UNIVERSITY OF SWAZILAND

Faculty of Health Science

Department of Environmental Health Sciences

Supplementary Examination 2010

Title of paper: CHEMISTRY FOR HEALTH SCIENCES

Course code: HSC 106

Time allowed: 3 hours

Marks allocation: 100 Marks

Instructions:

1) A Periodic Table and Data sheet are provided
2) Answer FOUR questions
3) Each question is weighted 25 marks
4) Begin each answer on a separate sheet of paper
5) All calculations/workout details should be submitted with your Answer Sheet(s)

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

QUESTION 1 [25 MARKS]

a) Convert the following figures to the units indicated: [12]

i) $4.03X10^6$ µg/ml.....kg/L
ii) $2.5x10^7$ dm^3..... ML
iii) 521.33 moles .... atoms
iv) 20 oz/gal .....g/L
v) 0.234 pm ..... fm
vi) 537 ng/m^3 ..... pg/l

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

b)

i) A nurse recorded the temperature of a patient "A" as 96.8 °F. Another nurse recorded the temperature of another patient "B" as 38.2 °C. Which patient has higher fever ? . [2]

ii) An order for medication reads: "Give 1.5 mg per kilogram of body weight." How much medication should be given to a patient of 165 lb. [2]]

1 lb = 0.4536 kg

iii) 100.1 µg of mercury , Hg, has a volume of $7.35x10^{-6}$ mL. Calculate the density of mercury in g/cm^3. [4]
density=mass/volume= 13.6 g/ml =13.6 g/cm^3

iv) Define SIU. [2]

v) Express the following in SIU system: [3]
length, volume, force

Express your answers to part 'b', where appropriate, to the correct degree of certainity

Useful equation:

$$^oF = \frac{9}{5}{}^oC + 32^o$$

QUESTION 2 [25 MARKS]

a) Briefly define the following terms used in scientific measurements:

i) Accuracy [4]
ii) Precision [4]
iii) Systematic error [4]
iv) Random error [4]

b) The following weights of tablets were given to pregnant women by an assistant nurse "A" to use as iodine supplements: 4.8 g, 5.2 g, 4.6 g and 4.9 g.
Calculate:

i) The mean [2]
ii) Standard deviation [2]
iii) Coefficient of variation [1]
iv) Another nurse "B" gave the following iodine tablets: 5.8g, 5600 mg, $6.2x0^{-3}$ kg, 5 900 000 μg. Calculate the mean mass of these supplements and the percentage relative error for the supplements given by nurse "B" if the correct masses are the ones given by Nurse "A".[2]
v) What types and likely sources of error are in the supplements made by nurse "B.

[2]

Useful Formulae:

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

QUESTION 3 [25 MARKS]

a) i) Indicate whether **any Two** of the following are s-block, p-block, d-block or f-block elements using electronic configurations. [4]
ii) Also indicate their environmental hazards and most likely source of the Two you have chosen in a(i): [6]

Arsenic Lead Cadmium Mercury

b) An antacid tablet was given to a patient to relieve stomach discomfort. Given that the antacid was magnesium hydroxide, $Mg(OH)_2$ which reacts with hydrochloric acid.

i) How many grams acid in the stomach will 1.50 g antacid tablet neutralize ?[4]
ii) What would be the pH of the stomach be if the antacid table is not prescribed for the patient [2]

Useful relation: $pH=-log[H^+]$

c) The following reagents have medicinal uses:

$CaSO_4$ $Al(OH)_3$ $FePO_4$ KIO_3 $NaHCO_3$

Chose **any Three** of the reagents and answer the following questions:

(i) Write the scientific names of the reagents [3]
(ii) Indicate the oxidation number of the element underlined [3]
(iv) Give the medicinal uses of the three reagents that you have chosen. [3]

QUESTION 4 [25 MARKS]

a) Write brief notes on **any one** of the following: [12]
(i) respiratory acidosis
(ii) metabolic acidosis
Define the cause, symptoms and treatment.

b) Define a buffer solution [3]
c) Give the four types of buffer systems in the body [4]
d) A patient with nausea an excessive twitching. X-ray evaluation and ultra sound scan shows an unusual renal growth. The patient's laboratory values were as follows:

Breathing rate	slow	Sodium	145mmol/L
CO_2	43 mmol/L	Potassium	3.0 mmol/L
HCO_3^-	41 mEq/L	pH	7.48
Cl^-(mEq/L)	80	PCO_2	63 mm Hg

i) What is the mechanism of this acid-base imbalance, justify your answer [4]
ii) What treatment would you prescribe [2]

Question 5 [25 Marks]

a) Write short notes on the following pairs:
i) isotonic solutions and hypotonic solutions [10]
ii) electrolyte and non electrolyte solutions [10]
Give examples for each and define the use or dangers of each in the body.

b) An assistant nurse was instructed by a doctor to prepare 100 ml of a 12 % (w/v) of an antibiotic from a 20 % (w/v) solution.
i) What volume of the 20 % antibiotic is needed to make the required antibiotic? [2]

ii) What is the concentration of the solution in ppm ? (1)

iii) What is the concentration of the solution in molar quantities ? (2)
Molecular weight of antibiotic is 2000 g/mol

Question 6 [25 Marks]

a) i) Define water pollution. [3]

ii) List and describe three major sources of water pollution. [6]

iii) Explain any two methods of water purification. [6]

b) Explain the difference between permanent and temporary water hardness. [6]

c) An environmentalist prepared standards for analysis of water samples by weighing 10 g $CaCl_2$ into a 250 ml volumetric flask using water up to the mark.

ii) Calculate the concentration of the solution in molar quantities [1]

ii) Calculate the concentration of the solution in ppm [1]

iii) Calculate the concentration of the solution in % (w/v) [1]

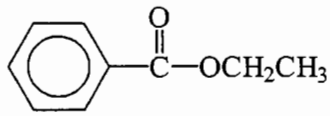
iv) Calculate the final concentration of the solution in ppm if 50 ml of water was added to the original solution. [1]

Question 7 [25 Marks]

a) i) Name the following organic compounds [3]

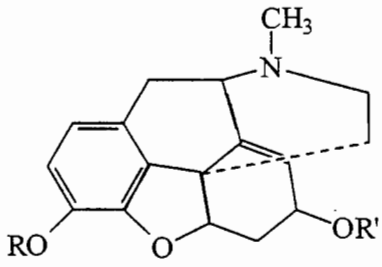
a) CH_3CH_2OH b) $CH_3CH_2\overset{\overset{O}{\|}}{C}-H$

c)



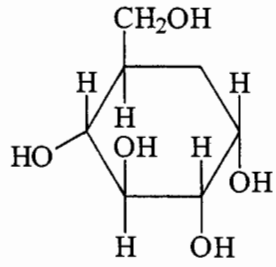
ii) Identify and name **any three** major groups of drugs from the list of organic compounds below. Describe its major effects on the body if taken in excess. [6]

a)



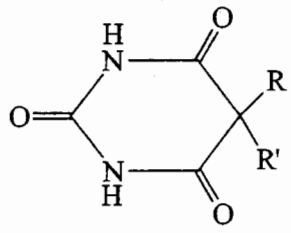
MORPHINE

b)



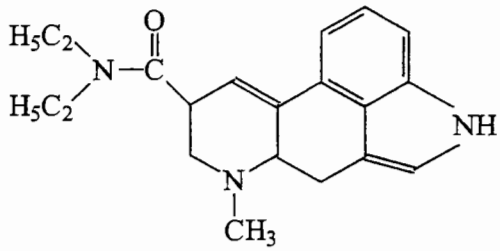
GLUCOSE

c)



LUMINAL

d)



LYSERGIC ACID DIETHYLAMINI (LSD)

b) Write short notes on the metabolic reactions of ANY TWO of the following [10]

i) carbohydrates
ii) fats
iii) proteins

c) Using chemical reactions give the chemical tests for ANY THREE of the following compounds: [6]

i) sugars and fats
ii) fats
iii) proteins
iv) alcohols
v) alkanes
vi) alkenes

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)

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	VII
Period 1	1 **H** 1.008																	2 H 4.0
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	1 N 20.
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	1 A 39.
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	3 K 83.
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	5 X 13
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	8 R 22
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.*

Useful Relations

$(RT)_{298.15K}$=2.4789 kJ/mol

$(RT/F)_{298.15K}$=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