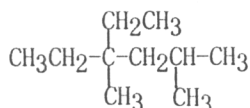


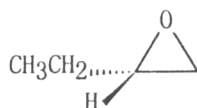
2 points each,
Total 100 points.

1. The IUPAC name of the following structure is:



- (A) 3-Ethyl-3,5-dimethylheptane (B) 3-Methyl-3-sec-butylheptane
(C) 2,4-Dimethyl-4-ethylheptane (D) 2-Ethyl-2,4-dimethylheptane
(E) 3-Ethyl-2,4-dimethylheptane

2. The IUPAC name of the following structure is:



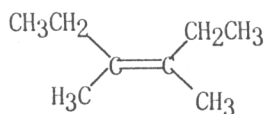
- (A) (R)-2-Ethyloxirane (B) (S)-2-Ethyloxirane (C) (R)-2-Ethylepoxide
(D) (S)-2-Ethylepoxide (E) (S)-3-Ethyloxirane

3. The IUPAC name of the following structure is:



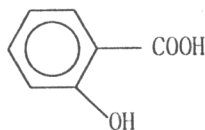
- (A) Pyrrole (B) Imidazole (C) Furan (D) Pyridine (E) Purine

4. The IUPAC name of the following structure is:



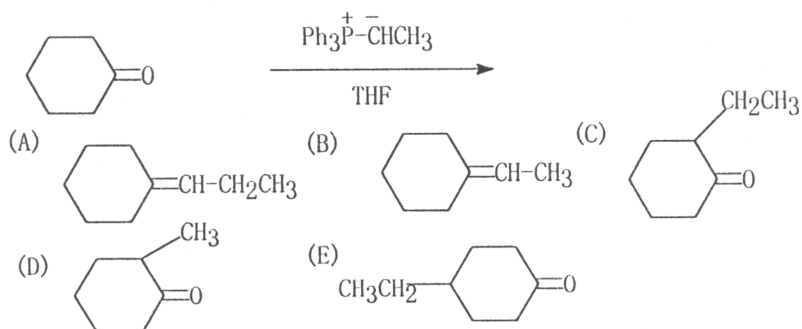
- (A) trans-3,4-Dimethyl-3-hexene (B) cis-3,4-Dimethyl-3-hexene
(C) trans-3,4-Diethyl-2-butene (D) cis-3,4-Diethyl-2-butene
(E) none of them

5. The IUPAC name of the following structure is:

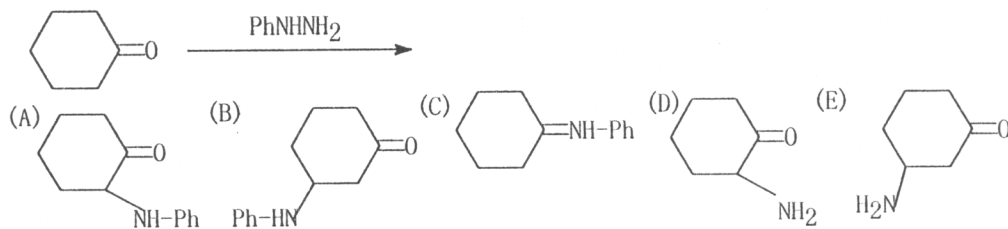


- (A) *p*-Hydroxybenzoic acid (B) *m*-Hydroxybenzoic acid (C) *o*-Hydroxybenzoic acid
(D) *p*-Hydroxybenzaldehyde (E) *m*-Hydroxybenzaldehyde

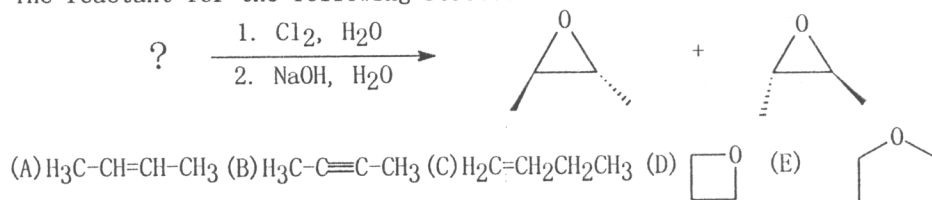
6. The final product for the following reaction is:



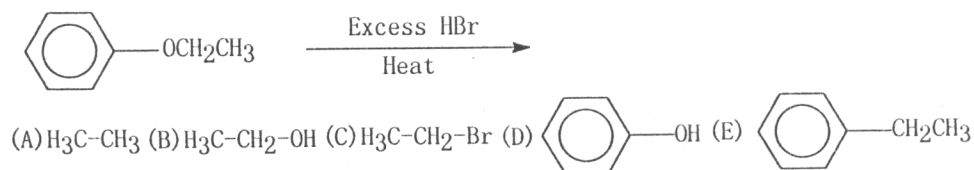
7. The final product for the following reaction is:



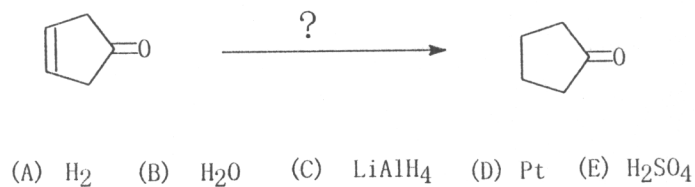
8. The reactant for the following reaction is:



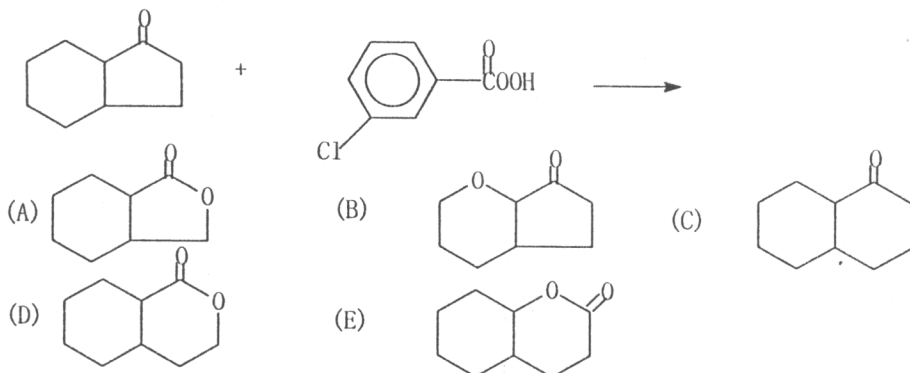
9. Two products for the following reaction are:



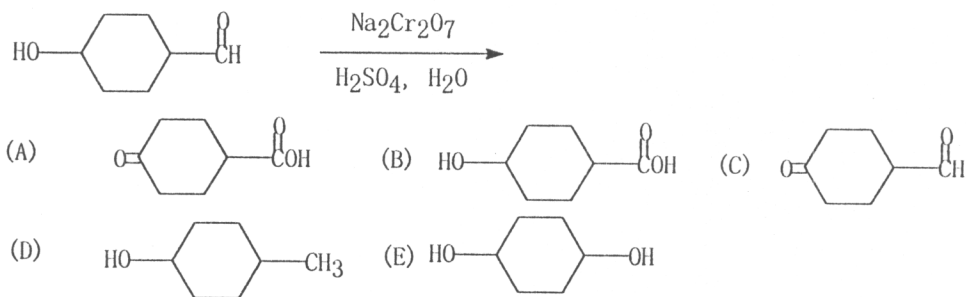
10. Two chemical reagents for the following reaction are:



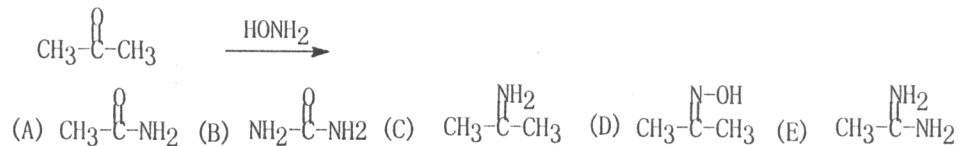
11. The final product for the following reaction is:



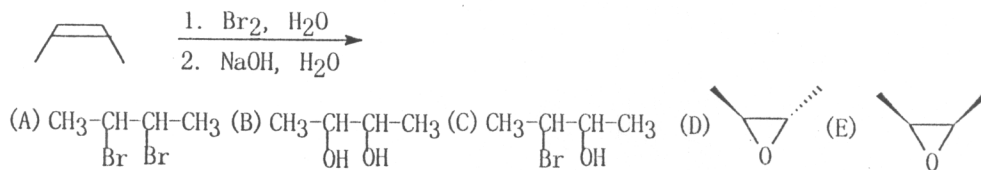
12. The final product for the following reaction is:



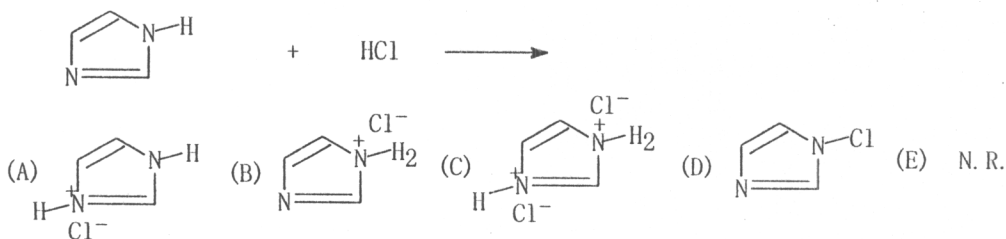
13. The final product for the following reaction is:



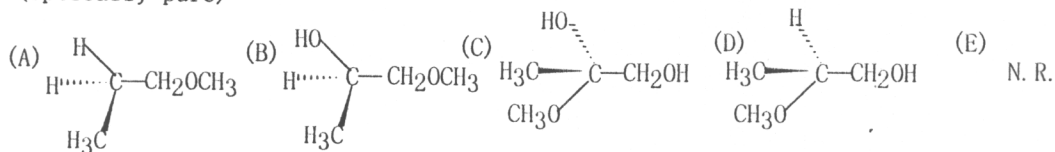
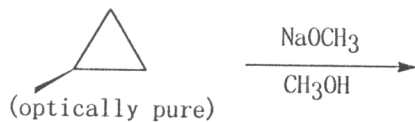
14. The final product for the following reaction is:



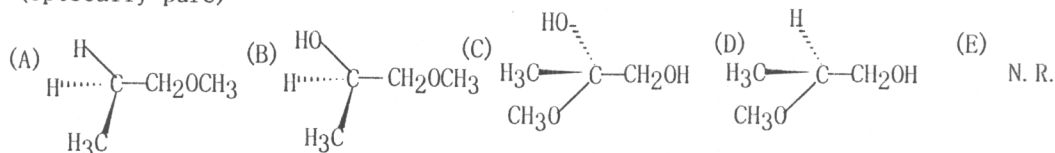
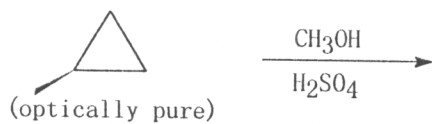
15. The final product for the following reaction is:



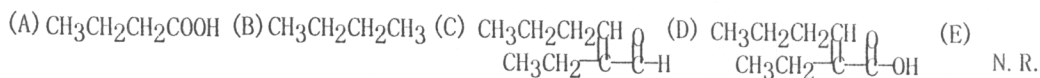
16. The final product for the following reaction is:



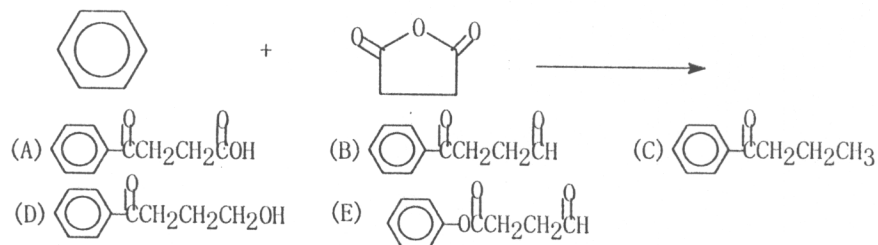
17. The final product for the following reaction is:



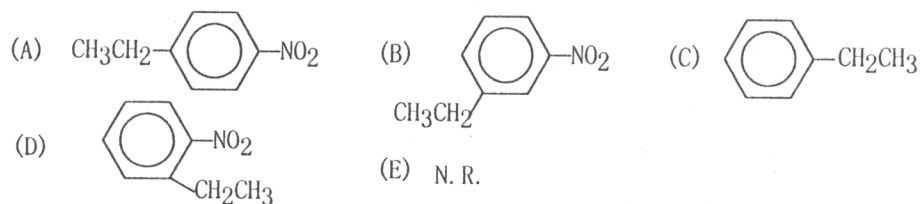
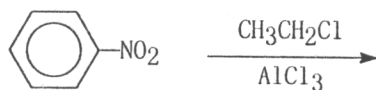
18. The final product for the following reaction is:



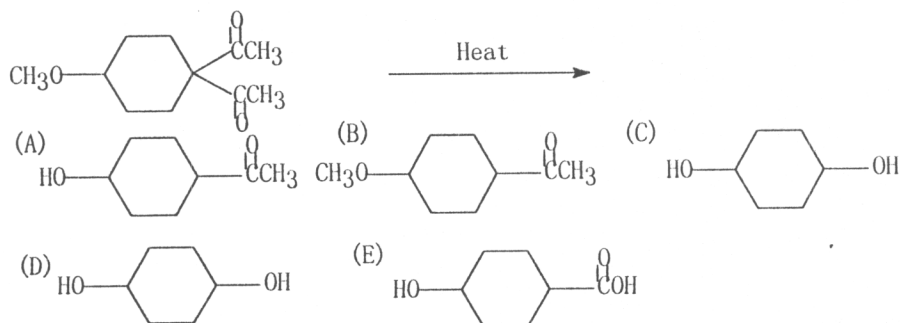
19. The final product for the following reaction is:



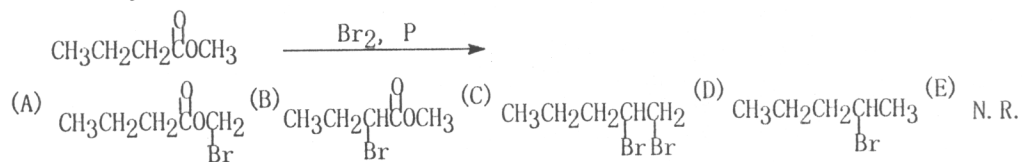
20. The final product for the following reaction is:



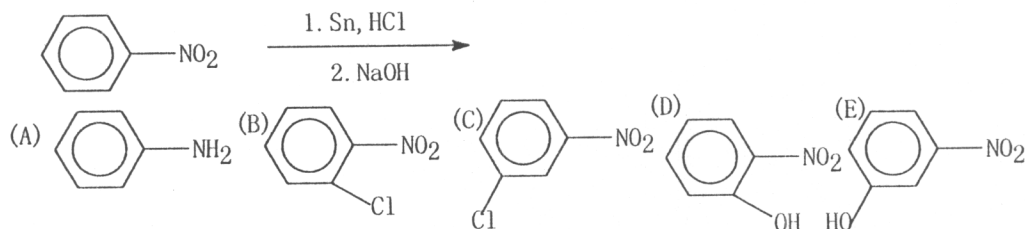
21. The final product for the following reaction is:



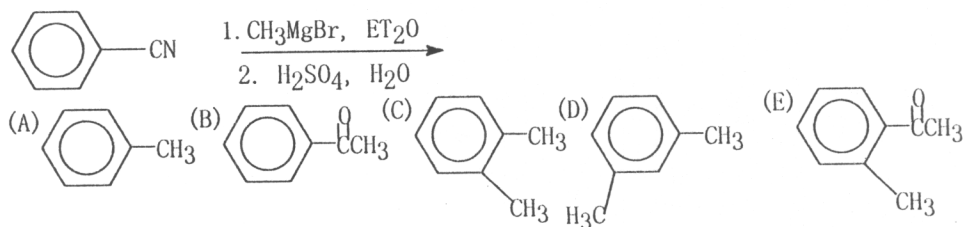
22. The final product for the following reaction is:



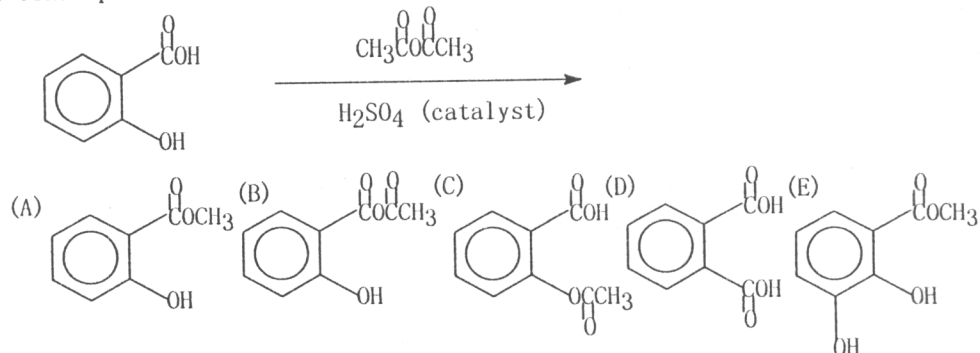
23. The final product for the following reaction is:



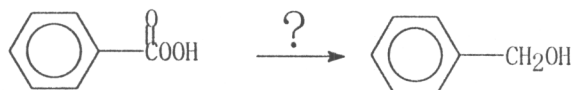
24. The final product for the following reaction is:



25. The final product for the following reaction is:

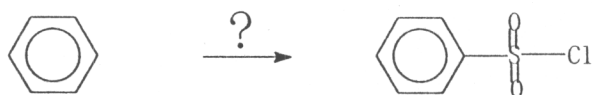


26. Three chemical reagents for the following reaction are (multiple choices):



- (A) LiAlH₄ (B) (CH₃CH₂)₂O (C) CH₃CH₂OH (D) CH₃OH (E) H₂O

27. Three chemical reagents for the following reaction are (multiple choices):



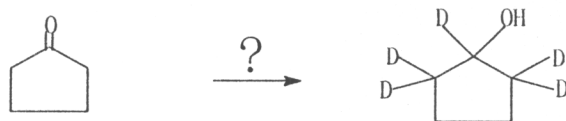
- (A) HCl (B) NaCl (C) SO₃ (D) H₂SO₄ (E) SOCl₂

28. Three chemical reagents for the following reaction are (multiple choices):



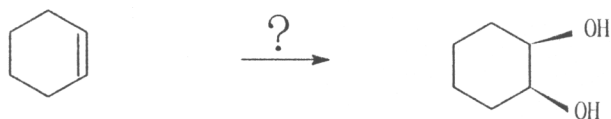
- (A) Na₂Cr₂O₇ (B) H₂SO₄ (C) HCl (D) H₂O (E) CH₃OH

29. Three chemical reagents for the following reaction are (multiple choices):



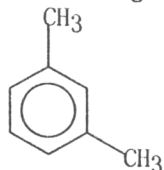
- (A) NaOD, D₂O (B) LiAlD₄, (CH₃CH₂)₂O (C) LiAlH₄, (CH₃CH₂)₂O
(D) D₂O (E) H₂O

30. Three chemical reagents for the following reaction are (multiple choices):



- (A) OsO₄ (B) H₂SO₄ (C) (CH₃)₂COOH (D) (CH₃CH₂)₂O (E) (CH₃)₃COH

31. How many peaks are present in the broadband decoupled ^{13}C -NMR spectrum of the following?

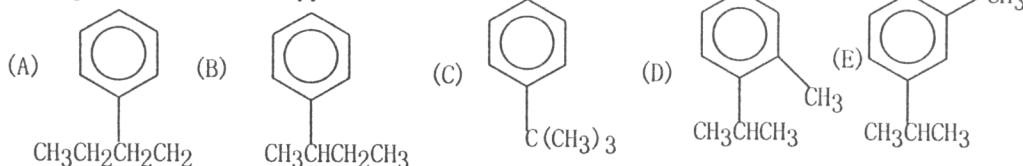


- (A) 4 (B) 5 (C) 6 (D) 7 (E) 8

32. From among the isomeric compounds of molecular formula $\text{C}_4\text{H}_9\text{Cl}$, provide a structural formula for the one having a ^1H -NMR spectrum that has several peaks including two distinct three-proton signals, one of them a triplet at 1.0 ppm and the other a doublet at 1.5 ppm.

- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$ (B) $\text{CH}_3\underset{\text{Cl}}{\text{CH}}\text{CH}_2\text{CH}_3$ (C) $\text{CH}_3\overset{\text{CH}_3}{\underset{\text{Cl}}{\text{C}}}-\text{CH}_3$ (D) $\text{CH}_3\overset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{Cl}$ (E) None of them

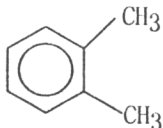
33. Provide a structural formula for the compound which has a molecular formula of $\text{C}_{10}\text{H}_{14}$ and ^1H -NMR spectrum with a 9H singlet at 1.3 ppm and the 5H multiplet at a range of 7.0 to 7.5 ppm.



34. Provide a structural formula for the compound which has a molecular formula of $\text{C}_4\text{H}_{10}\text{O}$ and ^{13}C -NMR spectrum with two carbon (CH_3) at 19.9 ppm, one carbon (CH) at 30.8 ppm, and one carbon (CH_2) at 69.4 ppm.

- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ (B) $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CH}_3$ (C) $\text{CH}_3\overset{\text{CH}_3}{\underset{\text{OH}}{\text{C}}}-\text{CH}_3$ (D) $\text{CH}_3\overset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{OH}$ (E) None of them

35. How many peaks are present in the ^1H -NMR spectrum with CH decoupling of the following?



- (A) 3 (B) 4 (C) 6 (D) 8 (E) 10

36. Which of the following is not a properties of alcohols?

- (A) Weakly acidic (B) Flammable (C) React with acid (D) high boiling point (E) All alcohols can be oxidized.

37. Which of the following does not react with alcohols?

- (A) NaOH (B) Na (C) H_2SO_4 (D) KMnO_4 (E) CH_3COOH

38. How many isomers of the formula $\text{C}_4\text{H}_{11}\text{N}$ are secondary amines?

- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

39. Which of the following alcohols cannot be produced by reduction of an aldehyde or ketone?
(A) 2-pentanol (B) Cyclohexanol (C) 2-Methyl-2-pentanol (D) 1-Methyl-1-butanol
(E) Cyclohexanol
40. Which of the following amino acid has amide side chain?
(A) Alanine (B) Aspartate (C) Asparagine (D) Histidine (E) Tryptophan
41. The main difference between aldehydes and ketones is
(A) Reactivity (B) Solubility (C) flammability (D) Polarity (E) Acidity
42. Which of the following amides does not form hydrogen bonds?
(A) Asparagine (B) Benzamide (C) Formamide (D) N-Methylformamide
(E) N,N-Dimethylformamide
43. How many amides of the formula C_3H_7NO can be drawn?
(A) 3 (B) 4 (C) 5 (D) 6 (E) 7
44. Which class of compounds has the lowest boiling point?
(A) Carboxylic acid esters (B) Amides (C) Carboxylic acids
(D) Carboxylic acid anhydride (E) Benzoic acid
45. Which of the following amino acid has thiol group?
(A) Threonine (B) Tyrosine (C) Glycine (D) Tryptophan (E) Cysteine
46. An unknown compound is insoluble in sodium hydroxide but soluble in cold concentrated sulfuric acid. It does not decolorize bromine and does not react with metallic sodium. The unknown compounds belong to
(A) Alkane (B) Alkene (C) Alcohol (D) Phenol (E) Ether
47. Which of the following functional groups does not contain a carbonyl group?
(A) Carboxylic acid (B) Ester (C) Ether (D) Ketone (E) Aldehyde
48. Which of the following is a cyclic ether?
(A) Enflurane (B) Phenol (C) Ethylene oxide (D) Methoxybenzene
(E) Methyl cyclohexyl ether
49. An amine and its ammonium salt differ in all respects except:
(A) Charge (B) Solubility (C) Carbon Skeleton (D) Basicity (E) Color
50. 3-Pentanone is unlikely to undergo which of the following reactions?
(A) Oxidation (B) Reduction (C) Acetal formation (D) aldol condensation
(E) None of them