UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

DEGREE IN ENVIRONMENTAL HEALTH SCIENCES

RESIT EXAMINATION PAPER 2017

TITLE OF PAPER : INSTRUMENTAL METHODS FOR
ENVIRONMENTAL ANALYSIS I

COURSE CODE : EHS 209

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. What does the term "sample matrix" mean? [3 Marks]

b. Give three examples of sample preparation processes and briefly describe each process. [9 Marks]

c. Define an outlier and how can it be identified? [3 Marks]

d. Draw a schematic diagram of a typical gas chromatography instrument

[10 Marks]

QUESTION TWO

a. Discuss the Plate theory in gas chromatography (use diagrams and equations in your discussion). [7 Marks]

b. How is column efficiency influenced by the following factors? (Use appropriate equations where necessary)

   (i)   'loading' of the column,

   (ii) N (number of theoretical plates) and

   (iii) H (height of plate)? What other factors influence it? [12 Marks]

c. In a chromatographic analysis of a mixture of pesticides, in which a 2.0 m long column was used, a peak with retention time t_r, of 16.4 min and a baseline width of 0.21 min, was identified as diuron. Calculate N and H for this column.

[6 Marks]

QUESTION THREE

a. Some aspects of the calibration process are part of the "figures of merit" for an analysis. Define calibration and the 5 figures of merit which should be evaluated in the process of establishing a calibration [12 Marks]

b. Explain why the drying step is essential in sample preparation of biological samples for metal analysis. [5 Marks]

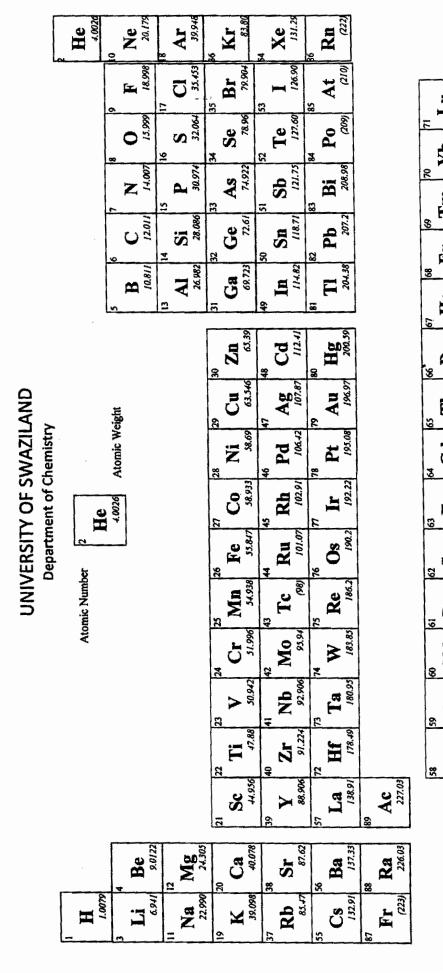c. In solvent extraction, what does a distribution coefficient of 1 mean?

[5 Marks]

d. Name two statistical terms that describe the accuracy of a data set [3 Marks]

QUESTION FOUR

a. Differentiate between packed and hollow columns in gas chromatography. Give advantages and disadvantages if each. **[8 Marks]**

b. In TLC, what is meant by elution strength? How is it adjusted? **[6 Marks]**

c. Explain why mixtures of solvents are commonly used in TLC as opposed to using pure solvents. **[5 Marks]**

d. Explain how solid-phase extraction (SPE) works and relate it to the principles of adsorption. **[6 Marks]**

QUESTION FIVE

a. Outline the process of preparing an external calibration curve. **[6 Marks]**

b. In the analysis of PCBs using gas chromatography, what type of detector is ideal? Explain why? **[12 Marks]**

c. State sequentially, the steps that should be followed in solving a given analytical problem (i.e. in the analysis of a given sample). **[7 Marks]**

UNIVERSITY OF SWAZILAND
Department of Chemistry

Atomic Number — 2

He
4.0026

Atomic Weight

Main Periodic Table

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 63.39	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															

Lanthanides / Actinides

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)