UNIVERSITY OF SWAZILAND

FACULTY OF AGRICULTURE AND CONSUMER SCIENCE

FINAL EXAMINATION

PROGRAMMES:

B.Sc. IN AGRONOMY: YEAR I
B.Sc. IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING: YEAR 1
B.Sc. IN AGRICULTURAL ECONOMICS AND AGRIBUSINESS MANAGEMENT: YEAR I
B.Sc. IN ANIMAL SCIENCE (DAIRY): YEAR I
B.Sc. IN AGRICULTURAL EDUCATION AND EXTENSION: YEAR I
B.Sc. IN ANIMAL SCIENCE: YEAR I
B.Sc. IN CONSUMER SCIENCES: YEAR I
B.Sc. IN CONSUMER SCIENCES IN EDUCATION: YEAR I
B.Sc. IN FOOD SCIENCE, NUTRITION AND TECHNOLOGY: YEAR I
B.Sc. HORTICULTURE: YEAR I
B.Sc. IN TEXTILE AND APPAREL DESIGN AND MANAGEMENT: YEAR I

COURSE CODE AND TITLE: CPR 103: CHEMISTRY
TIME ALLOWED: TWO [2] HOURS

INSTRUCTIONS:

1. ANSWER 4 QUESTIONS, 2 QUESTIONS FROM EACH SECTION
2. DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE CHIEF INVIGILATOR

NOTE: THIS PAPER CONTAINS 6 PAGES INCLUDING THE COVER PAGE

Section 1: Inorganic Chemistry

Question 1

a. Define the following terms:

i. Matter [2.5 marks]
ii. A liquid [2.5 marks]
iii. A compound [2.5 marks]
iv. Exothermic reaction [2.5 marks]
v. Condensation [2.5 marks]
vi. An atom [2.5 marks]

b. Differentiate between the terms: electrolyte and electrolysis. [5 marks]

c. Calculate the formula mass of Ammonium nitrate (NH_4NO_3) given the following information: N = 14.007 amu; H = 1.0079 amu; O = 15.999 amu [5 marks]

[25 marks]

Question 2

a. Calculate the atomic mass of Oxygen (O) in amu; given the following information of the isotopes:
Oxygen 16 [^{16}O] with abundance of 99.757 %;
Oxygen 17 [^{17}O] with abundance of 0.038 %; and
Oxygen 18 [^{18}O] with abundance of 0.205 %. [10 marks]

b. Calculate the percent (%) elemental composition of Potassium permanganate ($KMnO_4$) given the following information: K = 39.098 amu; Mn= 54.938 amu; O = 15.999 amu. [10 marks]

c. Convert: 0.58 M Sulphuric acid (H_2SO_4) to Normality. [5 marks]

[25 marks]

Question 3

a. You are provided with 7 M H_2PO_4 stock solution, what volume of this stock solution would you need to prepare 100 ml of 0.28 M H_2PO_4 solution? [10 marks]

b. You are required to make 150 ml of 0.89 M Sodium carbonate (Na_2CO_3); calculate the mass of the solute you would need to make this solution. [10 marks]

c. What are Deliquescent and Hygroscopic compounds? [5 marks]

[25 marks]

Section 2: Organic Chemistry

Question 4

a. Define the following terms:

i. An alkane [2.5 marks]
ii. Hydrocarbon [2.5 marks]
iii. An alkene [2.5 marks]
iv. A phenol [2.5 marks]
v. Protein [2.5 marks]
vi. An alcohol [2.5 marks]

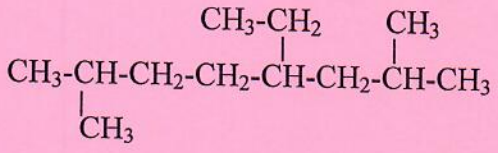
a. What is the molecular formula of an alkene containing six [6] carbon atoms? [5 marks]

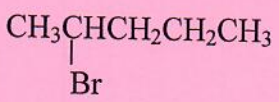
b. Determine the molecular formula of an alkyne that contains eighteen (18) hydrogen atoms. [5 marks]

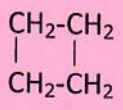
[25 marks]

Question 5

a. Give the IUPAC names of the following compounds: [1 mark each]

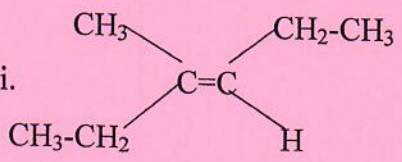
i. 

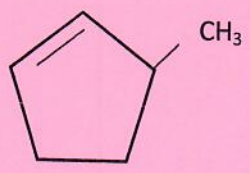
ii. 

iii. 

iv. $CH_2=CH-CH=CH-CH=CH-CH_3$

v. $CH_2=CH-CH=CH_2$

vi. 

vii. 

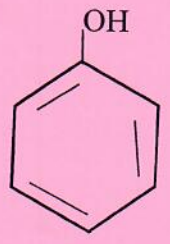
viii. $CH_3\text{-}CH_2\text{-}C{\equiv}C\text{-}CH(CH_3)\text{-}CH_3$

ix. $CH_3\text{-}CH_2\text{-}CH_2\text{-}C{\equiv}C\text{-}CH_3$

x. $CH_3\text{-}CH_2\text{-}C{\equiv}C\text{-}C(H)(CH_3)\text{-}CH_3$

xi.

xii.



xiii. $CH_3CH(CH_3)CH(NH_2)CH_3$

xiv. $CH_3CH_2CH_2NH_2$

xv. $CH_3CH_2\text{-}C(CH_3)(OH)\text{-}CH_3$

b. Write down the structural formula for each of the following compounds:

i. Propyn [2 marks]

ii. Ethylcyclohexane [2 marks]

iii. 4-ethyl-3-methyloctane [2 marks]

iv. Pentane [2 marks]

v. 2-methyl-2-pentene [2 marks]

[25 marks]

Question 6

1. Complete the following chemical equations: [2 marks each]

i. $CH_4 + Cl_2 \longrightarrow$

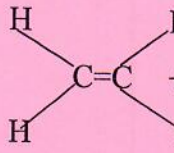
ii. $CH_3Cl + Cl_2 \longrightarrow$

iii. $CH_3CH_2CH_2CH_3 + 6.5O_2 \longrightarrow$

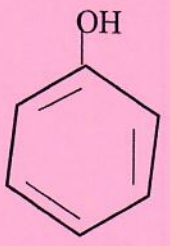
iv. $CH_4 + 2O_2 \xrightarrow{\text{Spark}}$

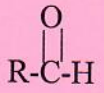
v. $CH_2{=}CH_2 + H_2 \longrightarrow$

vi. $CH_2{=}CH_2$ (ethane) $+ Br_2 \longrightarrow$

vii.  $+ KMnO_4 + H_2O \longrightarrow$

viii. $CH_3C{\equiv}CH + 2Br_2 \longrightarrow$

ix.  $+ \quad H_2SO_4 \longrightarrow$

x.  $\xrightarrow[H_2SO_4]{K_2Cr_2O_7}$

2. What are proteins and why are they important in our bodies? Give only two reasons. [5 marks]

[25 marks]

Extra information given:

1. Equation of a perfect gas: $pV = nRT$
2. Gas constant (R) = 8.31447×10^{-2} L bar K^{-1} mol^{-1}
3. Avogadro's constant: 6.02214×10^{23} mol^{-1}
4. Density of water: 1 g/cm^3
5. $pH = \log 1/[H^+] = -\log [H^+]$
6. $mA + nB \quad pC + qD$
7. $K = ([C]^p [D]^q)/ ([A]^m[B]^n)$
8. $X = p/K$
9. $F = k(C_1 \times C_2)/r^2$
10. $\Delta G = \Delta H - T\Delta S$
11. $C_1V_1=C_2V_2$

Periodic Table of the Elements

MERCK

1 Atomic number
2 Element symbol
3 Relative atomic mass
4 Melting point
5 Boiling point
6 Electronegativity (Allred, Rochow)
7 Oxidation states
8 Electron configuration

* Most stable isotope

Metals
Nonmetals
Transition metals
Elements of the f-series

Column labelling
IUPAC, Nomenclature of Inorganic Chemistry, 1989
IUPAC, Rules for Inorganic Nomenclature, 1970

Snarchem

BDH

1 Ia	2 IIa	3 IIIb	4 IVb	5 Vb	6 VIb	7 VIIb	8	9 VIII	10	11 Ib	12 IIb	13 IIIa	14 IVa	15 Va	16 VIa	17 VIIa	18 0
1 1.0079 -259.14 -252.87 2.2 **H** 1, -1 $1s^1$																	2 4.0026 <-272.2 -268.93 **He** $1s^2$
3 6.941 180.54 1347 1.0 **Li** 1 He $2s^1$	4 9.0122 1278 2970 1.5 **Be** 2 He $2s^2$											5 10.811 2079 2550 2.0 **B** 3 He $2s^2 2p^1$	6 12.011 3367 4827 2.5 **C** −4, 2, 4 He $2s^2 2p^2$	7 14.007 −209.86 −195.8 3.1 **N** −3, 2, 3, 4, 5 He $2s^2 2p^3$	8 15.999 −218.4 −182.96 3.5 **O** −2, −1 He $2s^2 2p^4$	9 18.998 −219.62 −188.14 4.1 **F** −1 He $2s^2 2p^5$	10 20.18 −248.67 −246.05 **Ne** He $2s^2 2p^6$
11 22.990 97.81 882.9 1.0 **Na** 1 Ne $3s^1$	12 24.305 648.8 1090 1.2 **Mg** 2 Ne $3s^2$											13 26.982 660.37 2467 1.8 **Al** 3 Ne $3s^2 3p^1$	14 28.086 1410 2355 1.7 **Si** 4 Ne $3s^2 3p^2$	15 30.974 44.1 280 2.1 **P** −3, 3, 5 Ne $3s^2 3p^3$	16 32.066 112.8 444.67 2.4 **S** −2, 2, 4, 6 Ne $3s^2 3p^4$	17 35.453 −100.98 −34.6 2.8 **Cl** −1, 1, 3, 5, 7 Ne $3s^2 3p^5$	18 39.948 −189.2 −185.7 **Ar** Ne $3s^2 3p^6$
19 39.098 63.65 774 0.9 **K** 1 Ar $4s^1$	20 40.078 839 1484 1.0 **Ca** 2 Ar $4s^2$	21 44.956 1541 2831 1.2 **Sc** 3 Ar $3d^1 4s^2$	22 47.67 1660 3287 1.3 **Ti** 3, 4 Ar $3d^2 4s^2$	23 50.942 1890 3380 1.5 **V** 2, 3, 4, 5 Ar $3d^3 4s^2$	24 51.996 1857 2672 1.6 **Cr** 2, 3, 6 Ar $3d^5 4s^1$	25 54.938 1244 1962 1.6 **Mn** 2, 3, 4, 6, 7 Ar $3d^5 4s^2$	26 55.845 1535 2750 1.6 **Fe** 2, 3, 6 Ar $3d^6 4s^2$	27 58.933 1495 2870 1.7 **Co** 2, 3 Ar $3d^7 4s^2$	28 58.693 1453 2732 1.8 **Ni** 2, 3 Ar $3d^8 4s^2$	29 63.546 1083 2567 1.8 **Cu** 1, 2 Ar $3d^{10} 4s^1$	30 65.39 419.6 907 1.7 **Zn** 2 Ar $3d^{10} 4s^2$	31 69.723 29.78 2403 1.8 **Ga** 3 Ar $3d^{10} 4s^2 4p^1$	32 72.61 937.4 2830 2.0 **Ge** 4 Ar $3d^{10} 4s^2 4p^2$	33 74.922 817 613 2.2 **As** −3, 3, 5 Ar $3d^{10} 4s^2 4p^3$	34 78.96 217 684.9 2.5 **Se** −2, 4, 6 Ar $3d^{10} 4s^2 4p^4$	35 79.904 −7.2 58.78 2.7 **Br** −1, 1, 3, 5, 7 Ar $3d^{10} 4s^2 4p^5$	36 83.80 −156.6 −152.3 **Kr** 2, 4 Ar $3d^{10} 4s^2 4p^6$
37 85.468 38.89 688 0.9 **Rb** 1 Kr $5s^1$	38 87.62 769 1384 1.0 **Sr** 2 Kr $5s^2$	39 88.906 1522 3338 1.1 **Y** 3 Kr $4d^1 5s^2$	40 91.224 1852 4377 1.2 **Zr** 4 Kr $4d^2 5s^2$	41 92.906 2468 4742 1.2 **Nb** 3, 5 Kr $4d^4 5s^1$	42 95.94 2617 4612 1.3 **Mo** 2, 3, 4, 5, 6 Kr $4d^5 5s^1$	43 *98.906 2172 4877 1.4 **Tc** 7 Kr $4d^6 5s^1$	44 101.07 2310 3900 1.4 **Ru** 3, 4, 8 Kr $4d^7 5s^1$	45 102.91 1966 3727 1.5 **Rh** 1, 2, 3, 4 Kr $4d^8 5s^1$	46 106.42 1552 3140 1.4 **Pd** 2, 4 Kr $4d^{10}$	47 107.87 961.9 2212 1.4 **Ag** 1, 2 Kr $4d^{10} 5s^1$	48 112.41 320.9 765 1.5 **Cd** 2 Kr $4d^{10} 5s^2$	49 114.82 156.6 2080 1.5 **In** 3 Kr $4d^{10} 5s^2 5p^1$	50 118.71 232.0 2270 1.7 **Sn** 2, 4 Kr $4d^{10} 5s^2 5p^2$	51 121.76 630.7 1750 1.8 **Sb** −3, 3, 5 Kr $4d^{10} 5s^2 5p^3$	52 127.60 449.5 990 2.0 **Te** −2, 4, 6 Kr $4d^{10} 5s^2 5p^4$	53 126.90 113.5 184.4 2.2 **I** −1, 1, 3, 5, 7 Kr $4d^{10} 5s^2 5p^5$	54 131.29 −111.9 −107.1 **Xe** 2, 4, 6 Kr $4d^{10} 5s^2 5p^6$
55 132.91 28.40 678.4 0.9 **Cs** 1 Xe $6s^1$	56 137.33 725 1640 1.0 **Ba** 2 Xe $6s^2$	57 138.91 921 3457 1.1 **La** 3 Xe $5d^1 6s^2$	72 178.49 2227 4602 1.2 **Hf** 4 Xe $4f^{14} 5d^2 6s^2$	73 180.95 2996 5425 1.3 **Ta** 5 Xe $4f^{14} 5d^3 6s^2$	74 183.84 3410 5660 1.4 **W** 2, 3, 4, 5, 6 Xe $4f^{14} 5d^4 6s^2$	75 186.21 3180 5627 1.5 **Re** 2, 4, 7 Xe $4f^{14} 5d^5 6s^2$	76 190.23 3045 5027 1.5 **Os** 2, 3, 4, 6, 8 Xe $4f^{14} 5d^6 6s^2$	77 192.22 2410 4130 1.6 **Ir** 1, 2, 3, 4, 6 Xe $4f^{14} 5d^7 6s^2$	78 195.08 1772 3827 1.4 **Pt** 2, 4 Xe $4f^{14} 5d^9 6s^1$	79 196.97 1064 2807 1.4 **Au** 1, 3 Xe $4f^{14} 5d^{10} 6s^1$	80 200.59 −38.84 356.6 1.5 **Hg** 1, 2 Xe $4f^{14} 5d^{10} 6s^2$	81 204.38 303.5 1457 1.4 **Tl** 1, 3 Xe $4f^{14} 5d^{10} 6s^2 6p^1$	82 207.2 327.5 1740 1.6 **Pb** 2, 4 Xe $4f^{14} 5d^{10} 6s^2 6p^2$	83 208.98 271.3 1560 1.7 **Bi** 3, 5 Xe $4f^{14} 5d^{10} 6s^2 6p^3$	84 *209.98 254 962 1.8 **Po** 2, 4, 6 Xe $4f^{14} 5d^{10} 6s^2 6p^4$	85 *209.99 302 337 2.0 **At** −1, 1, 3, 5, 7 Xe $4f^{14} 5d^{10} 6s^2 6p^5$	86 *222.02 −71 −61.8 **Rn** 2 Xe $4f^{14} 5d^{10} 6s^2 6p^6$
87 *223.02 27 677 0.9 **Fr** 1 Rn $7s^1$	88 *226.03 700 1140 1.0 **Ra** 2 Rn $7s^2$	89 *227.03 1050 3200 1.0 **Ac** 3 Rn $6d^1 7s^2$	104 *261.11 ****Db**	105 *262.11 ****Jl**	106 *263.12 ****Rf**	107 *262.12 ****Bh**	108 ****Hn**	109 ****Mt**									

Db Dubnium
Jl Joliotium
Rf Rutherfordium
Bh Bohrium
Hn Hahnium
Mt Meitnerium

** IUPAC Recommendation - 1997

	58	59	60	61	62	63	64	65	66	67	68	69	70	71
Lanthaniden **Lanthanides** **Lantánidos**	140.12 799 3426 1.1 **Ce** 3, 4 Xe $4f^2 6s^2$	140.91 931 3512 1.1 **Pr** 3, 4 Xe $4f^3 6s^2$	144.24 1021 3068 1.1 **Nd** 3 Xe $4f^4 6s^2$	*146.92 1168 2460 1.1 **Pm** 3 Xe $4f^5 6s^2$	150.36 1077 1791 1.1 **Sm** 2, 3 Xe $4f^6 6s^2$	151.96 822 1597 1.0 **Eu** 2, 3 Xe $4f^7 6s^2$	157.25 1313 3266 1.1 **Gd** 3 Xe $4f^5 5d^1 6s^2$	158.93 1356 3123 1.1 **Tb** 3, 4 Xe $4f^9 6s^2$	162.50 1412 2562 1.1 **Dy** 3 Xe $4f^{10} 6s^2$	164.93 1474 2695 1.1 **Ho** 3 Xe $4f^{11} 6s^2$	167.26 1497 2900 1.1 **Er** 3 Xe $4f^{12} 6s^2$	168.93 1545 1947 1.1 **Tm** 2, 3 Xe $4f^{13} 6s^2$	173.04 819 1194 1.1 **Yb** 2, 3 Xe $4f^{14} 6s^2$	174.97 1663 3395 1.1 **Lu** 3 Xe $4f^{14} 5d^1 6s^2$
Actiniden **Actinides** **Actínidos**	90 *232.04 1750 4790 1.1 **Th** 4 Rn $6d^2 7s^2$	91 *231.04 1600 1.1 **Pa** 4, 5 Rn $5f^2 6d^1 7s^2$	92 *238.03 1132 3818 1.2 **U** 3, 4, 5, 6 Rn $5f^3 6d^1 7s^2$	93 *237.05 640 3902 1.2 **Np** 3, 4, 5, 6 Rn $5f^4 6d^1 7s^2$	94 *244.06 641 3232 1.2 **Pu** 3, 4, 5, 6 Rn $5f^6 7s^2$	95 *243.06 994 2607 ~1.2 **Am** 3, 4, 5, 6 Rn $5f^7 7s^2$	96 *247.07 1340 ~1.2 **Cm** 3, 4 Rn $5f^7 6d^1 7s^2$	97 *247.07 ~1.2 **Bk** 3, 4 Rn $5f^9 7s^2$	98 *251.08 ~1.2 **Cf** 3, 4 Rn $5f^{10} 7s^2$	99 *252.08 ~1.2 **Es** 3 Rn $5f^{11} 7s^2$	100 *257.10 ~1.2 **Fm** 3 Rn $5f^{12} 7s^2$	101 *258.10 ~1.2 **Md** 3 Rn $5f^{13} 7s^2$	102 *259.10 **No** 2, 3 Rn $5f^{14} 7s^2$	103 *262.11 **Lr** 3 Rn $5f^{14} 6d^1 7s^2$

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