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

MAIN EXAMINATION PAPER 2016

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. Explain why the dissolution of water in octane (C_8H_{18}) is inhibited? **[4 Marks]**

b. The decomposition of N_2O_5 in the presence of carbon tetrachloride proceeds via the reaction

$$2N_2O_5\ (soln) \rightarrow 4NO_2\ (soln) + O_2\ (soln)$$

The reaction is first order and has a rate constant of $4.82 \times 10^{-3}\ s^{-1}$ at 64°C. Write the rate law for this reaction. **[5 Marks]**

c. 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)? **[6 Marks]**

d. Of the acids in the table below, which one is the strongest?

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]

e. The K_a of hypochlorous acid (HClO) is 3.0×10^{-8} at 25.0°C. What is the % ionization of hypochlorous acid in a 0.015 M aqueous solution of HClO at 25.0°C? **[7 Marks]**

QUESTION TWO

a. Complete the following statements;

(i) Bond polarity refers to_____.

(ii) Polar covalent bond refers to_____.

(iii) An oxidizing reagent is_____.

(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 _____ protons, _____ neutrons, and _____ electrons

(vii) The elements in groups 1A, 3-8B, and 6A are called, _____, _____ and _____, 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 44 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 oxidation number of Cl in $NaClO_4$ is _____.

[1 × 10 Marks]

b. What is the difference between a physical and a chemical change? **[3 Marks]**

c. Give the charge and electron configuration on the ion which is underlined in the following compounds:

(i) $\underline{Pb}(NO_3)_2$

(ii) $\underline{Cs}Cl$

(iii) $\underline{Si}O_2$

[3 × 4 Marks]

QUESTION THREE

a. 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) H_2O_2

(ii) KBr

(iii) $CuCl_2$

(iv) TiO_2 **[4×3 Marks]**

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

c. With reference to enthalpy changes, what does the term "standard conditions" mean? **[6 Marks]**

d. State Hess's Law.

[4 Marks]

QUESTION FOUR

a. Balance the following redox reaction equations in acidic media. For each equation, identify the reducing agent.

(i) $MnO_4^- + Br^- \rightarrow Mn^{2+} + Br_2$

(ii) $CN^- + Fe^{3+} \rightarrow CNO^- + Fe^{2+}$

[2 × 10 Marks]

b. What are; an Arrhenius acid, a Brønsted-Lowry acid and a Lewis acid?

[5 Marks]

QUESTION FIVE

a. If a sample containing only phosphorous and oxygen has percent composition 56.34% P and 43.66% O, could the sample be P_4O_{10}? **[10 Marks]**

b. When a 0.2312 g sample of a compound was analyzed, it was found to contain 0.0894 g of C, 0.0375 g of H, and 0.1043 g of N. Calculate the empirical formula of this compound. **[8 Marks]**

c. In an experiment, 40.0 cm^3 of 0.270 M barium hydroxide were mixed with 20.0 cm^3 of 0.330 M aluminium sulphate. What is the total mass of the precipitate that is formed?

[7 Marks]

SI Units and Conversions

Unit	Symbol	SI units
Newton	N	$kg.m.s^{-2}$
Pascal	Pa	$kg.m^{-1}.s^{-2}$ or $N.m^{-2}$
Joule	J	$kg.m^{2}.s^{-2}$ or N.m or AVs
Watt	W	$kg.m^{2}.s^{-3}$ or $J.s^{-1}$
Coulomb	C	A.s
Volt	V	$kg.m^{2}.s^{-3}.A^{-1}$ or $J.C^{-1}$
Ohm	Ω	$kg.m^{2}.s^{-3}.A^{-2}$ or $v.A^{-1}$
Amp	A	$1Cs^{-1}$

Pressure Units and conversion factors

Pa	I Pa = 1 $N.m^{-2}$
Bar	1 bar = 10^{5} Pa
Atmosphere	1 atm = 101.325 kPa
Torr	760 Torr = 1 atm
	760 Torr = 760 mmHg= 101.325 kPa

General data and Fundamental Constants

Gas constant	R	8.314 51 $J.K^{-1}.mol^{-1}$ 8.314 51 x 10^{-2} $L.bar.K^{-1}.mol^{-1}$ 8.205 78 x 10^{-2} $L.atm.K^{-1}.mol^{-1}$ 62.364 $L.Torr.K^{-1}.mol^{-1}$
Avogadro constant	N_A	6.022169 x 10^{23} mol^{-1}
Molar volume of an ideal gas at 0°C and 1 atm	V_m	22.414 dm^3

UNIVERSITY OF SWAZILAND

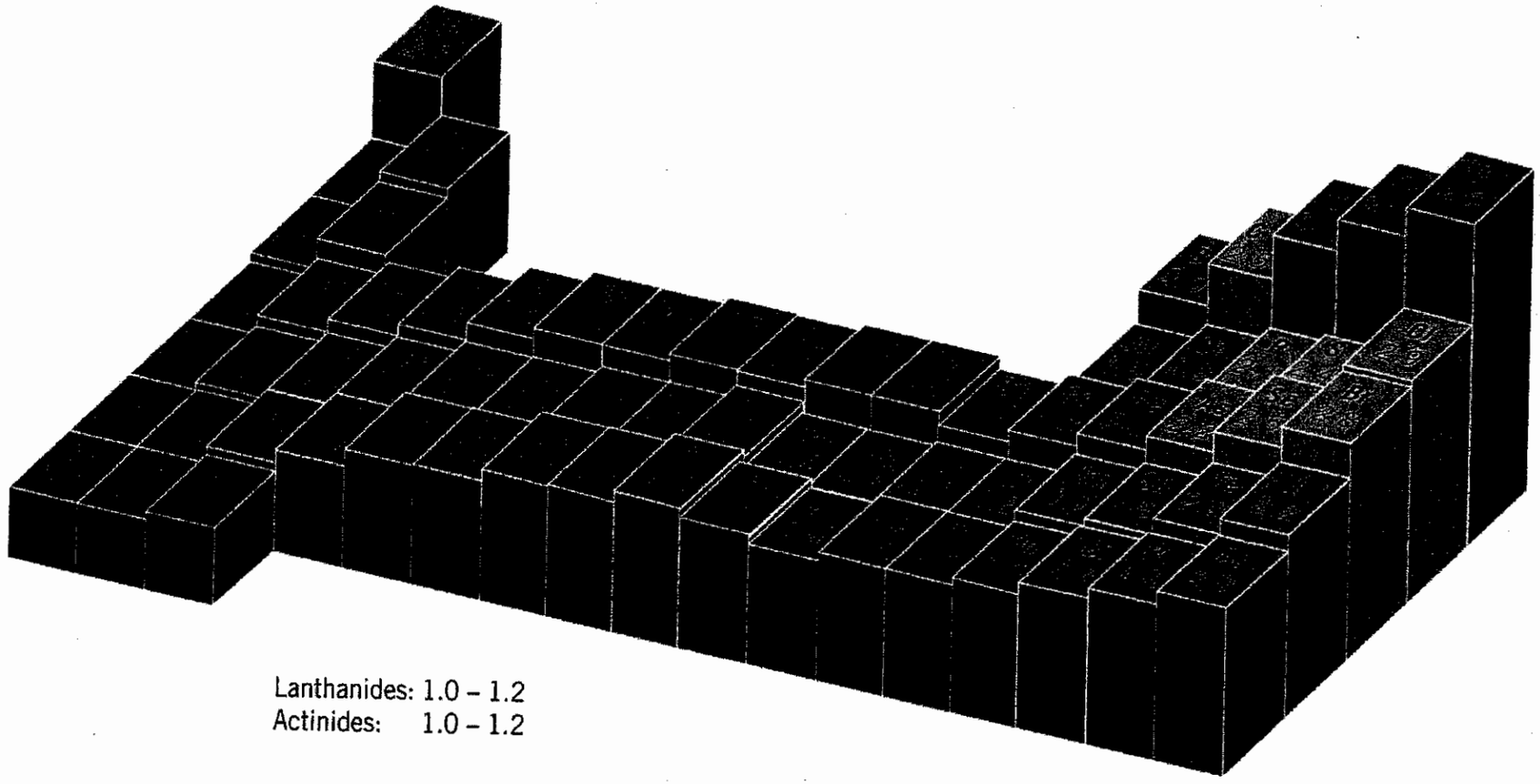
Department of Chemistry

Atomic Number 2 **He** 4.0026 Atomic Weight

1 **H** 1.0079																	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.179
11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.064	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.88	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.847	27 **Co** 58.933	28 **Ni** 58.69	29 **Cu** 63.546	30 **Zn** 65.39	31 **Ga** 69.723	32 **Ge** 72.61	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57 **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.03	89 **Ac** 227.03															

58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** 146.92	62 **Sm** 150.36	63 **Eu** 151.97	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** 237.05	94 **Pu** (244)	95 **Am** (234)	96 **Cm** (247)	97 **Bk** 247	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Electronegativity Table



Lanthanides: 1.0 – 1.2
Actinides: 1.0 – 1.2