

SEM 1: AC. YR 2019/2020



UNIVERSITY OF ESWATINI
FACULTY OF AGRICULTURE

RESIT EXAMINATION

PROGRAMMES:

B.Sc. AGRON: YEAR I
B.Sc. ABE: YEAR 1
B.Sc. AGRIC. ECON. & AGBMNGT: YEAR I
B.Sc. ANI. SCI. (DAIRY OPTION): YEAR I
B.Sc. AGRIC. EXT.: YEAR I
B.Sc. AGRIC. ED.: YEAR I
B.Sc. ANI. SCI.: YEAR I
B.Sc. CONS. SCI.: YEAR I
B.Sc. CONS. SCI. ED.: YEAR I
B.Sc. FSNT: YEAR I
B.Sc. HORT.: YEAR I
B.Sc. TADM: YEAR I

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

INSTRUCTIONS:

1. ANSWER 4 QUESTIONS IN TOTAL, 2 QUESTIONS FROM EACH SECTION
2. DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED

NOTE: THIS PAPER CONTAINS SEVEN (7) PAGES INCLUDING THIS COVER PAGE

SECTION 1: INORGANIC CHEMISTRY**QUESTION 1**

a. Define and/or give brief descriptions of the following terms:

- | | |
|--------------------------|-------------|
| i. A colloid | [2.5 marks] |
| ii. A solid | [2.5 marks] |
| iii. Solvent | [2.5 marks] |
| iv. Endothermic reaction | [2.5 marks] |
| v. Electrolyte | [2.5 marks] |
| vi. A nucleus | [2.5 marks] |

b. Calculate the formula mass of potassium dichromate ($K_2Cr_2O_7$) given the following information: K = 39.098 amu; Cr = 51.996 amu; O = 15.999 amu [5 marks]

c. Distinguish between a covalent and an ionic bond [5 marks]

[Total = 25 marks]

QUESTION 2

a. Calculate the atomic mass of Neon (Ne) in amu; given the following information of the isotopes:

Neon 20 [^{20}Ne] with abundance of 90.48 %

Neon 21 [^{21}Ne] with abundance of 0.27 %

Neon 22 [^{22}Ne] with abundance of 9.25 %

[10 marks]

b. Calculate the percent (%) elemental composition of zinc pyrophosphate ($Zn_2P_2O_7$) given the following information: Zn = 65.39 amu; P = 30.974 amu; O = 15.999 amu [10 marks]

c. Convert: 0.49 N Sulphuric acid to Molality [5 marks]

[Total = 25 marks]

QUESTION 3

a. What pressure (in bars) could 3.44 mol of argon gas exert in a vessel of volume 1600 ml at 24°C if it behaved as an ideal or a perfect gas? [5 marks]

b. You are required to make 200 ml of 0.77 M Sodium carbonate (Na_2CO_3); calculate the mass of the solute you would need to make this solution [10 marks]

c. Calculate the equilibrium constant of the reaction of CO and H_2O to produce CO_2 and H_2 given that the concentrations are as follows; $[CO] = 0.0044\text{ M}$, $H_2O = 0.0044\text{ M}$, $CO_2 = 0.0033\text{ M}$ and $[H_2] = 0.0033\text{ M}$ at 1000°C . [10 marks]

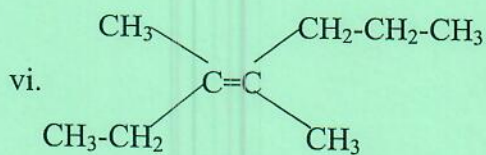
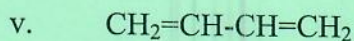
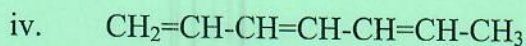
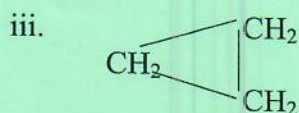
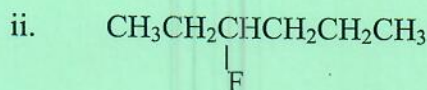
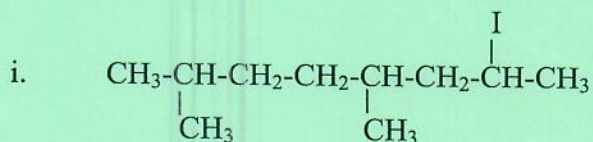
[Total = 25 marks]

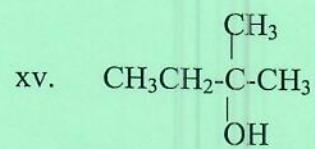
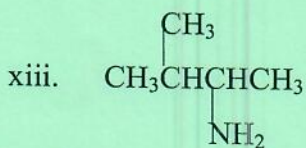
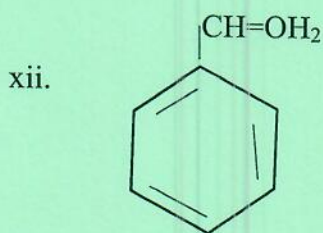
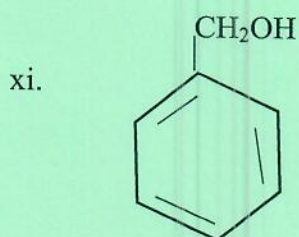
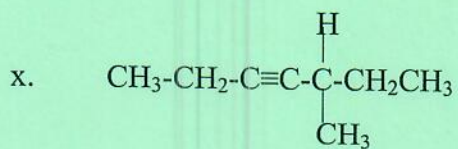
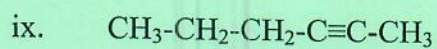
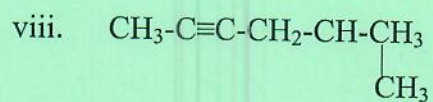
SECTION 2: ORGANIC CHEMISTRY**QUESTION 4**

- a. Define or briefly describe the following terms and phrases. Use a structural formula or an example where necessary
- i. Protein [2.5 marks]
 - ii. Hydrocarbon [2.5 marks]
 - iii. Saturated hydrocarbon [2.5 marks]
 - iv. Molecular formula [2.5 marks]
 - v. An alkyne [2.5 marks]
 - vi. A parent chain [2.5 marks]
- b. What is the molecular formula for a normal alkane containing three [3] carbon atoms [5 marks]
- c. What is the molecular formula for a normal alkene containing eighteen (16) hydrogen atoms [5 marks]
- [Total = 25 marks]**

QUESTION 5

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





[15 marks]

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

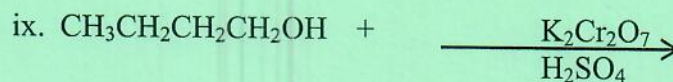
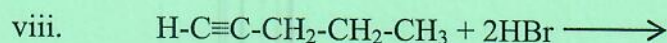
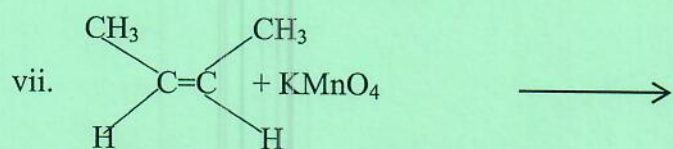
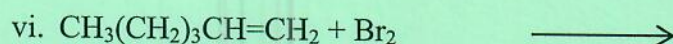
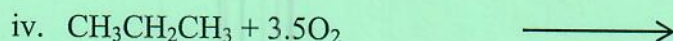
- i. Propane [2 marks]
- ii. Methylcyclohexane [2 marks]
- iii. 4-ethyl-3-methyloctane [2 marks]
- iv. Pentene [2 marks]
- v. 2-methyl-2-pentene [2 marks]

[Total = 25 marks]

QUESTION 6

a. Complete the following chemical equations:

[2 marks each]



[20 marks]

b. What are proteins and why are they important in our bodies (give only two reasons) [5 marks]

[Total = 25

marks]

EXTRA INFORMATION

1. Equation of a perfect gas: $pV = nRT$
2. Gas constant (R) = $8.31447 \times 10^{-2} \text{ L bar K}^{-1} \text{ mol}^{-1}$
3. Avogadro's constant: $6.02214 \times 10^{23} \text{ mol}^{-1}$
4. Density of water: 1 g/cm^3
5. $\text{pH} = \log 1/[\text{H}^+] = -\log [\text{H}^+]$
6. $m\text{A} + n\text{B} \rightleftharpoons p\text{C} + q\text{D}$
7. $K = ([\text{C}]^p [\text{D}]^q) / ([\text{A}]^m [\text{B}]^n)$
8. $X = p/K$
9. $F = k(\text{C}_1 \times \text{C}_2)/r^2$
10. $\Delta G = \Delta H - T\Delta S$
11. $\text{C}_1\text{V}_1 = \text{C}_2\text{V}_2$

1	2
1 H 1.0079 -255.14 -252.87 2.2 -1.1 1s	2 He 4.0026 -272.2 -268.93

102.91 3	196.6 4	372.7 5	1.5 6
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Periodic Table of the Elements

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

Merck

Nonmetals

Transition metals

Elements of the f-series

Column labelling

IUPAC, Nomenclature of Inorganic Chemistry, 1989

IUPAC, Rules for Inorganic Nomenclature, 1970

13	14	15	16	17	18
IIIA	IVA	VA	VIA	VIIA	0
5 B 10.81 2079 2550 2.0 -3, -2, -1 He 2s ² 2p ¹	6 C 12.01 3267 4827 2.5 -4, -2, -1 He 2s ² 2p ²	7 N 14.007 2079 209.86 3.1 -3, -2, -1 He 2s ² 2p ³	8 O 15.999 2011 -218.4 3.5 -2, -1 He 2s ² 2p ⁴	9 F 18.998 2011 -188.14 4.1 -1 He 2s ² 2p ⁵	10 Ne 20.18 -248.6 -248.05 4.1 He 2s ² 2p ⁶
13 Al 26.982 2974 2835 1.5 -3, -1 Ne 3s ² 3p ¹	14 Si 28.086 3574 2355 1.7 -4, -2 Ne 3s ² 3p ²	15 P 30.974 441 280 2.1 -3, -2, -1 Ne 3s ² 3p ³	16 S 32.064 444.67 -34.5 2.4 -2, -1 Ne 3s ² 3p ⁴	17 Cl 35.453 444.67 -100.98 2.8 -1, 1, 3, 5, 7 Ne 3s ² 3p ⁵	18 Ar 39.948 -185.7 -185.7 2.8 Ne 3s ² 3p ⁶
31 Ga 69.723 2974 2835 1.8 -3, -1 Ar 3d ¹⁰ 4s ¹ 4p ¹	32 Ge 72.64 2974 2835 2.0 -4, -2 Ar 3d ¹⁰ 4s ² 4p ²	33 As 74.922 2974 2835 2.2 -3, -2, -1 Ar 3d ¹⁰ 4s ² 4p ³	34 Se 78.96 2974 2835 2.5 -4, -2 Ar 3d ¹⁰ 4s ² 4p ⁴	35 Br 79.904 2974 2835 2.7 -1, 1, 3, 5, 7 Ar 3d ¹⁰ 4s ² 4p ⁵	36 Kr 83.80 -153.3 -153.3 2.7 Ar 3d ¹⁰ 4s ² 4p ⁶
49 In 76.72 2974 2835 1.7 -3, -1 Kr 4d ¹⁰ 5s ¹ 5p ¹	50 Sn 77.62 2974 2835 1.8 -4, -2 Kr 4d ¹⁰ 5s ² 5p ²	51 Sb 121.76 2974 2835 1.9 -3, -2, -1 Kr 4d ¹⁰ 5s ² 5p ³	52 Te 127.60 2974 2835 2.0 -4, -2 Kr 4d ¹⁰ 5s ² 5p ⁴	53 I 126.90 2974 2835 2.2 -1, 1, 3, 5, 7 Kr 4d ¹⁰ 5s ² 5p ⁵	54 Xe 131.29 -111.7 -111.7 2.2 Kr 4d ¹⁰ 5s ² 5p ⁶
81 Tl 204.38 2974 2835 1.4 -3, -1 Xe 4f ¹⁴ 5d ¹⁰ 6s ¹ 6p ¹	82 Pb 207.2 2974 2835 1.4 -4, -2 Xe 4f ¹⁴ 5d ¹⁰ 6s ² 6p ²	83 Bi 208.98 2974 2835 1.7 -3, -2, -1 Xe 4f ¹⁴ 5d ¹⁰ 6s ² 6p ³	84 Po 209 2974 2835 1.8 -4, -2 Xe 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴	85 At 209.98 2974 2835 2.0 -1, 1, 3, 5, 7 Xe 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵	86 Rn 222.02 -71 -71 2.0 Xe 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶

** IUPAC Recommendation - 1997

- Db Dubnium
- Jl Jolothium
- Rf Rutherfordium
- Bh Bohrium
- Hn Hahnium
- Mt Meitnerium

3	4	5	6	7	8	9	10	11	12
IIIB	IVB	VB	VIB	VII	VIII	IX	X	XI	XII
21 Sc 44.956 1501 1827 1.3 -3 Ar 3d ¹ 4s ²	22 Ti 47.88 1676 3539 1.3 -3, -2 Ar 3d ² 4s ²	23 V 50.942 1910 3409 1.3 -3, -2, -1 Ar 3d ³ 4s ²	24 Cr 51.996 1910 3409 1.6 -3, -2, -1 Ar 3d ⁵ 4s ¹	25 Mn 54.938 1910 3409 1.6 -3, -2, -1 Ar 3d ⁵ 4s ²	26 Fe 55.845 1910 3409 1.8 -2, -1 Ar 3d ⁶ 4s ²	27 Co 58.933 1910 3409 1.7 -2, -1 Ar 3d ⁷ 4s ²	28 Ni 58.693 1910 3409 1.8 -2, -1 Ar 3d ⁸ 4s ²	29 Cu 63.546 1910 3409 1.9 -1 Ar 3d ¹⁰ 4s ¹	30 Zn 65.39 1910 3409 1.7 -2 Ar 3d ¹⁰ 4s ²
39 Y 88.906 1501 1827 1.3 -3 Kr 4d ¹ 5s ²	40 Zr 91.224 1501 1827 1.3 -3, -2 Kr 4d ² 5s ²	41 Nb 92.906 1501 1827 1.3 -3, -2, -1 Kr 4d ⁴ 5s ¹	42 Mo 95.94 1501 1827 1.3 -3, -2, -1 Kr 4d ⁵ 5s ¹	43 Tc 98.906 1501 1827 1.4 -3, -2, -1 Kr 4d ⁵ 5s ²	44 Ru 101.07 1501 1827 1.4 -3, -2, -1 Kr 4d ⁶ 5s ²	45 Rh 102.91 1501 1827 1.5 -3, -2, -1 Kr 4d ⁷ 5s ²	46 Pd 106.42 1501 1827 1.4 -2, -1 Kr 4d ¹⁰ 5s ⁰	47 Ag 107.87 1501 1827 1.9 -1 Kr 4d ¹⁰ 5s ¹	48 Cd 112.41 1501 1827 1.5 -2 Kr 4d ¹⁰ 5s ²
57 La 138.91 1501 1827 1.1 -3 Xe 4f ¹ 5d ¹ 6s ²	72 Hf 178.49 1501 1827 1.2 -3, -2 Xe 4f ¹⁴ 5d ² 6s ²	73 Ta 180.95 1501 1827 1.3 -3, -2, -1 Xe 4f ¹⁴ 5d ³ 6s ²	74 W 183.84 1501 1827 1.4 -3, -2, -1 Xe 4f ¹⁴ 5d ⁴ 6s ²	75 Re 186.21 1501 1827 1.5 -3, -2, -1 Xe 4f ¹⁴ 5d ⁵ 6s ²	76 Os 190.23 1501 1827 1.5 -3, -2, -1 Xe 4f ¹⁴ 5d ⁶ 6s ²	77 Ir 192.22 1501 1827 1.6 -3, -2, -1 Xe 4f ¹⁴ 5d ⁷ 6s ²	78 Pt 195.08 1501 1827 1.4 -2, -1 Xe 4f ¹⁴ 5d ⁹ 6s ¹	79 Au 196.97 1501 1827 1.9 -1 Xe 4f ¹⁴ 5d ¹⁰ 6s ¹	80 Hg 200.59 1501 1827 1.5 -2 Xe 4f ¹⁴ 5d ¹⁰ 6s ²
89 Ac 227.03 1501 1827 1.0 -3 Rn 5f ¹ 6d ¹ 7s ²	104 Db 261.11 1501 1827 1.2 -3, -2 Rn 5f ¹⁴ 6d ² 7s ²	105 Db 262.11 1501 1827 1.3 -3, -2, -1 Rn 5f ¹⁴ 6d ³ 7s ²	106 Db 263.12 1501 1827 1.4 -3, -2, -1 Rn 5f ¹⁴ 6d ⁴ 7s ²	107 Db 264.12 1501 1827 1.5 -3, -2, -1 Rn 5f ¹⁴ 6d ⁵ 7s ²	108 Db 265.12 1501 1827 1.6 -3, -2, -1 Rn 5f ¹⁴ 6d ⁶ 7s ²	109 Db 266.12 1501 1827 1.7 -3, -2, -1 Rn 5f ¹⁴ 6d ⁷ 7s ²	110 Db 267.12 1501 1827 1.8 -3, -2, -1 Rn 5f ¹⁴ 6d ⁸ 7s ²	111 Db 268.12 1501 1827 1.9 -3, -2, -1 Rn 5f ¹⁴ 6d ⁹ 7s ²	112 Db 269.12 1501 1827 2.0 -3, -2, -1 Rn 5f ¹⁴ 6d ¹⁰ 7s ²

Lanthaniden Lanthanides Lantánidos	58 Ce 140.12 799 3486 1.1 -3, -2 Xe 4f ¹ 6s ²	59 Pr 140.91 931 3281 1.1 -3, -2 Xe 4f ² 6s ²	60 Nd 144.24 1012 3068 1.1 -3, -2 Xe 4f ⁴ 6s ²	61 Pm 144.91 1012 3068 1.1 -3, -2 Xe 4f ⁵ 6s ²	62 Sm 150.36 1077 3171 1.1 -3, -2 Xe 4f ⁶ 6s ²	63 Eu 151.96 1077 3171 1.0 -3, -2 Xe 4f ⁷ 6s ²	64 Gd 157.25 1313 3266 1.1 -3, -2 Xe 4f ⁷ 5d ¹ 6s ²	65 Tb 158.93 1313 3266 1.1 -3, -2 Xe 4f ⁹ 6s ²	66 Dy 162.50 1412 2562 1.1 -3, -2 Xe 4f ¹⁰ 6s ²	67 Ho 164.93 1474 2562 1.1 -3, -2 Xe 4f ¹¹ 6s ²	68 Er 167.26 1474 2562 1.1 -3, -2 Xe 4f ¹² 6s ²	69 Tm 168.93 1474 2562 1.1 -3, -2 Xe 4f ¹³ 6s ²	70 Yb 173.04 819 1194 1.1 -3, -2 Xe 4f ¹⁴ 6s ²	71 Lu 174.97 1665 3395 1.1 -3, -2 Xe 4f ¹⁴ 6s ²
Actiniden Actinides Actínidos	90 Th 232.04 1750 4770 1.1 -3, -2 Rn 5f ¹ 6d ¹ 7s ²	91 Pa 231.04 1600 4690 1.1 -3, -2 Rn 5f ² 6d ¹ 7s ²	92 U 238.03 1132 3902 1.2 -3, -2, -1 Rn 5f ³ 6d ¹ 7s ²	93 Np 237.05 1132 3902 1.2 -3, -2, -1 Rn 5f ⁴ 6d ¹ 7s ²	94 Pu 244.06 641 3332 1.2 -3, -2, -1 Rn 5f ⁶ 6d ¹ 7s ²	95 Am 243.06 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ⁰ 7s ²	96 Cm 247.07 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²	97 Bk 247.07 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²	98 Cf 251.08 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²	99 Es 252.08 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²	100 Fm 257.10 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²	101 Md 258.10 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²	102 No 259.10 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²	103 Lr 260.11 641 3332 1.2 -3, -2, -1 Rn 5f ⁷ 6d ¹ 7s ²