



FACULTY OF SCIENCE

DEPARTMENT OF CHEMICAL SCIENCES
NATIONAL DIPLOMA: BIOTECHNOLOGY
NATIONAL DIPLOMA: FOOD TECHNOLOGY

MODULE CHEMISTRY 1XB1
 CET1XB1

CAMPUS DFC

SUPPLEMENTARY EXAMINATION

DATE: 10/01/2020

SESSION: 08:00- 11:00

ASSESSORS

DR NW MAXAKATO
DR SP MALINGA

INTERNAL MODERATOR

PROF SO OLUWAFEMI

DURATION 3 HOURS

MARKS: 140

NUMBER OF PAGES: 6 PAGES AND 1 ANNEXURE

INSTRUCTIONS:

ANSWER BOTH SECTION A AND SECTION B IN SEPARATE ANSWER SHEETS.
FOR SECTION A, GIVE ALL NUMERICAL ANSWERS TO THE CORRECT
NUMBER OF SIGNIFICANT FIGURES AND WITH APPROPRIATE UNITS.
CONSULT THE PERIODIC TABLE FOR ALL SUPPLEMENTARY INFORMATION

CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT).

THIS QUESTION PAPER MUST BE PLACED INSIDE YOUR
ANSWER BOOK UPON HANDING IN.

REQUIREMENTS:

TWO ANSWER SHEETS.

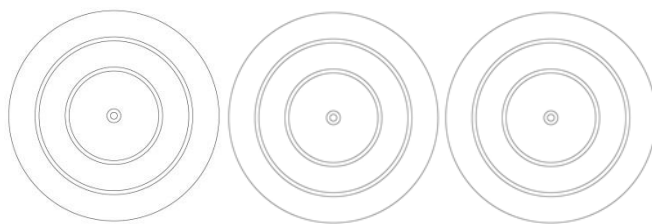
SECTION A
QUESTION 1

1.1 Perform the following calculations by reporting the answer with the correct number of significant figures

1.1.1 $(847.89 - 847.73) \times 14673$ (2)

1.1.2 $0.00015 \times 54.6 + 1.002$ (2)

1.2 Imagine that you get a chance to shoot five arrows into each of the targets depicted below. On each of the targets indicate the pattern that the five arrows make when you have:

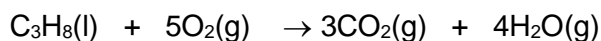


1.2.1 poor accuracy and good precision (2)

1.2.2 poor accuracy and poor precision (2)

1.2.3 good accuracy and good precision (2)

1.3 Propane (C_3H_8) is used as a fuel in cold climates as it has a lower freezing point than butane. Propane burns according to the following equation:



1.3.1 How many grams of oxygen will react with 240 g of propane? (3)

1.3.2 How many grams of carbon dioxide will be produced from 19.7 mol of oxygen? (2)

1.4 Name the following compounds:

1.4.1 $CH_3COOH(aq)$ (2)

1.4.2 $CoCO_3$ (2)

1.4.3 N_2O_5 (2)

1.5 Give the chemical formulae for each of the following inorganic compounds:

1.5.1 Ammonia (2)

1.5.2 Hydrosulfuric acid (2)

1.5.3 Ammonium bicarbonate (2)

[27]

QUESTION 2

- 2.1 Complete and write balanced chemical equations for each of the following reactions; remember to include phase labels. Also state the type of reaction that is occurring in each case.
- 2.1.1 Aqueous sodium sulphate is added to aqueous barium chloride (5)
2.1.2 Iron is added to sulphuric acid (5)
- 2.2 A solution of lead (II) nitrate is mixed with sodium chloride.
- 2.2.1 Write a balanced molecular equation for the reaction which occurs upon mixing these two solutions. (4)
2.2.2 Write a balanced net ionic reaction for the above reaction and identify spectator ions. (2)
2.2.3 Identify the precipitate that forms. (1)
- 2.3 Describe the preparation of 100 mL of 0,320 M sulphuric acid solution starting with 98,0% m/m solution which has a density of 1,840g cm⁻³. (6)

[23]

QUESTION 3

- 3.1 Distinguish between a strong acid and a concentrated acid using suitable examples. (2)
- 3.2 Ammonia is mixed with oxygen to form nitrogen monoxide and water vapour as follows:
- $$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$$
- In an experiment 3.00 g of NH₃ is mixed with 6.00 g of O₂.
- 3.2.1 Which is the limiting reactant? (5)
3.2.2 How much water is produced? (2)
3.2.3 How much excess reactant remains after the reaction has gone to completion? (3)
- 3.3 A paint sample was analysed for the concentration of lead. The following replicate concentrations (ppm) were obtained:
- 10.1; 10.4; 10.3; 10.0; 10.1; 10.5; 10.6
- Calculate the following with the aid of a calculator with statistical functions:
- 3.3.1 The mean and median of the data set. (2)
3.3.2 The coefficient of variance (CV) of the data set. (3)

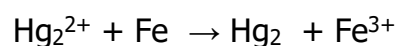
3.4 Determine the oxidation number for the indicated elements in each of the following compounds:

3.4.1 As in As_4 (1)

3.4.2 Cl in ClO_2^- (2)

3.5 Calculate the pH of a 0,05 M $\text{Sr}(\text{OH})_2$ solution. (4)

3.6 Consider the following equation:



3.6.1 Balance the equation (1)

3.6.2 Show oxidation half reaction (2)

3.6.3 Show reduction half reaction (2)

3.6.4 Identify the species being oxidised (1)

3.6.5 Identify the species being reduced (1)

[31]

SECTION B – ORGANIC CHEMISTRY**QUESTION 1**

1.1 Draw structures which correspond to the following given names.

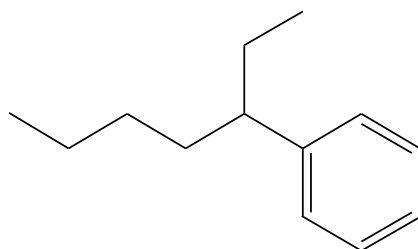
- 1.1.1 1,3,7-Octatriene (3)
1.1.2 Aniline (3)
1.1.3 Neopentane (3)
1.1.4 5-nonen-2-yne (3)
1.1.5 Acetylene (3)

[15]

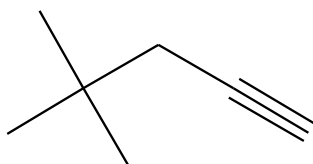
QUESTION 2

2.1 Give **IUPAC** names for the following structures:

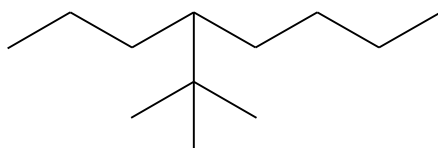
2.1.1



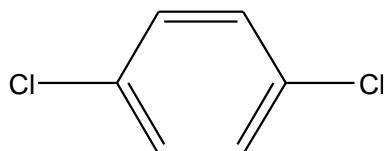
2.1.2



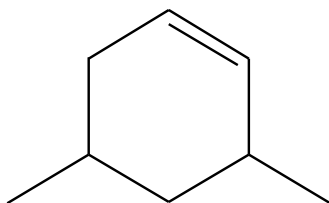
2.1.3



2.1.4



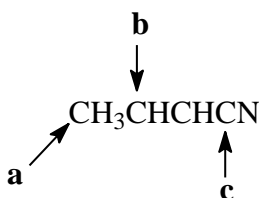
2.1.5



(3)

[16]**QUESTION 3**

3.1 Consider the following compound.

3.1.1 Predict the hybridization states of each of the carbon atoms marked **a**, **b** and **c**. (3)3.1.2 Draw an energy level diagram (labelled) for the hybridised states of the carbon atom marked **a** and **c**. (8)

3.2 Using examples to illustrate your answer, define the following:

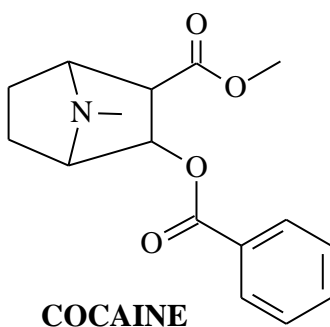
3.2.1 Homologous series (3)

3.2.2 Substitution reaction (3)

3.2.3 Geometric isomers (3)

3.3 Draw bond line diagrams of three isomers that correspond to the formula C_4H_8 . Name each of the three isomers (6)

3.4 List three functional groups that are present in cocaine. (3)

**[29]**

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

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

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce <i>140.12</i>	Pr <i>140.91</i>	Nd <i>144.24</i>	Pm <i>146.92</i>	Sm <i>150.36</i>	Eu <i>151.97</i>	Gd <i>157.25</i>	Tb <i>158.93</i>	Dy <i>162.50</i>	Ho <i>164.93</i>	Er <i>167.26</i>	Tm <i>168.93</i>	Yb <i>173.04</i>	Lu <i>174.97</i>
90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th <i>232.04</i>	Pa <i>231.04</i>	U <i>238.03</i>	Np <i>237.05</i>	Pu <i>(244)</i>	Am <i>(234)</i>	Cm <i>(247)</i>	Bk <i>247</i>	Cf <i>(251)</i>	Es <i>(252)</i>	Fm <i>(257)</i>	Md <i>(258)</i>	No <i>(259)</i>	Lr <i>(260)</i>

5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.179
13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.064	17 Cl 35.453	18 Ar 39.948
31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80
49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29
81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)