

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

Summer Examinations, 1999

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

CH302 - Analytical and Industrial Chemistry

Second Paper

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and Internal Examiners

Time allowed: **Three hours**

Answer question 1 and **four** other questions

1. Compulsory Multiple Choice Question on separate paper.
2. Write notes on **each** of the following:
 - a) The chlor-alkali industry.
 - b) Asymmetric catalysis.
3. Write notes on **each** of the following:
 - a) Homogeneous *versus* heterogeneous catalysis.
 - b) The Oxo process (hydroformulation of alkenes).
4. Answer **each** of the following:
 - a) Describe the structure of the chemical industry and its development since the 1930s. What are the top 5 industrial chemicals by weight? Give the names of five of the largest chemical companies.
 - b) What are the economic factors which must be taken into account when setting up a chemical plant? What is the effect of scale on any research and development which might be undertaken?

5. The details provided below show that it is possible to analyse a wide range of analgesics using a reverse phase column and a mobile phase containing acetonitrile and an aqueous buffer.

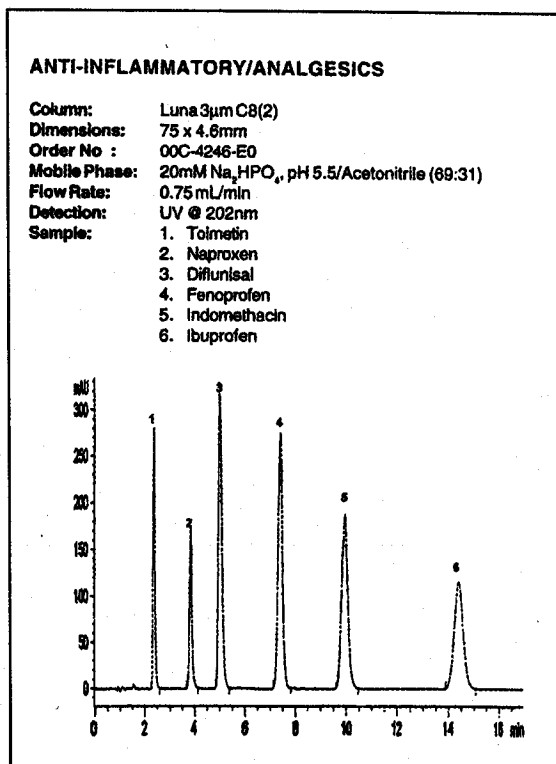
(a) Having considered the details of the analysis, identify what would be required in terms of HPLC equipment to carry it out.

(b) What would happen to the retention times if the proportion of acetonitrile in the mobile phase were increased? Explain your answer in terms of the retention mechanism for this type of chromatography.

(c) A new method of making ibuprofen gives a by-product whose retention time is always the same as ibuprofen and which as a result co-elutes with it. How would you show that a particular batch of ibuprofen contains none of the by-product and what additional equipment would you require?

(d) A program of work is being planned to monitor the effect of low concentrations of ibuprofen on a group of patients and it is suggested that a UV/visible detector may not be sensitive enough. Suggest an appropriate alternative detector and explain how it works.

(e) The following data were obtained for an analysis of ibuprofen using an appropriate internal standard. Use the data to determine the concentration of ibuprofen in the unknown sample.



Sample	Peak Area Ratio (Ibuprofen)/(IS)	[Ibuprofen] (mg/100ml)
Standard 1	0.273	18
Standard 2	0.632	42
Standard 3	0.945	63
Unknown	0.482	?

6. Figures 1(a) and 1(b) contain physical data for an organic compound. Deduce the structure of the compound.
7. Figures 2(a) and 2(b) contain physical data for an organic compound. Deduce the structure of the compound.
8. Figures 3(a) and 3(b) contain physical data for an organic compound. Deduce the structure of the compound.
9. What is ISO 9000?

While ISO 9000 does not define what a quality system should do, every organisation seeking ISO certification must meet certain requirements as outlined in Section 4 of the standard. Describe these requirements.