銘傳大學 97 學年度研究所碩士班招生考試

生物科技學系碩士班

有機化學試題(第二節)

(第一頁共六頁)(限用答案本作答) ☑可使用計算機 ☐不可使用計算機

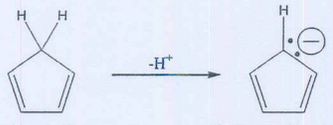
Grad. School Org. Chem. Ent. Exam. Dept. Biotech. 2008

The table of atomic masses is on page 6. 2 pts each

1. What is the formal charge on the nitrogen of "|N" in the following molecule, |N=N=N|, where | or _ represents nonbonding lone-pair electrons? **A.** +2, **B.** +1, **C.** 0, **D.** -1. [*Hint*: formal charge = (# of valence e^-) – (# of bonds) –(# of nonbonding e^-)]

2. For an S_N2 reaction, which one of the following description is correct? **A.** Back-side attack. **B.** Bimolecular. **C.** Inversion of steric configuration. **D.** All of the above.

3. In a Diels-Alder reaction, why CANNOT ethylene, $H_2C=CH_2$, be used as a dienophile? This is because **A.** ethylene is too small, **B.** ethylene is in its ground state, not an excited one, **C.** there is no electron-withdrawing group attached to carbons in this molecule, **D.** ethylene is easily polymerized.
4. An alkyl halide, RX, undergoes an E_1 reaction, but in competition with an S_{N1} reaction, what is most likely the alkyl halide? **A.** CH_3X, **B.** primary, RCH_2X, **C.** secondary, R_2CHX, **D.** tertiary, R_3CX.
5. What is the name of this functional group,  ? **A.** Amide. **B.** Carboxylic acid. **C.** Ester. **D.** Alcohol.
6. Why, under normal conditions, I_2 is solid, while F_2 is gas? This is because I_2 has more electrons, and therefore it has **A.** Stronger van der Waals forces. **B.** More polarizability. **C.** More attraction between I_2 molecules. **D.** All of the above.
7. Why does this reaction occur so easily? **A.** cyclopentadiene is acidic, **B.** cyclic compounds undergo hydrogen abstraction easily, **C.** dienes are always easily deprotonated, **D.** cyclopentadienyl anion is aromatic.



Cyclopentadiene Cyclopentadienyl anion

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8. Which one of the following description is correct for a meso compound? **A.** It has no optical activity. **B.** It contains an internal symmetry plane. **C.** The rotation of polarized light is canceled by chirality centers in this molecule. **D.** All of the above.

9. The rate of an S_N2 reaction can be increased or decreased when it is carried out in polar **APROTIC** solvent? **A.** Increased. **B.** Decreased. **C.** All of the above. **D.** None of the above.
10. For a reaction with decreased entropy, *i.e.*, ΔS is negative, can a reaction occur spontaneously (*i.e.*, ΔG is negative), given that $\Delta G = \Delta H - T\Delta S$? **A.** That's impossible!, **B.** only when the temperature is very low, **C.** the reaction must be exothermic, **D.** none of the above.

11. In a nucleophilic substitution reaction, the best leaving groups after they depart can be classified as **A.** Strong acids such as HI. **B.** Weak Acids such as HF. **C.** Strong bases such as F^-. **D.** Weak bases such as I^-.
12. The halide nucleophilicity in PROTIC solvent follows this order: $I^->Br^->Cl^->F^-$. This phenomenon is due primarily to **A.** van der Waals forces. **B.** Hydrogen bonding. **C.** Polymerization. **D.** Isomerization. of these ions with protic solvent.

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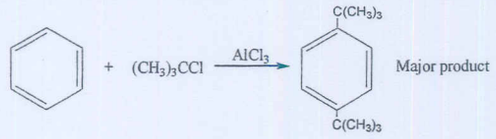
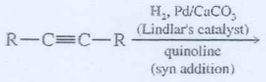
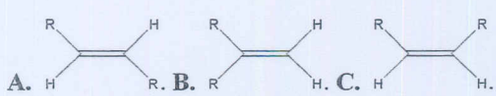
13. Why does the reaction occur as the one shown below? **A.** $(CH_3)_3C$- is an electro-withdrawing group, **B.** $(CH_3)_3C$- is an *ortho*- and *para*-directed substituent, **C.** $AlCl_3$ is a acid, **D.** benzene ring is too reactive.

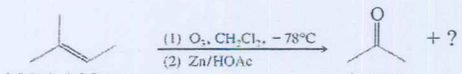


14. 


A. **B.** **C.** **D.** All of the above.

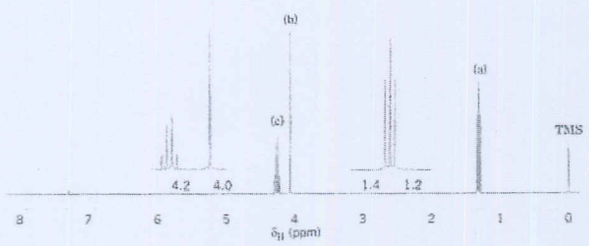
15. A particular stereoisomeric form of the starting material reacts in such a way that it gives a specific stereoisomeric form of the product. This is the description of **A.** Regioselective. **B.** Anchimeric. **C.** Isotopic. **D.** Stereospecific.

16. When a reaction that can potentially yield two or more constitutional isomers actually produce only one (or a predominant one), the reaction is said to be **A.** Stereospecific. **B.** Regioselective. **C.** Anchimeric. **D.** Isotopic.

17. In this reaction, ozonolysis, 

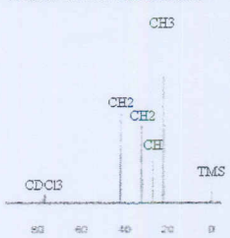
A.  **B.**  **C.**  **D.** All of the above.

18. A 300-MHz NMR spectrum is shown below:



What is this compound? **A.** $ClCH_2CO_2CH_2CH_3$. **B.** $C_2H_5OC_2H_5$. **C.** CH_3OH. **D.** C_2H_5Cl.

19. A compound is an isomer of $C_5H_{11}Br$. What is its structure?



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20. A thermal cracking reaction takes place as described as follows:

(1) $CH_3CH_2CH_2CH_2CH_3 \rightarrow CH_3\bullet + CH_3CH_2CH_2CH_2\bullet$

(2) $CH_3\bullet + CH_3\bullet \rightarrow CH_3CH_3$

(3) $CH_3CH_2\bullet + CH_3CH_2\bullet \rightarrow CH_3CH_2CH_2CH_3$

(4) $CH_3\bullet + CH_3CH_2\bullet \rightarrow CH_3CH_2CH_3$

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(5) $CH_3CH_2CH_2CH_2CH_3 \rightarrow CH_3CH_2\bullet + CH_3CH_2CH_2\bullet$

(6) $CH_3\bullet + CH_3CH_2CH_2CH_2CH_3 \rightarrow CH_4 + CH_3CH_2\underline{C}H_2CH_2CH_2\bullet$

For which of these reactions would you expect E_{act} to equal zero? **A.** 3,5,6. **B.** 1,2,3. **C.** 2,3,4. **D.** 3,4,1.

21. (*Cont.*) To be greater than zero? **A.** 2,4,5. **B.** 2,3,6. **C.** 3,5,6. **D.** 1,5,6.

22. (*Cont.*) To equal $\Delta H°$? **A.** 1,5. **B.** 2,4. **C.** 3,6. **D.** 2,5.

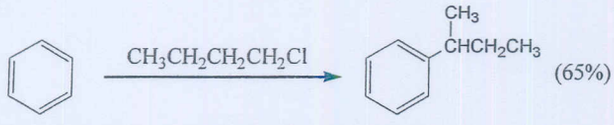
23. A tertiary radical,  , and a secondary radical,  , which is more stable? **A.** Tertiary. **B.** Secondary. **C.** They have the same stability. **D.** None of the above.

24. For a 2° alkyl halide, an S_N2 reaction can occur only with **A.** Strong bases such as F^-. **B.** Weak bases such as I^-. **C.** Strong acid such as HI. **D.** Weak acid such as HF.

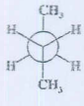
25. At room temperature, for a 3° alkyl halide, S_N1 and E1 reaction, which is more predominant? **A.** S_N1. **B.** E1. **C.** All of the above. **D.** None of the above.

26. The pKa of acetylene, H–C≡C–H, is 25, which is quite acidic compared to other organic species. This is because of **A.** The triple bond. **B.** Strong van der Waals force. **C.** 50% *s* character in the *sp*-hybrid orbital of alkyne carbons. **D.** All of the above.

27. Why is the product in the reaction listed below a major product? **A.** hydride shift leads to the generation of a secondary carbocation intermediate, **B.** benzene ring exhibits certain interaction toward $CH_3(CH_2)_3Cl$, **C.** monosubstituent always leads to a rearrangement of carbocation, **D.** alkyl halide is always unreactive toward a benzene ring..

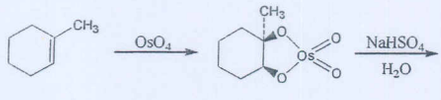


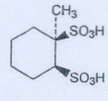
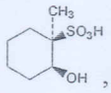
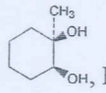
28. Which of the following conformations is called a Gauche form?

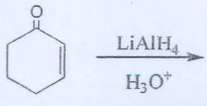
A.  **B.**  **C.**  **D.**  .

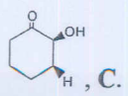
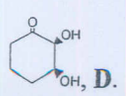
29. Why does cyclopropane,  , have such a large ring strain? **A.** Its bond angle is 60°. **B.** All the C-H bonds are in eclipsed-form. **C.** All of the above. **D.** None of the above.

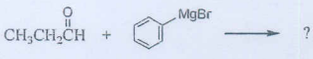
30. Is this compound,  , *R*- or *S*-form? **A.** *R*-form. **B.** *S*-form. **C.** All of the above. **D.** None of the above.

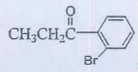
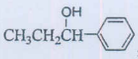
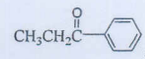
31 

? In this reaction, what is the product? **A.**  , **B.**  , **C.**  , **D.**  .

32. 

What is the product? **A.**  , **B.**  , **C.**  , **D.**  .

33. 

What is the product? **A.**  , **B.**  , **C.**  ,

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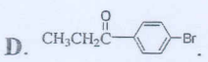
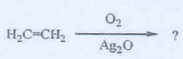
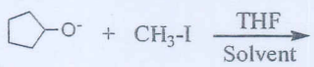
D.  .

34. For resonance structures, which one the following description is correct? **A.** None of these structures is a correct representation for the molecule or ion. **B.** The actual molecule or ion is better represented by a hybrid (average) of these structures. **C.** They differ only in the positions of the electrons. **D.** All of the above.

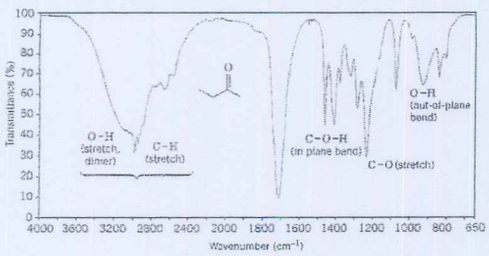
35. Please use VSEPR theory to predict the geometry of $:CCl_3^-$. **A.** Tetrahedral. **B.** Trigonal pyramidal. **C.** Linear. **D.** Square planar.

36.  What is the product? **A.** , **B.**  , **C.**  , **D.**  .

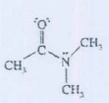
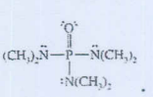
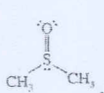
37. What is the name of this functional group, –C≡N? **A.** Alcohol. **B.** Aldehyde. **C.** Nitrile. **D.** Ketone.

38.  What is the product? **A.**  , **B.**  , **C.**  , **D.**  .

39. What is the functional group that appears at ~1,700 cm^{-1}? **A.** Nitrile. **B.** Carbonyl. **C.** Ether. **D.** Triple bond.



40. Why is crown ether an important organic molecule? **A.** It may dissolve polar metal ions in organic solvent, **B.** It may cause the excitation of spin-allowed species to higher energy levels, **C.** It can be used as a dienophile, **D.** It may reduce the ground state energy levels.

41. Which one of the following solvent is a PROTIC solvent? **A.** H_2O. **B.**  . **C.**  . **D.**  .

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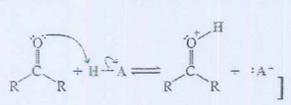
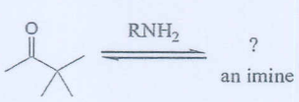
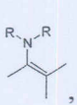
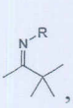
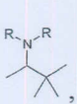
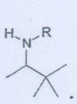
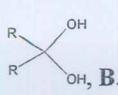
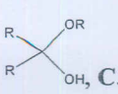
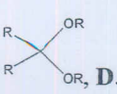
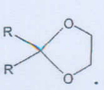
42. What is the most often first step in many reactions that alcohol, ether, aldehyde, ketone, ester, amides and carboxylic acids undergo? **A.** Bond breakage. **B.** Leaving group departure. **C.** Nucleophilic attack. **D.** Proton transfer. [*Hint*: ]

43.  What is the product, "?"? **A.**  , **B.**  , **C.**  , **D.**  .

44. Which of the following compound is a hemiacetal? **A.**  , **B.**  , **C.**  , **D.**  .

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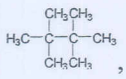
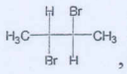
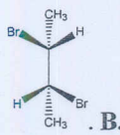
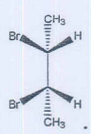
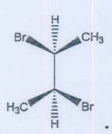
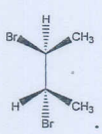
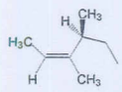
☑可使用計算機 ☐不可使用計算機

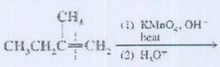
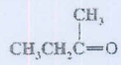
45. Why does this compound,  , melt at 100.7°C, while it boils at 106.3°C? **A.** It has a high molecular weight. **B.** It has too many carbon atoms. **C.** It is highly branched. **D.** It contains no chloride atoms.

46. This molecule,  , can also be drawn as **A.**  **B.**  **C.**  **D.**  .

47. In an S_N1 reaction such as $(CH_3)_3C–Cl + 2H_2O \rightarrow (CH_3)_3C–OH + H_3O^+ + Cl^-$, what is the slowest (rate-determining) step? **A.** The heterolytic cleavage of C–Cl bond. **B.** Water attack to the carbocation. **C.** Proton transfer to another water molecule. **D.** All of the above.

48. In a 1,4-*trans* disubstituted cyclohexane (), what are the relationships between these two substituents? (a: axial; e: equatorial) **A.** a,a or e,e, **B.** a,e or e,a, **C.** a,e or e,e, **D.** a,a, or e,a.

49. What is the IUPAC name of this compound,  ? **A.** (*Z*,4*R*)-3,4-Dimethyl-1-hexene. **B.** (*E*,4*R*)-3,4-Dimethyl-2-pentene. **C.** (*E*,4*S*)-3-methyl-2-hexene. **D.** (*Z*,4*S*)-3,4-Dimethyl-2-hexene.

50. What is (are) the product(s) for the following reaction,  ? **A.**  . **B.** CO_2. **C.** H_2O. **D.** All of the above.

↓ ↓ ↓ ↓ ↓ ↓ ↓

本試題兩面印刷

銘傳大學 97 學年度研究所碩士班招生考試

生物科技學系碩士班

有機化學試題(第二節)

(第六頁共六頁)(限用答案本作答)　　□可使用計算機 □不可使用計算機

Answers:　請依下列格式將答案寫至答案本

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.____
41.____	42.____	43.____	44.____	45.____	46.____	47.____	48.____	49.____	50.____

PERIODIC TABLE OF THE ELEMENTS

Per.	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	O	Pri.
1	1 H 1s¹ 1.008																	2 He 1s² 4.003	K
2	3 Li 2s¹ 6.941	4 Be 2s² 9.012											5 B 2s²2p¹ 10.81	6 C 2s²2p² 12.01	7 N 2s²2p³ 14.01	8 O 2s²2p⁴ 16.00	9 F 2s²2p⁵ 19.00	10 Ne 2s²2p⁶ 20.18	L K
3	11 Na 3s¹ 22.99	12 Mg 3s² 24.31											13 Al 3s²3p¹ 26.98	14 Si 3s²3p² 28.09	15 P 3s²3p³ 30.97	16 S 3s²3p⁴ 32.07	17 Cl 3s²3p⁵ 35.45	18 Ar 3s²3p⁶ 39.95	M L K
4	19 K 4s¹ 39.01	20 Ca 4s² 40.08	21 Sc 3d¹4s² 44.96	22 Ti 3d²4s² 47.87	23 V 3d³4s² 50.94	24 Cr 3d⁵4s¹ 52.00	25 Mn 3d⁵4s² 54.94	26 Fe 3d⁶4s² 55.85	27 Co 3d⁷4s² 58.93	28 Ni 3d⁸4s² 58.69	29 Cu 3d¹⁰4s¹ 63.55	30 Zn 3d¹⁰4s² 65.39	31 Ga 4s²4p¹ 69.72	32 Ge 4s²4p² 72.61	33 As 4s²4p³ 74.92	34 Se 4s²4p⁴ 78.96	35 Br 4s²4p⁵ 79.90	36 Kr 4s²4p⁶ 83.80	N M L K
5	37 Rb 5s¹ 85.47	38 Sr 5s² 87.62	39 Y 4d¹5s² 88.91	40 Zr 4d²5s² 91.22	41 Nb 4d⁴5s¹ 92.91	42 Mo 4d⁵5s¹ 95.94	43 Tc 4d⁵5s² [98]	44 Ru 4d⁷5s¹ 101.1	45 Rh 4d⁸5s¹ 102.9	46 Pd 4d¹⁰ 106.4	47 Ag 4d¹⁰5s¹ 107.9	48 Cd 4d¹⁰5s² 112.4	49 In 5s²5p¹ 114.8	50 Sn 5s²5p² 118.7	51 Sb 5s²5p³ 121.8	52 Te 5s²5p⁴ 127.6	53 I 5s²5p⁵ 126.9	54 Xe 5s²5p⁶ 131.3	O N M L K
6	55 Cs 6s¹ 132.9	56 Ba 6s² 137.3	57–71 Ln	72 Hf 5d²6s² 178.5	73 Ta 5d³6s² 180.9	74 W 5d⁴6s² 183.9	75 Re 5d⁵6s² 186.2	76 Os 5d⁶6s² 190.2	77 Ir 5d⁷6s² 192.2	78 Pt 5d⁹6s¹ 195.0	79 Au 5d¹⁰6s¹ 197.0	80 Hg 5d¹⁰6s² 200.6	81 Tl 6s²6p¹ 204.4	82 Pb 6s²6p² 207.2	83 Bi 6s²6p³ 209.0	84 Po 6s²6p⁴ [210.0]	85 At 6s²6p⁵ [210.0]	86 Rn 6s²6p⁶ [222.0]	P O N M L K
7	87 Fr 7s¹ [223.0]	88 Ra 7s² 226.0	89–103 An	104 Rf 6d²7s² [261]	105 Db 6d³7s² [262]	106 Sg 6d⁴7s² [263]	107 Bh 6d⁵7s² [262]	108 Hs 6d⁶7s² [265]	109 Mt 6d⁷7s² [266]										

Atomic Number — 1 H — Element Symbol; Arrangment of extranuclear electrons — 1s¹ — 1.008 — Atomic Weight

Metal　Non-metal　Rare gases　Transition　Amphoteric

本試題兩面印刷

試題完