

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

Semester 1 Examinations, 2001-2002

Third University B.Sc. Examination in Science
(Including denominated degrees)

CH304 - Analytical and Industrial Chemistry

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and Internal Examiners

Time allowed: **Two** hours

Answer four questions

All questions carry equal marks. Leave the first page of the Answer Book blank and list on it clearly the numbers of the questions attempted.

1. Answer (a) and (b)

(a) Distinguish between primary and secondary chemistry journals. Give examples of each type.

[13 marks]

(b) Write short notes on (i) electronic journals and (ii) 'innovative journals'.

[12 marks]

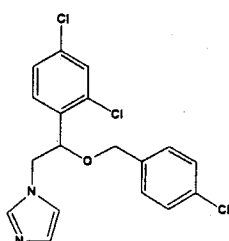
2. Answer (a) and (b)

(a) Outline the origin of x-ray fluorescence and describe the nomenclature employed for x-ray fluorescent lines. Show how the wavelength of the K_{α} line varies with atomic number and outline the consequence of this in choosing detectors for x-ray fluorescence spectrometers. Describe the typical construction and mode of operation of a wavelength dispersive x-ray fluorescence spectrometer. [13 marks]

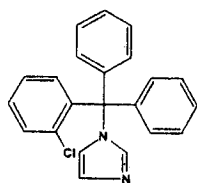
(b) Outline the advantages of x-ray fluorescence spectroscopy as an analytical technique.

[12 marks]

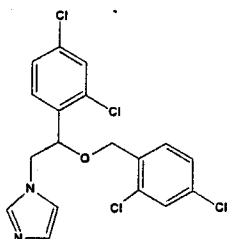
3. The chromatogram and accompanying information provide details of how a number of agents useful in treating fungal infections can be analysed by HPLC. The mobile phase used is a 35/65 mixture of acetonitrile (ACN) and an aqueous phosphate buffer.



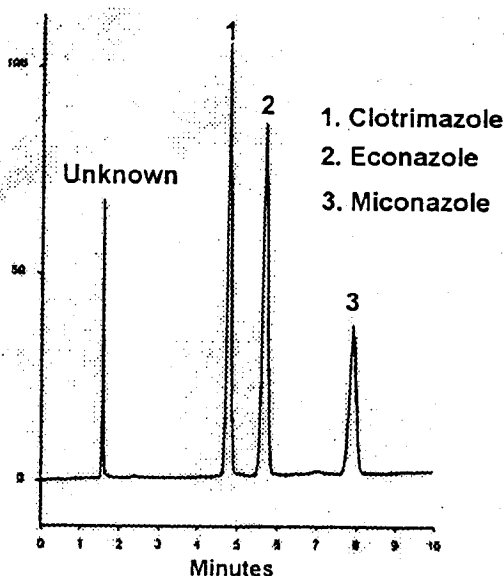
Miconazole



Clotrimazole



Econazole



Column:	ZORBAX Bonus-RP, 4.6 x 150 mm
Mobile Phase:	35% 25 mM NaH ₂ PO ₄ , dibasic (pH 6.5 with H ₃ PO ₄) : 65% ACN
Inj. Vol:	2 µL
Flow Rate:	1 mL/min
Temperature:	Ambient
Detection:	UV (220 nm)

- Draw a schematic diagram of a HPLC system which would be required to run the analysis. [4 Marks]
- The column used is described as an RP (Reversed Phase) column. Explain, using an example, what is meant by an RP column. [4 Marks]
- On the basis that the column is of the RP type, is econazole more or less polar than miconazole? Explain your answer. [4 Marks]
- Explain how the detector used actually works. [4 Marks]
- A sample, analysed by this method contains a peak at approximately 8 minutes. What can you deduce from this and how would you set about confirming your deductions? [4 Marks]
- Compare and contrast GC and HPLC as analytical techniques. [5Marks]

4. "Some analytical techniques require the use of primary standards and standard reference materials while others do not". Discuss the use and importance of primary standards and standard reference materials in the context of this statement. You should refer to a number of analytical techniques in your answer. [25 marks]

More on next page

5. Of all the thermal analysis techniques available, Differential Scanning Calorimetry (DSC) has proved to be the most useful in the pharmaceutical industry. Outline some of the applications of this technique in the pharmaceutical industry, highlighting its advantages and disadvantages over other analytical techniques with which you are familiar. [25 marks].
6. Answer (a) and (b)
- (a) What are the principal raw material sources for carbon and sulfur based compounds used by the chemical industry? [13 marks]
- (b) . Outline the major factors involved in the implementation of catalyzed processes in batch and flow reactors. [12 marks]
7. Answer **each** of the following
- (a) Describe the Monsanto acetic acid process and explain the new development that is likely to replace it. [12 marks]
- (b) Olefins may be polymerized using Ziegler or free radical methods. Give a mechanism for the Ziegler process and outline the types of applications there are for the different types of polymer products. [13 marks]
8. Answer (a), (b), (c) and (d).
- (a) Describe the instrumentation used in modern gas liquid chromatography. [6 marks]
- (b) Explain the following terms;.
- i) retention time [3 marks]
- ii) theoretical plate [3 marks]
- iii) capillary column [3 marks]
- (c) Describe the role of temperature in gas chromatography [5 marks]
- (d) Calculate the number of theoretical plates in a column when the retention time is 6 min and the peak width is 50 sec. [5 marks]