

國立臺北科技大學 109 學年度碩士班招生考試

系所組別：3520 化學工程與生物科技系化學工程碩士班乙組

第二節 有機化學 試題

第 1 頁 共 4 頁

注意事項：

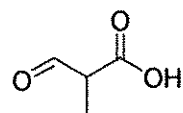
1. 本試題共三大題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、Multiple-choice questions (80 points, 2 points for each)

****NOTE:** Please give your answers *in a Table form* as shown below in your answer sheet.

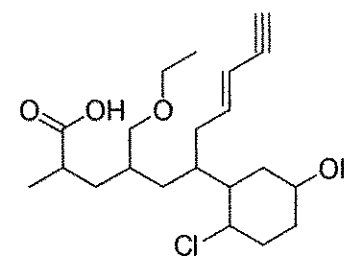
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
31.	32.	33.	34.	35.	36.	37.	38.	39.	40.

1. Which of the following lists the correct common names for ethanal, methanal, and ethanol, respectively?
 - (A). Acetaldehyde, formaldehyde, ethyl alcohol
 - (B). Ethyl alcohol, propionaldehyde,
 - (C). Ethyl alcohol, formaldehyde, acetaldehyde
 - (D). Isopropyl alcohol, ethyl alcohol, formaldehyde
2. Which of the following are considered terminal functional groups?
 - I. Aldehydes II. Ketones III. Carboxylic acids
 - (A). I only (B). III only (C). I and III only (D). I, II, and III
3. If all prefixes were dropped, what would be the name of the parent root of this molecule?



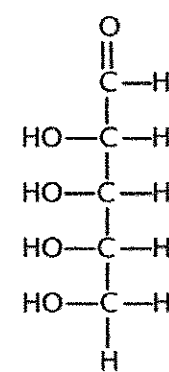
- (A) Propanoate (B) Propanol (C) Propanoic acid (D) Propa noic anhydride

4. The IUPAC name for the following structure ends in what suffix?



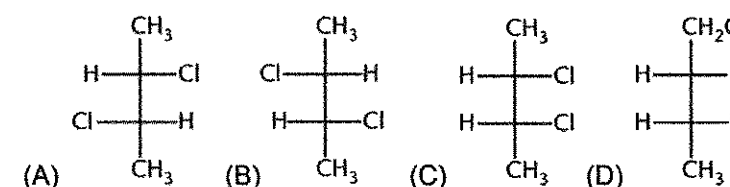
- (A) -ol (B) -one (C) -oic acid (D) -yne

5. Which of the following does NOT show optical activity?
 - (A) (R)-2-butanol (B) (S)-2-butanol (C) A solution containing 1 M (R)-2-butanol and 2 M (S)-2-butanol (D) A solution containing 2 M (R)-2-butanol and 2 M (S)-2-butanol
6. How many stereoisomers exist for the following (Fischer projection) aldehyde?

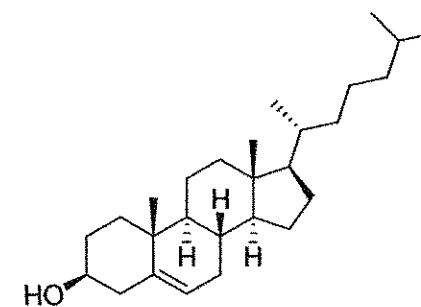


- (A) 2 (B) 8 (C) 9 (D) 16

7. Which of the following compounds is optically inactive?



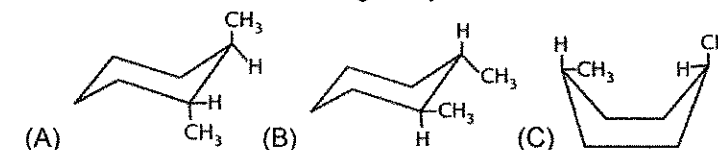
8. Cholesterol, shown below, contains how many chiral centers?



cholesterol

- (A) 5 (B) 7 (C) 8 (D) 9

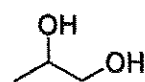
9. Which isomer of the following compound is the most stable?



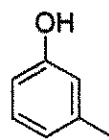
- (D) they are all equally stable

注意：背面尚有試題

10. A carbon atom participates in one double bond. As such, this carbon contains orbitals with:
 (A) hybridization between the *s*-orbital and one *p*-orbital. (B) hybridization between the *s*-orbital and two *p*-orbitals. (C) hybridization between the *s*-orbital and three *p*-orbitals. (D) no hybridization between the *s*-orbital and *p*-orbitals
11. Which of the following are Lewis bases? I. Ag⁺ II. H₂O III. NH₃
 (A) A, I only (B) I and II only (C) II and III only (D) I, II, and III
12. Rank the following in order of decreasing nucleophilicity in an aprotic solvent: (a)RO⁻, (b)RCOOH, (c)ROH, (d)HO⁻
 (A) b > c > a > d (B) d > c > a > b (C) a > d > c > b (D) b > a > d > c
13. Rank the following in order of decreasing electrophilicity: (a)CR₃⁺, (b)CH₃OH, (c)CH₃OCH₃, (d)CH₃Cl
 (A) c > a > b > d (B) a > b > c > d (C) c > d > a > b (D) a > d > b > c
14. Rank the following in order of decreasing leaving group ability: (a)H₂O, (b)HO⁻, (c)Br⁻, (d)H⁻
 (A) a > c > b > d (B) a > b > c > d (C) b > c > a > c (D) b > d > a > c
15. Rank the following in order of decreasing oxidation state: (a)amine, (b)carboxylic acid, (c)aldehyde, (d)alkane
 (A) cadb (B) bcad (C) bacd (D) dacb
16. Tertiary alcohols are oxidized with difficulty because:
 (A) there is no hydrogen attached to the carbon with the hydroxyl group.
 (B) there is no hydrogen attached to the α-carbon of the carbonyl
 (C) tertiary alcohols contain hydroxyl groups with no polarization.
 (D) they are relatively inert.
17. The IUPAC name of this molecule is:

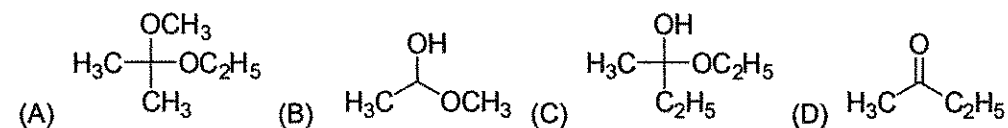
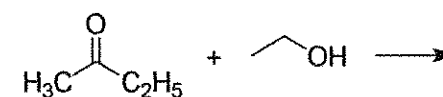


- (A) ethane-1,2-diol. (B) propane-1,2-diol. (C) dimethanol. (D) dipropanol.

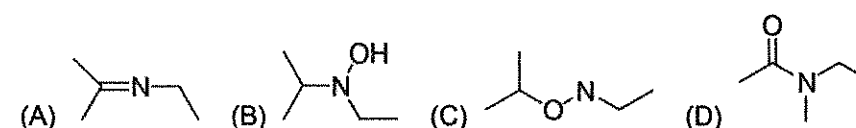
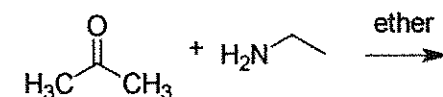


18. The IUPAC name of this molecule is:
 (A) 2-methylcyclohexanol. (B) *m*-methylphenol. (C) *p*-methylphenol. (D) 3-methylcyclohexanol.
19. All of the following are true with respect to carbonyls EXCEPT:
 (A) the carbonyl carbon is electrophilic.
 (B) the carbonyl oxygen is electron-withdrawing.
 (C) a resonance structure of functional group places a positive charge on the carbonyl carbon.
 (D) the π electrons are mobile and are pulled toward the carbonyl carbon.

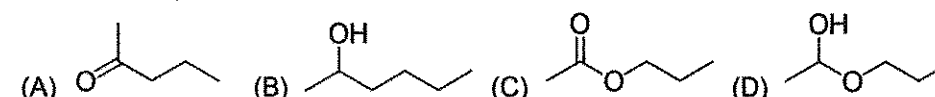
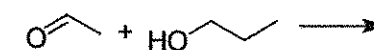
20. What is the product of the reaction below?



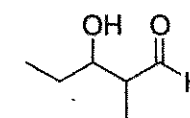
21. What is the product of the reaction below?



22. What is the product of the reaction below?



23. Which of the following reactions would produce the compound below?



- (A) CH₃CHO + CH₃CH₂CH₂CHO → (B) CH₃COCH₃ + CH₃CH₂CH₂CHO →
 (C) CH₃CH₂COCH₃ + CH₃CHO → (D) CH₃CH₂CHO + CH₃CH₂CHO →

24. Why does the equilibrium between keto and enol tautomers lie far to the keto side?

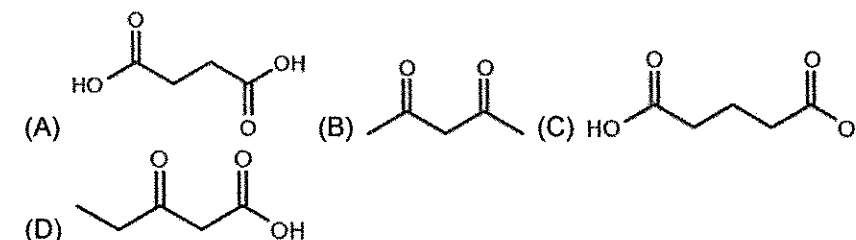
- I. The keto form is more thermodynamically stable.
 II. The enol form is lower energy.
 III. The enol form is more thermodynamically stable.

- (A) I only (B) III only (C) I and II only (D) II and III only

25. The aldol condensation is an example of which reaction type(s)?

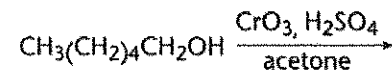
- I. Dehydration II. Cleavage III. Nucleophilic addition
 (A) I only (B) I and III only (C) II and III only (D) I, II, and III

26. Which of these compounds would be expected to decarboxylate when heated?

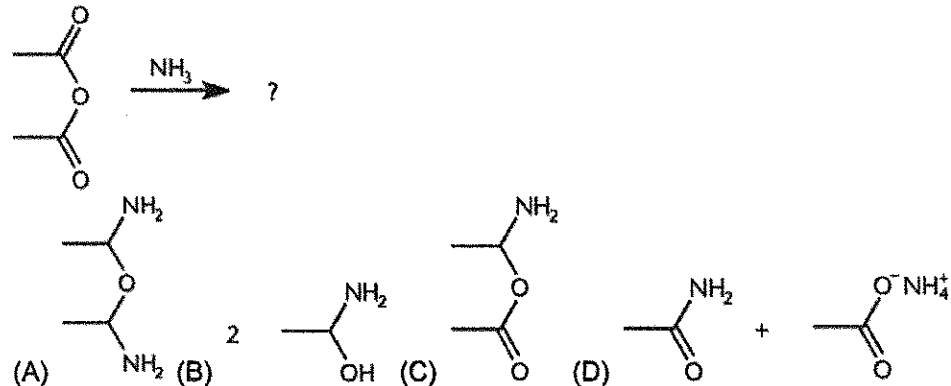


27. Which of the following carboxylic acids will be the most acidic?
 (A) $\text{CH}_3\text{CHClCH}_2\text{COOH}$ (B) $\text{CH}_3\text{CH}_2\text{CCl}_2\text{COOH}$ (C) $\text{CH}_3\text{CH}_2\text{CHClCOOH}$ (D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

28. What is the final product of the following reaction?



- (A) $\text{CH}_3(\text{CH}_2)_4\text{CHO}$ (B) $\text{CH}_3(\text{CH}_2)_4\text{COOH}$ (C) $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$ (D) $\text{HOOC}(\text{CH}_2)_4\text{COOH}$
29. Which of the following would be the best method of producing methyl propanoate?
 (A) Reacting propanoic acid and methanol in the presence of a mineral acid
 (B) Reacting methanoic acid and propanol in the presence of a mineral acid
 (C) Reacting propanoic anhydride with an aqueous base
 (D) Reacting propanoic acid with an aqueous base
30. What would be the product(s) of the reaction below?

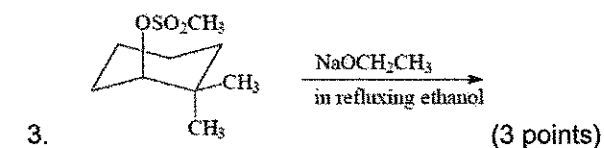
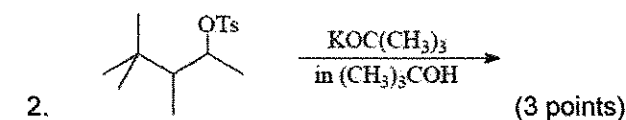
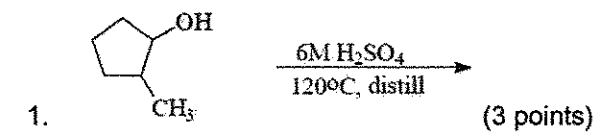


31. Each of the acyl compounds listed below contains a six-membered ring EXCEPT:
 (A) δ -lactam. (B) cyclohexane carboxylic acid. (C) γ -butyrolactone. (D) the anhydride formed from intramolecular ring closure of pentanedioic acid.
32. Which of the following would be most reactive toward nucleophiles?
 (A) Propyl ethanoate (B) Propanoic acid (C) Propanamide (D) Propanoic anhydride
33. Which of the following would be formed if methyl bromide were reacted with phthalimide and followed by hydrolysis with an aqueous base?
 (A) $\text{C}_2\text{H}_5\text{NH}_2$ (B) CH_3NH_2 (C) $(\text{C}_2\text{H}_5)_3\text{N}$ (D) $(\text{CH}_3)_4\text{N}^+\text{Br}^-$
34. Intermediates in the Strecker synthesis include all of the following nitrogen-containing functional groups EXCEPT:
 (A) nitrile. (B) imine. (C) amide. (D) amine.
35. Oxygen (O_2) does not exhibit an IR spectrum because:
 (A) it has no molecular motions. (B) it is not possible to record IR spectra of a gaseous molecule.
 (C) molecular vibrations do not result in a change in the dipole moment of the O_2 molecule. (D) molecular oxygen contains four lone pairs overall.
36. If IR spectroscopy were employed to monitor the oxidation of benzyl alcohol to benzaldehyde, which of the following would provide the best evidence that the reaction was proceeding as

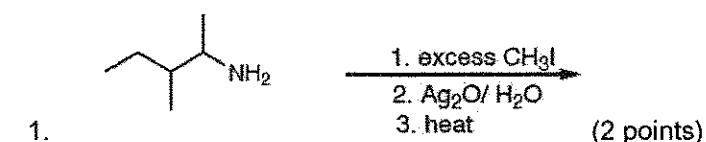
planned?

- (A) Comparing the fingerprint region of the spectra of starting material and product
 (B) Noting the change in intensity of the peaks corresponding to the benzene ring
 (C) Noting the appearance of a broad absorption peak in the region of $3100\text{--}3500\text{ cm}^{-1}$
 (D) Noting the appearance of a strong absorption in the region of 1750 cm^{-1}
37. Which of the following chemical shifts could correspond to an aldehydic proton signal in a ^1H -NMR spectrum? (A) 9.5 ppm (B) 7.0 ppm (C) 11.0 ppm (D) 1.0 ppm
38. The isotope ^{12}C is not useful for NMR because:
 (A) it is not abundant in nature. (B) its resonances are not sensitive to the presence of neighboring atoms. (C) it has no magnetic moment. (D) the signal-to-noise ratio in the spectrum is too low.
39. Which of the following compounds would be most effective in extracting benzoic acid from a diethyl ether solution?
 (A) Tetrahydrofuran (B) Aqueous hydrochloric acid (C) Aqueous sodium hydroxide (D) Water
40. Which of the following would be the best procedure for extracting acetaldehyde from an aqueous solution?
 (A) A single extraction with 100 mL of ether (B) Two successive extractions with 50 mL portions of ether (C) Three successive extractions with 33.3 mL portions of ether (D) Four successive extractions with 25 mL portions of ether

二、Give the **major organic product** of the following reactions. Also, state the **mechanism** (E1/E2/SN1/SN2/E1cB) through which each reaction proceeds. (9 points, 3 points for each)



三、Provide the missing products, reagents/conditions or reactants, as required. Do not forget to include stereochemistry as appropriate. (11 points)



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