OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE

Rain Semester 2019/2020 Session, Examination

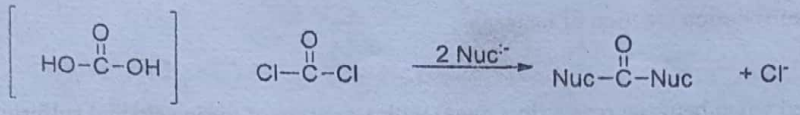
CHM 202: Basic Organic Chemistry

November, 2021 **Time Allowed: 2 hr.** **Question Type 4**

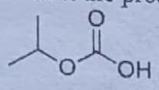
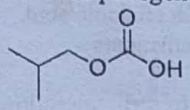
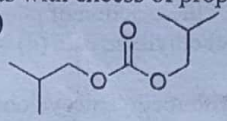
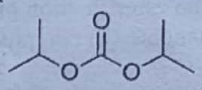
Name ..... **Dept**..... **Reg No**.....

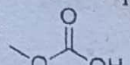
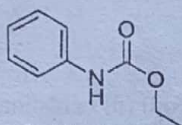
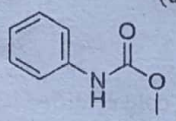
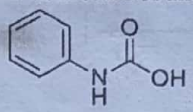
(1) Which of the following can be hydrolyzed in acidic solution to give propanoic acid?
(a) $CH_3CH_2CH_2OCOCH_3$ (b) $CH_3CH_2CH_2CN$ (c) CH_3CH_2CN (d) none of the options (a)-(c)

Use the following information to answer questions 2-4:
Phosgene is the acid chloride of carbonic acid. Although phosgene was used as a war gas in World War I, It is now used as a reagent for the synthesis of many useful products. Phosgene reacts like other acid chlorides, but it can react twice.

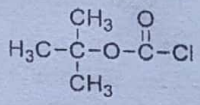


Carbonic acid **Phosgene**

(2) Predict the product formed when phosgene reacts with excess of propan-2-ol
(a) 
(b) 
(c) 
(d) 

(3) Predict the product formed when phosgene reacts with 1 equivalent of methanol and followed by 1 equivalent of aniline.
(a) 
(b) 
(c) 
(d) 

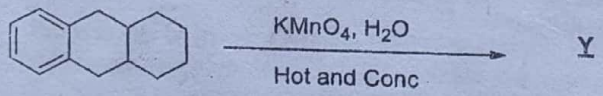
(4) *tert*-butyloxycarbonyl chloride is an important reagent for the synthesis of peptides and proteins. Which reagent would be reacted with phosgene to form *tert*-butyloxycarbonyl chloride?



***tert*-butyloxycarbonyl chloride**

(a) Butanone (b) Butanol (c) *tert*-butyloxy (d) 2-methylpropan-2-ol

(5) Consider the following reaction to form compound **Y**;

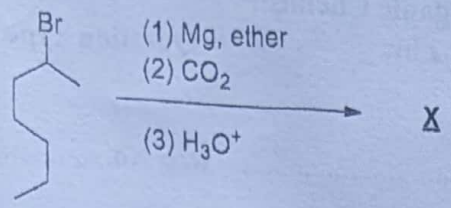


What is the IUPAC name of compound **Y**?
(a) Benzoic acid (b) Toluene (c) Benzene-1,2-dicarboxylic acid (d) Benzene dicarboxylic acid

(6) Which one of the following compounds does not undergo a Friedel-Crafts reaction?
(a) benzene (b) chlorobenzene (c) nitrobenzene (d) toluene

(7) Which one of the following reactions is most likely to give a polysubstituted product?
(a) Friedel-Crafts alkylation (b) Friedel-Crafts acylation (c) nitration (d) halogenation

(8) Consider the following reaction to form compound **X**;



What is the IUPAC name of compound **X**?
(a) 2-methylheptanoic acid (b) 2-methylpentanoic acid (c) 2-octanoic acid (d) 2-haptanoic acid

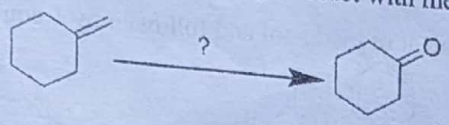
(9) Identify the electrophile in a Friedel-Crafts alkylation.
(a) aluminum chloride (b) carbocation (c) aluminum tetrachloride ion (d) carbanion

(10) Identify the electrophile in the sulfonation reaction of benzene.
(a) SO_2^+ (b) H_2SO_4 (c) SO_3^+ (d) SO_3

(11) Predict the major product formed when benzene reacts (just once) with a mixture of nitric acid and sulfuric acid.
(a) Nitrobenzene (b) sulfurobenzene (c) benzene sulfonic acid (d) benzene sulfonate

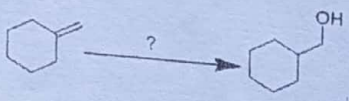
(12) Predict the esterification product of the reaction of phenol with ethanoic acid.
(a) Phenylethanoate (b) ethyphyloate (c) ethylbenzoate (d) benzylethanoate

(13) Which reagents would you react with methylenecyclohexane to form the following;



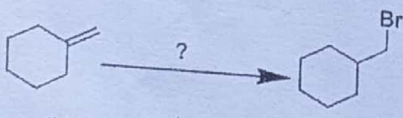
(a) ozonolysis (b) hot alkaline $KMnO_4$ (conc) (c) cold acidified $KMnO_4$ (dil) (d) oxidation

(14) Which reagents would you react with methylenecyclohexane to form the following;



(a) H+/H_2O (b) BHF.THF followed by H_2O_2/OH^- (c) H_2O, heat (d) H_2O_2/OH

(15) Which reagent would you react with methylenecyclohexane to form the following;



(a) HBr gas (b) Br_2 (c) HBr/peroxide (d) Br_2/peroxide

(16). Predict the major product of the reaction of 2-methylbut-2-ene with HCl
(a) 2-chloro-3-methylbutane (b) 2-chloro-2-methyl butane (c) 2-chloro-2-methyl propane (d) 2-chloro-2-methyl pentane

(17). Which alkyl halide(s) would undergo dehydrogenation to give the following pure alkene, methylenecyclohexane? (a) 1-bromo-1-methylcyclohexane (b) cyclohexylmethylbromide
(c) cyclohexylmethylbromide & 1-bromo-2-methylcyclohexane (d) none of the above

(18). Which alkyl halide(s) would undergo dehydrogenation to give the following pure alkene, hexene?
(a) bromohexane & 2-bromohexane (b) 3-bromohexane & 2-bromohexane (c) bromohexane (d) 3-bromohexane

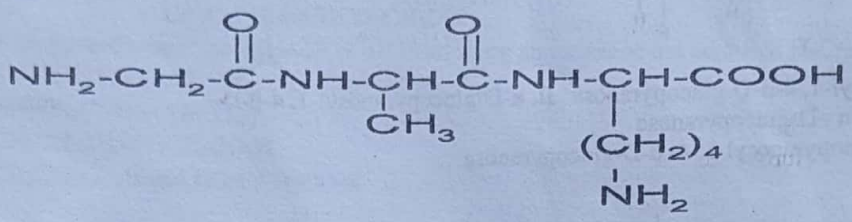
(19). Predict the products formed by sodium hydroxide-promoted dehydrohalogenation of 1-bromo-2-methylcyclohexane.
(a) methylcyclohexene (b) 3-methylcyclohexene (c) methylcyclopentene (d) 3-methylcyclopentene

(20). Show how you would prepare cyclopentene from cyclopentanol. The reagent for the transformation is;
(a) alkali/heat (b) heat (c) H_2SO_4/heat (d) none of the above

(21). Which of the following protein structures best describes a fibrous protein?
A. Primary structure B. Secondary structure C. Tertiary structure D. Super-helix structure

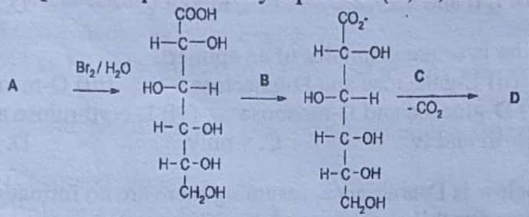
(22). In the Strecker's synthesis of Alanine, the alkanal of choice as one of the starting materials should be:
A. Propanal B. Butanal C. Methanal D. Ethanal

(23). Provide the IUPAC name of the compound given below:



A. Alanylglycyllysine B. Glutamylvalinylalanine C. Glycylalanyllysine D. Valinylalanyllysine

(24). Provide the names of compounds represented by alphabets (A, B, C and D) in the chemical equation given below:



A. D-glucose, Calcium carbonate, Ferric in hydrogen peroxide and D-arabinose, respectively.
B. D-mannose, Calcium chloride, Nitric acid and D-ribose, respectively.
C. D-galactose, Calcium hydrogen carbonate, Hydrogen over nickel and D-arabinose, respectively.
D. D-fructose, Calcium hydrogen carbonate, Hypochloric acid and D-arabinose, respectively.

(25). In the solid state, amino acids exist as:
A. Amphoteric B. Isoelectric point C. Zwitterions D. Amides

(26). Proteins can be divided into the following classes:
A. Fibrous and globular proteins B. Soluble and insoluble proteins C. Collagen and keratin proteins D. Secondary and tertiary proteins.

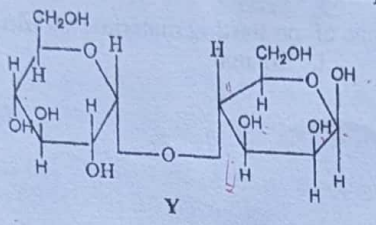
(27). Which of the statements below is/or are true about Cellulose?
(i) It is a linear polymer (ii) It can form helix (iii) It is digestable by human
(iv) It is made up of several α-glycosidic bonds (v) Its partial hydrolysis gives Maltose
(vi) It has branches at between 20 and 25 monosaccharide units.
A. i and ii B. i, iii and v C. ii, iv and v D. i, iv and vi

(28). Which of the following sugars are disaccharides obtained from the partial hydrolysis of amylopectin?
(i) Maltose (ii) Sucrose (iii) Isomaltose (iv) Cellobiose (v) Lactose
(vi) Galactose
A. i and iii B. ii and iii C. iv and vi D. i, iv and v

(29) The intramolecular reaction in monosaccharides leading to the formation of the Haworth structure is/or are called:
(i) Anomerization (ii) Monomerization (iii) Mutarotation (iv) Hemiacetal reaction
(v) Deoxyaldo reaction (vi) Cyanohydrin reaction
A. i and ii B. iii and iv C. iv, v and vi D. i and iv

(30). Which carbon in aldohexoses is used to identify them as either "D-" or "L-" sugars?
A. Carbon 2 B. Carbon 3 C. Carbon 4 D. Carbon 5

(31). What is the IUPAC name of the compound **Y** given below?



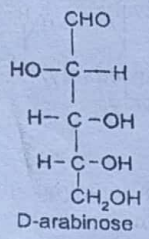
Y

A. α-D-glucopyranosyl-1, 4-β-D-glucopyranose B. α-D-glucopyranosyl-1, 4-β-D-mannopyranose C. β -D-glucopyranosyl-1, 4- α –D-glucopyranose
D. α -D-mannopyranosyl-1, 4- β-D-glucopyranose

(32). Which of the statements below is/or are true about compound **Y** in question 31 above:
(i) It is a disaccharide (ii) It is negative to Tollens' test (iii) It contains a peptide bond (iv) It is a reducing sugar (v) Its trivial name is maltose
(vi) It is digestable by human enzyme
A. i, iv and vi B. i, ii and v C. i, iii and v D. i, iv, v and vi

(33). Which of the following pairs is/or are examples of an epimer:
(i) D-glucose and L-glucose (ii) L-galactose and D-galactose (iii) D-mannose and D-fructose
(iv) D-arabinose and D-fucose (v) D-glucose and D-mannose (vi) L-erythrulose and D-erythrulose
A. i, ii and vi B. iii and iv C. v only D. iv and v

(34). The Aldopentose given below is D-arabinose, assuming there are no formation of meso compounds, how many stereoisomers can be written for this sugar?



D-arabinose

A. 4 B. 6 C. 8 D. 10

(35). When D-glucose undergoes hemiacetals reaction, it forms:
(i) α-D-glucopyranose (ii) α-D-Fructofuranose (iii) β-D-glucopyranose
(iv) Haworth D-glucose (v) Aldohexose (vi) D-mannose
A. i and ii B. iii and iv C. i and iii D. i, iv, v and vi

(36). The following factors influence the rate of lipid oxidation in foods except:
A. Fatty acid composition B. Moisture C. Pro-oxidants D. Volume of lipid

(37). The advanced stage of auto-oxidation of lipids leads to the formation of the following compound:
A. Malonaldehyde B. Nonanal C. Glycerol D. Hydroperoxides

(38). The following are true about the auto-oxidation of Oleic acid; it leads to the formation of:
(i) glycerol (ii) 7-hydrperoxide (iii) decomposition of hydroperoxides
(iv)alkoxy radical (v) alkanal and (vi) scission of oxygen-oxygen bond.
A. I, ii and iii B. ii, iii, iv and vi C. iii, iv, v and vi D. i, ii, iii, iv, v and vi

(39). Compound lipids are made up the following:
(i) Fatty acids (ii) Glycerol (iii) Phosphoric acid (iv) Margarine
(v) Hydroperoxide and (vi) Malonaldehyde
A. i and ii B. i, ii and iv C. i, ii and iii D. i, ii, v and vi

(40). The trivial name of the following fatty acid whose shorten form is given below is:

$C\ 20{:}4\ \Delta^{5,8,11,14}$

A. Linoleic acid B. Eicosatetraenoic acid C. Eicosapentaenoic D. Arachidonic acid

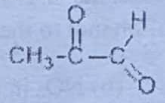
(41). The compound 'leaf alcohol' is partly responsible for the smell of new-mown grass.

$CH_3CH_2CH{=}CHCH_2CH_2OH$

What will be formed when 'leaf alcohol' is oxidized using an excess of hot acidified $K_2Cr_2O_7$?
(a) $CH_3CH_2CH(OH)CH(OH)CH_2CO_2H$
(b) $CH_3CH_2COCOCH_2CO_2H$
(c) $CH_3CH_2CH{=}CHCH_2CO_2H$
(d) $CH_3CH_2CO_2H$ and $HO_2CCH_2CO_2H$

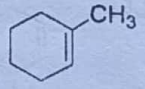
(42). The following are proposed oxidation of organic compounds by the given reagents?
i. CH_3CH_2CHO + Fehling's reagent
ii. $CH_3CH_2CH_2CHO$ + Tollens' reagent
iii. CH_3CHO + 2,4-dinitrophenylhydrazine reagent
Which of the statement combination is/are correct ?
(a) i, ii and iii are correct (b) i and ii only are correct (c) ii and iii only are correct (d) i only is correct

(43). Burnt sugar has a characteristic smell caused partly by the following compound:



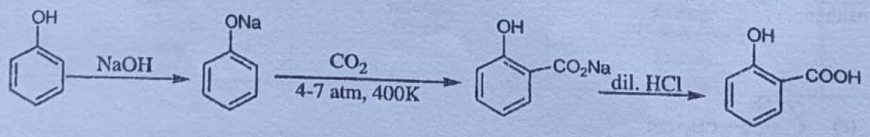
This compound contains two functional groups.
Which reagent will react with **only one** of the functional groups?
(a) acidified potassium dichromate (VI) (b) 2,4-dinitrophenylhydrazine
(c) Hydrogen cyanide (d) Sodium hydroxide

(44). Give the IUPAC name of the alcohol which on undergoing dehydration yields each of the following alkenes as the **major product** respectively;
i) $CH_3CH_2CH_2CH_2CH{=}CH_2$ ii) $(CH_3)_2C{=}CHCH_3$ iii) $(CH_3)_2C{=}C(CH_3)_2$ iv)



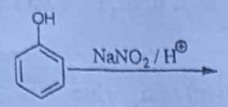
(a) hexan-2-ol; 3-methylbutan-3-ol; 3-methylbutan-3-ol; 1-methylcyclohexan-1-ol
(b) hexen-2-ol; 2-methylbutan-2-ol; 3-methylbutan-2-ol; 2-methylcyclohexan-2-ol
(c) hexan-1-ol; 2—methylbutan-3-ol; 2-methylbutan-3-ol; cyclohexylmethanol
(d) hexan-1-ol; 2-methylbutan-2-ol; 3-methylbutan-2-ol; cyclohexylmethanol

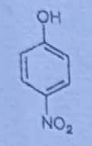
(45). The reaction below is an example of

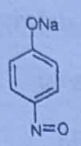


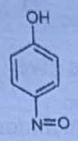
(a) Reimer-Tiemann reaction (b) Gattermann-Koch reaction (c) Kolbe Schmidt reaction (d) Williamson's reaction

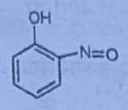
(46). What is the product of the reaction below;



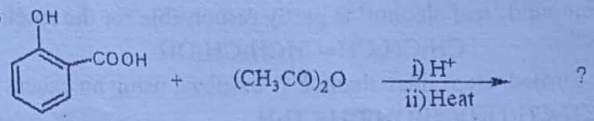
(a) 

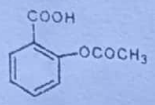
(b) 

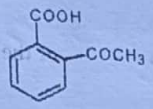
(c) 

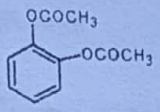
(d) 

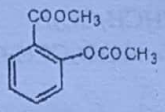
(47). What is the major product of this reaction;



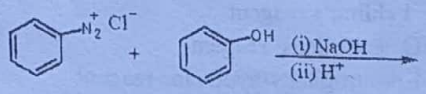
(a) 

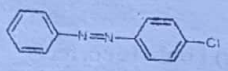
(b) 

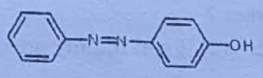
(c) 

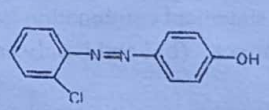
(d) 

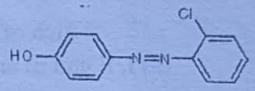
(48). Predict the product of the reaction;



(a) 

(b) 

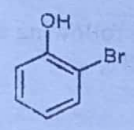
(c) 

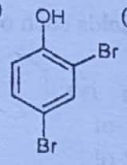
(d) 

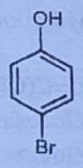
(49). Which of the substituents or group when introduced in the aromatic nucleus in the positions stated, will promote the acidic properties of phenol to the greatest extent ?

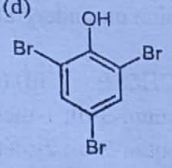
(a) Cl in the 4-position (b) NO_2 in the 4-position (c) Cl in the 2-position (d) NO_2 in the 2-position

(50). Treatment of phenol with bromine in a non-polar solvent in the cold gives as the major product;

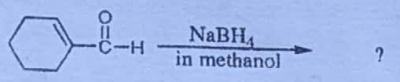
(a) 

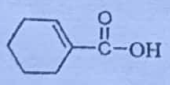
(b) 

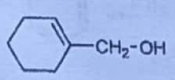
(c) 

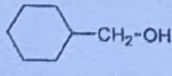
(d) 

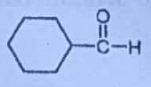
(51). Consider the reaction below. Which is the major product of the reaction?



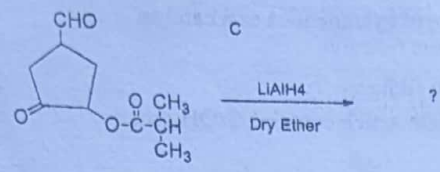
(a) 

(c) 

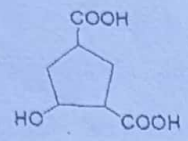
(b) 

(d) 

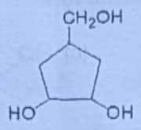
(52). Consider the reaction below;



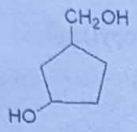
What is the product of the reaction?

(a) 

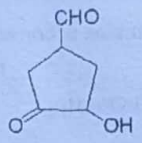
and $(CH_3)_2CH_2OH$

(b) 

and $(CH_3)_2CH\text{-}CH_2OH$

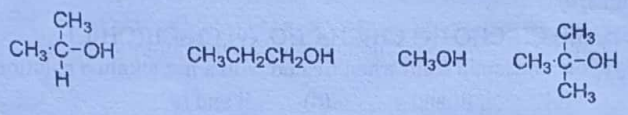
(c) 

and $(CH_3)_2CH_2OH$

(d) 

and $(CH_3)_2CH_2OH$

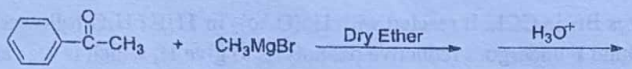
(53). Consider the following lettered compounds below and arrange them in order of their increasing acidity;

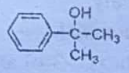


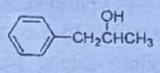
A B C D

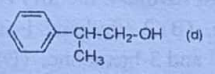
(a) **C < D < B < A** (b) **D < A < B < C** (c) **C < B < A < D** (d) **C < B < D < B**

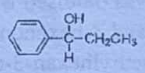
(54). What is the major product of the following reaction?



(a) 

(b) 

(c) 

(d) 

(55). Determine the specific rotation of an organic compound if a solution of it containing 0.75 g/ 10 mL is placed in a 1 dm polarimeter tube and its observed rotation at 25 °C (D line) is: + 12. (ii) what is the specific rotation of its enantiomer; (iii) What is its specific rotation of the organic compound if its concentration is doubled respectively?

(A) +1.6; -1.6 and +0.8 (B) +16; -16; and +8 (C) +16°; -16° and +16° (D) +16°; -16°; and +8°

(56). Primary alcohols can be oxidized to aldehydes using either acidified potassium dichromate (VI) or acidified potassium manganate (VII). Both these oxidizing agents change colour as they are reduced.

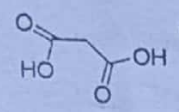
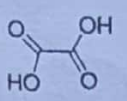
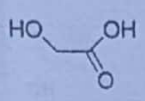
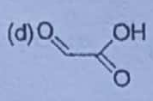
	Acidified Potassium Dichromate (VI)		Acidified Potassium Manganate (VII)	
	Before	After	Before	After
(a)	Green	Orange	Purple	Colourless
(b)	Orange	Green	Colourless	Purple
(c)	Orange	Green	Purple	Colourless
(d)	Purple	Colourless	Orange	Green

What is the colour of each oxidizing agent before and after it has reacted?

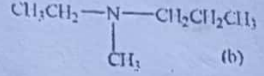
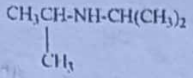
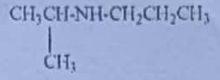
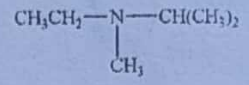
(57). A compound E CH_3CH_2-CO-CH_2CH_3 reacts with hydrogencyanide to form an organic product F, what is the name and feature that applies to the cyanohydrin formed?

(a) 2-ethyl-2-hydroxybutanenitrile and its formation requires the use of cyanide ions as a catalyst
(b) 2-hydroxy-2-ethylpropanenitrile and it has one chiral centre
(c) 2-ethyl-2-hydroxypropanenitrile and it is formed by electrophilic addition
(d) 2-ethyl-2-hydroxybutanenitrile and it is formed via an intermediate which contains C-OH group

(58). Hydroxyethanal, $HOCH_2CHO$, is heated under reflux with an excess of acidified potassium dichromate (VI) until no further oxidation takes place. What is the skeletal formula of the organic product?

(a) 
(b) 
(c) 
(d) 

(59). Which of the following structural formulas is correct for the compound; ethylmethyl-(2-propyl)amine?

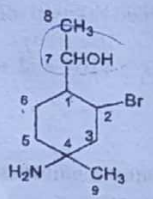
(a) 
(b) 
(c) 
(d) 

(60). 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

(61). What are the products of ozonolysis of 2,4-dimethylhex-3-ene?
(a) butanal and butan-2-one (b) 2-methylpropanal and butan-2-one
(c) 1-methylpropanone and 2-methylpropanal (d) 2-methylpropanal and butan-3-one

(62). An hydrocarbon F (C_7H_{14}) decolorizes Br_2 in CCl_4. It reacted with $Hg(OAc)_2$ in THF / H_2O followed by reduction with $NaBH_4$ to form compound G. Compound F undergoes reductive ozonolysis to give H, which is the same compound obtained when 3-hexanol was oxidised with KMnO4. Identify compounds F, G and H respectively.
(A) 3-heptene; 3-heptanol and 3-hexanone. (B) 2-ethylpent-1-ene; 2-methylhexan-3-ol and 3-hexanal.
(C) 2-ethylpent-1-ene; 3-methylhexan-3-ol and 3-hexanone. (D) 3-methylhex-2-ene; 3-methylhexan-3-ol and 3- hexanoic acid.

(63).



Consider the compound above having its C-atoms numbered 1 – 9. Indicate the chiral C-atom(s) in the molecule: (A) 1, 2, 4 & 7; (B) 2, 4 & 7; (C) 2, 4, 5; (D) 2 & 7 only

(64). Alkanes can be prepared by the following methods except: (i) Dehydrohalogenation; (ii) Hydration of alkenes; (iii) Hydrogenation of unsaturated hydrocarbons (iv) Electrophilic addition reaction.

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

8

(65). Arrange the following groups in order of decreasing priority according to Cahn Ingold Prelog rule:

$(CH_3)_3C$- ; CH_3CHOH- ; HO- ; CH_2=CH- and HC≡C−

(A) HC≡C− ; HO- ; $(CH_3)_3C$- ; CH_2=CH (B) HO- ; HC≡C− ; $(CH_3)_3C$- ; CH

(C) HO- ; HC≡C− ; CH_2=CH ; $(CH_3)_3C$- (D) HO- ; $(CH_3)_3C$- ; HC≡C− ; CH

(66). The following is/are correct for S_N1 reaction mechanism except: (i) The geometry of the transition state It is favoured with primary alkyl halide; (iii) The substrate and product are of opposite configuration (iv) Th product are of same geometry.

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

(67). Give the total number of resonance canonical structures for methoxybenzene and the number of the car structures that are ionic. (A) 4, 2 (B) 3, 1 (C) 5, 2 (D) 5, 3

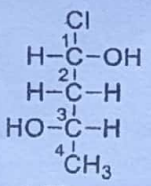
(68). Arrange the following in decreasing order of acidity: Ethanoic acid; dichloroethanoic acid; monochlor and trichloroethanoic acid, give reason for your answer.

(A) Trichloroethanoic acid; dichloroethanoic acid; monochloroethanoic acid; ethanoic acid; mesomeric effect of Cl grup
(B) Ethanoic acid; Trichloroethanoic acid; dichloroethanoic acid; monochloroethanoic acid; inductive effect of Cl grup
(C) Trichloroethanoic acid; dichloroethanoic acid; monochloroethanoic acid; ethanoic acid; inductive effect of Cl grup
(D) Ethanoic acid; monochloroethanoic acid; dichloroethanoic acid; trichloroethanoic acid; inductive effect

(69). Arrange the following in order of decreasing boiling point: HF; H_2O; HCl. (A) HF; HCl; H_2O

(B) HCl; HF; H_2O (C) H_2O; HCl; HF (D) H_2O; HF; HCl

(70).



Consider the above compound: How many chiral C-atoms are present; indicate the specific configuration of al atoms present and give the number of optically active isomers of the compound. (A) 2; 1S, 3S; 2. (B) 2; 1R, 1S, 3S; 4 (D) 2; 1S, 3S; 4