

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.

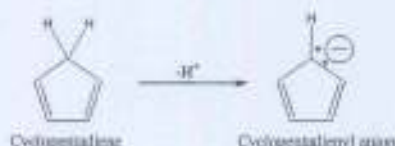
2008

The table of atomic masses is on page 6.

2 pts each

- 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⁻)]
- 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.
- 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.
- 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 .

- What is the name of this functional group, ? A. Amide. B. Carboxylic acid. C. Ester. D. Alcohol.
- 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.
- 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.



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- 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.
- 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.
- 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.
- 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^- .
- 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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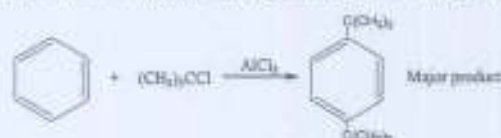
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13. Why does the reaction occur as the one shown below? A. $(\text{CH}_3)_3\text{C}-$ is an electro-withdrawing group, B. $(\text{CH}_3)_3\text{C}-$ is an *ortho*- and *para*-directed substituent, C. AlCl_3 is an acid, D. benzene ring is too reactive.



14. $\text{R}-\text{C}\equiv\text{C}-\text{R} \xrightarrow[\text{(syn addition)}]{\text{H}_2, \text{Pd/CaCO}_3, \text{(Lindlar's catalyst)}}$ 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, $\xrightarrow[\text{(2) Zn/HOAc}]{\text{(1) O}_3, \text{CH}_2\text{Cl}_2, -78^\circ\text{C}}$ Acetone + ? A. B. C. D. All of the above.

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



- What is this compound? A. $\text{ClCH}_2\text{CO}_2\text{CH}_2\text{CH}_3$. B. $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$. C. CH_3OH . D. $\text{C}_2\text{H}_5\text{Cl}$.
19. A compound is an isomer of $\text{C}_5\text{H}_{11}\text{Br}$. What is its structure?



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

- (1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3 \rightarrow \text{CH}_3^\bullet + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2^\bullet$
- (2) $\text{CH}_3^\bullet + \text{CH}_3^\bullet \rightarrow \text{CH}_3\text{CH}_3$
- (3) $\text{CH}_3\text{CH}_2^\bullet + \text{CH}_3\text{CH}_2^\bullet \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- (4) $\text{CH}_3^\bullet + \text{CH}_3\text{CH}_2^\bullet \rightarrow \text{CH}_3\text{CH}_2\text{CH}_3$

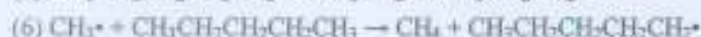
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For which of these reactions would you expect E_{act} to equal zero? A. 3,5,6. B. 1,2,3. C. 2,3,4. D. 3,4,1.

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 ΔH° ? A. 1,5. B. 2,4. C. 3,6. D. 2,5.

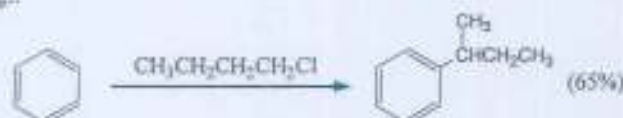
23. A tertiary radical, $\text{R}-\text{C}(\text{R})_2\cdot$, and a secondary radical, $\text{R}-\text{C}(\text{R})\cdot$, which is more stable? A. Tertiary. B. Secondary. C. They have the same stability. D. None of the above.

24. For a 2° alkyl halide, an $\text{S}_{\text{N}}2$ reaction can occur only with A. Strong bases such as F^- . B. Weak bases such as F^- . C. Strong acid such as HI . D. Weak acid such as HF .

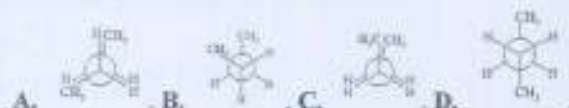
25. At room temperature, for a 3° alkyl halide, $\text{S}_{\text{N}}1$ and $\text{E}1$ reaction, which is more predominant? A. $\text{S}_{\text{N}}1$. B. $\text{E}1$. C. All of the above. D. None of the above.

26. The pK_{a} of acetylene, $\text{H}-\text{C}\equiv\text{C}-\text{H}$, 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 $\text{CH}_2(\text{CH}_2)_3\text{Cl}$, C. monosubstituent always leads to a rearrangement of carbocation, D. alkyl halide is always unreactive toward a benzene ring.

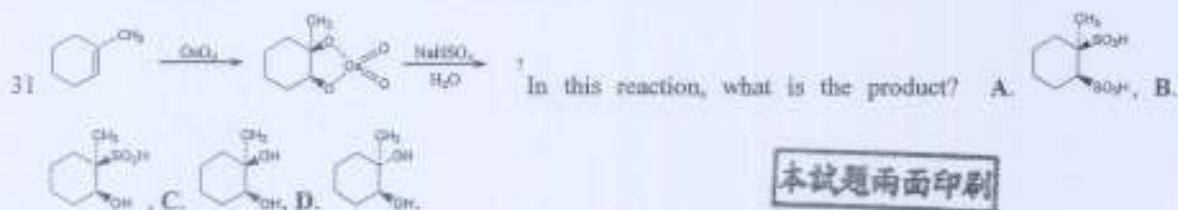


28. Which of the following conformations is called a Gauche form?

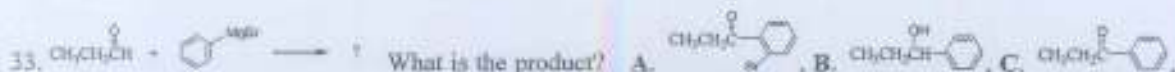


29. Why does cyclopropane, , have such a large ring strain? A. Its bond angle is 60° . B. All the C-H bonds are in eclipsed-form. C. All of the above. D. None of the above.

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



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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.

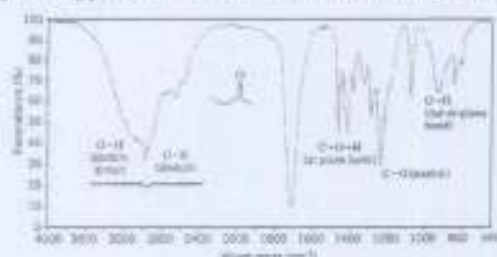
35. Please use VSEPR theory to predict the geometry of $:CCl_3^-$. A. Tetrahedral. B. Trigonal pyramidal. C. Linear. D. Square planar.

36. H2C=CH2 $\xrightarrow[AgCl]{O_3}$ What is the product? A. HOCH2CH2OH, B. CH3CHO, C. CH3COCH3, D. CH3COOH.

37. What is the name of this functional group, $-C\equiv N$? A. Alcohol. B. Aldehyde. C. Nitrile. D. Ketone.

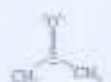
38. c1ccccc1[O-] + CH3I $\xrightarrow[\text{Solvent}]{\text{THF}}$ What is the product? A. c1ccccc1OC, B. c1ccccc1OC(=O)C, C. c1ccccc1OC(=O)C, D. c1ccccc1O.

39. What is the functional group that appears at $\sim 1,700\text{ cm}^{-1}$? 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. H2O. B. CH3COCH3. C. (CH3)3SiOH. D. (CH3)3SiCH3.



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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.



43. CH3COCH3 + RNH2 <=> ? an imine. What is the product, "?"? A. CH3C(=NR)CH3, B. CH3C(OH)CH3, C. CH3C(=O)CH3, D. CH3C(=O)NR.

44. Which of the following compound is a hemiacetal? A. CH3CH(OH)CH3, B. CH3CH(OR)CH3, C. CH3CH(OH)CH2OR, D. CH3CH(OR)CH2OR.


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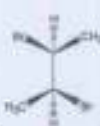

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(第五頁共六頁)(限用答案本作答)

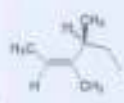
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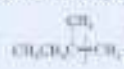
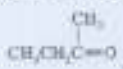
45. Why does this compound, , melt at 100.7°C, while it boils at 106.3°C? A. It has a high molecular weight. B. It has too many carbon atoms. C. It is highly branched. D. It contains no chloride atoms.

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,4R)-3,4-Dimethyl-1-hexene. B. (E,4R)-3,4-Dimethyl-2-pentene. C. (E,4S)-3-methyl-2-hexene. D. (Z,4S)-3,4-Dimethyl-2-hexene.

50. What is (are) the product(s) for the following reaction,  $\xrightarrow[\text{(2) } H_2O]{\text{(1) } KMnO_4, OH^-}$? A.  B. CO_2 C. H_2O D. All of the above.

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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																		O	N															
1	1 H 1.008											2 He 4.003																						
2	3 Li 6.941	4 Be 9.012	<div>Alkali Metals</div> <div>Alkaline Earth Metals</div> <div>Transition Metals</div> <div>Non-metals</div> <div>Halogens</div> <div>Noble Gases</div>										5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 18.99	10 Ne 20.18																
3	11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95																
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80																
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc [98]	44 Ru 101.1	45 Rh 101.1	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3																
6	55 Cs 132.9	56 Ba 137.3	57 La [139]	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm [145]	62 Sm 150.4	63 Eu 152.1	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.1	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po [209]	85 At [210]	86 Rn [222]		
7	87 Fr [223]	88 Ra [226]	89 Ac [227]	90 Th [232]	91 Pa [231]	92 U [238]	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]	103 Lr [262]	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [277]	109 Mt [268]	110 Ds [271]	111 Rg [272]	112 Cn [285]	113 Nh [286]	114 Fl [289]	115 Mc [290]	116 Lv [293]	117 Ts [294]	118 Og [294]		

試題完