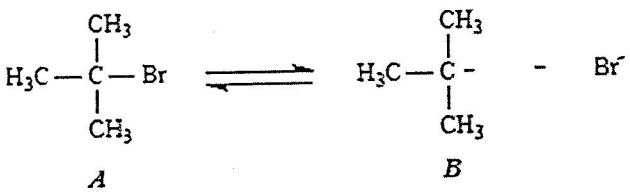
(B) a rearrangement reaction.

(C) an elimination reaction.

(D) an addition reaction.

(E) a pericyclic reaction.

11. What is the Species **B** of the following reaction?



(A) a carbocation (B) a radical (C) a carbanion (D) a carbine (E) a carbyne

12. Which of the following amino acids has an aromatic side chain?

(A) Isoleucine (B) Valine (C) Tyrosine (D) Threonine (E) Glycine

13. Which of the following statements is TRUE?

(A) Both DNA and RNA are completely double-stranded.

(B) Both DNA and RNA are completely single-stranded.

(C) Both DNA and RNA contain ribose.

(D) Both DNA and RNA contain uracil.

(E) Both DNA and RNA contain phosphate.

14. Which of the following is NOT a property of a reaction protecting group?

(A) Change the reactivity of a functional group

(B) Inert to reaction conditions

(C) Becomes a permanent part of the product

(D) Alters the mechanism of the desired reaction

(E) All are properties of a protecting group

15. To what structural feature does the term "protein primary structure" refer to?

(A) The sequence of amino acids in proteins

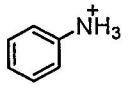
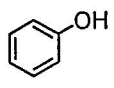
(B) The overall folding pattern of proteins

(C) The aggregation of polypeptides

(D) The conformation of local regions of polypeptides

(E) The association of several protein chains into a closely packed arrangement

16. Rank the following compounds in order from the strongest acid to the weakest acid:

(I) H_3O^+　　(II)  　　(III)  　　(IV) H_2O

(A) I > II > III > IV

(B) I > III > II > IV

(C) II > I > III > IV

(D) II > III > I > IV

(E) III > II > IV > I

17. Which of the following compounds will undergo an SN2 reaction most readily?

(A) $(CH_3)_3CCH_2I$

(B) $(CH_3)_3CCl$

(C) $(CH_3)_2CHI$

(D) $(CH_3)_2CHCH_2CH_2CH_2Cl$

(E) $(CH_3)_2CHCH_2CH_2CH_2I$

18. What is the horizontal axis of a mass spectrum?

(A) mass (B) mass/energy (C) mass/charge (D) charge (E) ion

19. What is the vertical axis of a mass spectrum?

(A) mass (B) energy (C) abundance (D) field strength (E) charge

20. Which of the following would not produce nuclear magnetic resonance?

(A) ^{2}H (B) ^{14}N (C) ^{16}O (D) ^{19}F (E) ^{13}C

21. Which feature in the ^{1}H NMR spectrum provides information about the relative numbers of hydrogen atoms of each type found in a compound?

(A) number of signals

(B) integration of signals

(C) splitting of signals

(D) chemical shift

(E) spin-spin signals

22. Which of the following statements about an SN2 reaction is TRUE?

(A) the reaction occurs in two steps

(B) rate = k[RX]

(C) stabilization of R+ is important

(D) the reaction causes racemization

(E) the reaction is favored by aprotic solvents

23. Which of the following statements about an SN1 reaction is TRUE?

(A) the reaction occurs in one-step

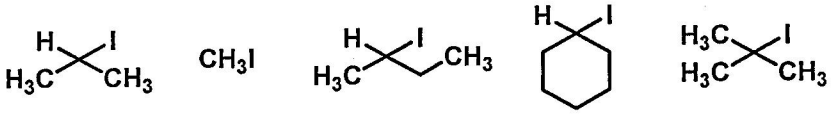
(B) there is no effect on reaction rate by nucleophile

(C) primary alkyl halides react faster than secondary alkyl halides

(D) the reaction proceeds with inversion of stereochemistry

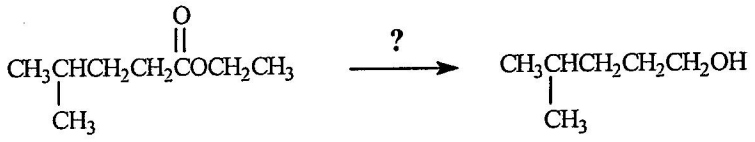
(E) the reaction is favored by aprotic solvents

24. Which of the following is the most reactive species in an SN1 reaction?



(A)　(B)　(C)　(D)　(E)

25. What is the best choice of reagent to achieve the following transformation?



(A) CrO_3, H_3O^+, acetone

(B) pyridium chlorochromate, CH_2Cl_2

(C) $SOCl_2$, pyridine

(D) $NaBH_4$

(E) $LiAlH_4$