UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

RESIT EXAMINATION PAPER 2019

TITLE OF PAPER : ORGANIC CHEMISTRY AND BIOCHEMISTRY FOR NURSES

COURSE CODE : GNS 112

DURATION : 2 HOURS

MARKS : 100

INSTRUCTIONS : READ THE QUESTIONS & INSTRUCTIONS CAREFULLY

: ANSWER **ANY FOUR** QUESTIONS

: EACH QUESTION **CARRIES 25** MARKS.

: WRITE NEATLY & CLEARLY

: NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE EXAMINATION ROOM.

: BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

QUESTION ONE

a. Identify whether the following statements are true or false.

(i) The overall polarity of organic molecules is high. **[2 Marks]**

(ii) Humans digest starch but not cellulose because of differences in the type of linkage between the glucose monomers of these substances **[2 Marks]**

(iii) The majority of glucose molecules exist in ring structure. **[2 Marks]**

(iv) A carbon with three or more attached groups will be chiral. **[2 Marks]**

(v) The DNA double helix is held together by hydrogen bonds and London dispersion forces. **[2 Marks]**

b. Draw saturated structures for the following compounds and fill in non-bonding valence electrons where they can be found.

i) Bromo, chloroethane **[3 Marks]**

ii) Carbon monoxide **[3 Marks]**

iii) Methanal **[3 Marks]**

iv) 2,4' dichloro biphenyl **[3 Marks]**

v) 2-chloro-4-ethoxyhexanal **[3 Marks]**

Total: **[25 Marks]**

QUESTION TWO

a. Explain what is meant by the term 'anticoagulant' and give three examples of anticoagulants. **[7 Marks]**

b. What is the difference between blood serum and blood plasma? **[4 Marks]**

c. Steriods are a class of biomolecules made up of three six-membered carbon rings and one five-membered ring with an aliphatic chain attached on the five carbon ring. Give three examples of steroids and give the function of each example. **[6 Marks]**

d. Draw all structural isomers of hexene, C_6H_{12}, that have unbranched carbon chains. **[8 marks]**

Total: **[25 Marks]**

QUESTION THREE

a. Account for the following facts;

(i) Tertiary carbocations do not undergo S_N2 type of reactions. **[5 Marks]**

(ii) Cyclobutane, a cyclic alkane, and 1-butene, an alkene, have the same molecular formular **[5 Marks]**

(iii) Terminal alkenes form minor products of reactions involving the dehydration of alcohols. **[5 Marks]**

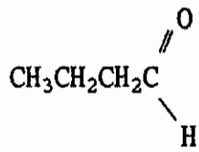
(iv) Carbon forms 4 covalent bonds yet its ground state electron configuration only has two unpaired electrons. **[5 Marks]**

(v) Non-bonding electron pairs also play a role in the determination of molecular geometry. **[5 Marks]**

Total: **[25 Marks]**

QUESTION FOUR

a) Consider the structure of butanal shown below and answer the following questions



i) Fill in the non-bonding valence electrons that are missing from the line bond structure. **[3 Marks]**

ii) Determine the hybridization of carbon 1 atom. **[3 Marks]**

iii) Predict the bond angle of substituents bonded to carbon 1 **[3 Marks]**

b) Draw the structural formular of 6-ethyl-3-decene. **[6 Marks]**

c) Of the 20 amino acids found in our bodies, _____ of them must be ingested because our bodies cannot synthesize sufficient quantities of them. **[4 Marks]**

d) What is the difference between E1 and E2 reactions? **[6 Marks]**

Total: **[25 Marks]**

QUESTION FIVE

a. Give the molecular formula of a hydrocarbon containing five carbon atoms that is;

(i) An alkane **[2 Marks]**

(ii) Cycloalkane **[2 Marks]**

(iii) An alkene **[2 Marks]**

(iv) An alkyne. **[2 Marks]**

b. Explain why the molecular formulars of the answers given in a. (i) and (ii) are different. **[Marks 4]**

c. Draw structural formulars of examples of the following classes of organic compounds

(i) Carboxylic acid **[2 Marks]**

(ii) Ketone **[2 Marks]**

(iii) Esters **[2 Marks]**

(iv) Secondary Amine **[2 Marks]**

d. Write a balanced chemical equation for the reaction of 2-pentyne and excess hydrogen. **[5 Marks]**

Total: **[25 Marks]**

General data and fundamental constants

Quantity	Symbol	Value
Speed of light	c	$2.997\,924\,58 \times 10^{8}$ m s^{-1}
Elementary charge	e	$1.602\,177 \times 10^{-19}$ C
Faraday constant	$F = N_A e$	9.6485×10^{4} C mol^{-1}
Boltzmann constant	k	$1.380\,66 \times 10^{-23}$ J K^{-1}
Gas constant	$R = N_A k$	8.314 51 J K^{-1} mol^{-1}
		$8.205\,78 \times 10^{-2}$ dm^3 atm K^{-1} mol^{-1}
		6.2364×10 L Torr K^{-1} mol^{-1}
Planck constant	h	$6.626\,08 \times 10^{-34}$ J s
	$\hbar = h/2\pi$	$1.054\,57$ X-10^{-34} J s
Avogadro constant	N_A	$6.022\,14 \times 10^{23}$ mol^{-1}
Atomic mass unit	u	$1.660\,54 \times 10^{-27}$ Kg
Mass		
electron	m_e	$9.109\,39 \times 10^{-31}$ Kg
proton	m_p	$1.672\,62 \times 10^{-27}$ Kg
neutron	m_n	$1.674\,93 \times 10^{-27}$ Kg
Vacuum permittivity	$\varepsilon_o = 1/c^2\mu_o$	$8.854\,19 \times 10^{-12}$ J^{-1} C^2 m^{-1}
	$4\pi\varepsilon_o$	$1.112\,65 \times 10^{-10}$ J^{-1} C^2 m^{-1}
Vacuum permeability	μ_o	$4\pi \times 10^{-7}$ J s^2 C^{-2} m^{-1}
		$4\pi \times 10^{-7}$ T^2 J^{-1} m^3
Magneton		
Bohr	$\mu_B = e\hbar/2m_e$	$9.274\,02 \times 10^{-24}$ J T^{-1}
nuclear	$\mu_N = e\hbar/2m_p$	$5.050\,79 \times 10^{-27}$ J T^{-1}
g value	ge	2.002 32
Bohr radius	$a_o = 4\pi\varepsilon_o\hbar/m_e e^2$	$5.291\,77 \times 10^{-11}$ m
Fine-structure constant	$\alpha = \mu_o e^2 c/2h$	$7.297\,35 \times 10^{-3}$
Rydberg constant	$R_\infty = m_e e^4/8h^3 c\varepsilon_o^2$	$1.097\,37 \times 10^{7}$ m^{-1}
Standard acceleration of free fall	g	9.806 65 m s^{-2}
Gravitational constant	G	$6.672\,59 \times 10^{-11}$ N m^2 Kg^{-2}

Conversion factors

1 cal	=	4.184 joules (J)	1 erg	=	1×10^{-7} J
1 eV	=	$1.602\,2 \times 10^{-19}$ J	1 eV/molecule	=	96 485 kJ mol^{-1}

Prefixes

f	p	n	μ	m	c	d	k	M	G
femto	pico	nano	micro	milli	centi	deci	kilo	mega	giga
10^{-15}	10^{-12}	10^{-9}	10^{-6}	10^{-3}	10^{-2}	10^{-1}	10^{3}	10^{6}	10^{9}

GROUPS

PERIODS	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9	10 VIIIB	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1.008 H 1																	4.003 He 2
2	6.941 Li 3	9.012 Be 4											10.811 B 5	12.011 C 6	14.007 N 7	15.999 O 8	18.998 F 9	20.180 Ne 10
3	22.990 Na 11	24.305 Mg 12	TRANSITION ELEMENTS										26.982 Al 13	28.086 Si 14	30.974 P 15	32.06 S 16	35.453 Cl 17	39.948 Ar 18
4	39.098 K 19	40.078 Ca 20	44.956 Sc 21	47.88 Ti 22	50.942 V 23	51.996 Cr 24	54.938 Mn 25	55.847 Fe 26	58.933 Co 27	58.69 Ni 28	63.546 Cu 29	65.39 Zn 30	69.723 Ga 31	72.61 Ge 32	74.922 As 33	78.96 Se 34	79.904 Br 35	83.80 Kr 36
5	85.468 Rb 37	87.62 Sr 38	88.906 Y 39	91.224 Zr 40	92.906 Nb 41	95.94 Mo 42	98.907 Tc 43	101.07 Ru 44	102.91 Rh 45	106.42 Pd 46	107.87 Ag 47	112.41 Cd 48	114.82 In 49	118.71 Sn 50	121.75 Sb 51	127.60 Te 52	126.90 I 53	131.29 Xe 54
6	132.91 Cs 55	137.33 Ba 56	138.91 *La 57	178.49 Hf 72	180.95 Ta 73	183.85 W 74	186.21 Re 75	190.2 Os 76	192.22 Ir 77	195.08 Pt 78	196.97 Au 79	200.59 Hg 80	204.38 Tl 81	207.2 Pb 82	208.98 Bi 83	(209) Po 84	(210) At 85	(222) Rn 86
7	223 Fr 87	226.03 Ra 88	(227) **Ac 89	(261) Rf 104	(262) Ha 105	(263) Unh 106	(262) Uns 107	(265) Uno 108	(266) Une 109	(267) Uun 110								

Atomic mass → 10.811
Symbol → B
Atomic No. → 5

*Lanthanide Series	140.12 Ce 58	140.91 Pr 59	144.24 Nd 60	(145) Pm 61	150.36 Sm 62	151.96 Eu 63	157.25 Gd 64	158.93 Tb 65	162.50 Dy 66	164.93 Ho 67	167.26 Er 68	168.93 Tm 69	173.04 Yb 70	174.97 Lu 71
**Actinide Series	232.04 Th 90	231.04 Pa 91	238.03 U 92	237.05 Np 93	(244) Pu 94	(243) Am 95	(247) Cm 96	(247) Bk 97	(251) Cf 98	(252) Es 99	(257) Fm 100	(258) Md 101	(259) No 102	(260) Lr 103

( ) indicates the mass number of the isotope with the longest half-life.