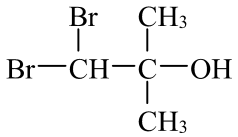
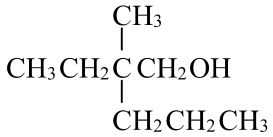
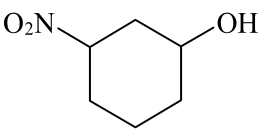
TOPIC	SUBTOPIC	LEARNING OUTCOMES	MAPPING COGNITIVE DOMAINS			
			C1	C2	C3	C4
Hydroxy Compounds	8.1 Nomenclature	a) Draw the structures, classify and name the hydroxy compounds (parent chain ≤C_{10}) according to IUPAC nomenclature		√		
	8.2 Physical properties of Alcohols	a) Analyze the physical properties: i. Boiling point ii. Solubility in water				√
	8.3 Preparation of Alcohols	a) Explain the preparation of alcohol by: i. Fermentation ii. Hydration of alkenes iii. Hydrolysis of haloalkanes iv. Addition of Grignard reagents to carbonyl compounds			√	
		b) Outline the synthesis of alcohols			√	
	8.4 Chemical properties of Alcohols	a) Explain the reactions of alcohols with reference to: i. Reaction with sodium ii. Esterification iii. Dehydration iv. Substitution reactions using HX, PX_3, PCl_5 or $SOCl_2$			√	
		b) Explain the oxidation reactions with $KMnO_4/H^+$, $Cr_2O_7^{2-}/H^+$, CrO_3/H^+ and PCC/CH_2Cl_2			√	
		c) Explain the identification tests to distinguish classes of alcohols using Lucas reagent, i.e. concentrated $HCl/ZnCl_2$				√
		d) Outline the synthesis of compounds related to reactions of alcohols				√
		e) Explain iodoform test, i.e I_2/OH^- to identify methyl carbinol $CH_3CH(OH)$			√	
	8.5 Phenol	a) Compare the acidity of phenol, alcohol and water				√
		b) Explain the chemical properties of phenol with reference to: i. Reaction with sodium ii. Reaction with sodium hydroxide iii. Identification tests using $FeCl_3$ solution and bromine water			√	

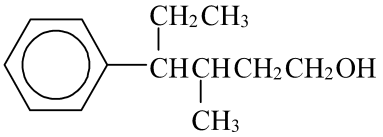
1. Classify the following compounds as primary, secondary or tertiary and give their IUPAC names.

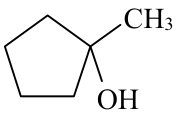
[LO: 8.2]

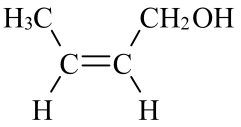
(a) 

(b) 

(d) 

(e) 

(c) 

(f) 

2. The following names are incorrect. Draw the structural formulae and give the correct IUPAC names. ***[LO: 8.2]***

(a) 4-butanol

(b) 1,1-dimethyl-2-cyclopentanol

(c) 6-methyl-3-ethylcyclohexanol

(d) 7-chloro-4-heptanol

3. Arrange the following compounds in increasing order of boiling point. Explain your answer.

(a) 1,2-ethanediol, n-butane, 1-propanol, 1,3-propanediol

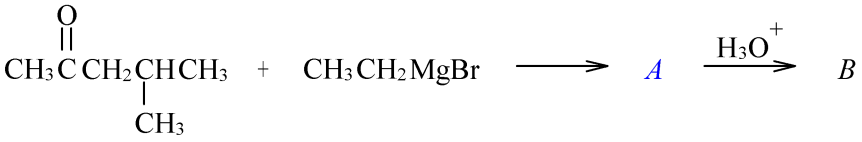
(b) $(CH_3)_2CHCH_2OH$, $(CH_3)_2CH(CH_2)_2CH_2OH$, $(CH_3)_2CH(CH_2)_3CH_2OH$ ***[LO: 8.3(i)]***

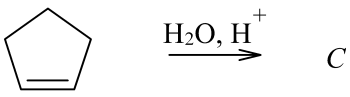
4. Arrange the compounds in each set in decreasing order of solubility in water. Explain your answer. ***[LO:8.3(ii)]***

(a) ethanol, 1-pentanol, 1-hexanol

(b) hexane, 1-hexanol, 1,2-ethanediol

5. Draw the structural formulae of A to D in the following equations. ***[LO: 8.2(f)]***

(a) 

(b) 

(c) $(CH_3)_2CHCH_2Cl + NaOH(aq) \xrightarrow[\text{reflux}]{} D$

6. Write equation for each of the following reactions. ***[LO: 8.5(a) & 8.5(b)]***

(a) 2-butanol heated with acidified $KMnO_4$ solution

(b) 2-propanol heated with concentrated H_2SO_4

(c) 2-methyl-1-propanol heated with acidified $K_2Cr_2O_7$ solution

(d) methanol reacts with PCl_5

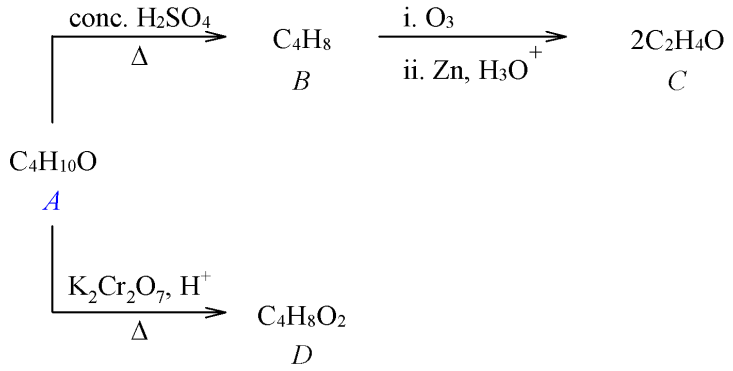
(e) 1,2-ethanediol with potassium

(f) glacial ethanoic acid heated with 2-propanol in the presence of concentrated H_2SO_4

(g) 1-hexanol reacts with PCC/CH_2Cl_2

(h) cyclopentanol reacts with $SOCl_2$,pyridine

7. Predict the structural formulae of A to D in the reaction series below.



[LO:8.5(a) iii] [LO: 8.2(m)i] [LO:8.1] [LO:8.5(a)]

8. Give a chemical test to distinguish between

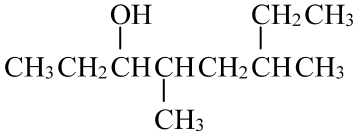
(a) 2-methyl-1-propanol and 2-methyl-2-propanol ***[LO: 8.5(c)]***

(b) 1-butanol and 2-propanol ***[LO: 8.5(c)]***

(c) benzene and cyclohexanol ***[LO: 8.5(b)]***

(d) 2-methyl-2-butanol and 2-butanol ***[LO: 8.5(d)]***

9. The structural formula of alcohol A is given below:



(a) Give the IUPAC name of A. ***[LO: 8.1]***

(b) Is A optically active? Explain your answer.

(c) Classify alcohol A as 1°, 2° or 3°. ***[LO: 8.2]***

(d) Give the major product of the dehydration of A. ***[LO: 8.5(a)iii]***

10. An alcohol $C_4H_{10}O$ which has several isomers gave the following observations:

I Isomer L gives negative result with Lucas reagent and forms butanoic acid when oxidised with acidified potassium dichromate solution

II Isomer M is optically active and gives positive result with I_2/NaOH.

III Isomer N reacts instantly with Lucas reagent but does not decolourise acidified solution of potassium dichromate.

Explain the above observations and suggest the structural formulae of isomers L, M and N.

[LO: 8.5(b)&(c)]

11. Show the preparation of:

(a) propanone from 2-bromopropane ***[LO: 8.2(a) & 8.5(b)]***

(b) 1,2-dibromoethane from ethanol ***[LO:8.5 (iii) & 8.2 (h)ii]***

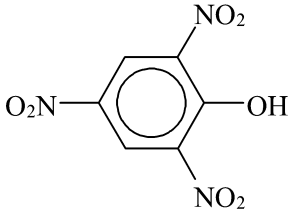
12. Compound P is an alcohol. Upon oxidation with acidified $KMnO_4$ solution, a ketone, Q is formed. P reacts with PBr_3 to give R which is then purified and refluxed in dry ether along with Mg metal to form a Grignard reagent, S. S is treated with Q followed by acidic hydrolysis to yield 3,4-dimethyl-3-hexanol. Identify P, Q, R and S. Write all the equations for reactions involved.

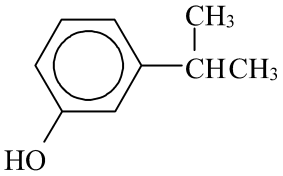
[LO: 8.1,8.5(b),8.5(a)iv,8.2(e),(f)]

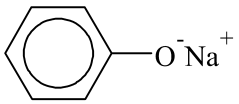
PHENOLS

13. Give the IUPAC name for each of the following compounds. ***[LO: 8.2(a)]***

(a) 

(c) 

(b) 

(d) 

14. Draw the structural formulae of the following compounds. ***[LO: 8.2(b)]***

(a) 2-bromo-6-nitrophenol

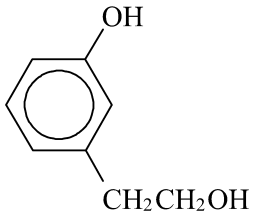
(b) 5-chloro-2-methylphenol

(c) 4-tert-butyl-2,6-difluorophenol

(d) 4-amino-2,5-dichlorophenol

15. Arrange the following compounds in order of increasing acidity. Explain your answer.
water, ethanol and phenol ***[LO: 8.6(a)]***

16. The structural formula of X is shown below:



Draw the structural formula of the product formed when X reacts with

(a) sodium ***[LO: 8.6(b)i]***

(b) aqueous sodium hydroxide ***[LO: 8.6(b)ii]***

(c) phosphorus pentachloride ***[LO: 8.5(a)iv]***

(d) propanoic acid refluxed with traces of concentrated sulfuric acid ***[LO: 8.5(a)ii]***

17. Explain the following observations:

(a) Phenol is soluble in aqueous solution of sodium hydroxide but cyclohexanol is not. ***[LO: 8.6(b)ii]***

(b) Ethanol reacts with iodine in aqueous solution of sodium hydroxide to produce yellow precipitate but 1-propanol does not. ***[LO: 8.5(d)]***

18. Compound Y, C_7H_8O, is insoluble in water but dissolves in dilute aqueous NaOH. When Y is treated with bromine water, it is converted rapidly into a compound with molecular formula $C_7H_5OBr_3$.

(a) Suggest the structural formula of Y. ***[LO: 8.2]***

(b) Write all the equations involved. ***[LO: 8.6(b)ii & iii]***

(c) Give one confirmatory test for Y. ***[LO: 8.6(b) iii]***