

**UNIVERSITY OF SWAZILAND
DIPLOMA IN ENVIRONMENTAL HEALTH SCIENCE/NURSING
EXAMINATION PAPER 2009**

TITLE OF PAPER : **CHEMISTRY HEALTH SCIENCES**

COURSE CODE : **HSC 106**

TIME : **3 HOURS**

TOTAL MARKS : **100 MARKS**

INSTRUCTIONS :

- THIS EXAMINATION PAPER HAS SEVEN QUESTIONS.**
- ANSWER FOUR QUESTIONS ONLY**
- EACH QUESTION IS 20 MARKS**
- AT LEAST TWO QUESTIONS MUST BE ANSWERED FROM EACH SECTION.**
- 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: [12]

- i) 4.03 kg/L $\mu\text{g/ml}$
- ii) 25 ML..... dm^3
- iii) 3.14×10^{26} atoms..... moles
- iv) 149.47 g/L.....oz/gal
- v) 234 fm.....pm
- vi) 537 pg/l..... ng/m^3

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

b)
i) A sample of water gave a temperature reading of 113 F. Determine the reading in °C. [2]

ii) An order for medication reads: "Give 3.12 mg per kilogram of body weight." How much medication should be given to a patient of 213 lb. [2]

$$1 \text{ lb} = 0.4536 \text{ kg}$$

iii) 100.1 μg of mercury, Hg, has a volume of 7.35×10^{-5} mL. Calculate the density of mercury in g/cm^3 . [4]

iv) Define SIU. [2]

v) Express the following in SIU system: [3]
length, mass, pressure

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

Useful equation:

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

QUESTION 2 [25 MARKS]

a) Write short notes explaining the differences between the following **pairs**:

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

b) A patient was to be given 3.231 mg of de-worming tablets. Two students Maxwell and Phetsile weighed tablets five times to get the following readings:

Maxwell	Phetsile
3.451	3.217
3.314	3.193
3.291	3.208
3.264	3.226
3.352	3.301

Calculate (for both Maxwell and Phetsile):

- i) the mean [2]
- ii) Standard deviation [2]
- iii) % Coefficient of variation [2]
- iv) % Relative error [2]

c) Which measurements from 2(c) above are the most ? [2]

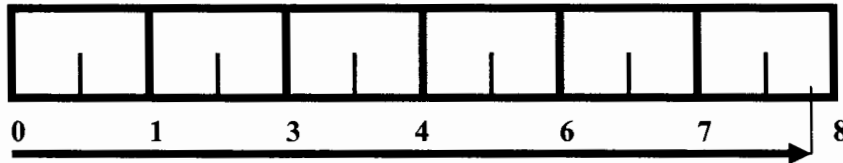
- i) accurate
- ii) precise

d) What type(s) of error are in the measurements by ? [2]

- i) Maxwell
- ii) Phetsile

e) What appropriate action would you take to prevent the errors you have given in 2(d) above ? [1]

f) i) Express the reading of the following analog instrument in the form $\bar{x} \pm S_x$ where \bar{x} is the average and S_x is the deviation. [2]



ii) Estimate the degree of precision and accuracy in g(i) [2]

Useful Formulae:

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

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 [6]
 - ii) Ionisation energy and electronegativity [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 Hund's rule, Aufbau building 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

QUESTION 4 [25 MARKS]

- a) i) Indicate whether of the following are s-block, p-block, d-block or f-block elements using electronic configurations. [4]
- Arsenic Lead Cadmium Mercury
- ii) Also indicate their environmental hazards and most likely source of the Two you have chosen in a(i): [5]
- 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? [5]
 - ii) What would be volume of HCl if the density of HCl is 1.136 g/ml [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 5 [25 MARKS]

- a) Write brief notes on **any one pair** of the following: [6]
(i) respiratory acidosis and metabolic acidosis or
(ii) isotonic solutions and hypotonic solutions
Define the cause, symptoms and treatment.
- b) Define a buffer solution [2]
- 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]
- e) 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)

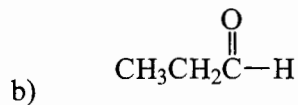
Question 6 [25 Marks]

- a) Write short notes explaining the difference between electrolyte and non electrolyte solutions. [4]

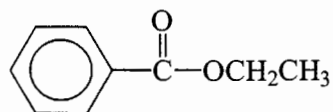
Give examples for each and define the use or dangers of each in the body.
- b) i) Define water pollution. [3]
ii) List and describe three major sources of water pollution. [6]
iii) Explain any three methods of water purification. [6]
- c) Explain the difference between permanent and temporary water hardness. [2]
- d) An environmentalist prepared standards for analysis of water samples by weighing 10 g CaCl₂ to the 250 ml volumetric flask using water.
- i) 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]
iii) 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]



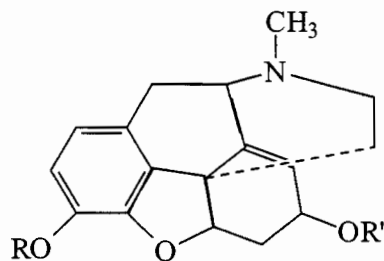
c)



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.

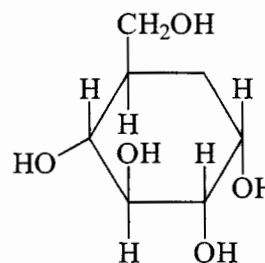
[6]

a)



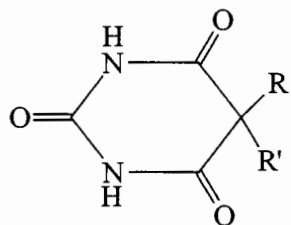
MORPHINE

b)



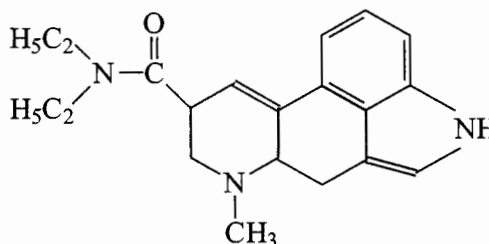
GLUCOSE

c)



LUMINAL

d)



LYSERGIC ACID DIETHYLAMINE
(LSD)

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

- i) carbohydrates
- ii) fats
- ii) 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)