UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science
BACHELOR OF SCIENCE IN ENVIRONMENTAL HEALTH

RESIT EXAMINATION PAPER 2021

TITLE OF PAPER	:	CHEMISTRY FOR HEALTH SCIENCES
COURSE CODE	:	EHS 111
DURATION	:	2 HOURS
MARKS	:	100
INSTRUCTIONS	:	READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	:	ANSWER **ANY FOUR** QUESTIONS
	:	EACH QUESTION **CARRIES 25** MARKS.
	:	WRITE NEATLY & CLEARLY
	:	NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE EXAMINATION ROOM.
	:	BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

QUESTION ONE

a. Complete the following statements;

(i) Bond polarity refers to_____.

(ii) Covalent bond refers to_____.

(iii) A separation process that depends on differing abilities of substances to form gases is called_____.

(iv) Gases and liquids share the property of _____.

(v) A common English set of units for expressing volume is gallon. The SI unit for volume is _____.

(vi) An atom of the most common isotope of gold, ^{197}Au, has _____ neutrons.

(vii) The elements in groups 3-8B are called, _____, respectively.

(viii) The specific gravity of 55% nitric acid is 1.40 at room temperature. What volume (in cm^3) would be occupied by a 20 g sample of nitric acid?

(ix) Aluminium reacts with a certain non-metallic element to form a compound with the general formula Al_2X_3. Element X must be from Group _____ of the Periodic Table of Elements.

(x) The number of non-bonding electron pairs in PF_3 is _____.

[20 Marks]

b. The value of $\Delta H°$ for the reaction below is -1107 kJ:

$$2Ba\ (s) + O_2\ (g) \rightarrow 2BaO\ (s)$$

How many kJ of heat are released when 15.75 g of Ba (s) reacts completely with oxygen to form BaO (s)? **[5 Marks]**

Total 25 marks

QUESTION TWO

a. *Use the table below to answer the questions that follow.*

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	$\Delta H°_f$ (kJ/mol)	$\Delta G°_f$ (kJ/mol)	S (J/K-mol)
Carbon			
$C_{(s, diamond)}$	1.88	2.84	2.43
$C_{(s, graphite)}$	0	0	5.69
$C_2H_{2\ (g)}$	226.7	209.2	200.8
$C_2H_{4\ (g)}$	52.30	68.11	219.4
$C_2H_{6\ (g)}$	-84.68	-32.89	229.5
$CO_{(g)}$	-110.5	-137.2	197.9
$CO_{2\ (g)}$	-393.5	-394.4	213.6
Hydrogen			
$H_{2(g)}$	0	0	130.58
Oxygen			
$O_{2\ (g)}$	0	0	205.0
$H_2O_{(l)}$	-285.83	-237.13	69.91

(i) The value of $\Delta S°$ for the catalytic hydrogenation of acetylene to ethene,

$C_2H_2\ (g) + H_2\ (g) \rightarrow C_2H_4\ (g)$

is _____ J/K· mol. **[4 marks]**

(ii) The combustion of acetylene in the presence of excess oxygen yields carbon dioxide and water:

$2C_2H_2\ (g) + 5O_2\ (g) \rightarrow 4CO_2\ (g) + 2H_2O\ (l)$

The value of $\Delta S°$ for this reaction is _____ J/K· mol. **[4 marks]**

(iii) The value of $\Delta S°$ for the reaction

$2C\ (s, diamond) + O_2\ (g) \rightarrow 2CO\ (g)$

is _____ J/K· mol. **[4 marks]**

(iv) The value of $\Delta S°$ for the catalytic hydrogenation of ethene to ethane,

C_2H_4 (g) + H_2(g) → C_2H_6 (g)

is _____ J/K· mol. **[4 marks]**

b. The element X has three naturally occurring isotopes. The isotopic masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is _____ amu.

Isotope	Abundance	Mass
^{159}X	30.60	159.37
^{163}X	15.79	162.79
^{164}X	53.61	163.92

[9 Marks]

Total 25 marks

QUESTION THREE

a. What is the empirical formula of a compound that contains 27.0% S, 13.4% O, and 59.6% Cl by mass? **[8 Marks]**

b. Use the electronegativity table to determine whether the following compounds are ionic or covalent (pure or polar) compounds. Provide a reason for each answer.

(i) HO_2

(ii) ZnCl

(ii) KBr

(iii) $AgNO_2$

(iv) CuO

(v) C_2H_6 **[12 Marks]**

c. What volume (mL) of a concentrated solution of sodium hydroxide (6.00 M) must be diluted to 200. mL to make a 1.50 M solution of sodium hydroxide? **[5 Marks]**

Total 25 marks

QUESTION FOUR

a. (a) What is the oxidation number of the underlined atoms?

(i) $\underline{Br}O_3^-$

(ii) $H\underline{N}O_3$

(iii) $H\underline{S}O_4^-$ **[9 Marks]**

b. Considering your answers in (a), write out the electron configuration for the underlined elements. **[6 Marks]**

c. What are the bond polarity limits for a polar covalent compound? **[2 Marks]**

d. State the first law of thermodynamics. **[3 Marks]**

e. Of the acids in the table below, which one is the weakest acid?

Acid	K_a
HOAc	1.8×10^{-5}
$HCHO_2$	1.8×10^{-4}
HClO	3.0×10^{-8}
HF	6.8×10^{-4}

[3 Marks]

f. With reference to enthalpy changes, what does the term "standard conditions" mean? **[2 Marks]**

Total 25 marks

QUESTION FIVE

a. Solid aluminum and gaseous oxygen react in a combination reaction to produce aluminum oxide:

$$Al\,(s) + O_2\,(g) \rightarrow Al_2O_3\,(s)$$

In a particular experiment, the reaction of 2.77 g of Al with 2.9 g of O_2 produced 3.83 g of Al_2O_3.

(i) Balance the chemical reaction equation. (3 marks)

(ii) What is the % yield of the reaction? (5 marks)

(iii) Identify the limiting reagent. (3 marks)

[11 Marks]

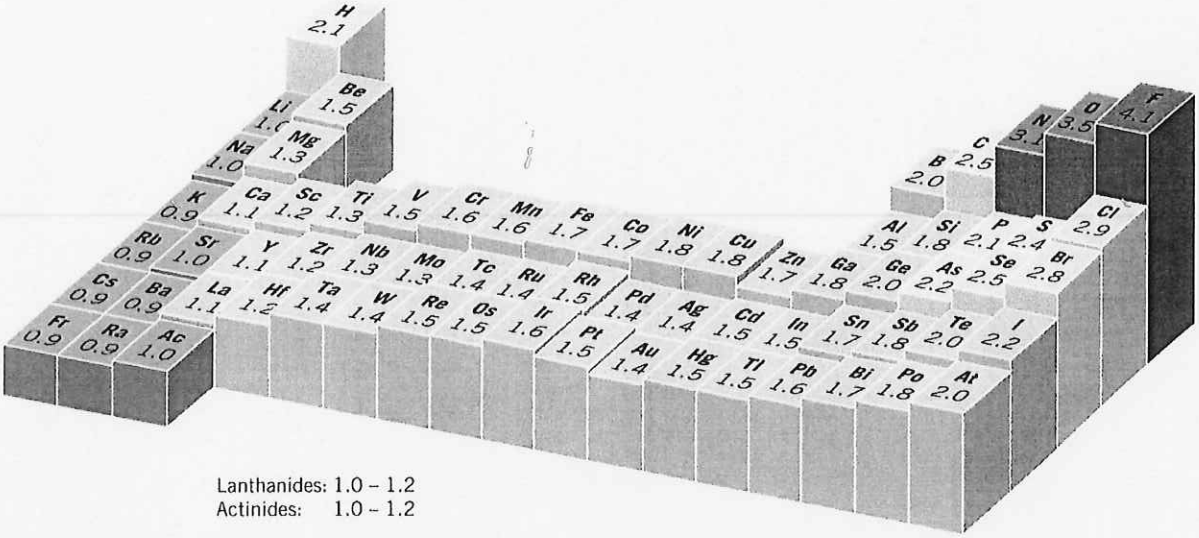
b. Consider the equation below;

$$Fe_2S_3 + HNO_3 \rightarrow Fe(NO_3)_3 + S + NO_2$$

Balance the redox reaction equation in acidic solution. (Show all the steps for this process)

[14 Marks]

Total 25 marks



Lanthanides: 1.0 – 1.2
Actinides: 1.0 – 1.2