



UNIVERSITY OF SWAZILAND  
Faculty of Health Sciences  
Department of Environmental Health Science  
BACHELOR OF SCIENCE IN ENVIRONMENTAL HEALTH

RESIT EXAMINATION PAPER 2017

TITLE OF PAPER : ORGANIC CHEMISTRY FOR HEALTH SCIENCES

COURSE CODE : EHS 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. Hydrocarbon A has the formula  $C_9H_{12}$  and absorbs 3 equivalents of hydrogen to yield B,  $C_9H_{18}$ , when hydrogenated over a Pd/C catalyst. Give the structures of both A and B [4 Marks]
- b. \_\_\_\_\_ is the ability of carbon to form long chains with itself therefore creating millions of organic compounds. [2 Marks]
- c. Organic compounds contain heteroatoms such as H, N, O, S, P and \_\_\_\_\_ . [2 Marks]
- d. Benzene contains only \_\_\_\_\_ hybridised carbons. [2 Marks]
- e. Draw saturated structures for the following compounds and fill in non-bonding valence electrons where they can be found.
- 1,2-dichloroethane
  - Carbon monoxide
  - Methanol
  - 2,4'-dichloro biphenyl
  - 2-bromo-4-methoxyhexanal

[15 Marks]  
[Total: 25 Marks]

**QUESTION TWO**

- a. Dissolved organic carbon (DOC) is derived from the decomposition of naturally occurring material in water.
- Name any four classes of organic compounds that make up DOC. [8 Marks]
  - What are the water treatment problems associated with the presence of DOC? Give a brief discussion on how these problems occur [9 Marks]
- b. 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;
- Primary carbocations do not undergo  $S_N1$  type of reactions. [5 Marks]

- (ii) Terminal alkenes form minor products of reactions involving the dehydration of alcohols.

[5 Marks]

b. Draw structures of the compounds described below and give the IUPAC name for each structure

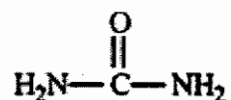
- (i) An aromatic compound containing one benzene ring and a single carboxyl group which is *ortho* to a bromo group and *para* to a hydroxyl group.
- (ii) A straight chain of eight carbons with two methyl groups on the second carbon, an *isopropyl* group on the fourth carbon and a carbonyl group on the eighth carbon.
- (iii) An unsaturated compound,  $C_3H_6$ , undergoes a halogenation reaction to produce dichloride product, A. Draw the molecular structure of Product A.

[15 Marks]

[Total: 25 Marks]

#### QUESTION FOUR

- a) Consider the structure of urea shown below and do the following:



- i) Fill in the non-bonding valence electrons that are missing from the line bond structure. [4 Marks]
- ii) Determine the hybridization of the carbon atom. [2 Marks]
- iii) Predict the bond angle of  $\text{NH}_2-\text{C}=\text{O}$  in urea. [3 Marks]
- b) There are two molecules with the molecular formula  $C_3H_9N$ . Draw them and describe how they differ. [6 Marks]
- c) What is the difference between  $S_N1$  and  $S_N2$  reactions? [6 Marks]
- d) Give examples of each type of reaction in (c). [4 Marks]

[Total: 25 Marks]

**QUESTION FIVE**

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

- (i) An alkane
- (ii) Cycloalkane
- (iii) An alkene
- (iv) An alkyne.

**[Marks 8]**

b. Explain why the molecular formulae of the answers given in a. (i) and (ii) are different.

**[Marks 4]**

c. Using appropriate examples, explain the difference between

- (i) Alkane and an alkyl group
- (ii) A saturated and unsaturated hydrocarbon
- (iii) A branched and a straight chain hydrocarbon
- (iv) Benzene and cyclohexane

**[8 Marks]**

d. Write a balanced chemical equation for the reaction of 2-butene and bromine.

**[5 Marks]**

**[Total: 25 Marks]**

**UNIVERSITY OF SWAZILAND**  
Department of Chemistry

1	<b>H</b> 1.0079	2	<b>He</b> 4.0026
3	<b>Li</b> 6.941	4	<b>Be</b> 9.0122
11	<b>Na</b> 22.990	12	<b>Mg</b> 24.305
19	<b>K</b> 39.098	20	<b>Ca</b> 40.078
37	<b>Rb</b> 85.47	38	<b>Sr</b> 87.62
55	<b>Cs</b> 132.91	56	<b>Ba</b> 137.33
87	<b>Fr</b> (223)	88	<b>Ra</b> 226.03

21	<b>Sc</b> 44.956	22	<b>Ti</b> 47.88	23	<b>V</b> 50.942	24	<b>Cr</b> 51.996	25	<b>Mn</b> 54.938	26	<b>Fe</b> 55.847	27	<b>Co</b> 58.933	28	<b>Ni</b> 58.69	29	<b>Cu</b> 63.546	30	<b>Zn</b> 65.39
39	<b>Y</b> 88.906	40	<b>Zr</b> 91.224	41	<b>Nb</b> 92.906	42	<b>Mo</b> 95.94	43	<b>Tc</b> (98)	44	<b>Ru</b> 101.07	45	<b>Rh</b> 102.91	46	<b>Pd</b> 106.42	47	<b>Ag</b> 107.87	48	<b>Cd</b> 112.41
57	<b>La</b> 138.91	72	<b>Hf</b> 178.49	73	<b>Ta</b> 180.95	74	<b>W</b> 183.85	75	<b>Re</b> 186.2	76	<b>Os</b> 190.2	77	<b>Ir</b> 192.22	78	<b>Pt</b> 195.08	79	<b>Au</b> 196.97	80	<b>Hg</b> 200.59
89	<b>Ac</b> 227.03																		

5	<b>B</b> 10.811	6	<b>C</b> 12.011	7	<b>N</b> 14.007	8	<b>O</b> 15.999	9	<b>F</b> 18.998
13	<b>Al</b> 26.982	14	<b>Si</b> 28.086	15	<b>P</b> 30.974	16	<b>S</b> 32.064	17	<b>Cl</b> 35.453
31	<b>Ga</b> 69.723	32	<b>Ge</b> 72.61	33	<b>As</b> 74.922	34	<b>Se</b> 78.96	35	<b>Br</b> 79.904
49	<b>In</b> 114.82	50	<b>Sn</b> 118.71	51	<b>Sb</b> 121.75	52	<b>Te</b> 127.60	53	<b>I</b> 126.90
81	<b>Tl</b> 204.38	82	<b>Pb</b> 207.2	83	<b>Bi</b> 208.98	84	<b>Po</b> (209)	85	<b>At</b> (210)

58	<b>Ce</b> 140.12	59	<b>Pr</b> 140.91	60	<b>Nd</b> 144.24	61	<b>Pm</b> 146.92	62	<b>Sm</b> 150.36	63	<b>Eu</b> 151.97	64	<b>Gd</b> 157.25	65	<b>Tb</b> 158.93	66	<b>Dy</b> 162.50	67	<b>Ho</b> 164.93	68	<b>Er</b> 167.26	69	<b>Tm</b> 168.93	70	<b>Yb</b> 173.04	71	<b>Lu</b> 174.97
90	<b>Th</b> 232.04	91	<b>Pa</b> 231.04	92	<b>U</b> 238.03	93	<b>Np</b> 237.05	94	<b>Pu</b> (244)	95	<b>Am</b> (243)	96	<b>Cm</b> (247)	97	<b>Bk</b> 247	98	<b>Cf</b> (251)	99	<b>Es</b> (252)	100	<b>Fm</b> (257)	101	<b>Md</b> (258)	102	<b>No</b> (259)	103	<b>Lr</b> (260)