UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION 2015,MAY

TITLE OF PAPER	:	Introductory Organic Chemistry
COURSE NUMBER	:	C203
TIME	:	Three Hours
INSTRUCTIONS	:	**Section A is compulsory**. Answer any **three** questions from Section B. Each question carries **25** marks

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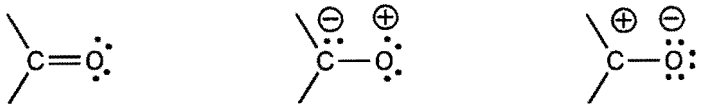
This Examination Paper Contains Ten Printed Pages Including This Page

You are not supposed to open the paper until permission to do so has been grated by the Chief Invigilator.

Section A: (compulsory – answer all questions)

1. Which of the following resonance structures is not a significant contributor to the hybrid for the carbonyl group?



I II III

a. I

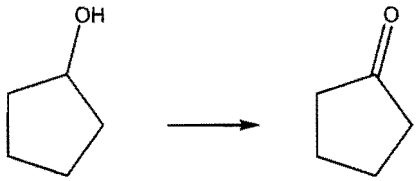
b. II

c. III

d. Neither II nor III is important

e. All are significant contributors

2. The following transformation would be considered a(n)?



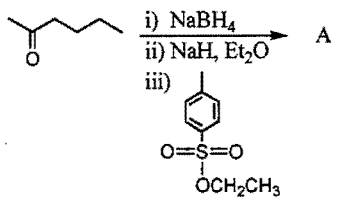
a. Reduction
b. Oxidation
c. Addition
d. Elimination
e. Rearrangement

3. Which reaction is an oxidation?
   a. $RCHO \longrightarrow RCO_2H$
   b. $RCH_2OH \longrightarrow RCHO$
   c. $RCH_2OH \longrightarrow RCO_2H$
   d. None of these
   e. All of these

4. Which of the reagents listed below would efficiently accomplish the transformation of $CH_3CH_2CH{=}CHCH_2CH_2CHO$ into $CH_3CH_2CH{=}CHCH_2CH_2CH_2OH$?

   a. $KMnO_4$,
   b. $NaBH_4$,
   c. Br_2 in CCl_4,
   d. H_2/Ni,
   e. Two of the above

5. What would be the major product of the following reaction?



a. $CH_3CH_2OCH(CH_3)CH_2CH_2CH_2CH_3$

b. $(CH_3CH_2O)_2CHCHOHCH_2CH_2CH_3$

c. $(CH_3CH_2)_2CHOHCH_2CH_2CHOHCH_3$

d. $CH_3OCH(C_2H_5)CH_2CH_2CH_2CH_3$

e. $CH_3CH_2CH(OCH_3)CH_2CH_2CHOHCH_3$

6. What is the predominant product from the reaction of 2-hexanol with $KMnO_4$?

a. CH_3CO_2H

b. $CH_3(CH_2)_3CO_2H$

c. $CH_3(CH_2)_3\overset{\overset{O}{\|}}{C}CH_3$

d. $CH_3(CH_2)_4CO_2H$

e. A) and B)

7. Which of the reagents listed below would serve as the basis for a simple chemical test to distinguish between $(CH_3)_3COH$ and $(CH_3)_2CHCH_2OH$?

a. NaH

b. $NaOH/H_2O$

c. Br_2 in CCl_4

d. Cold conc. H_2SO_4

e. CrO_3 in H_2SO_4

8. What is the predominant product from the reaction of 2-hexanol with PCC in CH_2Cl_2?

a. CH_3CO_2H

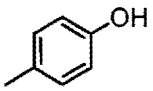
b. $CH_3(CH_2)_3CO_2H$

c. $CH_3(CH_2)_3\overset{\overset{O}{\|}}{C}CH_3$

d. $CH_3(CH_2)_4CO_2H$

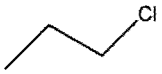
e. A) and B)

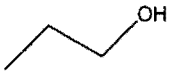
9. What is the IUPAC name for:

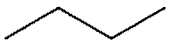


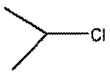
a. *p*-Hydroxyphenol
b. *p*-Dihydroxybenzene
c. Resorcinol
d. 1,4-dihydroxybenzene
e. 4-methylphenol

10. Which of the following has the highest boiling point?

a. 

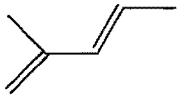
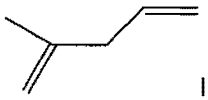
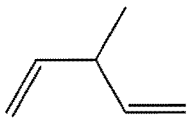
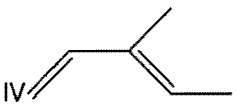
b. 

c. 

d. 

e. None of the above

11. Ozonolysis of an unknown compound gave $CH_2=O$, CH_3CHO and CH_3COCHO. What are possible structures for the unknown compound?

I  II  III  IV 

a. I and II
b. I and IV
c. II and III
d. II and IV
e. None of the above

Section B: (answer any 3 questions)

Question 1

a. i) Write two isomeric structures of the compounds with the molecular formula C_2H_6O.

ii) Name the two isomers

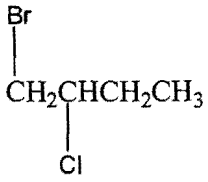
iii) Give the organic classes of these compounds ***(5marks)***

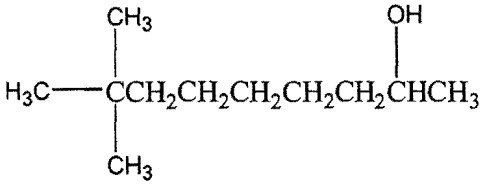
b. Write the Fischer Projection structures for: ***(4marks)***

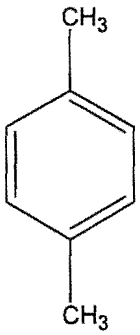
(i) (R)-2-butanol

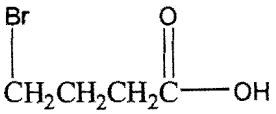
(ii) (S)-glyceraldehyde {2,3-dihydroxypropanal, $HOCH_2CH(OH)CHO$}

c. Give IUPAC names for the following compounds:

(i) 

(ii) 

(iii) 

(iv)  ***(8marks)***

d. Arrange the following alkyl bromides in order of decreasing reactivity in an S_N2 reaction; 1-bromo-2-methylbutane, 1-bromo-3-methylbutane, 2-bromo-2-methylbutane, and 1-bromopentane ***(4marks)***

e. Determine the products that will be formed from the S_N2 reaction of:***(4marks)***

i. 2-bromobutane and hydroxide ion (OH^-)

ii. (R)-2-bromobutane and hydroxide ion (OH^-)

Question 2

a. Account for the fact that the boiling points of phenol and toluene are 182°C and 110.6°C, respectively, even though they have almost the same molecular weight

(5 marks)

(b) Write the Fischer Projection structures for:

(iii) (R)-2-Bromopropanoic acid

(iv) (R)-2,3-Dihydroxypropanal

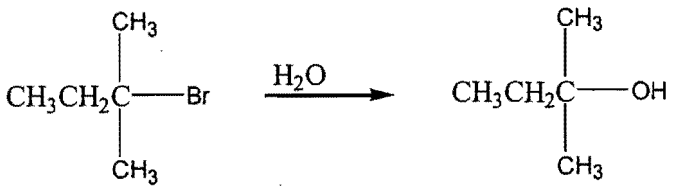
(v) (S)-2-Aminobutanoic acid

(vi) (2S,3S)-Dichlorobutanoic acid

(vii) (2R,3R)-Dibromobutanal **(10 marks)**

b. Show all the steps of the following reaction by S_N1 mechanism.

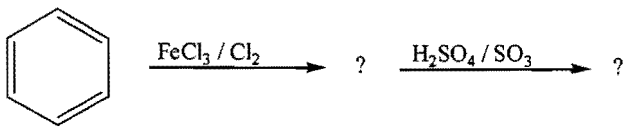
(10 marks)



Question 3

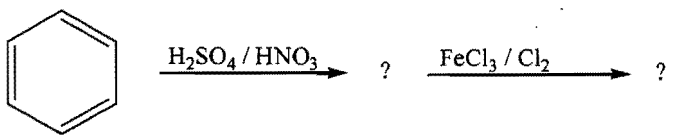
(a) Write the structure of the indicated intermediate products and the principal organic products of the following reactions:

(i)

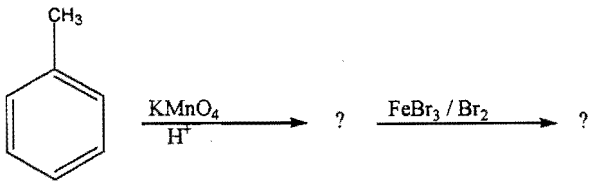


(4marks)

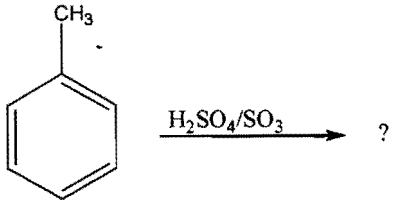
(ii)



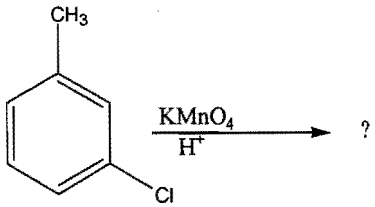
(4marks)

(iii) 

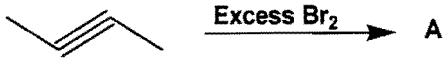
(4marks)

(iv) 

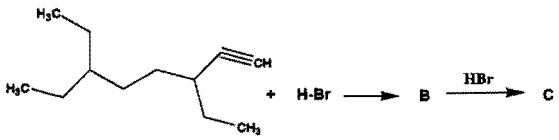
(2marks)

(v) 

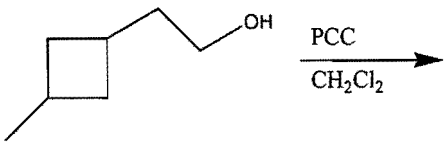
(2marks)

vi) 

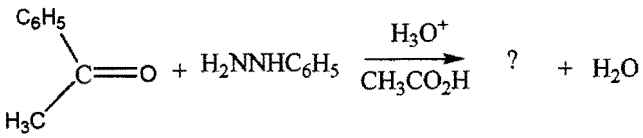
(2 marks)

vii) 

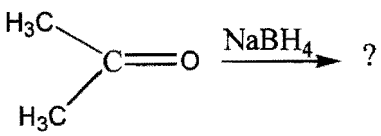
(2marks)

viii) 

(2marks)

ix) 

(2marks)

x) 

(1marks)

Question 4

(a) Define the terms:

(i) Aldol addition

(ii) Crossed or mixed aldol additions *(4 marks)*

(b) What kinds of products are formed from these reactions? *(2 marks)*

(c) Show the net reactions for the formation of the aldol adduct from

(i) propanal in dilute NaOH

(ii) acetone in dilute NaOH **(4 marks)**

(e) Outline a general mechanism for the acid-catalyzed aldol additions of carbonyl compounds. *(7 marks)*

f) What would be the product of the reaction of phenylmagnesium bromide with each of the following reagents?

1. H_2O
2. C_6H_5COCl
3. H_2CO
4. $CH_3CH_2CH_2CH_2CH_2COOH$ *(8 marks)*

Question 5

(b) What would be the products of the hydration of 3,3-dimethyl-1-pentene $\{CH_3CH_2CH_2(CH_3)_2CH{=}CH_2\}$ using:

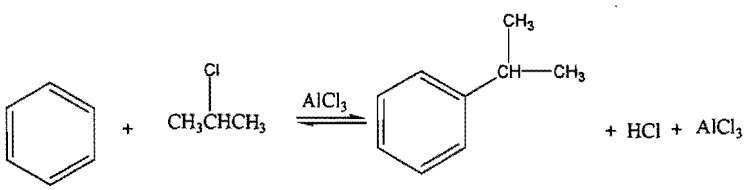
(i) Acid-catalysed hydration *(5 marks)*

(ii) Oxymecuration-demercuration *(5 marks)*

(iii) Hydroboration-oxidation *(5 marks)*

(c) Outline the mechanism for the following Friedel-Crafts Alkylation reaction:

(10 marks)



UNIVERSITY OF SWAZILAND

CHEMISTRY DEPARTMENT

C203 SECTION A ANSWER SHEET

STUDENT ID NUMBER:_____

The correct answer must be indicated by putting a circle on the letter for that answer on the answer sheet provided. If you change your answer, please cancel the wrong answer with a cross and then put a circle around the correct one. If more than one option has a circle around it a zero will be given for that question.

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E

hydrogen 1 H 1.0079																	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078		scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62		yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 * *	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	unununium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]				

*Lanthanide series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
**Actinide series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]