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

DEGREE IN ENVIRONMENTAL HEALTH SCIENCES

FINAL 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. Define absorbance and transmittance in absorption spectroscopy. **[4 Marks]**

b. Obtain an expression that relates the two terms in a). **[2Marks]**

c. State Beer's law and use appropriate equations that define this law. **[5 Marks]**

d. Briefly describe the working principles of prisms and diffraction gratings as monochromators. **[10 Marks]**

e. Titanium is reacted with hydrogen peroxide in 1 M sulphuric acid to form a coloured complex. If a 2.00 ×10-5 absorbs 31.5% of the radiation at 415 nm, what is;

i) The absorbance

ii) Transmittance and %T for a 6.00 $\times 10^{-5}$ M solution **[4 Marks]**

QUESTION TWO

a. Draw and label a schematic diagram of an atomic absorption spectroscopy instrument. **[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. **[10 marks]**

QUESTION THREE

a. A wastewater effluent sample known to contain *para* nitrophenol (abbreviated as PNP, Mw139.11 g.mol−1) was analysed using UV/vis spectrometer, in a 0.1 cm cuvette, was found to transmit 77% of the incident light at a certain wavelength at 318 nm (PNP's maximum absorbance wavelength). If the molar absorptivity of this substance at this wavelength is 17.9 cm/1g/1L, what is the concentration of the substance in moles/L? (Pay attention to units and use the correct conversions). **[9 Marks]**

b. Discuss the two types of monochromators, and list advantages and disadvantages of each. **[16 Marks]**

QUESTION FOUR

a. 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]**

b. What is the function of a chopper in atomic absorption spectroscopy? **[6 Marks]**

c. What are the figures of merit when choosing a suitable detector for instrumental methods? **[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 μL of 0.05 M KCl solution was added. The net emission signals in arbitrary units are 32.1 and 58.6 a.u. 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. **[12 Marks]**

c. Describe how to prepare a KBr pallet for IR spectroscopy. **[4 Marks]**

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