UNIVERSITY OF SWAZILAND
DIPLOMA IN ENVIRONMENTAL HEALTH SCIENCE
SUPPLEMENTARY EXAMINATION PAPER 2008

TITLE OF PAPER	:	CHEMISTRY FOR HEALTH SCIENCES
COURSE CODE	:	HSC 106
TIME	:	3 HOURS
TOTAL MARKS	:	100 MARKS
INSTRUCTIONS ONLY	:	ANSWER ANY FOUR QUESTIONS
	:	EACH QUESTION IS 20 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.
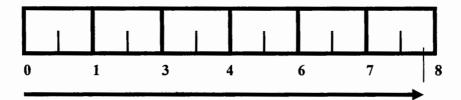
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QUESTION 1 [25 MARKS]

a) Convert the following figures to the units indicated: [4]

    i)   72 pulse/min............pulses/sec
    ii)   25 mL....................L
    iii)   50 μg......................mg
    iv) 6.4×10^{24} atoms..........moles

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)   i)   Write short notes explaining the differences between Systematic and random errors. [6]

       ii)   Explain the difference between accuracy and precision. [6]

c)

    i)   Give the correct reading of the following measurement in the form $x \pm S_x$. [2]

    ii)   Calculate the degree of precision as a percentage coefficient of variation (or percentage relative standard deviation, %RSD) in your reading. [2]

    iii)   Calculate the percentage relative error (% RE) in the reading by using the difference between the reading without any correction and the reading after correction. [2]

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

    v)   What are the two sources of error in this device ? [1]

Useful Formulae:

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

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^+ [3]

c)   i)   Using Hunds rule, Agfbau builing up principle and the periodic table write the electronic configurations of **any Two** of the following elements.   [4]
        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   Iron

QUESTION 3 [25 MARKS]

a) Define the term "empirical formula" and "molecular formula". [6]

b) Give three ways by which the empirical formula may be obtained. [3]

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 [10]
ii)   Calculate the molecular formula for the hormone [6]

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

QUESTION 4 [25 Marks]

a)   Using equations define the following terms:
        i)   Molarity   [4]
        ii)   Normality   [2]
        iii)   Equivalents   [3]

b)   A nurse is asked to prepare 5 % (w/v) solution of an antibiotic using water.
        i)   Calculate the amount of antibiotic required in a 250 ml container. [3]
        ii)   Calculate the amount of the 5 % (w/v) antibiotic prepared required to make 1 % (w/v) in a 25 ml container. [3]

d)   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 sulphuricc acid. How many grams acid in the stomach will 3.0 g antacid tablet neutralize ?[10]

QUESTION 5 [25 MARKS]

a)   i)   Define a buffer solution. [2]
        ii)   Name three kinds of buffers found in the body.[3]
        iii)   Using an example of one body buffer explain how a buffer behaves on ingestion of acidic drinks. [5]

b)   Briefly discuss **any one** of the following: [10]
        i)   Respiratory Acidosis
        ii)   Metabolic Alkalosis

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

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c)   A 25 year old woman is admitted to hospital. On admission her laboratory results were as follows:

Blood pressure	90/40 mm Hg	Sodium	130 mmol/L
Deep respirations	35/min	Potassium	6.5mmol/L
Pulse	120/min	pH	6.73
glucose	16 mmol/l	PCO_2	10 mm Hg
protein	150 μg/dl	Blood ketones	positive

    i)   Using the data given explain the condition of the patient, giving specific reasons for the condition. [3]

    ii)   What treatment would you prescribe. [2]

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)

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