



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

RESIT EXAMINATION PAPER 2019

- 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

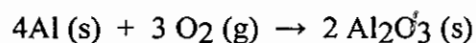
 - : NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE EXAMINATION ROOM.

 - : BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

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

QUESTION ONE

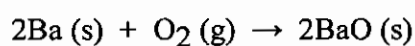
- a. Solid aluminum and gaseous oxygen react in a combination reaction to produce aluminum oxide:



In a particular experiment, the reaction of 2.5 g of Al with 2.5 g of O₂ produced 3.5 g of Al₂O₃. What is the % yield of the reaction?

[9 Marks]

- b. The value of ΔH° for the reaction below is -1107 kJ:



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

[6 Marks]

- c. Of the acids in the table below, which one is the strongest 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]

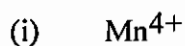
- d. The K_a of hypochlorous acid (HClO) is 3.0×10^{-8} at 25.0°C. What is the % ionization of hypochlorous acid in a 0.015 M aqueous solution of HClO at 25.0°C?

[7 Marks]

Total: 25 marks

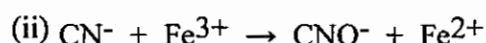
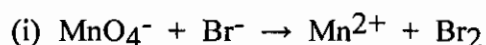
QUESTION TWO

a. Write the full electron configuration of the following ions



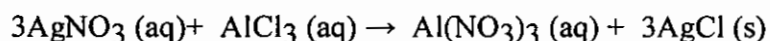
[3 × 3 Marks]

b. For each of the following redox reaction equations, identify oxidizing and reducing agents and assign oxidation numbers of all atoms involved in the redox reaction.



[2 × 4 Marks]

c. Silver nitrate and aluminum chloride react with each other by exchanging anions:



What mass in grams of AgCl is produced when 4.22 g of AgNO₃ react with 7.73 g of AlCl₃?

[8 Marks]

Total: 25 Marks

QUESTION THREE

a. A sample of a liquid with a mass of 8.657 g was decomposed into its elements and gave 5.217 g of carbon, 0.9620 g of hydrogen, and 2.478 g of oxygen. What is the percentage composition of this compound? [6 Marks]

b. Determine the pOH of a 0.35 M aqueous solution of CH₃NH₂ (methylamine).

The K_b of methylamine is 2.7×10^{-4} .

[7 Marks]

c. Classify the following acids and bases using the various acids and bases

definitions. For each classification, state the reason why.

(i) NH_3

(ii) H_2O

(iii) OH^-

(iv) CO

[12 Marks]

Total: 25 Marks

QUESTION FOUR

- a. What are the bond polarity limits for a polar covalent compound? [4 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) SO_2
- (ii) CsBr
- (iii) PbNO_2
- (iv) ZnO
- (v) C_2H_6 [15 Marks]
- c. State the first law of thermodynamics. [3 Marks]
- d. With reference to enthalpy changes, what does the term "standard conditions" mean? [3 Marks]

Total: 25 marks

QUESTION FIVE

- a. If a sample is found to contain only phosphorous & oxygen has percent composition 56.34% P & 43.66% O, is the molecular formula of the sample 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 cm³ of 0.270 M barium hydroxide were mixed with 20.0 cm³ of 0.330 M aluminium sulphate. What is the total mass of the precipitate that forms? **[7 Marks]**

Total: 25 marks

PERIODIC TABLE OF ELEMENTS

GROUPS

PERIODS	GROUPS																		
	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	IA	IIA	IIIB	IVB	VB	VIB	VIIA	VIII	VIIIB	IX	X	XI	XII	IIIA	IVA	VIA	VIIA	VIIIA	
1	1.008 H																	4.003 He	
2	6.941 Li 3	9.012 Be 4												12.011 C 6	14.007 N 7	15.999 O 8	18.998 F 9	20.180 Ne 10	
3	22.990 Na 11	24.305 Mg 12											26.982 Al 13	28.086 Si 14	30.974 P 15	32.06 S 16	35.453 Cl 17	39.948 Ar 18	
4	39.098 K 19	40.078 Ca 20	44.956 Sc 21	47.88 Ti 22	50.942 V 23	51.996 Cr 24	54.938 Mn 25	55.847 Fe 26	58.933 Co 27	58.69 Ni 28	63.546 Cu 29	65.39 Zn 30	69.723 Ga 31	72.61 Ge 32	74.922 As 33	78.96 Se 34	79.904 Br 35	83.80 Kr 36	
5	85.468 Rb 37	87.62 Sr 38	88.906 Y 39	91.224 Zr 40	92.906 Nb 41	95.94 Mo 42	98.907 Tc 43	101.07 Ru 44	102.91 Rh 45	106.42 Pd 46	107.87 Ag 47	112.41 Cd 48	114.82 In 49	118.71 Sn 50	121.75 Sb 51	127.60 Te 52	126.90 I 53	131.29 Xe 54	
6	132.91 Cs 55	137.33 Ba 56	138.91 *La 57	178.49 Hf 72	180.95 Ta 73	183.85 W 74	186.21 Re 75	190.2 Os 76	192.22 Ir 77	195.08 Pt 78	196.97 Au 79	200.59 Hg 80	204.38 Tl 81	207.2 Pb 82	208.98 Bi 83	(209) Po 84	(210) At 85	(222) Rn 86	
7	223 Fr 87	226.03 Ra 88	(227) **Ac 89	(261) Rf 104	(262) Ha 105	(263) Unh 106	(262) Uns 107	(265) Uno 108	(266) Une 109	(267) Uun 110									

Atomic mass →
Symbol →
Atomic No. →

TRANSITION ELEMENTS

*Lanthanide Series	140.12 Ce 58	140.91 Pr 59	144.24 Nd 60	(145) Pm 61	150.36 Sm 62	151.96 Eu 63	157.25 Gd 64	158.93 Tb 65	162.50 Dy 66	164.93 Ho 67	167.26 Er 68	168.93 Tm 69	173.04 Yb 70	174.97 Lu 71
**Actinide Series	232.04 Th 90	231.04 Pa 91	238.03 U 92	237.05 Np 93	(244) Pu 94	(243) Am 95	(247) Cm 96	(247) Bk 97	(251) Cf 98	(252) Es 99	(257) Fm 100	(258) Md 101	(259) No 102	(260) Lr 103

() indicates the mass number of the isotope with the longest half-life.

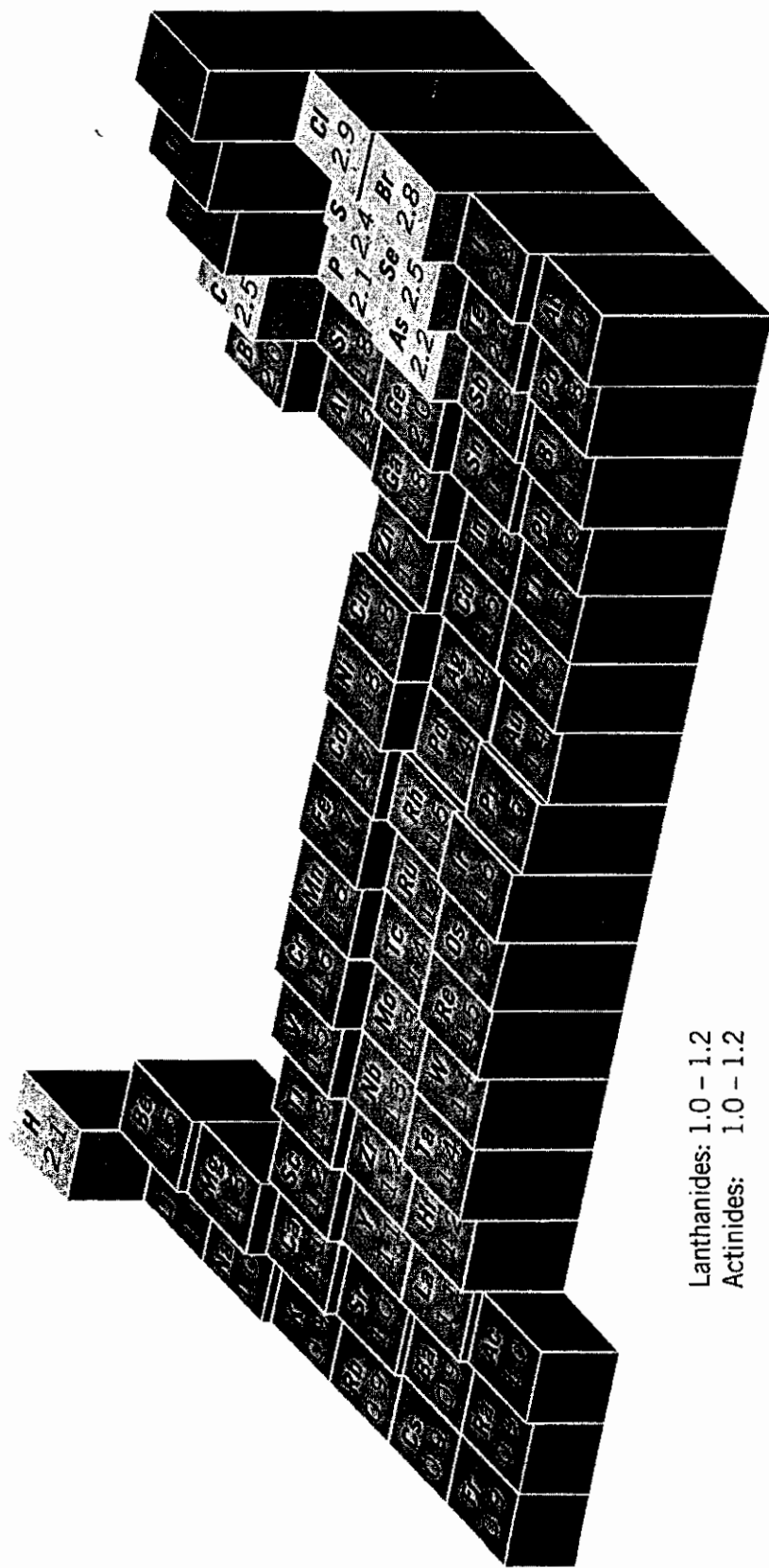
General data and fundamental constants

Quantity	Symbol	Value
Speed of light	c	$2.997\,924\,58 \times 10^8 \text{ m s}^{-1}$
Elementary charge	e	$1.602\,177 \times 10^{-19} \text{ C}$
Faraday constant	$F = N_A e$	$9.6485 \times 10^4 \text{ C mol}^{-1}$
Boltzmann constant	k	$1.380\,66 \times 10^{-23} \text{ J K}^{-1}$
Gas constant	$R = N_A k$	$8.314\,51 \text{ J K}^{-1} \text{ mol}^{-1}$ $8.205\,78 \times 10^{-2} \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$ $6.2364 \times 10 \text{ L Torr K}^{-1} \text{ mol}^{-1}$
Planck constant	h	$6.626\,08 \times 10^{-34} \text{ J s}$
	$\hbar = h/2\pi$	$1.054\,57 \times 10^{-34} \text{ J s}$
Avogadro constant	N_A	$6.022\,14 \times 10^{23} \text{ mol}^{-1}$
Atomic mass unit	u	$1.660\,54 \times 10^{-27} \text{ Kg}$
Mass		
electron	m_e	$9.109\,39 \times 10^{-31} \text{ Kg}$
proton	m_p	$1.672\,62 \times 10^{-27} \text{ Kg}$
neutron	m_n	$1.674\,93 \times 10^{-27} \text{ Kg}$
Vacuum permittivity	$\epsilon_0 = 1/c^2 \mu_0$	$8.854\,19 \times 10^{-12} \text{ J}^{-1} \text{ C}^2 \text{ m}^{-1}$
	$4\pi\epsilon_0$	$1.112\,65 \times 10^{-10} \text{ J}^{-1} \text{ C}^2 \text{ m}^{-1}$
Vacuum permeability	μ_0	$4\pi \times 10^{-7} \text{ J s}^2 \text{ C}^{-2} \text{ m}^{-1}$ $4\pi \times 10^{-7} \text{ T}^2 \text{ J}^{-1} \text{ m}^2$
Magneton		
Bohr	$\mu_B = e\hbar/2m_e$	$9.274\,02 \times 10^{-24} \text{ J T}^{-1}$
nuclear	$\mu_N = e\hbar/2m_p$	$5.050\,79 \times 10^{-27} \text{ J T}^{-1}$
g value	g_e	2.002 32
Bohr radius	$a_0 = 4\pi\epsilon_0 \hbar^2 / m_e e^2$	$5.291\,77 \times 10^{-11} \text{ m}$
Fine-structure constant	$\alpha = \mu_0 e^2 c / 2\hbar$	$7.297\,35 \times 10^{-3}$
Rydberg constant	$R_\infty = m_e e^4 / 8\hbar^2 c \epsilon_0^2$	$1.097\,37 \times 10^7 \text{ m}^{-1}$
Standard acceleration of free fall	g	$9.806\,65 \text{ m s}^{-2}$
Gravitational constant	G	$6.672\,59 \times 10^{-11} \text{ N m}^2 \text{ Kg}^{-2}$

Conversion factors

1 cal	=	4.184 joules (J)	1 erg	=	$1 \times 10^{-7} \text{ J}$
1 eV	=	$1.602\,2 \times 10^{-19} \text{ J}$	1 eV/molecule	=	96 485 kJ mol ⁻¹

Prefixes	f	p	n	μ	m	c	d	k	M	G
	femto	pico	nano	micro	milli	centi	deci	kilo	mega	giga
	10^{-15}	10^{-12}	10^{-9}	10^{-6}	10^{-3}	10^{-2}	10^{-1}	10^3	10^6	10^9



Lanthanides: 1.0 – 1.2

Actinides: 1.0 – 1.2

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