UNIVERSITY OF SWAZILAND

Faculty of Health Sciences

Diploma in Environmental Health /General Nursing Science
Supplementary Examination 2009

Title of paper: CHEMISTRY FOR HEALTH SCIENCES

Course code: HSC 106

Time allowed: 3 hours

Marks allocation: 100 Marks

Instructions:

1) Read the questions and instructions carefully
2) Answer ALL questions
3) Each question is 25 marks
4) A Periodic Table and Data Sheets are provided this paper.
5) All calculations/workout details should be submitted with your answer sheet (s).
6) Begin each question on a separate sheet of paper

This paper is not to be opened until the invigilator has granted permission

SECTION B

ANSWER AT LEAST TWO QUESTIONS

QUESTION 1 [25 MARKS]

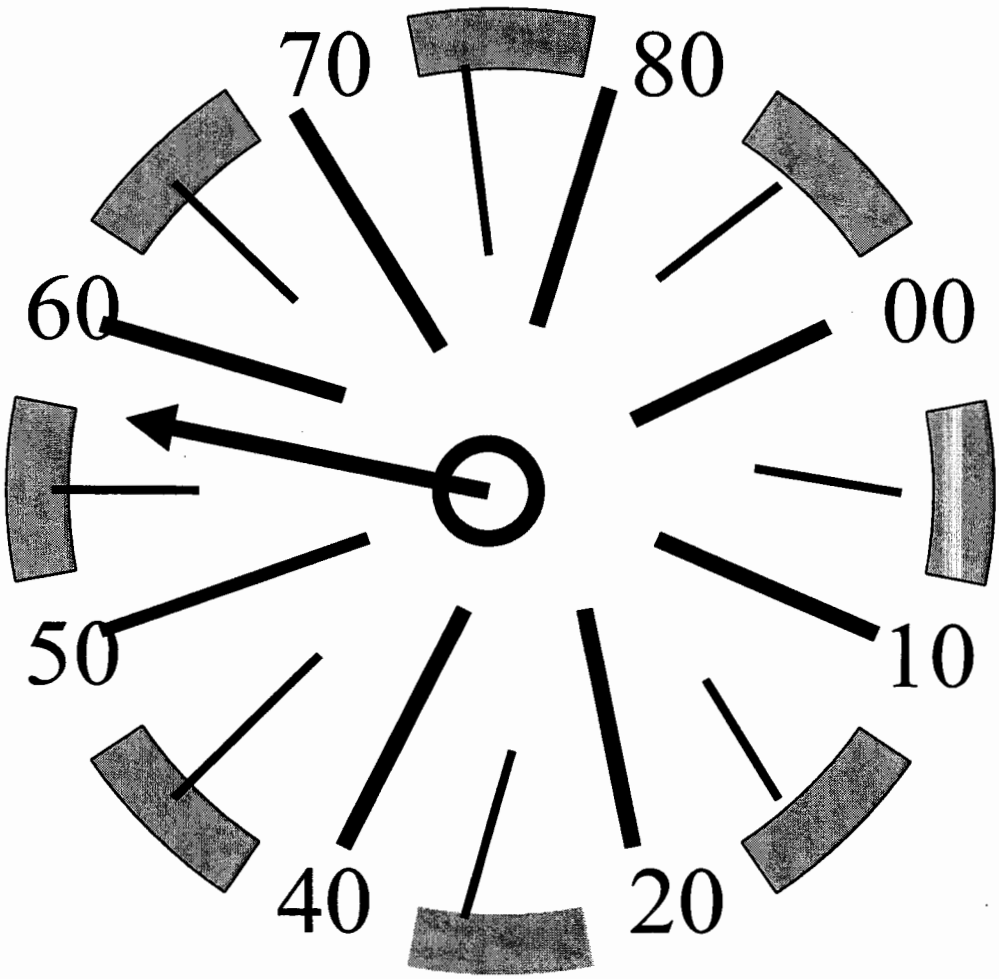
a) Convert the following figures to the units indicated: [8]

i) 92 pulse/min.....pulses/sec
ii) 35 mL.....L
iii) 30 μg.....mg
iv) $3.2x10^{24}$ atoms.....moles

Recall: *1 minute = 60 secs* *1 oz = 28.4 g*
1 in. = 2.54 cm 1 gal = 3.8 L $6.023x10^{23}$ = 1mole

b) Write short notes explaining the differences between Systematic and random errors. [8]

c) Give the correct reading of the following measurement in the form $x \pm S_x$. [3]



d)

i) Calculate the degree of precision as a percentage coefficient of variation (or percentage relative standard deviation, %RSD) in your reading. [1]

ii) Calculate the percentage relative error (% RE) in the reading by using the difference between the reading without any correction and the reading after correction. [1]

iii) Based on the % RSD and the % RE would you consider readings from this instrument reliable, explain. [2]

iv) What are the two sources of error in this device ? [2]

Useful Formulae:

$$standard\ deviation\ S_x = \sqrt{\frac{\sum_{i=1}^{N}(\bar{x} - x_i)^2}{N-1}};\quad mean\quad \bar{x} = \frac{\sum_{i=1}^{N} x_i}{N}$$

QUESTION 2 [25 MARKS]

a). Explain the difference between the following pairs of terms. Give examples for each pairs.

i). Ionic bonding and Covalent bond [6]

ii) Hunds rule and Agfbau builing up principle [6]

b). Draw Lewis structures or diagrams to show and name the type of bonding for each of the following:

(i) calcium chloride [2]

(ii) NH_4^+ [2]

c) i) Using Hunds rule, Agfbau builing up principle and the periodic table write the electronic configurations of **any Two** of the following elements. [5]

ii) Also indicate the role in health and the most likely dietary sources of the **Two** you have chosen in c(i): [4]

Iodine Iron Calcium

QUESTION 3 [25 MARKS]

a) Define the term "Empirical formula". [6]

b) Give three ways by which the empirical formula may be obtained. [6]

c) 6.853 mg of a sex hormone containing C, H and O was burned to determine its molecular formula. On burning 20.08 mg CO_2 and 5.023 mg of H_2O were obtained. The formula weight of the substance was found to be 270 g/mol.

i) Calculate the Empirical formula for the hormone [8]

ii) Calculate the molecular formula for the hormone [5]

[note that the unit 1 mg = 0.001 g = $1x10^{-3}$g]

QUESTION 4 [25 MARKS]

a) Briefly discuss any one of the following: [15]
   i) Respiratory Alkalosis
   ii) Metabolic Alkalosis

   In your discussion include the cause, the symptoms and the treatment.

b) A 30 year old woman is admitted to Mbabane Clinic. On admission her arterial blood results were as follows:

HCO3-	28 mEq/L	pH	7.21
Barbiturates	160 mEq/lL	PCO_2	52 mm Hg
Heroin	30 Meq/L	Blood ketones	positive

   i) Using the data given diagnose the condition of the patient, giving specific reasons for your diagnoses. [6]
   ii) What treatment would you prescribe for this patient. [4]

NORMAL LABORATORY VALUES FOR BLOOD TESTS

	USUAL REFERENCE RANGE	
Specific Gravity		1.056
Hemoglobin Count Hb		Men: 14 - 18g /dL Women: 12 -16 g/dL
HCO^-_3 Bicarbonate	24 - 28 mmol/L	24 - 28 mEq/L
Glucose	(3.6-6.1 mmol/L)	65 - 110 mg/dL
BUN (Blood Urea Nitrogen)	2.9 - 7.1 mmol/L	8 - 20 mg/dL
Ca^{+2}	(2.1-2.6 mmol/L)	8.5 - 10.3 mg/dL
Cl^-	(96-106 mmol/L)	96 - 106 mEq/L
Cholesterol		150 - 220 mg/dL
CO_2	24-29 mmol/L	24-29 mEq/L
PCO_2		35-45 mmHg
PO_2		80 - 100 mm Hg
pH		7.35 - 7.45
Fatty acids	0.3-0.8 mmol/L	0.3-2 mg/dL
Protein		6-8 µg/dL
Phosphate	1 - 1.5 mmol/L	3-4.5 mg/dL
ketone bodies		0.3-2 mg/dL
K^+	3.5-5 mmol/L	3.5 - 5 mEq/L
Na^+	136-145 mmol/L	136 - 145 mEq/L
Uric Acid	Men: 0.18 - 0.54 Women: 0.15 - 0.46 mmol/L	Men: 3 - 9 mg/dL Women: 2.5 - 7.5 mg/dL Children: 1.5 g/L (150mg/dL)

Useful Relations

$(RT)_{298\cdot15K}$=2.4789 kJ/mol

$(RT/F)_{298\cdot15K}$=0.025 693 V

T/K:	100.15	298.15	500.15	1000.15
T/Cm^{-1}:	69.61	207.22	347.62	695.13

1mmHg=133.222 N m^{-2}

hc/k=1.438 78x10^{-2} m K

1atm	1 cal	1 eV	$1cm^{-1}$
1.01325x10^{5} Nm^{-2}	4.184 J	1.602 189x10^{-19} J	0.124x10^{-3} eV
760torr		96.485 kJ/mol	1.9864x10^{-23}J
1 bar		8065.5 cm^{-1}	

SI-units:

1 L = 1000 ml = 1000cm^3 = 1 dm^3

1 dm = 0.1 m

1 cal (thermochemical) = 4.184 J

dipole moment: 1 Debye = 3.335 64x10^{-30} C m

force: ***1N=1J m^{-1}= 1kgms^{-2}***=10^5 dyne pressure: ***1Pa=1Nm^{-2}***=1Jm^{-3}

1J = 1 Nm

power: 1W = 1J s^{-1} potential: 1V =1 J C^{-1}

magnetic flux: 1T=1Vsm^{-2}=1JCsm^{-2} current: 1A=1Cs^{-1}

Prefixes:

p	n	m	m	c	d	k	M	G
pico	nano	micro	milli	centi	deci	kilo	mega	giga
10^{-12}	10^{-9}	10^{-6}	10^{-3}	10^{-2}	10^{-1}	10^{3}	10^{6}	10^{9}

General Data

speed of light	**c**	**2.997 925x10^{8} ms^{-1}**
charge of proton	*e*	1.602 19x10^{-19} C
Faraday constant	F=L*e*	9.648 46x10^{4} C mol^{-1}
Boltzmann constant	**k**	**1.380 66x10^{-23} J K^{-1}**
Gas constant	**R=Lk**	**8.314 41 J K^{-1} mol^{-1}**
		8.205 75x10^{-2} dm^3 atm K^{-1} mol^{-1}
Planck constant	**h**	**6.626 18x10^{-34} Js**
	$\hbar = \frac{h}{2\pi}$	1.054 59x10^{-34} Js
Avogadro constant	**L or N_{av}**	**6.022 14x10^{23} mol^{-1}**
Atomis mass unit	u	1.660 54x10^{-27} kg
Electron mass	**m_e**	**9.109 39x10^{-31} kg**
Proton mass	m_p	1.672 62x10^{-27} kg
Neutron mass	m_n	1.674 93x10^{-27} kg
Vacuum permittivity	$\varepsilon_o = \mu_o^{-1}c^{-2}$	8.854 188x10^{-12} J^{-1} C^2 m^{-1}
Vacuum permeability	μ_o	4πx10^{-7} Js^2C^{-2} m^{-1}
Bohr magneton	$\mu_B = e\hbar/2m_e$	9.274 02x10^{-24} JT^{-1}
Nuclear magneton	$\mu_N = e\hbar/2m_p$	5.05079x10^{-27} JT^{-1}
Gravitational constant	G	6.67259x10^{-11} Nm^2kg^{-2}
Gravitational acceleration	**g**	**9.80665 ms^{-2}**
Bohr radius	a_o	5.291 77x10^{-11} m

THE PERIODIC TABLE OF ELEMENTS

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1
	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VI
Period 1	1 H 1.008																	
2	3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	
3	11 Na 22.99	12 Mg 24.31											13 Al 26.9	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.01	25 Mn 54.9	26 Fe 55.85	27 Co 58.71	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.7	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.91	
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 91.22	42 Mo 95.94	43 Tc 98.9	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	
6	55 Cs 132.9	56 Ba 137.3	71 Lu 174.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 196.9	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 208.9	84 Po 210	85 At 210	
7	87 Fr 223	88 Ra 226.0	103 Lr 257	104 Unq	105 Unp	106 Unh	107 Uns	108 Uno	109 Une									

NON-METALS

METALLOIDS

METALS

Lanthanides	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm 146.9	62 Sm 150.9	63 Eu 151.3	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0
Actinides	89 Ac 227.0	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.1	94 Pu 239.1	95 Am 241.1	96 Cm 247.1	97 Bk 249.1	98 Cf 251.1	99 Es 254.1	100 Fm 257.1	101 Md 258.1	102 No 255

*Numbers **below** the symbol indicates the **atomic masses**; and the numbers above the symbol indicates the atomic numbers.*

SOURCE: International Union of Pure and Applied Chemistry, I mills, ed., Quantities, Units, and symbols in Physical Chemistry, Blackwell Scientific publications, Boston, 1988, pp 86-98.