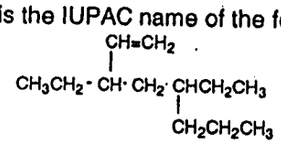
一. 單選題 (80%) 注意: 1. 每題2分, 每答錯一題倒扣0.5分
2. 答案請依序寫在答案紙的答案格上

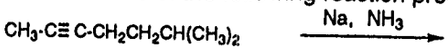
1. What is the IUPAC name of the following compound?



1. 3-ethyl-5-propyl-1-heptene
2. 5-ethyl-3-vinyloctane
3. 4,6-diethyl-1-octene
4. 3,5-diethyl-1-octene

2. Which of the following is ethyl 4-(dimethylamino)butanoate?
1. $(CH_3NH)_2CHCH_2CH_2CO_2CH_2CH_3$
2. $NH_3CH_2C(CH_3)_2CH_2CO_2CH_2CH_3$
3. $(CH_3)_2C(NH_2)CH_2CH_2CO_2CH_2CH_3$
4. $(CH_3)_2NCH_2CH_2CH_2CO_2CH_2CH_3$

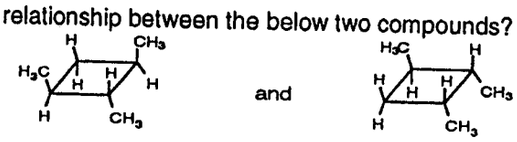
3. The correct IUPAC name of the following reaction product is:



1. *cis*-2-methyl-5-heptene
2. *trans*-2-methyl-5-heptene
3. *cis*-6-methyl-2-heptene
4. *trans*-6-methyl-2-heptene

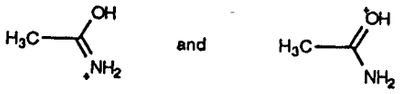
4. The heats of combustion ($-\Delta H°$) of heptane and 3,3-dimethylpentane are 4817 and 4809 kJ/mol, respectively. Which statement is true?
1. Heptane is 8 kJ/mol more stable than 3,3-dimethylpentane.
2. 3,3-Dimethylpentane is 8 kJ/mol more stable than heptane.
3. Stabilities cannot be compared since they are not isomers.
4. Stabilites cannot be compared since they give different combustion products.

5. What is the relationship between the below two compounds?



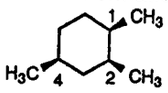
1. identical
2. enantiomers
3. diastereomers
4. constitutional isomers

6. What is the relationship between the below two structures?



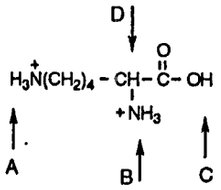
1. resonance forms
2. stereoisomers
3. conformational isomer
4. tautomers

7. The most stable conformation of the compound shown has:



1. all methyl groups equatorial
2. equatorial methyl groups at C–1 and C–2, axial at C–4
3. equatorial methyl groups at C–1 and C–4, axial at C–2
4. equatorial methyl groups at C–2 and C–4, axial at C–1

8. In strongly acidic solution the amino acid lysine exists as the dication. As the pH is raised, which proton is lost to form the monocation?



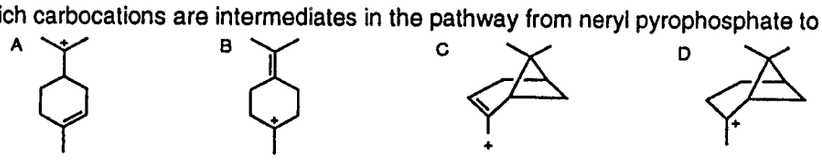
1. A 2. B 3. C 4. D

9. Which of the following does **NOT** correctly describe S_N2 reactions?
   1. Tertiary halides react faster than secondary halides.
   2. Rate of reaction depends on the alkyl halide and nucleophile concentrations.
   3. Substitution occurs with inversion of the tetrahedral arrangement of bonds.
   4. The transition state species can be described as a pentavalent carbon.

10. Which of the following is most reactive to potassium methoxide ($KOCH_3$) in methanol?
    1. fluorobenzene 2. m-fluoronitrobenzene 3. p -fluoronitrobenzene 4. p-dinitrobenzene

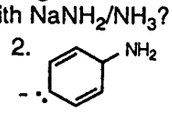
11.

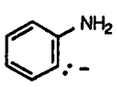
Which carbocations are intermediates in the pathway from neryl pyrophosphate to α-pinene?



1. A and C 2. A and D 3. B and C 4. B and D

12. Which of the following is not an intermediate in the nucleophilic substitution reaction of chlorobenzene with $NaNH_2/NH_3$?

1. 
2. 

3. 

4. They are all intermediates

13. Which of the following gives predominate 1,4 addition when it reacts with an α,β-unsaturated ketone or aldehyde?
    1. CH_3MgBr 2. CH_3Li 3. $LiAlH_4$ 4. $LiCu(CH_3)_2$

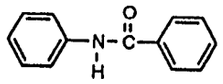
14. Which reaction below is mechanistically similar to the Baeyer-Villiger oxidation of ketones in that an alkyl group migrates to an oxygen as the weak oxygen-oxygen single bond broken?
    1. Reaction of alkenes with peroxyacetic acid
    2. Reaction of organoboranes with hydrogen peroxide and base
    3. Reaction of vicinal diols with periodic acid
    4. Reaction of alcohols with chromic acid

15. Which of the following are true about the intermediate cyclohexadienyl anion in the addition-elimination mechanism?
    A. The intermediate is aromatic
    B. All six carbons in the ring are sp^2 hydridization
    C. The negative charge is resonance stabilized
    D. Electron-withdrawing groups stailize the intermediate

    1. A and B 2. B and D 3. A and D 4. C and D

16. Which of the following would be the best method to make m-bromoethylbenzene from benzene?
1. (1) benzene + $CH_3CH_2Cl/AlCl_3$ (2) Br_2/Fe
2. (1) benzene + Br_2/Fe (2) $CH_3CH_2Cl/AlCl_3$
3. (1) benzene + $CH_3COCl/AlCl_3$ (2) Zn(Hg), HCl (3) Br_2/Fe
4. (1) benzene + $CH_3COCl/AlCl_3$ (2) Br_2/Fe (3) Zn(Hg), HCl

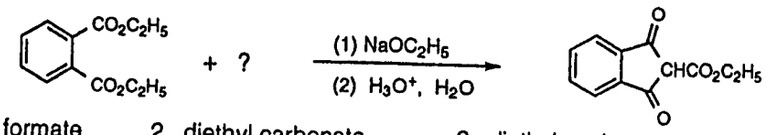
17. Where would the compound shown below undergo nitration by HNO_3/H_2SO_4?



ring 1 ring 2

1. ortho/para positions on ring 1
2. meta position on ring 1
3. ortho/para position on ring 2
4. meta position on ring 2

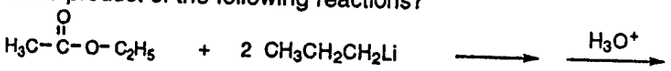
18. Identify the missing reagent in the below.



1. ethyl formate 2. diethyl carbonate 3. diethyl oxalate 4. ethyl acetate

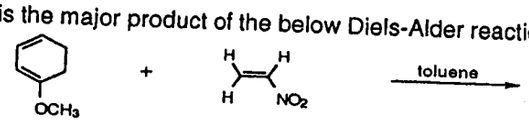
19. A cycloalkene has the formula C_6H_{10}. Which of the following cycloalkenes would give a pair of diastereomers upon epoxidation with peroxyacetic acid?
1. cyclohexene
2. 4-methylcyclopentene
3. 1-methylcyclopentene
4. 3,3-dimethylcyclobutene

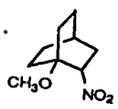
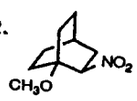
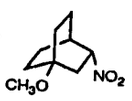
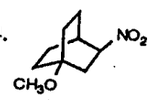
20. What is the product of the following reactions?



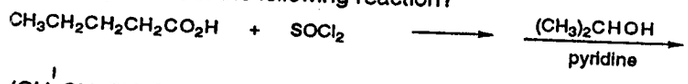
1. $CH_3COCH_2CH_2CH_3$
2. $CH_3CH(OH)CH_2CH_2CH_3$
3. $CH_3C(OH)(CH_2CH_2CH_3)_2$
4. $CH_3CH_2C(OH)(CH_2CH_2CH_3)_2$

21. What is the major product of the below Diels-Alder reaction?



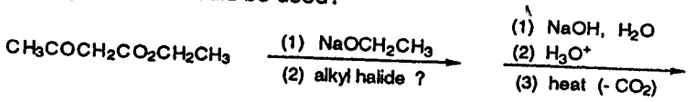
1. 
2. 
3. 
4. 

22. What is the product of the following reaction?



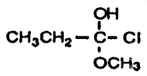
1. $(CH_3CH_2CH_2CH_2CO)_2O$
2. $CH_3CH_2CH_2CH_2COCH(CH_3)_2$
3. $(CH_3)2CHCO_2CH_2CH_2CH_2CH_3$
4. $CH_3CH_2CH_2CH_2CO_2CH(CH_3)_2$

23. If one wishes to prepare 5-methyl-2-hexanone using the acetoacetic ester synthesis, which of the following alkyl halides would be used?



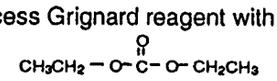
1. $(CH_3)_2CHBr$ 2. $(CH_3)_2CHCH_2Br$ 3. $(CH_3)_2CHCH_2CH_2Br$ 4. $CH_3CH_2CHBrCH_3$

24. The following tetrahedral intermediate will decompose to give:



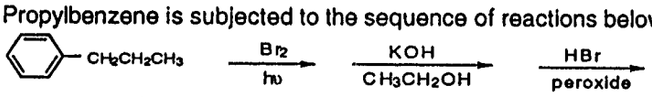
1. propanoyl chloride + CH_3OH
2. propanoic acid and CH_3Cl
3. propanal and HCl
4. methyl propanoate and HCl

25. Reaction of excess Grignard reagent with the following gives a :



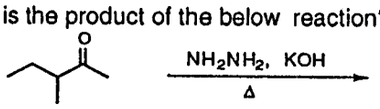
1. ketone
2. tertiary alcohol
3. secondary alcohol
4. ester

26. Propylbenzene is subjected to the sequence of reactions below. What is the final product?



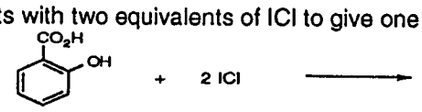
1. C_6H_5-$CH_2CH_2CH_2Br$
2. C_6H_5-$CHBrCH_2CH_3$
3. C_6H_5-$CH_2CHBrCH_3$
4. C_6H_5-$CHBrCH_2CH_2Br$

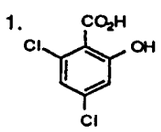
27. What is the product of the below reaction?

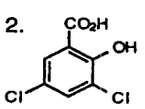


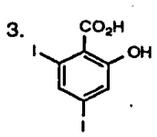
1. 3-methylpentane
2. 3-methyl-2-pentanol
3. 3-methyl-2-pentene
4. 3-methyl-1-pentyne

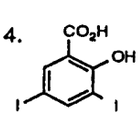
28. Salicylic acid reacts with two equivalents of ICl to give one of the products below. Which one is it?



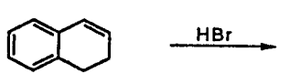
1. 

2. 

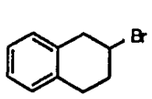
3. 

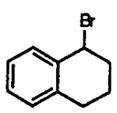
4. 

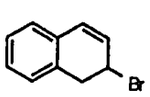
29.



Predict the product(s) of the reaction.

1. 

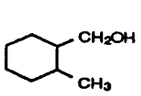
2. 

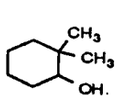
3. 

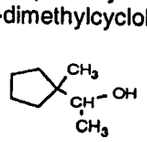
4. about equal amounts of 1 and 2

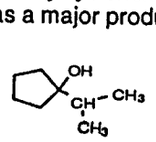
30. What is the product of the reaction of butanal with excess methanol and a trace of acid catalyst?
1. $CH_3CH_2CH(OCH_3)CHO$
2. $CH_3CH_2CH_2CH_2OCH_3$
3. $CH_3CH_2CH_2CO_2CH_3$
4. $CH_3CH_2CH_2CH(OCH_3)_2$

31. Acid treatment of all the alcohols shown below except one yields 1,2-dimethylcyclohexene as a major product. Which alcohol will **NOT** yield 1,2-dimethylcyclohexene as a major product?

1. 

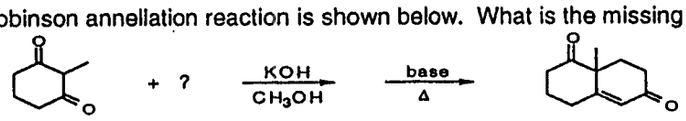
2. 

3. 

4. 

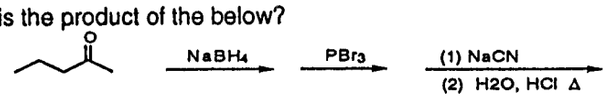
32. Compound **A**, $C_6H_{12}O_2$, was found to be optically active. Compound **A** was slowly oxidized to an optically active carboxylic acid **B**, $C_6H_{12}O_3$, by $Ag(NH_3)_2^+$. With HNO_3, compound **A** was oxidized to an achiral dicarboxylic acid **C**. Which of the following statement is true?
1. Compound **A** is an aldehyde containing a terminal hydroxyl group
2. In compound **B**, there is a methyl substituent on C-2
3. Compound **A** can convert into an optically active compound with $NaBH_4$
4. The specific rotation ($[\alpha]$) of compound **C** is not equal to zero

33. The Robinson annellation reaction is shown below. What is the missing material in the first step?



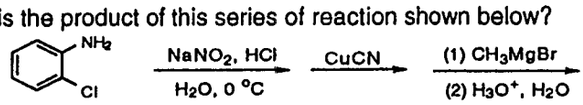
1. CH_2=CHCOCH$_3$ 2. CH_3CH=CHCHO 3. CH_2=CHCH$_2$CHO 4. $CH_3COCH_2CH_3$

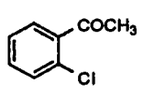
34. What is the product of the below?

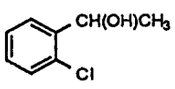


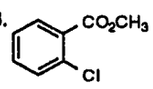
1. 2-methyl-1-pentanol
2. 2-bromo-3-methylpentanoic acid
3. 2-methylpentanoic acid
4. 4-hydroxyhexanoic acid

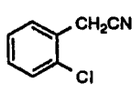
35. What is the product of this series of reaction shown below?



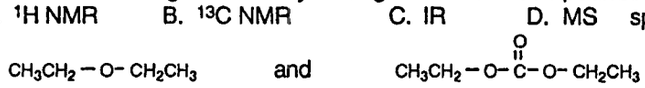
1. 

2. 

3. 

4. 

36. Which of the following could easily distinguish the two compounds shown below?
A. ^{1}H NMR B. ^{13}C NMR C. IR D. MS spectrum



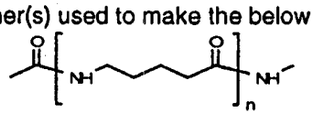
1. A and B 2. B and C 3. B, C and D 4. A, C and D

37. A compound, C_9H_{12}, gave a C-13 NMR spectrum (broadband decoupling) with 3 peaks. Which compound below would give such a spectrum?
1. 1,2,3-trimethylbenzene
2. 1,2,4-trimethylbenzene
3. 1,3,5-trimethylbenzene
4. isopropylbenzene

38. A compound has a composition of $C_{10}H_{12}O_2$ and gives the following NMR and IR data. Which compound below best fits these data?
^{1}H NMR δ 1.2(t, 3H), 2.3 (q, 2H), 4.5 (s, 2H), 7.3 (m, 5H) ; IR 1735 cm^{-1}

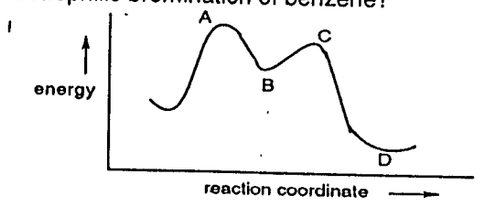
1. $C_6H_5CO_2CH_2CH_2CH_3$
2. $C_6H_5CH_2CO_2CH_2CH_3$
3. $CH_3CH_2CO_2CH_2C_6H_5$
4. $CH_3CH_2CH_2CO_2C_6H_5$

39. Identify the monomer(s) used to make the below polymer.



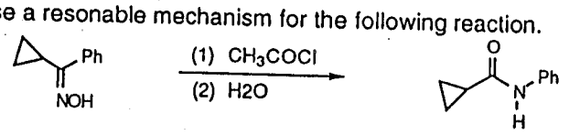
1. $H_2NCH_2CH_2CH_2CH_2CO_2H$
2. $H_2NCH_2CH_2CH_2CH_2NH_2$ and $HO_2CCH_2CH_2CH_2CH_2CO_2H$
3. $HOCH_2CH_2CH_2CH_2CONH_2$
4. $H_2NCH_2CH_2CH_2CH_2NH_2$ and $HO_2CCH_2CO_2H$

40. Which point on the reaction coordinate corresponds to the species shown to the right for the electrophilic bromination of benzene?

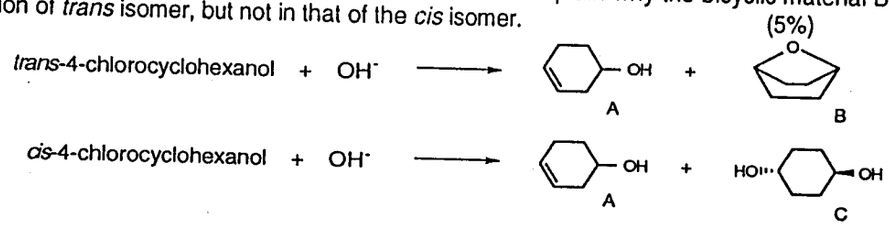


1. A 2. B 3. C 4. D

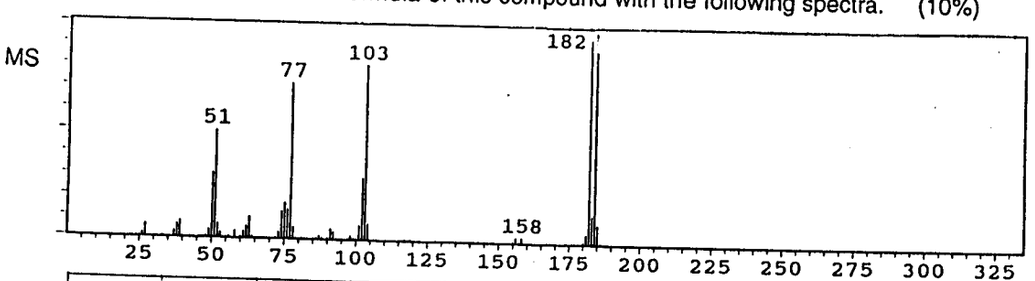
二. Propose a resonable mechanism for the following reaction. (5%)

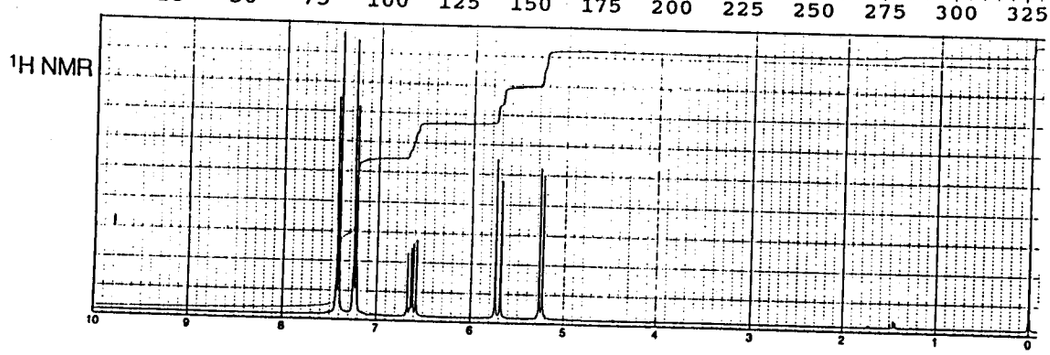


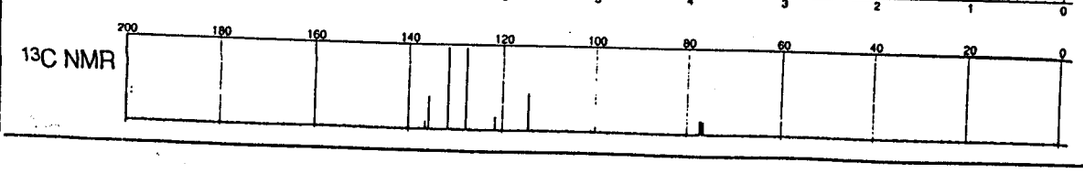
三. The *cis* and *trans* stereoisomers of 4-chlorocyclohexanol give different products when they react with OH^-. Give the mechanism for the formation of product C and explain why the bicyclic material B is observed in the reaction of *trans* isomer, but not in that of the *cis* isomer. (5%)



四. A compound contains 52.46% of C, 3.83% of H and one other atom. Deduce the molecular formula, molecular weight and structural formula of this compound with the following spectra. (10%)







化學研究所 有機化学 (一)單選題请依此樣式作答 (附張)

一.

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.___

** 此為樣張. 請在答案卷作答 **