銘傳大學 98 學年度研究所碩士班招生考試

生物科技學系碩士班

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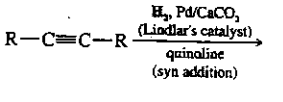
第二節　　有機化學

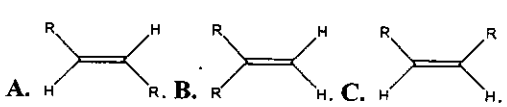
有機化學試題

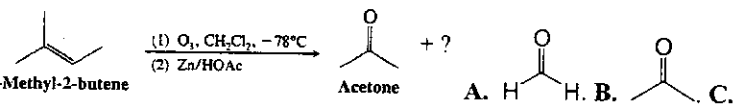
Graduate School Entrance Exam for Organic Chemistry in the Department of Biotechnology　　2009

Please feel free to use your calculator. (可以使用計算機)　　**The table of atomic masses is on page 5.**

Multiple Choices　　2 pts each

1. 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.
2. A tertiary carbocation (R_3C^+) is more stable than any one of other degrees. This is mainly due to the effect of **A.** Anchimeric assistance. **B.** Racemization. **C.** Hyperconjugation. **D.** Isomerization.
3. The two CONFORMATIONS of a molecule can be interconverted by **A.** Isomerization. **B.** Temperature elevation. **C.** Isolation. **D.** Rotation of single bonds.
4. A racemic mixture contains two **A.** Enantiomers. **B.** Diastereomers. **C.** Polymers. **D.** Isomers. of 1:1 ratio.
5. 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.
6. 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.
7. 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^-.
8. 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.
9. For an S_N1 reaction, which one of the following descriptions is correct? **A.** The first step requires heterolytic cleavage of the carbon-halide bond. **B.** That departure of the halide takes place at all is largely because of the ionizing ability of the solvent, water. **C.** Water molecules surround and stabilize the cation and anion that are produced. **D.** All of the above.
10. 



D. All of the above.
11. 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.
12. 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.
13. In this reaction, ozonolysis, 

 . **D.** All of the above.
14. A 300-MHz NMR spectrum is shown below:

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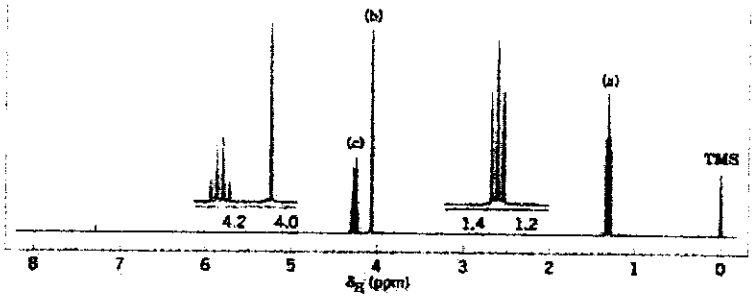
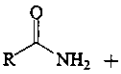


What is this compound? **A.** $ClCH_2CO_2CH_2CH_3$. **B.** $C_2H_5OC_2H_5$. **C.** CH_3OH. **D.** C_2H_5Cl.

15. In Hoffmann degradation,  $+ Br_2 + 4\ NaOH \rightarrow 2NaBr + Na_2CO_3 + 2H_2O +$ **A.** R-Br. **B.** R-COCl. **C.** R-NH_2. **D.** R-CH_3.

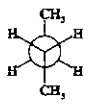
16. A tertiary radical,  , and a secondary radical,  , which is more stable? **A.** Tertiary. **B.** Secondary. **C.** They have the same stability. **D.** None of the above.

17. 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.

18. 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.

19. The pKa of acetic acid, CH_3CO_2H, is 4.75, while the pKa of $ClCH_2CO_2H$ is 2.86 (*i.e.*, more acidic). This is due to the effect of **A.** Resonance effect. **B.** Steric effect. **C.** Inductive effect. **D.** Neighboring effect.

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

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

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21. 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.

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

23. In a reaction where bond breaking and formation occur simultaneously, this reaction is called **A.** Oxidative reaction. **B.** Reductive reaction. **C.** Element reaction. **D.** Concerted reaction.

24. 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.

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

26. For a decyl alcohol, the portion marked by * is called **A.** Hydrophilic portion. **B.** Hydrophobic portion. **C.**

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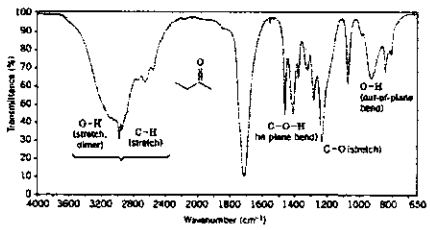
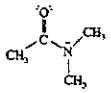
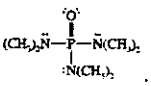
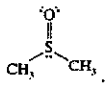
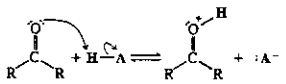
All of the above. **D.** None of the above.

Decyl alcohol

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



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

29. 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. 

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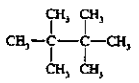
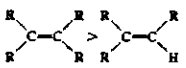
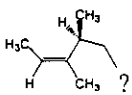
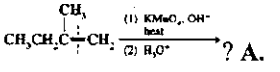
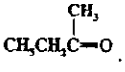
30. What is the name of this compound,  ? **A.** 5-chloro-4-methyl-23-cyclohexene-1-ol. **B.** 2-chloro-3-methyl-3-cyclohexene-1-ol. **C.** 6-chloro-2-methyl-3-cyclohexene-6-ol. **D.** 2-chloro-6-methyl-3-cyclohexene-4-ol.

31. 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.

32. The relative stability is  . This is because $R_2C{=}CR_2$ is **A.** a molecule with higher molecular weight. **B.** a molecule with more polarizability. **C.** more substituted. **D.** electrophilic.

33. 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.

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

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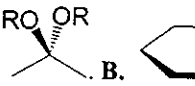
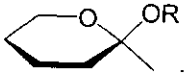
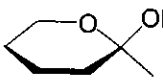
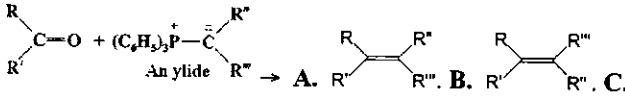
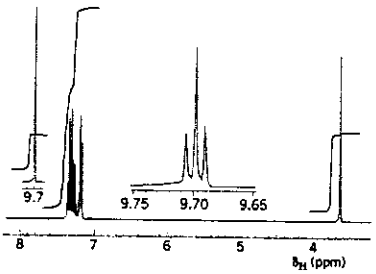
35. For a thermodynamic-control reaction, which one of the following descriptions is correct? **A.** It depends on the rate of a reaction. **B.** It depends on the stabilities of the products. **C.** All of the above. **D.** None of the above.

36. Which one of the following organic compounds is a hemiacetal? **A.**  **B.**  **C.**  **D.** 

37.  **A.** **B.** **C.** All of the above. **D.** None of the above.

38. In the ^{1}H-NMR spectrum shown below, what is the proton that appears at the δ = 9.7ppm? **A.** A hydrocarbon hydrogen. **B.** An alkene hydrogen. **C.** An aromatic hydrogen. **D.** An aldehyde hydrogen.



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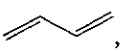
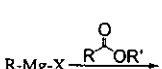
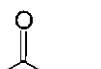
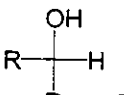
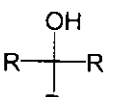
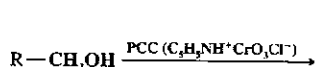
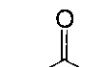
39. Cyclopentadiene,  , is very acidic (pK_a = 16), compared to other hydrocarbon species. This is because **A.** its conjugate base is cyclopentadienyl anion, an aromatic compound. **B.** it has six hydrogens attached to the same ring. **C.** it is a five-membered ring. **D.** All of the above.

40. [10]Annulene,  , is NOT an aromatic compound, albeit it has 10 π electrons. This is because **A.** it does not contain 4n+2 π electrons. **B.** it is not cyclic. **C.** it is not planar. **D.** it does not have a closed ring system.

41. Why does the maximum absorption (λ_{max}) of 1,3-butadiene,  , occur at 217 nm (*i.e.*, lower energy), while the λ_{max} of 1,4-pentadiene,  , is 178 nm? **A.** 1,4-pentadiene has more carbons. **B.** 1,3-butadiene is a more symmetric molecule. **C.** 1,4-pentadiene is aromatic. **D.** 1,3-butadiene contains conjugated diene.

42.  (where X = Cl, Br, or I) **A.**  **B.**  **C.**  **D.** 

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

44. In an acid-catalyzed ring opening reaction like the one shown below, why does the reaction occur at the more substituted carbon? **A.** This reaction is kinetic control. **B.** This reaction is under thermodynamic control. **C.** This carbon is 3° and therefore it may accumulate more partial positive charge. **D.** This reaction can be faster under normal conditions.

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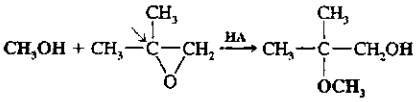


45. $C_6H_5CH_2OH + PBr_3 \rightarrow$ **A.** C_6H_5Br. **B.** $C_6H_5CH_2OBr$. **C.** $C_6H_5CH_2Br$. **D.** $C_6H_5CO_2H$.

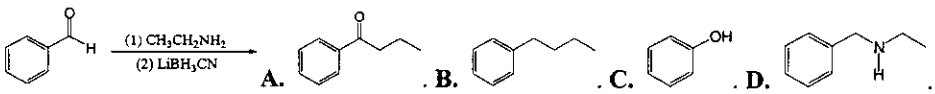
46. The interconversion between an enol isomer and a keto isomer is called **A.** Polarizatioin. **B.** Polymerization. **C.** Isomerization. **D.** Tautomerization.

47. In acetone, the keto form,  , and the enol form,  , which one is more predominant under normal conditions? **A.** The keto form. **B.** The enol form. **C.** It depends on the conditions. **D.** None of the above.

48. What starting compound would you use in an aldol cyclization to prepare this compound,  ? **A.**  .

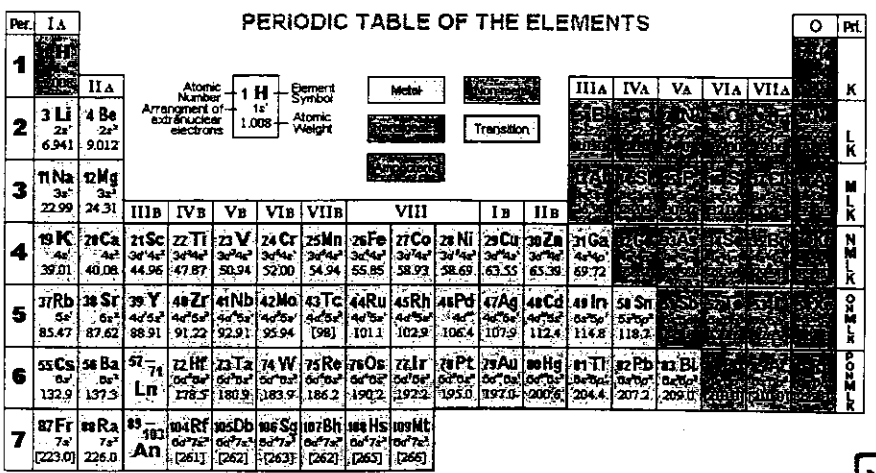
B.  . **C.**  . **D.**  .

49. $C_6H_5CH{=}CHCOC_6H_5 + CN^-$ (a weak nucleophile)→ **A.** $C_6H_5CH(CN)\text{-}CH_2COC_6H_5$. **B.** $C_6H_5CH{=}CHCOCN$. **C.** $C_6H_5CH_2\text{-}CHCNCOC_6H_5$. **D.** None of the above.

50. 

Answers: 請依下列格式書寫至答案本

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.____



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