



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

SPECIAL 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

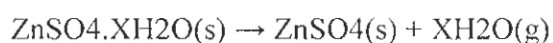
Zinc is an essential trace element which is necessary for the healthy growth of animals and plants. Zinc deficiency in humans can be easily treated by using zinc salts as dietary supplements.

- a. One salt which is used as a dietary supplement is a hydrated zinc sulphate, $ZnSO_4 \cdot xH_2O$, which is a colourless crystalline solid. Crystals of zinc sulphate may be prepared in a school or college laboratory by reacting dilute sulphuric acid with a suitable compound of zinc.

Give the formulae of two simple compounds of zinc that could each react with dilute sulfuric acid to produce zinc sulphate.

..... and [5 Marks]

- (b) A simple experiment to determine the value of x in the formula $ZnSO_4 \cdot xH_2O$ is to heat it carefully to drive off the water.



A student placed a sample of the hydrated zinc sulphate in a weighed boiling tube and re-weighed it. He then heated the tube for a short time, cooled it and reweighed it when cool. This process was repeated four times. The final results are shown below.

Mass of empty tube (g)	Mass of tube + hydrated salt (g)	Mass of tube + salt after fourth heating (g)
74.25	77.97	76.34

- (i) Why was the boiling tube heated, cooled and reweighed four times? [3 Marks]
- (ii) Calculate the amount, in moles, of the anhydrous salt produced. [6 Marks]
- (iii) Calculate the amount, in moles, of water driven off by heating. [6 Marks]
- (iv) Write out the electron configuration of Zn in this compound. [5 Marks]

QUESTION TWO

a. A table containing twelve pure substances is given below.

NOTE:

- These substances can be used more than once in answering questions A to K.
- Write the full formula of each substance used in the answer.
- Some questions have more than one answer and some may have no answer.
- When no answer is available write 'none' or 'no answer'
- Each question (i to x) is worth two marks.
- The mark will be assigned only if the complete answer is given.

C	H ₂ S	CoSO ₄	S
CaCO ₃	As	Al	Rb
FeS	Br ₂	NH ₃	Mg

- (i) Has an electronic structure with 2 unpaired electrons
- (ii) Has 2 valence electrons in its atom
- (iii) Forms an ion with a spectroscopic electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
- (iv) Forms mono-atomic anions
- (v) Has a core (inner) electronic configuration of $1s^2 2s^2 2p^6$
- (vi) Has one half-filled p sublevel
- (vii) Contains or is a monovalent atom
- (viii) Example(s) of an ionic compound
- (ix) Example(s) of a diatomic molecule
- (x) Atoms in its structure are joined together by pure covalent bonds only

[20 Marks]

b. In the process of attempting to characterize a substance, a chemist makes the following observations:-

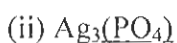
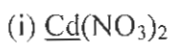
The substance is a silvery white, lustrous metal. It melts at 649°C and boils at 1105°C. The substance burns in air, producing an intense white light. It reacts with chlorine to give a brittle white solid. The substance can be pounded into thin sheets or drawn into wires. It is a good conductor of electricity.

Identify any two chemical and two physical properties of the unknown substance.

[5 Marks]

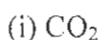
QUESTION THREE

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



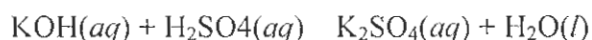
[9 Marks]

b. Use the Table of Electronegativity to determine whether the following are ionic or covalent (pure or polar) compounds. Provide a reason for your answer.



[6 Marks]

c. Eighteen grams (18.0 g) of potassium hydroxide are dissolved in 850.0 mL of deionised water. The resulting solution reacts with sulfuric acid according to the following equation:



(i) Determine the number of moles in the KOH solution?

(ii) Calculate the number of moles/L of the sulfuric acid solution if 500.0 mL of the KOH reacts with 800.0 mL of the acid.

(iii) Give the IUPAC name of the sulfur-containing product.

[10 Marks]

QUESTION FOUR

A student performs a titrimetric analysis to determine the amount of iron in a sample using potassium dichromate in basic medium.

a. Construct a balanced chemical equation for the reaction.

[20 Marks]

b. Identify the reducing and oxidizing agents.

[5 Marks]

QUESTION FIVE

Qualitative analysis of an unknown acid was found to contain only carbon, hydrogen and oxygen. In a quantitative analysis, a 10.46 mg sample was found in oxygen and gave 22.17 mg carbon dioxide and 3.40 mg water. The molecular mass was determined to be 166 gmol⁻¹. When 0.1680 g of the acid was titrated with 0.1250 M sodium hydroxide, the end point was reached after 16.18 mL of the base added.

- a. What is the empirical formula of the acid? **[10 Marks]**
- b. What is its molecular formula? **[6 Marks]**
- c. Is the acid mono-, di- or triprotic? **[3 Marks]**
- d. Calculate the percent composition of the acid. **[6 Marks]**

UNIVERSITY OF SWAZILAND
Department of Chemistry

Atomic Number		Atomic Weight	
1	H 1.0079	2	He 4.0026
3	Li 6.941	4	Be 9.0122
11	Na 22.990	12	Mg 24.305
19	K 39.098	20	Ca 40.078
37	Rb 85.47	38	Sr 87.62
55	Cs 132.91	56	Ba 137.33
87	Fr (223)	88	Ra 226.03
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
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
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
89	Ac 227.03	89	Ac 227.03
5	B 10.811	6	C 12.011
7	N 14.007	8	O 15.999
9	F 18.998	10	Ne 20.179
13	Al 26.982	14	Si 28.086
15	P 30.974	16	S 32.064
17	Cl 35.453	18	Ar 39.948
31	Ga 69.723	32	Ge 72.61
33	As 74.922	34	Se 78.96
35	Br 79.904	36	Kr 83.80
49	In 114.82	50	Sn 118.71
51	Sb 121.75	52	Te 127.60
53	I 126.90	54	Xe 131.29
81	Tl 204.38	82	Pb 207.2
83	Bi 208.98	84	Po (209)
85	At (210)	86	Rn (222)
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 243
96	Cm 247	97	Bk 247
98	Cf 251	99	Es 252
100	Fm 257	101	Md 258
102	No 259	103	Lr 260