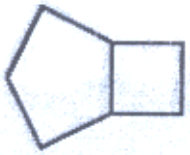
1-50 (2 points for each)

1. What is the name of the compound shown?



A. Bicyclo[4.1.0]heptane
B. Bicyclo[3.1.1]heptane
C. Bicyclo[3.2.0]heptane
D. Bicyclo[2.2.1]heptane

2. Which of the alkenes shown has the greatest heat of combustion?

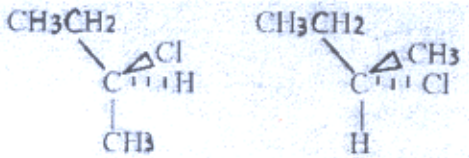
A. $CH_2{=}CHCH_2CH_2CH_3$ B. $(CH_3)_2C{=}CHCH_3$

C. CH_3 H
\ /
C=C
/ \
H CH_2CH_3

D. CH_3 CH_2CH_3
\ /
C=C
/ \
H H

3. Which of the following nucleophiles is the most reactive?
A. CH_3COOH
B. CH_3COO^-
C. CH_3OH
D. CH_3O^-

4. What is the relationship between the compounds shown?



A. Same compound
B. Enantiomers
C. Diastereomers
D. Structural isomers

5. Which of the following reactions yields $(CH_3)_3CCl$?

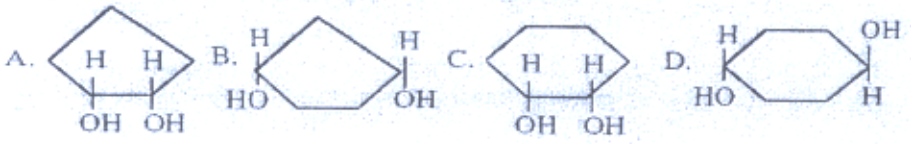
A. $(CH_3)_3COH + HCl \longrightarrow$

B. $(CH_3)_2C{=}CH_2 + Cl_2 \xrightarrow{CCl_4}$

C. $(CH_3)_2CHCH_2OH + SOCl_2 \longrightarrow$

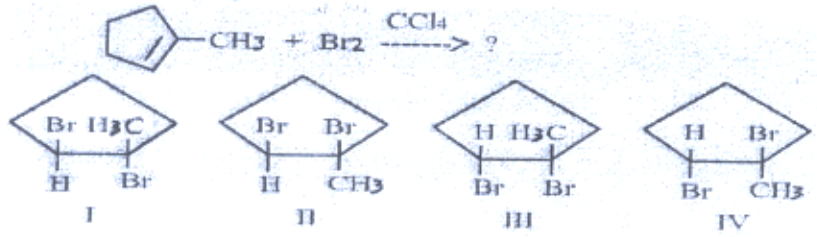
D. $(CH_3)_3CH + Cl_2 \xrightarrow{CCl_4}$

6. Which of the following is NOT a meso compound?



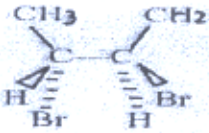
(背面仍有題目,請繼續作答)

7. What are the major products of the reaction shown?



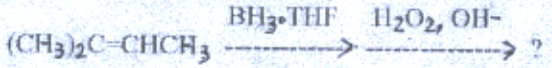
A. I and III B. I and IV C. II and III D. II and IV

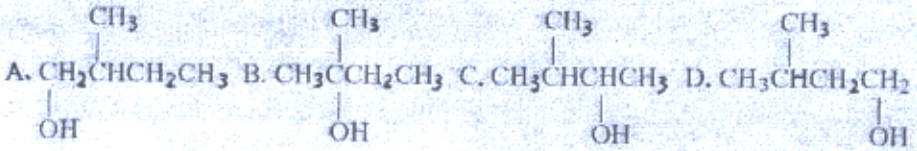
8. What is the configuration of the molecule shown?



A. 2S, 3S B. 2S, 3R C. 2R, 3S D. 2R, 3R

9. What is the major organic product of the reaction shown?

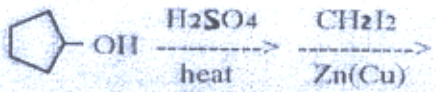


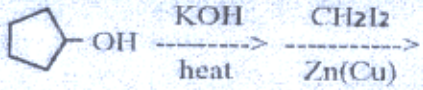


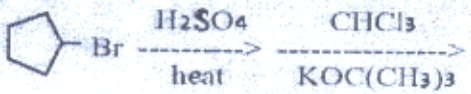
10. Which of the following solutions can be used in a test to distinguish between the compounds $CH_2=CHCH_2CH_3$ and $CH_2=CHCH_2CH_2Br$?

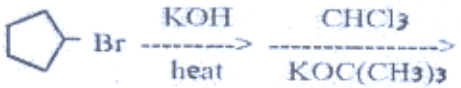
A. conc. H_2SO_4
B. Br_2/CCl_4
C. $AgNO_3$/ethanol
D. $KMnO_4/H_2O$

11. Which of the following sequences can be used to make

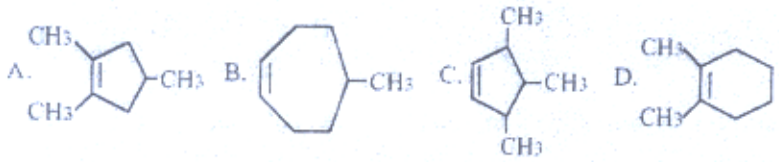
A. 

B. 

C. 

D. 

12. An unknown alkene was subjected to ozonolysis, and the product of the reaction was the compound shown. What is the structure of the unknown?



13. Which of the following sequences gives cyclohexane from cyclohexanol?

A. KOH, alcohol, heat; then Zn, HCl
B. Zn, HCl; then H_2, Pd
C. H_2, Ni; then H_2SO_4, heat
D. H_2SO_4, heat; then H_2, Pt

14. What are the bases in the reaction shown?

A. I and III B. I and IV C. II and III D. II and IV

15. Which of the SN2 reactions below is the FASTEST?

A. $CH_3Br + HC{\equiv}C^- \rightarrow CH_3C{\equiv}CH + Br^-$
B. $CH_3Br + HC{\equiv}CH \rightarrow CH_3C{\equiv}CH + HBr$
C. $CH_3CH_2Br + HC{\equiv}C^- \rightarrow CH_3CH_2C{\equiv}CH + Br^-$
D. $CH_3CH_2Br + HC{\equiv}CH \rightarrow CH_3CH_2C{\equiv}CH + HBr$

16. Rate data for the reaction shown is given in the table. What is the mechanism of this reaction?
$CH_3CH_2I + CH_3O^- \rightarrow CH_3CH_2OCH_3 + I^-$

Run no.	$[CH_3CH_2I]$	$[CH_3O^-]$	Rel. Rate
1	0.01	0.01	1
2	0.02	0.01	2
3	0.01	0.02	2

A. SN1
B. SN2
C. E1
D. E2

17. Which of the carbocations shown do NOT rearrange?

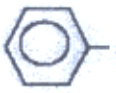
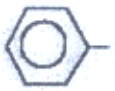
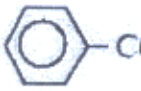
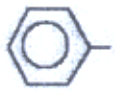
I. $CH_3CH_2CH_2\overset{+}{C}H_2$ II. $CH_3\overset{+}{C}HCH_2CH_3$ III. $(CH_3)_2CH\overset{+}{C}H_2$ IV. $(CH_3)_3\overset{+}{C}$

A. I and III B. I and IV C. II and III D. II and IV

(背面仍有題目,請繼續作答)

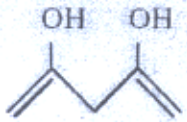
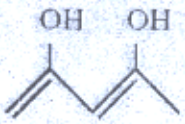
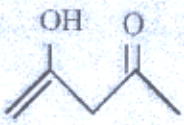
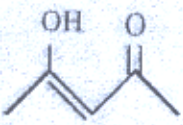
18. Which of the following is the best synthesis of cyclohexene from cyclohexane?
A. KOH, alcohol
B. H_2SO_4, heat
C. Br_2, light; then KOH, alcohol
D. Br_2, light; then H_2SO_4, heat

19. Which of the following compounds is insoluble in both water and 5% HCl, and soluble in both 5% NaOH and 5% $NaHCO_3$?

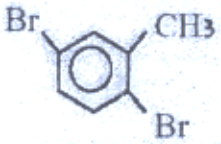
A.  B.  C.  D. 

20. Which of the following is a step in the mechanism of the acid-catalyzed enolization of propanal, CH_3CH_2CHO?
A. $CH_3CH_2CHO + OH^- \rightarrow H_2O + {}^-CH_2CH_2CHO$
B. $CH_3CH_2CHO + H_2O \rightarrow OH^- + CH_3CH_2CHO$
C. $CH_3CH_2CHO + H_2O \rightarrow OH^- + CH_3CH_2CHOH^+$
D. $CH_3CH_2CHO + H_3O^+ \rightarrow H_2O + CH_3CH_2CHOH^+$

21. What is the structure of the most stable enol form of the compound shown?

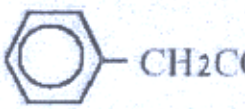
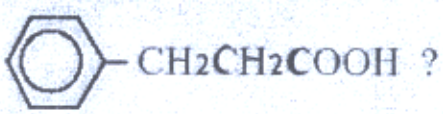
A.  B.  C.  D. 

22. What is the name of the compound shown?



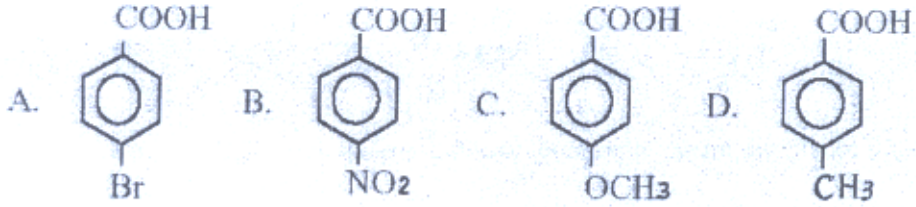
A. 3,6-Dibromo-2-methylbenzene
B. 2,6-Dibromo-1-methylbenzene
C. 3,6-Dibromotoluene
D. 2,5-Dibromotoluene

23. Which of the following reaction sequences can be used to convert

 into  ?

A. $LiAlH_4$, then H_3O+; PBr_3; Mg/ether, CO_2, then H_3O+
B. $SOCl_2$; $(CH_3)_2CuLi$; $LiAlH_4$, then H_3O+
C. $SOCl_2$; then NaCN, then H_3O+/heat
D. $LiAlH_4$, then H_3O+; H_2CrO_4

24. Which of the following compounds is the strongest acid?



25. Which of the following gives benzaldehyde from benzoic acid?

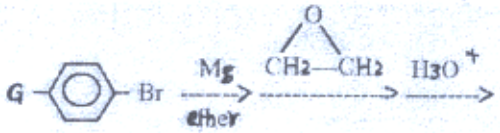
A. $LiAlH_4$

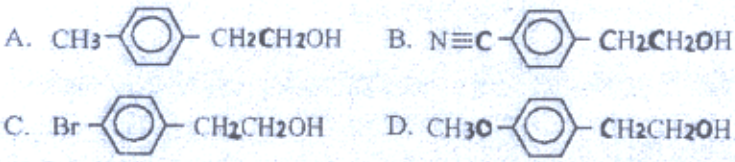
B. PCC (pyridinium chlorochromate)

C. $NaBH_4$, followed by $Na_2Cr_2O_7/H_2SO_4$

D. $SOCl_2$, followed by H_2/Ni_2B

26. Which of the following alcohols cannot be synthesized using the reaction sequence shown?





27. Which of the following reagents can be used to distinguish between 1-pentanol and 2-pentanol?

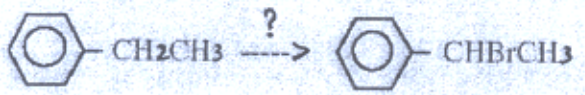
A. $I_2/NaOH$

B. CrO_3/H_2SO_4

C. Br_2/CCl_4

D. Br_2/H_2O

28. Which of the following reagents is used to carry out the transformation shown?



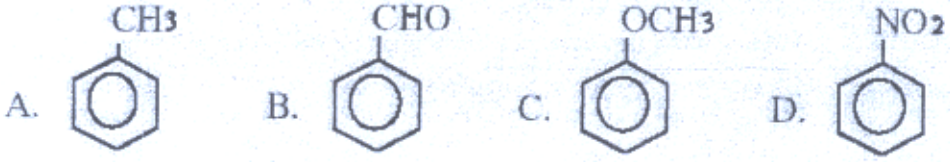
A. $Br_2/FeBr_3$

B. Br_2/light

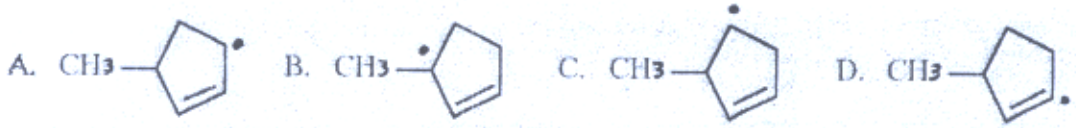
C. Br_2/P

D. Br_2/H_2O

29. Which of the following compounds is the most reactive toward $Br_2/FeBr_3$?



30. Which of the following free radicals is the most stable?



(背面仍有題目,請繼續作答)

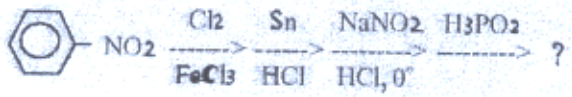
31. What alkene is the major product of the dehydration of $(CH_3)_3C\text{-}CH_2OH$ with concentrated sulfuric acid?

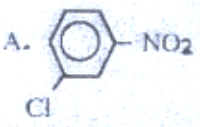
A. 1-Pentene
B. 2-Pentene
C. 2-Methyl-1-butene
D. 2-Methyl-2-butene

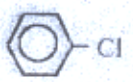
32. Which of the following reagents can be used to distinguish between 1-pentene and 1-pentyne?

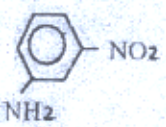
A. Br_2 in CCl_4
B. Cold aqueous $KMnO_4$
C. Chromic acid
D. Silver nitrate in aqueous ammonia

33. What is the product of the reaction sequence shown?



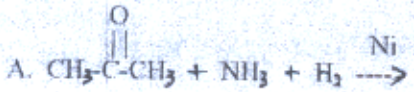
A. 

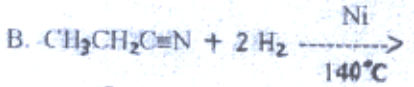
B. 

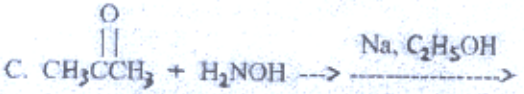
C. 

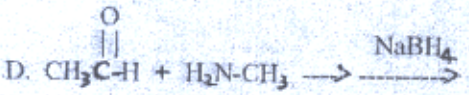
D. 

34. Which of the following processes does not yield a primary amine?

A. 

B. 

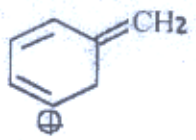
C. 

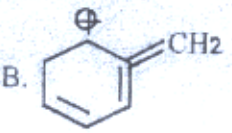
D. 

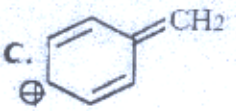
35. How many signals are present in the proton nmr spectrum of the compound shown? (Neglect signal splitting).

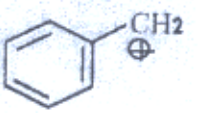
A. 1 B. 2 C. 3 D. 4

36. Which of the following is the most important contributor to the resonance hybrid?

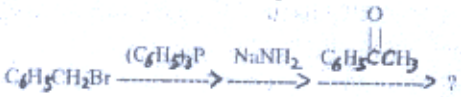
A. 

B. 

C. 

D. 

37. What is the major organic product of the following reaction sequence?



A. $C_6H_5CH-C-CH_3$ (with C_6H_5 below)

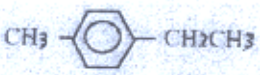
B. $C_6H_5CH_2CH{=}CHC_6H_5$

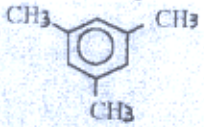
C. $C_6H_5CH{=}CHCC_6H_5$ (O above)

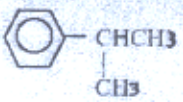
D. $C_6H_5CH_2CC_6H_5$ (O above)

38. An unknown compound having the formula C9H12 gave the following proton nmr spectrum. What is the structure of this unknown?

doublet at 1.25 ppm
septet at 2.90 ppm
multiplet at 7.25 ppm

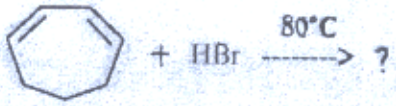
A. 

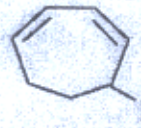
B. 

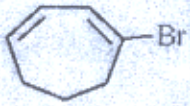
C. 

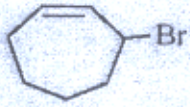
D. 

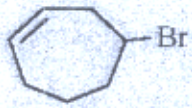
39. What is the major organic product of the reaction shown?



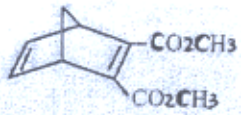
A. 

B. 

C. 

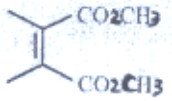
D. 

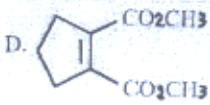
40. What dienophile is used to synthesize the compound shown?



A. $CH_3OC-C{\equiv}C-COCH_3$ (O above each C)

B. $CH_3OC-CH{=}CH-COCH_3$ (O above each C)

C. 

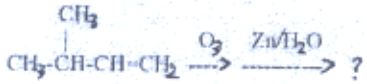
D. 

41. Which of the following compounds is soluble in concentrated H_2SO_4, gives no reaction with either $AgNO_3$/alcohol or $Ag(NH_3)_2$, and rapidly decolorizes Br_2/CCl_4?

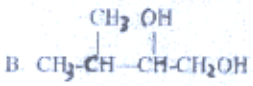
A. $CH_3CH_2CH_2$-Br B. $CH_3C{\equiv}CH$ C. CH_3CHCH_3 (OH below) D. $CH_3C{\equiv}CCH_3$

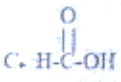
(背面仍有題目,請繼續作答)

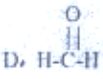
42. Which of the following compounds is a product of the reaction shown?



A. CH_2-CH-OH

B. 

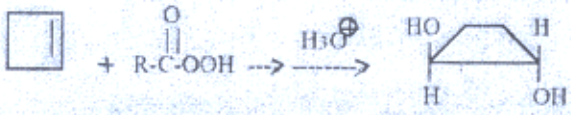
C. 

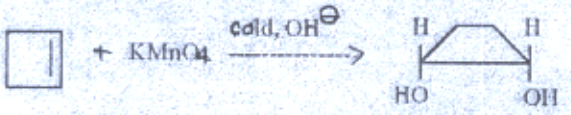
D. 

43. Which of the following reactions does not occur as shown?

A. CH_3-CH=CH_2 + HBr ---> $CH_3CHBrCH_3$

B. CH_3-CH-CH_2 + 2 H_2O ---> $CH_3CHOHCH_2OH$

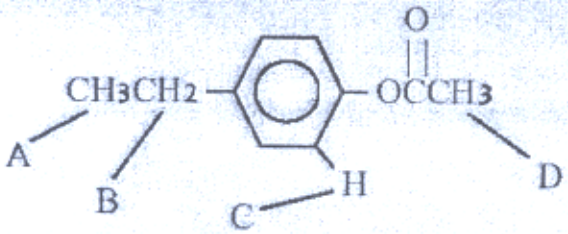
C. 

D. 

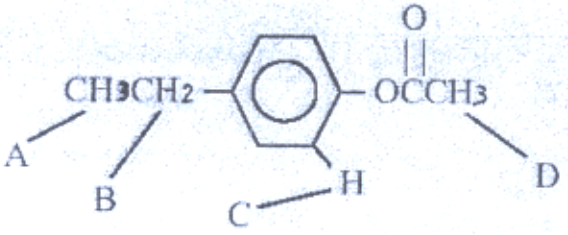
44. Which of the following compounds has the protons having the highest chemical shift (value of ppm) in this set?

A. $(CH_3)_2Mg$ B. CH_3COH C. CH_3CH D. $(CH_3)_3N$

45. Which of the indicated proton(s) is (are) the most shielded (highest value of ppm)?



46. Which of the indicated proton(s) is (are) the most de-shielded (lowest value of ppm)?



47-50. Write down each of the following unknowns from the given proton magnetic resonance and/or infrared spectroscopic information.

47. $C_3H_5Cl_3$
singlet, δ=2.2 ppm, 3H
singlet, δ=4.0 ppm, 2H

48. $C_5H_{10}Br_2$
doublet, δ=0.9 ppm, 6H
multiplet, δ=1.5 ppm, 1H
triplet, δ=1.85 ppm, 2H
triplet, δ=5.3 ppm, 1H

49. C_3H_8O. IR: broad peak near 3400 cm^{-1}
pmr: doublet, δ=1.2 ppm, 6H
singlet, δ=2.0 ppm, 1H
septet, δ=4.0 ppm, 1H

50. $C_{10}H_{12}O$. IR: peak at 1710 cm^{-1}
pmr: singlet, δ= 2.1 ppm, 3H
multiplet, δ=3.0 ppm, 4H
multiplet, δ=7.1 ppm, 5H