



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

DEGREE IN ENVIRONMENTAL HEALTH SCIENCES
SUPPLEMENTARY EXAMINATION PAPER 2016

TITLE OF PAPER : INSTRUMENTAL METHODS FOR ENVIRONMENTAL ANALYSIS II

COURSE CODE : EHM 212

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. Discuss the working principles of the flame atomic emission spectrometry
[8 Marks]
- b. Give five advantages of ICP (inductively coupled plasma) spectroscopic method of analysis over other conventional spectroscopic methods. [10 Marks]
- c. What are the characteristics of stray radiations that cause deviations from Beer's law during spectroscopic analysis? [7 Marks]

QUESTION TWO

- a. What are the necessary precautions that should be taken in the handling of a cuvette/cell, during a UV spectrophotometric analysis? [8 Marks]
- b. Explain why compounds containing the same chromophore will have different maximum absorbance wavelengths. [7 Marks]
- c. Discuss the effect of the slit width on the resolution of a spectrophotometer and the adherence to Beer's law/ compare it with the spectral slit width. [10 marks]

QUESTION THREE

- a. Describe how to prepare a KBr pallet for IR spectroscopy. [4 Marks]
- b. For the chemical, ionization and types of interferences
 - (i) Explain their causes
 - (ii) Discuss the steps normally taken to correct or eliminate each of them
 - (iii) Discuss the steps usually taken to correct or eliminate ionization interferences
 [12 Marks]
- c. For each of the following spectral regions, suggest an appropriate monochromator and state the reasons for each choice
 - (i) IR
 - (ii) Visible
 - (iii) UV
 [9 Marks]

QUESTION FOUR

- a. Explain the term deviation from Beer's law and discuss the different types of deviations **[5 Marks]**
- b. Discuss the causes and possible corrective measures of real deviations from Beer's law. **[10 Marks]**
- c. Briefly describe the working principles of prisms and diffraction gratings as monochromators. **[10 Marks]**

QUESTION FIVE

- a. A serum sample is analyzed for potassium by flame emission spectrometry using standard additions. Two 0.500 mL aliquots are added to 5.00 mL portions of water. To one portion, 10 μ L of 0.05 M KCl solution was added. The net emission signals in arbitrary units are 32.1 and 58.6. What is the concentration of potassium in the serum? **[9 Marks]**
- b. Explain what is an internal standard and how does it improve the precision of atomic spectrometry measurements. **[9 Marks]**
- c. Explain the term interference with regards to flames and furnaces. **[7 Marks]**

PERIODIC TABLE OF ELEMENTS

GROUPS																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
IA	IIA	IIIB	IVB	VB	VIB	VII	VIII	VIII	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1.008																	4.003
H																	He
1																	2
6.941	9.012									10.811	12.011	14.007	15.999	18.998	20.180		
Li	Be									B	C	N	O	F	Ne		
3	4									5	6	7	8	9	10		
22.990	24.305									26.982	28.086	30.974	32.06	35.453	39.948		
Na	Mg									Al	Si	P	S	Cl	Ar		
11	12									13	14	15	16	17	18		
TRANSITION ELEMENTS																	
39.098	40.078	44.956	47.88	50.942	51.996	54.938	55.847	58.933	58.69	63.546	65.39	69.723	72.61	74.922	78.96	79.904	83.80
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
85.468	87.62	88.906	91.224	92.906	95.94	98.907	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121.75	127.60	126.90	131.29
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
132.91	137.33	138.91	178.49	180.95	183.85	186.21	190.2	192.22	195.08	196.97	200.59	204.38	207.2	208.98	(209)	(210)	(222)
Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
223	226.03	(227)	(261)	(262)	(263)	(262)	(265)	(266)	(267)								
Fr	Ra	**Ac	Rf	Ha	Unh	Uns	Uno	Une	Uun								
87	88	89	104	105	106	107	108	109	110								

*Lanthanide Series

**Actinide Series

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

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