

OBAFEMI AWOLowo UNIVERSITY, ILE-IFE

DEPARTMENT OF CHEMISTRY

Rain Semester 2019/2020 Session, Mid Semester Test; CHM 202 (Basic Organic Chemistry)

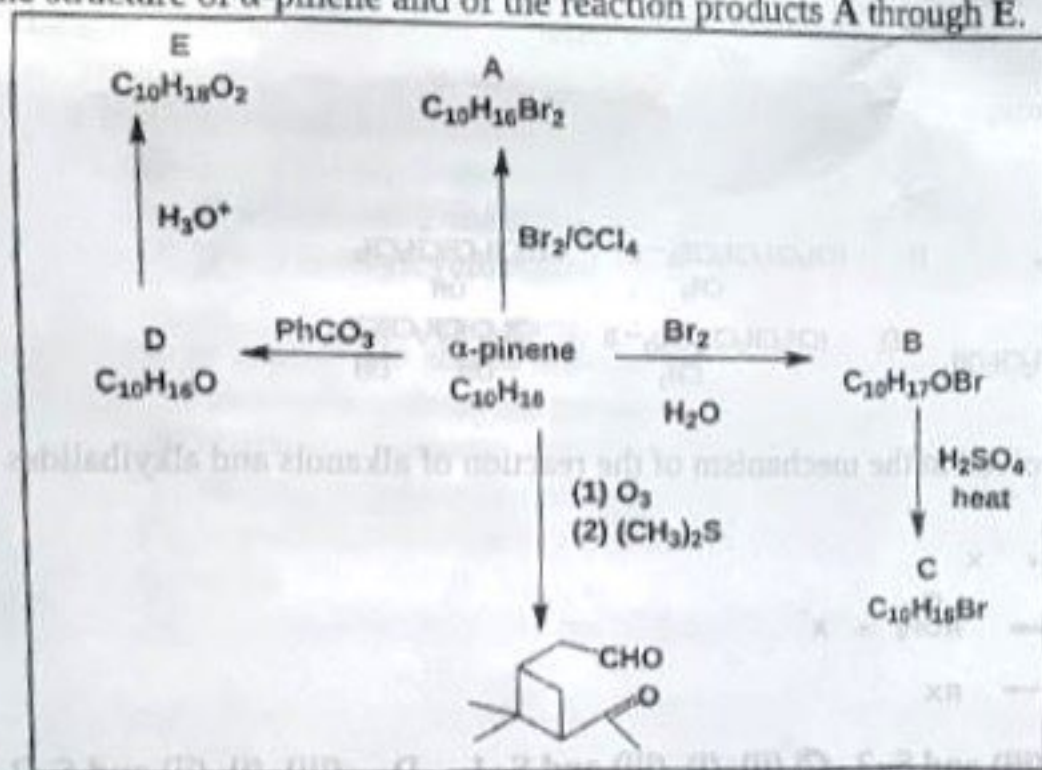
April, 2023

Time Allowed: 1 hr.

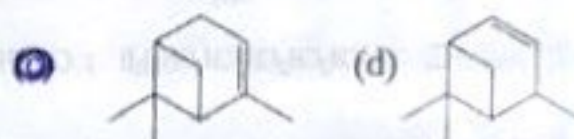
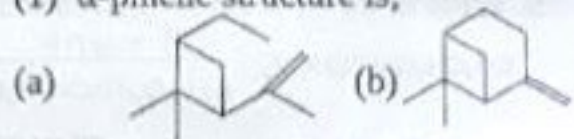
Question Type 4

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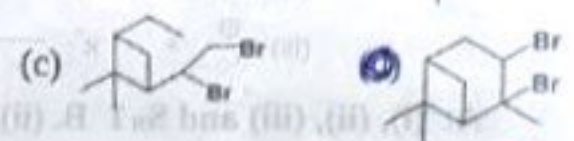
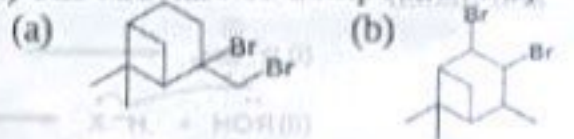
Use the following information to answer questions 1-5: One of the constituents of turpentine is α -pinene, formula ($C_{10}H_{16}$). The following scheme (called a "road map") gives some reactions of α -pinene. Determine the structure of α -pinene and of the reaction products A through E.



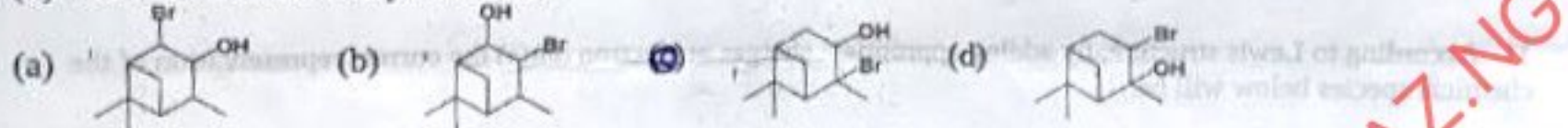
(1) α -pinene structure is;



(2) The structure of Compound A is;



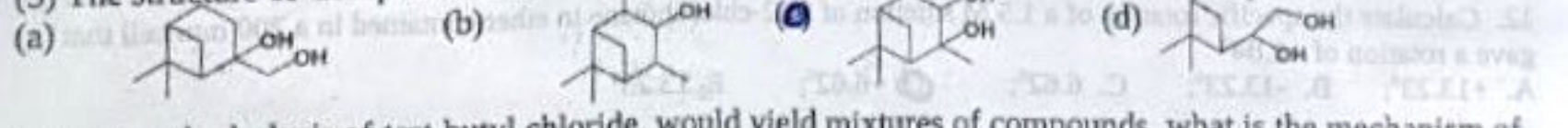
(3) The structure of Compound B is;



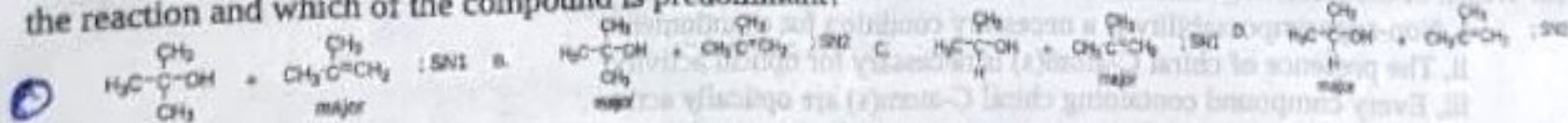
(4) The structure of Compound C is;



(5) The structure of Compound E is;



6. Alkaline hydrolysis of *tert*-butyl chloride, would yield mixtures of compounds, what is the mechanism of the reaction and which of the compound is predominant?



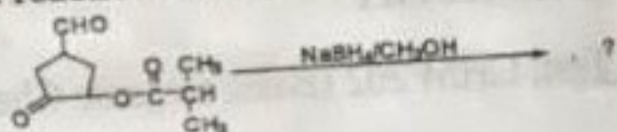
7. Consider the following organic molecules;

- (i) CH_3CH_2OH (ii) $CH_3CH_2CH(OH)CH_2CH_3$ (iii) CH_3CHO
 (iv) CH_3CH_2CHO (v) $CH_3CH(OH)CH_3$

Which of these molecules would produce a yellow antiseptic solid when treated with a hot alkaline solution of iodine?

- A. (ii) only B. (i) only C. (i), (iii) and (v) D. (ii) and (iv)

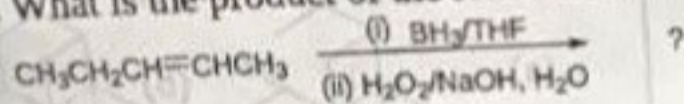
3. Consider the reaction below;



What is/are the product of the reaction?

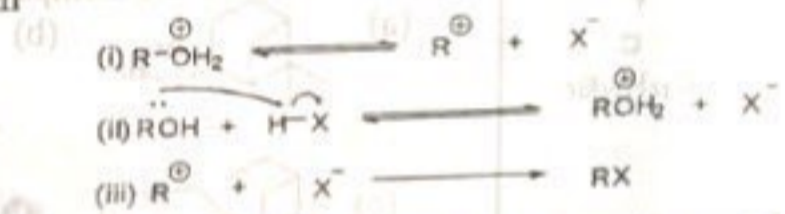
- A. and only
 B. only
 C. and only
 D. only

9. What is the product of the reaction below;



- A. $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_3\text{B}$; $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$
 B. $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_3\text{B}$; $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$
 C. $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_3\text{B}$; $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 D. $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_3\text{B}$; $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$

10. Arrange in correct order the steps involved in the mechanism of the reaction of alkanols and alkylhalide and match



- A. (i), (ii), (iii) and $\text{S}_\text{N}1$ B. (ii), (i), (iii) and $\text{S}_\text{N}2$ C. (ii), (i), (iii) and $\text{S}_\text{N}1$ D. (iii), (i), (ii) and $\text{S}_\text{N}2$

11. According to Lewis structure, by adding appropriate charges or electron dot(s) the correct representation of the chemical species below will be:

- (i) CH_2^+ (ii) $\text{H}_2\text{C}=\ddot{\text{N}}$ (iii) $\text{H}_3\text{C}-\ddot{\text{C}}\text{H}_2$
 (A) (i) CH_2^+ (ii) $\text{H}_2\text{C}=\ddot{\text{N}}^-$ (iii) $\text{H}_3\text{C}-\ddot{\text{C}}\text{H}_2$ (B) (i) CH_2^+ (ii) $\text{H}_2\text{C}=\ddot{\text{N}}^+$ (iii) $\text{H}_3\text{C}-\ddot{\text{C}}\text{H}_2$
 (C) (i) CH_2^+ (ii) $\text{H}_2\text{C}=\ddot{\text{N}}^-$ (iii) $\text{H}_3\text{C}-\ddot{\text{C}}\text{H}_2$ (D) (i) CH_2^+ (ii) $\text{H}_2\text{C}=\ddot{\text{N}}^+$ (iii) $\text{H}_3\text{C}-\ddot{\text{C}}\text{H}_2$

12. Calculate the specific rotation of a 1.5 M solution of R, 2-chlorobutane in ether contained in a 200 mm cell that gave a rotation of $+1.84^\circ$
 A. $+13.23^\circ$; B. -13.23° ; C. 6.62° ; D. $+6.62^\circ$; E. 13.23°

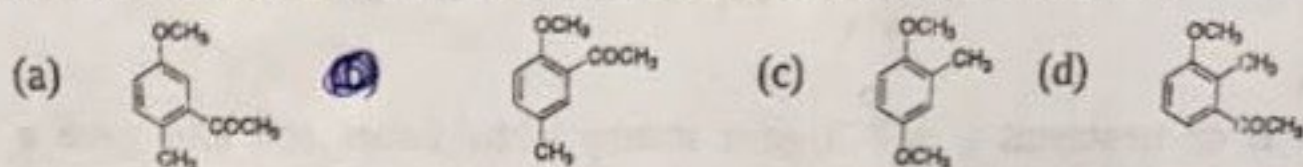
13. Which of the following statements is or are correct?
 i, Non-superimpossibility is a necessary condition for enantiomers
 ii, The presence of chiral C-atom(s) is necessary for optical activity
 iii, Every compound containing chiral C-atom(s) are optically active
 iv, Equimolar amounts of enantiomers are optically inactive but can be separated
 v, Equimolar amounts of enantiomers are optically inactive and cannot be separated
 A. i, ii & iv only; (B) iii only; (C) ii & v only; (D) i, iii & iv.

14. Arrange in order of decreasing boiling points: ethyldimethylamine; N-butylamine and diethylamine.
 A) ethyldimethylamine > diethylamine > N-butylamine; (B) diethylamine > ethyldimethylamine > N-butylamine
 C) N-butylamine > diethylamine > ethyldimethylamine; (D) N-butylamine < diethylamine < ethyldimethylamine
 E) ethyldimethylamine < diethylamine < N-butylamine.

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15. Predict the major product formed when benzene reacts (just once) with 1-chlorobutane, AlCl_3
 (A) n-butyl benzene (B) iso-butyl benzene (C) sec-butyl benzene (D) tert-butyl benzene

16. Predict the major product of the reaction of p-methylanisole with acetylchloride + AlCl_3



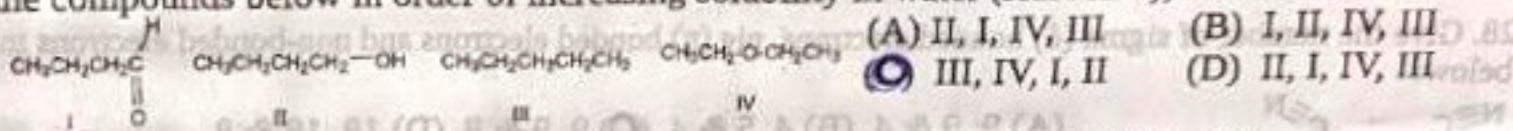
17. An unknown compound, X, $\text{C}_5\text{H}_9\text{Br}$, does not react with bromine or with dilute KMnO_4 . Upon treatment with potassium *tert*-butoxide, X gives only one product, Y (C_5H_8). Unlike X, Y decolorizes bromine and changes KMnO_4 from purple to brown. Catalytic hydrogenation of Y gives methylcyclobutane. Ozonolysis reduction of Y gives dialdehyde, Z, $\text{C}_5\text{H}_8\text{O}_2$. Propose consistent structures for X, Y and Z.

- (a) X = 1-methylcyclobut-1-ene; Y = 1-bromo-1-methylcyclobutane; Z = hexane-2,5-dione
 (b) X = 1-bromo-3-methylcyclobutane; Y = 3-methylcyclobutene; Z = 2-methylbutan-1,4-dial
 (c) X = 1-bromo-2-methylcyclobutane; Y = 2-methylcyclobutene; Z = 4-oxopentanal
 (d) X = 3-methylcyclobutene; Y = 1-bromo-3-methylcyclobutane; Z = 2-methylbutan-1,4-dial

18. Name an appropriate alkene and reaction conditions (reagents) that may be used to prepare the alcohol (methylcyclohexanol) without the possibility of forming a mixture;

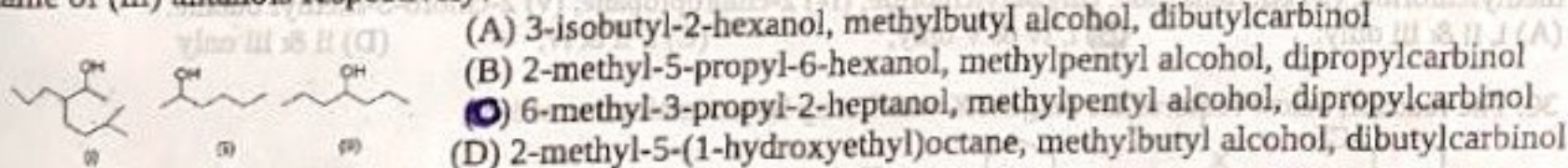
- (a) Methylcyclohexene, reacting with borane in tetrahydrofuran, followed by basic hydrogen peroxide
 (b) Methylcyclohexene, reacting with dilute H_2SO_4 with heating
 (c) 3-methylcyclohexene, reacting with borane in tetrahydrofuran, followed by basic hydrogen peroxide
 (d) 3-methylcyclohexene, reacting with dilute H_2SO_4 with heating

19. Arrange the compounds below in order of increasing solubility in water (least first);



20. Predict the major product formed when benzene reacts (just once) with $\text{CH}_2(\text{COCl})_2$, AlCl_3
 (A) $\text{PhCH}(\text{COCl})_2$ (B) $\text{Ph}(\text{CO})_2\text{CH}$ (C) $\text{PhCOCH}_2\text{COCl}$ (D) PhCOCH_3

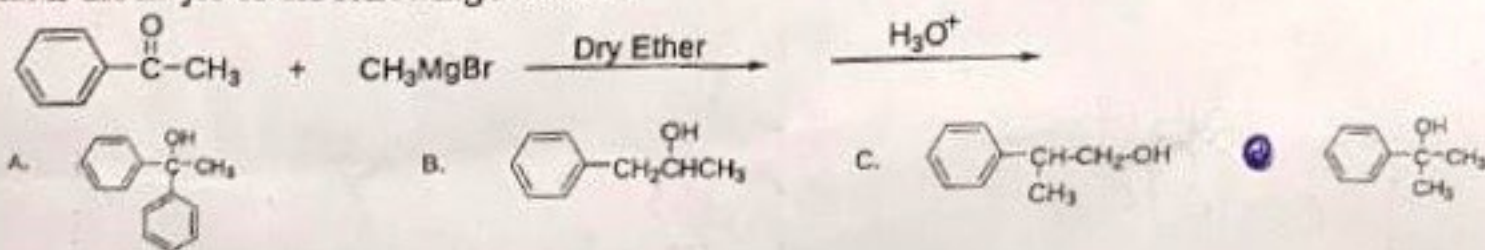
21. What is the IUPAC name of (i), common (functional class system) name of (ii) and carbinol system of name of (iii) alkanols respectively?



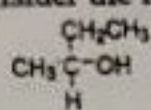
22. How many chiral C-atom(s) and optical isomers would each of the following compounds have?

- (i) 3-Bromopentan-2,4-diol and (ii) 2,3-dibromopentane
 (A) 2, 2 and 2,4 respectively (B) 2, 2 and 2,4 respectively (C) 3, 6 and 2, 4 respectively (D) 3, 8 and 2, 4 respectively

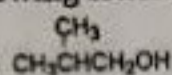
23. What is the major of the following reaction?



24. Consider the following lettered compounds below and arrange them in order of their increasing acidity;



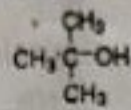
A



B



C



D

- (A) $\text{C} < \text{D} < \text{B} < \text{A}$ (B) $\text{D} < \text{A} < \text{B} < \text{C}$
 (C) $\text{C} < \text{B} < \text{A} < \text{D}$ (D) $\text{C} < \text{B} < \text{D} < \text{B}$

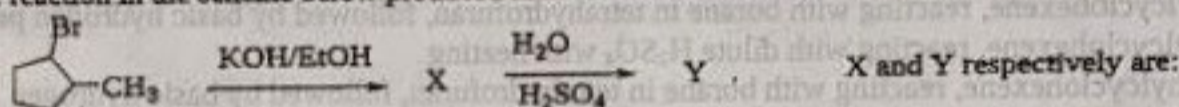
25. An organic compound B on treatment with PCl_5 gave steamy white fumes and also gave a yellow antiseptic solid with hot alkaline solution of iodine. What functionality is present in the compound B and the steps involved in the mechanism of the reaction in the formation of the yellow solid?

- A. $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$; oxidation, iodination, cleavage
 B. $\text{R}-\overset{\text{OH}}{\text{C}}-\text{CH}_3$; iodination, oxidation cleavage
 C. $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$; cleavage, iodination, oxidation
 D. $\text{R}-\overset{\text{OH}}{\text{C}}-\text{CH}_3$; oxidation, iodination, cleavage

26. Arrange the under-listed carboxylic acids in order of increasing acidity. Give reason for your arrangement.
 I = $\text{CH}_2\text{ClCO}_2\text{H}$; II = $\text{CH}_3\text{CO}_2\text{H}$; III = $\text{C}_6\text{H}_5\text{CO}_2\text{H}$; IV = $\text{CHCl}_2\text{CO}_2\text{H}$.

- (A) $\text{I} < \text{II} < \text{III} < \text{IV}$. +M effect. (B) $\text{II} < \text{I} < \text{IV} < \text{III}$. -I effect;
 (C) $\text{I} < \text{II} < \text{III} < \text{IV}$. -M effect. (D) $\text{II} < \text{I} < \text{IV} < \text{III}$. +I effect. (E) $\text{II} < \text{IV} < \text{III} < \text{I}$. +I effect.

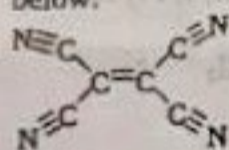
27. The reaction in the scheme below produced X as an intermediate which reacted further to give Y.



X and Y respectively are:

- (A) $\text{Cyclopentane ring with OH and CH}_3$ & $\text{Cyclopentane ring with CH}_3$
 (B) $\text{Cyclopentane ring with CH}_3$ & $\text{Cyclopentane ring with OH and CH}_3$
 (C) $\text{Cyclopentane ring with CH}_2$ & $\text{Cyclopentane ring with OH and CH}_3$
 (D) $\text{Cyclopentane ring with CH}_2$ & $\text{Cyclopentane ring with OH and CH}_3$

28. Give the number of sigma (σ) bonded electrons, pi (π) bonded electrons and non-bonded electrons in the molecule below:

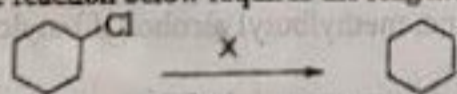


- (A) 9; 9 & 4. (B) 4, 5 & 4. (C) 9, 9 & 8. (D) 18, 18 & 8

29. Which of the following alkyl chlorides would be a useful reagent in the Wurtz synthesis of 2,3-dimethyl butane: (i) methylchloride; (ii) ethylchloride; (iii) butylchloride; (iv) 2-chloropropane; (v) 2-chloro-3-methyl butane.

- (A) i, ii & iii only; (B) i, iv & v only; (C) i, ii & iv; (D) ii & iii only

30. The reaction below requires the reagent X which may be a combination of i-iv



The reagent x required to effect this reaction is:

- i = KOH/EtOH ; ii = NaBH_4 ; iii = $\text{H}_2\text{O}/\text{H}_2\text{SO}_4$; iv = Zn/HCl .

- (A) i & ii; (B) ii & iii; (C) ii & iv; (D) iii & iv

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