UNIVERSITY OF SWAZILAND
DEGREE IN GENERAL NURSING
SUPPLEMENTARY EXAMINATION PAPER 2013/14

TITLE OF PAPER	:	**INTEGRATED BASIC SCIENCES**
COURSE CODE	:	**HSC 106**
TIME	:	**3 HOURS**
TOTAL MARKS	:	**100 MARKS**
INSTRUCTIONS	:	**THIS QUESTION PAPER HAS SEVEN (7) QUESTIONS**
	:	**ANSWER ANY FOUR QUESTIONS**
	:	**EACH QUESTION IS 25 MARKS**
	:	**A PERIODIC TABLE AND DATA SHEETS ARE PROVIDED WITH THIS EXAMINATION PAPER**
	:	**NO FORM OF ANY PAPER SHOULD BE BROUGHT INTO NOR TAKEN OUT OF THE EXAMINATION ROOM**
	:	**BEGIN THE ANSWER TO EACH QUESTION ON A SEPARATE SHEET OF PAPER**
	:	**ALL CALCULATIONS/WORKOUT DETAILS SHOULD BE SUBMITTED WITH YOUR ANSWER SHEET(S)**

DO NOT OPEN THIS EXAMINATION PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

QUESTION 1 [25 MARKS]

a) Convert the following figures to the units indicated: [6]

i) 1.02 kg ..... g
ii) 25 mL.....L
iii) 50 µg.....mg
iv) 1.2×10^{24} atoms.....moles
v) 72 pulse/min.....pulses/sec
vi) 20 oz/gal.....g/L

Recall: *1 minute = 60 secs* *1 oz = 28.4 g*
1 in. = 2.54 cm *1 gal = 3.8 L* 6.023×10^{23} *= 1mole*

b) An order for medication reads: "Give 1.49 mg per kilogram of body weight." How much medication should be given to a patients of 165 lb. [2]

1 lb = 0.4536 kg

c) A nurse by the name of Nontobeko recorded the temperature of a patient as 98.8 °F. Another nurse "Velaphi" recorded the temperature of another patient as 38.2 °C. Which patient has fever ? [2]

Useful equation:

$$^{o}F = \frac{9}{5}{}^{o}C + 32^{o}$$

c) Write short notes explaining the differences between **any one** of the following **pairs**:

i) Accuracy and precision [4]
ii) Systematic and random errors [4]

d) The following weights of tablets were given to pregnant women to use as Iron supplements: 5.8 g, 6.2 g, 5.6 g and 5.9 g.
Calculate:

i) The mean [2]
ii) Standard deviation [2]
iii) Coefficient of variation [1]
iv) % Relative error given that the right weight for iron supplementation as recommended by the WHO is 5.5 g.[2]

Useful Formulae:

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

Question 2 [25 Marks]

(a) Briefly discuss the differences between following pairs of terms.
(i). Compounds and Mixtures [4]
(ii).Colloids and solutions [4]

(b) Which of the following events are chemical changes and which ones are physical changes.
(1) When heated in a pan, sugar turns brown (caramelizes). [1]
(2) When stirred in water, table salt seems to disappear. [1]
(3) A bleaching agent causes a coloured fabric to lose its colour. [1]
(4) A silver fork tarnishes slowly in air. [1]

(b) Define the Daltons' Atomic Theory. In your answer, using an example of your choice, explain the flaws (problem) with this theory. [12]

(c) Given that the natural abundance of oxygen isotopes: ^{16}O is 99.76%, ^{17}O is 0.04% and ^{16}O is 0.20%, Calculate the relative atomic weight (in g/mole) of oxygen. [1]

QUESTION 3 [25 MARKS]

a) Explain the difference between the following pairs of terms. Give examples for each pairs.
i) Ionic bonding and Covalent bond [4]
ii) Hunds rule and Pauli Exclusion Principle [4]

b) Based on the electronic configurations of the elements, explain why each of the following is true [5]:

(i) ionisation of neon is greater than that of Fluorine
(ii) atomic radius of sulfur is less than that of sodium
(iii)ionisation of oxygen is less than that of nitrogen
(iv)electron affinity of carbon is greater than that of nitrogen
(v) Electronegativety of bromine is greater than that of potassium

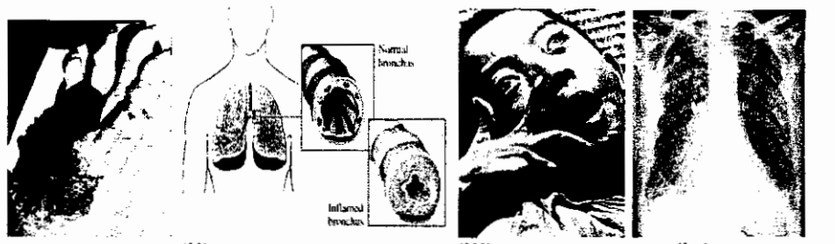
c) Draw Lewis structures or diagrams to show and name the type of bonding for each of the following: [4]
(i) calcium chloride
(ii) NH_4^+
(iii) H_2O

$$NH_3 + BF_3 \rightarrow NH_3BF_3$$

(iv) CH_2CH_2

c). i) Using Hunds rule, Aufbau buidling up principle and the periodic table write the electronic configurations of **any Three** of the following elements. [4]
Arsenic Lead Cadmium Mercury

ii) Identify and name environmental hazards of the elements that you have chosen in c(i) from the pictures below and indicate the most likely sources. [4]



(i).....(ii).....(iii).....(iv).....

QUESTION 4 [25 MARKS]

a) i) Define a buffer solution [2]
ii) Name four kinds of buffers found in the body. [8]
write the appropriate equation for each buffer

b) Briefly discuss **any one** of the following: [6]
i) Respiratory Acidosis
ii) Metabolic Acidosis

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

c) A 28 year old homeless man is rushed to RFM hospital. He is comatose and in respiratory depression. The emergency department nurse recognizes this patient as having a previous history of drug use including heroin. The arterial blood gases show a pH of 7.21; total CO_2 of 52 mm Hg; and a HCO_3^- of 28 mmol/L.
i) Using the data given diagnose the condition of the patient, giving specific reasons for your diagnoses. [6]
ii) What treatment would you prescribe. [3]

Question 5 [25 Marks]

a) Write short notes on the following terms: [12]
i) isotonic solutions
ii) hypotonic solutions
iii) hypertonic solutions

Give examples for each and define the use or dangers of each in the body.

b) Balance each of the following chemical equations.

i) $C_3H_8+O_2 \rightarrow CO_2 + H_2O$ [2]

ii) $SO_2 + HNO_3 \rightarrow H_2SO_4 + NO$ [2]

iii) $Fe_2(SO4)_3+NH_3+H_2O \rightarrow Fe(OH)_3+(NH_4)_2SO_4$ [2]

c) A 2.5 g sample of orange juice is titrated with 0.15 M NaOH. If orange juice (which has ascorbic acid $C_4H_7O_4COOH$) requires 40 mls of NaOH solution for complete neutralisation:

i) write a balanced equation for this reaction [2]

ii) Calculate the mass of ascorbic acid in orange juice [3]

iii) Calculate the percentage of ascorbic acid in orange juice [2]

Question 6 [25 Marks]

a) Using diagrams explain why water dissolves NaCl to form an electrolyte solution [5].

b) 10 g of Carbonic acid, H_2CO_3, in 10 L of ground water reacts with calcium carbonate, $CaCO_3$, to form calcium hydrogen carbonate, $Ca(HCO_3)_2$.

(i) Write the balanced equation for the reaction. [1]

(ii) Calculate the amount of calcium hydrogen carbonate, $Ca(HCO_3)_2$ produced in g. [4]

(iii) What is the concentration of calcium hydrogen carbonate in ppb. [2]

(iv) Calculate the original concentration of Carbonic acid, H_2CO_3 in moles/L. [1]

c) List and describe three major sources of water pollution. [3]

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

e) Explain any three methods of purification. [3]

Question 7[25 Marks]

a) Give the general chemical formulae for the following major classes of organic compounds. [4]

a) carboxylic acids

b) aldehydes

c) alcohols

d) esters

Give an example and one general use in human health for each

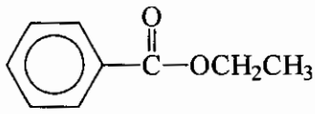
b) Name the following organic compounds [4]

a) CH_3CH_2OH

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

b)

(d) $CH_3CH_2\ CH_2\ CH_3$



c) Write short notes on the metabolic reactions of the following [12]
(i). carbohydrates
(ii). fats
(iii). proteins

c) Using chemical reactions give the chemical tests for **ANY FIVE** the following compounds: [5]
i) sugars
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	18
	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
Period 1	1 **H** 1.008																	2 **He** 4.003
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	10 **Ne** 20.18
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	18 **Ar** 39.95
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	36 **Kr** 83.80
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	54 **Xe** 131.3
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	86 **Rn** 222
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	**g**	**9.80665 ms^{-2}**
acceleration		
Bohr radius	a_o	5.291 77x10^{-11} m