NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY NAME:
NATURAL RESOURCES AND SPATIAL SCIENCES

DEPARTMENT NAME:
AGRICULTURE AND NATURAL RESOURCES SCIENCES

QUALIFICATION : BACHELOR OF AGRICULTURE	
QUALIFICATION CODE: 07BAGR	**LEVEL:** 5
COURSE: Introduction to Chemistry	**COURSE CODE:** ICA511S
DATE: 07 June 2019	**SESSION:** 18H00 – 21H00
DURATION: 3 Hours	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Ms. Emma Elmary **GAMROS**
MODERATOR:	Mrs. Lucia Tuyeni—Kelao **KAFIDI**

INSTRUCTIONS

1. Answer ALL the questions.
2. Write clearly and neatly.
3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. Examination paper.
2. Examination script.
3. Calculator

THIS QUESTION PAPER CONSISTS OF 7 PAGES *(Excluding This Front Page)*

Section A: MULTIPLE CHOICE QUESTIONS **[40]**

- *There are 20 multiple choice questions in this section. Each question carries 2 marks.*
- Answer ALL questions by selecting the letter of the correct answer.
- Choose the best possible answer for each question, even if you think there is another possible answer that is not given.

1. A vertical column (a group) of the Periodic table should have the same
   A. atomic number
   B. atomic mass number
   C. electron number in the outer energy level
   D. number of energy shells
   E. valence
2. The maximum number of electrons that can be accommodated in the n = 3 shell is
   A. 27
   B. 18
   C. 16
   D. 14
   E. 12
3. The molar mass of C_2H_6O is
   A. 46.08 amu
   B. 30.08 amu
   C. 30.08 g
   D. 46.08 g
   E. 23.0 g
4. The number of molecules in 1.0×10^{-6} mol CH_3CH_2OH are
   A. 6.0×10^{17}
   B. 6×10^{17}
   C. 6.0×10^{-17}
   D. 6.0×10^{18}
   E. 6.0×10^{-18}
5. Convert 0.000070 to standard scientific notation with correct number of significant figures.
   A. 7×10^{-4}
   B. 7.0×10^{-4}
   C. 7×10^{-5}
   D. 7.0×10^{-5}
   E. 70×10^{-5}
6. What is the volume of a 0.0122 kg of metal with a density of 9.43 g/cm^3
   A. 12.2 cm^3
   B. 1.29 cm^3
   C. 0.773 cm^3
   D. 0.00129 cm^3
   E. 9.43 cm^3

7. How many electrons can be described by the following quantum numbers?

   n = 3, l = 2, ml = -1, ms = +1/2

   A. 0
   B. 1
   C. 2
   D. 3
   E. 6

8. Which of the following are true statements about the Periodic Table?
    A. Electronegativity increases from left to right
    B. Ionisation energy decreases from left to right
    C. Electronegativity increases from top to bottom
    D. Both A and B above
    E. A, B and C above
9. Use the following information to identify the atom or ion: 16 protons, 16 neutrons, and 14 electrons.
    A. S^{2+}
    B. O^{2-}
    C. O^{2+}
    D. S^{2-}
    E. Ne
10. What is the electron configuration for the most stable ion of the element chlorine, $_{17}Cl$.
    A. $1s^2 2s^2 2p^6 3s^2 3p^6$
    B. $1s^2 2s^2 2p^6 3s^2 3p^5$
    C. $1s^2 2s^2 2p^6 3s^2 3p^4$
    D. $1s^2 2s^2 2p^6 3s^2 3d^6$
    E. $1s^2 2s^2 2p^6 3s^2$
11. The element with atomic number 53 describes a
    A. Metal
    B. Halogen
    C. Metalloid
    D. Noble gas
12. What is the mass number of an atom of nitrogen that has 8 neutrons?
    A. 8
    B. 7
    C. 14
    D. 15
    E. 16
13. Which of the following masses is the largest?
    A. 0.200 g
    B. 0.020 kg
    C. 20.0 mg
    D. 2000 g
    E. They are all equal
14. What element do all organic compounds contain?
    A. C
    B. H
    C. O
    D. Fe
    E. P

15. To what organic family does the following molecule belong?

$$H- C \equiv C- H$$

A. Alcohol
B. Alkyne
C. Ether
D. Carboxylic acid
E. Ester

16. The correct formula for aluminium nitrate is

A. Al3N2
B. Al3NO3
C. Al(NO2)3
D. Al(NO3)3
E. None of the above

17. Which element has exactly five electrons in the highest principal energy level (the outer shell)?

A. Se
B. Ba
C. P
D. Ge
E. None of the above

18. For the reaction below, how many moles of N2 are required to produce 18mol NH3?

$N2 + 3H2 \rightarrow 2NH3$

A. 1
B. 9
C. 4
D. 18
E. 36

19. An isotope is an element whose atomic mass is made up of

A. Same proton number
B. Same number of neutrons
C. Same number of electrons
D. Number of neutron(s) plus the number of proton(s)
E. None of the above

20. White sugar and salt are

A. Homogenous mixture
B. Heterogeneous solution
C. Colloidal solutions
D. Suspensions
E. All of the above

Section B: STRUCTURED QUESTIONS **[60]**

- *There are TEN questions in this section. Answer all Questions.*
- Show clearly, where necessary, how you arrive at the answer as the working will carry marks too.

QUESTION 1 **[8]**

Express the answer to each of the following problems with the correct number of significant figures.

1.1 106.23g + 70.0 [2]

1.2 30.70 kg x 1.3 m x 1.3 m/(60.0 s x 60.0 s) [2]

1.3 0.09121mm × 11.3mm [2]

1.4 0.225mg – 0.0667mg [2]

QUESTION 2 **[5]**

An atom of an element has two electrons in the n=1 shell, eight electrons in the n=2 shell, and five electrons in the n=3 shell. From this information, give for the element

2.1 its atomic number [1]
2.2 its approximate atomic weight [1]
2.3 the total number of s electrons in its atom [1]
2.4 the total number of d electrons in its atom [1]
2.5 the name of the element [1]

QUESTION 3 **[5]**

Complete the following table by filling in the compound name or formula as required.

Name	Formula
Barium bromide	
Aluminium sulfide	
	MgO
	KMnO4
Strontium nitride	

QUESTION 4 **[5]**

A much sought-after high explosive has the following composition: C, 20.7%; N, 24.1 %; O, 55.2%. What is its empirical formula?

QUESTION 5 **[4]**

Calculate the following quantities:

5.1 Mass, in grams, of 0.105 moles sucrose ($C_{12}H_{22}O_{11}$) [2]
5.2 Moles of $Zn(NO_3)_2$ in 143.50 g of this substance [2]
5.3

QUESTION 6 **[3]**

Sodium hydroxide reacts with carbon dioxide as follows:

$2NaOH_{(s)} + CO_{2(g)} \rightarrow Na_2CO_{3(s)} + H_2O_{(l)}$

Determine the limiting reagent when 1.85 mol NaOH and 1.00 mol CO_2 are allowed to react.

QUESTION 7 **[8]**

State whether the following statements are True of False. (1 mark each)

7.1 Acid should always be added to water when doing a dilution.
7.2 Gloves should be worn when working with toxic chemicals and hot glassware.
7.3 Sandals should never be worn in the laboratory.
7.4 Long, loose hair is a fire hazard.
7.5 Chemical waste should be disposed of down the sink unless told otherwise.
7.6 Long sleeves should be rolled up before working in the lab.
7.7 It is a safety violation to leave your lab area dirty.
7.8 It isn't hazardous to eat or drink in the lab if you've put all of the chemicals at your lab area away.

QUESTION 8 **[4]**

What is the maximum number of orbitals with:

8.1 n=4 l=1
8.2 n=2 l=2
8.3 n=3 l=2
8.4 n=5 l=1 ml = -1

QUESTION 9 **[12]**

Balance the following equations

9.1 $CuOH + Al(NO_2)_3 \leftrightarrow CuNO_2 + Al(OH)_3$
9.2 $NaHCO_3 \leftrightarrow Na_2CO_3 + H_2O + CO_2$
9.3 $C_4H_8 + O_2 \leftrightarrow CO_2 + H_2O$
9.4 $NaOH + Li_2SO_4 \leftrightarrow Na_2SO_4 + LiOH$
9.5 $AgNO_2 + Ni_2O_3 \leftrightarrow Ag_2O + Ni(NO_2)_3$
9.6 $Zn + AgNO_3 \leftrightarrow Ag + Zn(NO_3)_2$

QUESTION 10 **[6]**

State the four quantum numbers, then explain the possible values they may have and what they actually represent.

Total Marks: 100

USEFUL CONSTANTS:

Gas constant, R= 8.3145 $Jmol^{-1} K^{-1}$
1 atm = 101 325 Pa = 760 mmHg = 760 torr
Avogadro's Number, NA = 6.022 X 10^{23} mol^{-1}
Planck's constant, h = 6.626 x 10^{-34} Js
Speed of light, c = 2.998 x 10^{8} ms^{-1}

PERIODIC TABLE OF THE ELEMENTS

1																	18
1 **H** 1.00794	2											13	14	15	16	17	2 **He** 4.00260
3 **Li** 6.941	4 **Be** 9.01218											5 **B** 10.81	6 **C** 12.011	7 **N** 14.0067	8 **O** 15.9994	9 **F** 18.9984	10 **Ne** 20.179
11 **Na** 22.9898	12 **Mg** 24.305	3	4	5	6	7	8	9	10	11	12	13 **Al** 26.9815	14 **Si** 28.0855	15 **P** 30.9738	16 **S** 32.06	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.0983	20 **Ca** 40.08	21 **Sc** 44.9559	22 **Ti** 47.88	23 **V** 50.9415	24 **Cr** 51.996	25 **Mn** 54.9380	26 **Fe** 55.847	27 **Co** 58.9332	28 **Ni** 58.69	29 **Cu** 63.546	30 **Zn** 65.38	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.9216	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.8
37 **Rb** 85.4678	38 **Sr** 87.62	39 **Y** 88.9059	40 **Zr** 91.22	41 **Nb** 92.9064	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.906	46 **Pd** 106.42	47 **Ag** 107.868	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.69	51 **Sb** 121.75	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.29
55 **Cs** 132.905	56 **Ba** 137.33	71 **Lu** 174.967	72 **Hf** 178.49	73 **Ta** 180.948	74 **W** 183.85	75 **Re** 186.207	76 **Os** 190.2	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.967	80 **Hg** 200.59	81 **Tl** 204.383	82 **Pb** 207.2	83 **Bi** 208.908	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.025	103 **Lr** (260)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (264)	108 **Hs** (265)	109 **Mt** (268)	110 Uun (269)	111 Uuu (272)	112 Uub (269)		114 Uuq		116 Uuh		118 Uuo

Lanthanides:	57 **La** 138.906	58 **Ce** 140.12	59 **Pr** 140.908	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.925	66 **Dy** 162.50	67 **Ho** 161.930	68 **Er** 167.26	69 **Tm** 166.934	70 **Yb** 173.04

Actinides:	89 **Ac** 227.028	90 **Th** 232.038	91 **Pa** 231.036	92 **U** 238.029	93 **Np** 237.048	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)