

UNIVERSITY OF SWAZILAND

RE-SIT EXAMINATION

2018, JULY

TITLE OF PAPER : Functional Group Chemistry and Stereochemistry

COURSE NUMBER : CHE232

TIME : Three Hours

INSTRUCTIONS : Answer any **FOUR** questions. Each question carries **25** marks

This Examination Paper Contains **FIVE** Printed Pages Including This Page
*You are not supposed to open the paper until permission to do so have been granted
by the Chief Invigilator.*

Question 1

Draw the structures of the following organic compounds.

(25)

- i. Cis-2-bromo-2-pentene
- ii. 2-ethoxy-2methyl-2-pentene
- iii. 3-methoxycyclohexene
- iv. 3-methylPhenol
- v. 1,2-dimethylbenzene
- vi. 3-bromoBenzoic acid
- vii. N-hexyl-N-methyloctanamine
- viii. 1-bromo-3-methyl-2-nonanone
- ix. 2-ethoxy-4-methoxyheptanal
- x. Cyclobutylcyclopropyl ether
- xi. 4-methyl-2-octyne
- xii. 5-ethyl-3-flouro-3-methyl-octanoic acid
- xiii. Propanone

Question 2

b. Briefly explain the following terms and give examples:

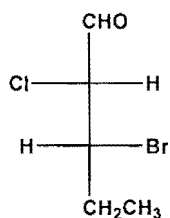
(8)

- i. Racemic mixture
- ii. Diastereomers
- iii. Enantiomers
- iv. Meso compound

c. Briefly discuss how a racemic mixture can be resolved.

(5)

d. Examine the Fisher projection structures for 3-bromo-2-chloro-pentanal molecule and answer the following questions.



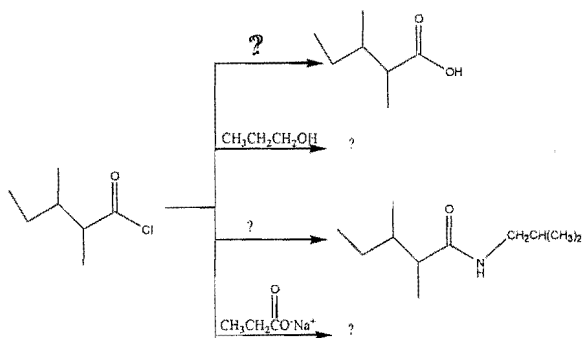
Draw the Fisher projection structures for all the possible stereoisomers and name them (include R and S configuration).

(12)

Question 3

a. Provide the missing reagents for the following chemical reactions.

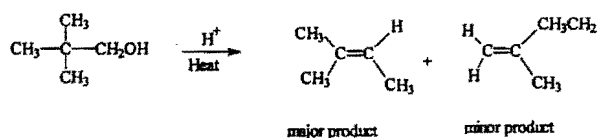
(10)



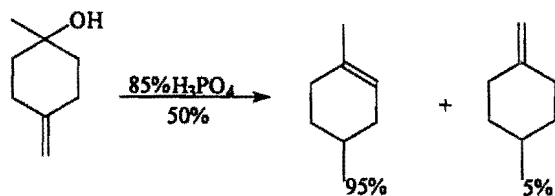
- b. Give a mechanism showing a Grignard reagent reacting with CO_2 (10)
- c. Carboxylic acids usually have higher boiling points than alkanes with the same number of carbons (5)

Question 4

- a. The following reactions are examples of acid-catalysed dehydration of alcohols. Such reactions normally produce a mixture of isomeric alkenes, as shown in the schemes below.



- i. (10)



- ii. (10)

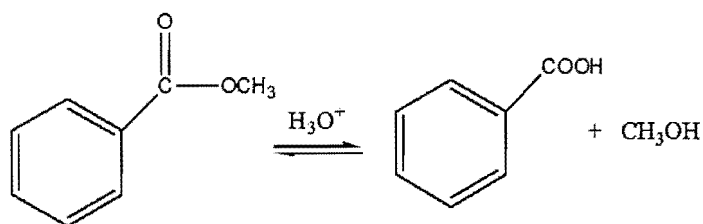
- iii. Explain the role of the acid catalyst in these reactions. (5)

Question 5

- a. Outline the mechanism for the Friedel-Crafts acylation of nitrobenzene and any acyl chloride of your choice (10)
- b. The addition of water to alkenes catalysed by an acid is always complicated by rearrangements. Give examples (using an alkene of your choice) for the Markovnikov's addition of water and anti-Markovnikov's addition using suitable reagents which are not complicated by rearrangement of the intermediate carbocation. (10)
- c. Account for the difference in boiling points of alkenes and alcohols. (5)

Question 6

- a) Write the reaction equations, including structures of both reactants and products, for the reaction of methylbenzene with:
- i. $\text{H}_2\text{SO}_4/\text{HNO}_3$ (3)
 - ii. $\text{FeCl}_3/\text{Cl}_2$ (3)
 - iii. $\text{CH}_3\text{CH}_2\text{COCl}/\text{AlCl}_3$ (3)
 - iv. 2-chloropropane/ AlCl_3 (3)
 - v. $\text{H}_2\text{SO}_4/\text{SO}_3$ (3)
- b. show the mechanism for the acid catalysed ester hydrolysis of the following reaction. Show all steps.



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Department of Chemistry

1 H <small>1.0079</small>	Atomic Number																2 He <small>4.0026</small>	Atomic Weight																2 He <small>4.0026</small>
3 Li <small>6.941</small>	4 Be <small>9.0122</small>																	5 B <small>10.811</small>	6 C <small>12.011</small>	7 N <small>14.007</small>	8 O <small>15.999</small>	9 F <small>18.998</small>	10 Ne <small>20.179</small>											
11 Na <small>22.990</small>	12 Mg <small>24.305</small>																	13 Al <small>26.982</small>	14 Si <small>28.086</small>	15 P <small>30.974</small>	16 S <small>32.064</small>	17 Cl <small>35.453</small>	18 Ar <small>39.948</small>											
19 K <small>39.098</small>	20 Ca <small>40.078</small>	21 Sc <small>44.956</small>	22 Ti <small>47.88</small>	23 V <small>50.942</small>	24 Cr <small>51.996</small>	25 Mn <small>54.938</small>	26 Fe <small>55.847</small>	27 Co <small>58.933</small>	28 Ni <small>58.69</small>	29 Cu <small>63.546</small>	30 Zn <small>65.39</small>	31 Ga <small>69.723</small>	32 Ge <small>72.61</small>	33 As <small>74.922</small>	34 Se <small>78.96</small>	35 Br <small>79.904</small>	36 Kr <small>83.80</small>																	
37 Rb <small>85.47</small>	38 Sr <small>87.62</small>	39 Y <small>88.906</small>	40 Zr <small>91.224</small>	41 Nb <small>92.906</small>	42 Mo <small>95.94</small>	43 Tc <small>(98)</small>	44 Ru <small>101.07</small>	45 Rh <small>102.91</small>	46 Pd <small>106.42</small>	47 Ag <small>107.87</small>	48 Cd <small>112.41</small>	49 In <small>114.82</small>	50 Sn <small>118.71</small>	51 Sb <small>121.75</small>	52 Te <small>127.60</small>	53 I <small>126.90</small>	54 Xe <small>131.29</small>																	
55 Cs <small>132.91</small>	56 Ba <small>137.33</small>	57 La <small>138.91</small>	72 Hf <small>178.49</small>	73 Ta <small>180.95</small>	74 W <small>183.85</small>	75 Re <small>186.2</small>	76 Os <small>190.2</small>	77 Ir <small>192.22</small>	78 Pt <small>195.08</small>	79 Au <small>196.97</small>	80 Hg <small>200.59</small>	81 Tl <small>204.38</small>	82 Pb <small>207.2</small>	83 Bi <small>208.98</small>	84 Po <small>(209)</small>	85 At <small>(210)</small>	86 Rn <small>(222)</small>																	
87 Fr <small>(223)</small>	88 Ra <small>226.03</small>	89 Ac <small>227.03</small>																																
																		58 Ce <small>140.12</small>	59 Pr <small>140.91</small>	60 Nd <small>144.24</small>	61 Pm <small>146.92</small>	62 Sm <small>150.36</small>	63 Eu <small>151.97</small>	64 Gd <small>157.25</small>	65 Tb <small>158.93</small>	66 Dy <small>162.50</small>	67 Ho <small>164.93</small>	68 Er <small>167.26</small>	69 Tm <small>168.93</small>	70 Yb <small>173.04</small>	71 Lu <small>174.97</small>			
																		90 Th <small>232.04</small>	91 Pa <small>231.04</small>	92 U <small>238.03</small>	93 Np <small>237.05</small>	94 Pu <small>(244)</small>	95 Am <small>(243)</small>	96 Cm <small>(247)</small>	97 Bk <small>247</small>	98 Cf <small>(251)</small>	99 Es <small>(252)</small>	100 Fm <small>(257)</small>	101 Md <small>(258)</small>	102 No <small>(259)</small>	103 Lr <small>(260)</small>			