

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Autumn Examinations 2013

Module Title: Pharmaceutical Chemistry

Module Code: CHEO 6006

School : Science

Programme Title: BSc in Analytical & Pharmaceutical Chemistry – Stage 1
 BSc in Analytical Chemistry with Quality Assurance – Stage 1

Programme Code: SCHEM_7_Y1
 SCHQA_8_Y1

External Examiner(s): Dr. C. Lennon

Internal Examiner(s): Dr. M. Sheahan

Instructions: Answer any **FOUR** questions. *All questions carry equal marks*

Duration: 2 Hours

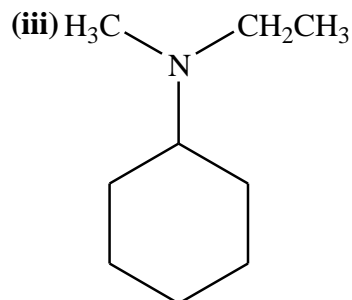
Sitting: Autumn 2013

Requirements for this examination:

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.
If in doubt please contact an Invigilator.

Q1.

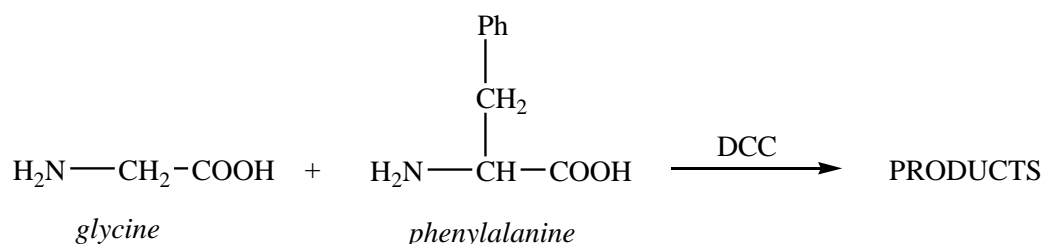
- (a) List six properties of an ideal medicine (3 marks)
- (b) Would you expect aspirin (acetylsalicylic acid, pK_a 3.5) to be ionized or non-ionized in the bloodstream (pH ~ 7.2)? Use the data provided to calculate its % ionization in the bloodstream (4 marks)
- (c) State how the solubility, absorption, drug-target interactions and the duration of action of a drug molecule are influenced by whether a drug is ionized or non-ionized (6 marks)
- (d) Write a brief note on generics (4 marks)
- (e) Name the following molecules



(3 marks)

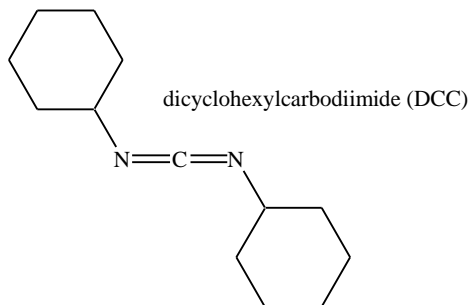
Q2.

- (a) List three properties of amino acids (2 marks)
- (b) Give the structures of the four dipeptide products which are formed when glycine reacts with phenylalanine in the presence of DCC (3 marks)



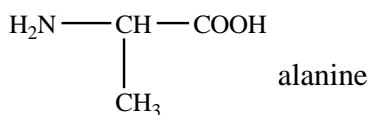
- (i) Explain the strategy used to control the reaction so that one specific dipeptide is formed. Support your answer with the relevant structural formulae (6 marks)

- (ii) What is the purpose of DCC (structure shown) in the reaction; hence show the first step of the reaction



(5 marks)

- (c) Use Fischer projection formula to distinguish between D- and L- alanine



(4 marks)

Q3.

- (a) Write a comprehensive note on pharmacopoeia. Include in your note what are they, their purpose, what might be included in a typical monograph (10 marks)
- (b) Give an overview of GMP regulations as they apply to
- The manufacture of pharmaceutical products
 - The methods used in the production, testing, handling & storage of API's.

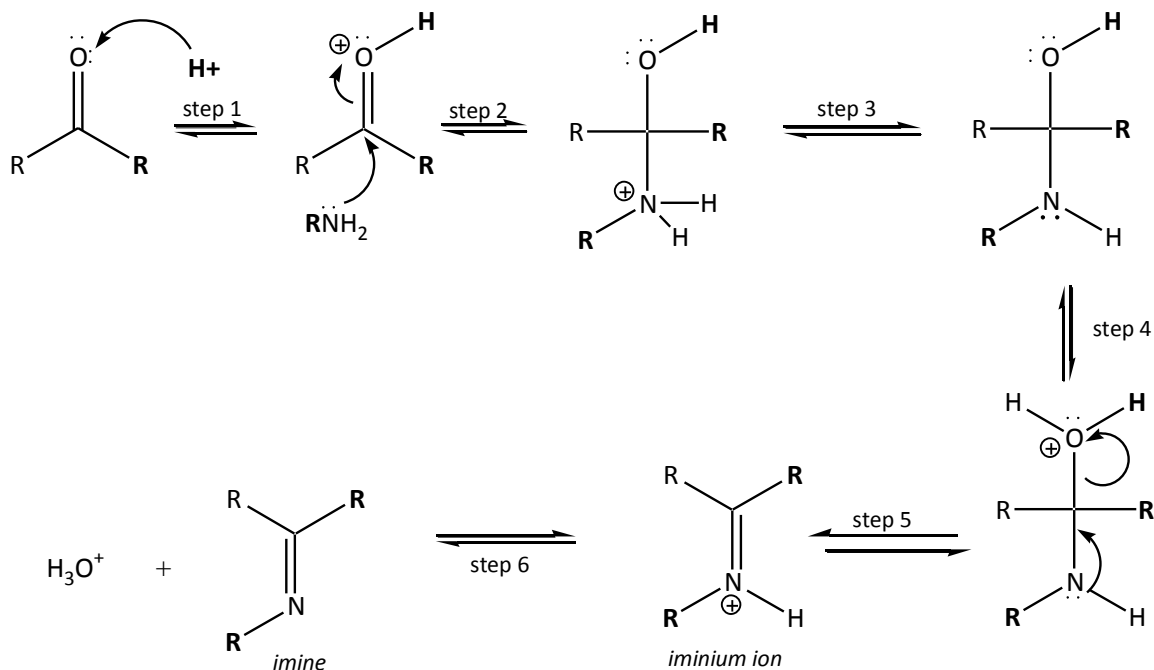
(10 marks)

Q4.

- (a) Give four properties of a clinically useful antibiotic (2 marks)
- (b) Outline the mode of action of (i) the penicillins and (ii) the sulphonamides (6 marks)
- (c) Write an informative note on antiviral agents with the following as guidelines for your answer; an outline of general viral structure, the development of new antiviral agents, replication process, different types of antiviral agents (12 marks)

Q5.

(a) The mechanism for the addition of a primary amine to a ketone is as shown. Answer the underwritten questions related to this mechanism.



- (i) What is the purpose of the acid catalyst (H^+) in the first step? (2 marks)
- (ii) The optimum pH for the reaction is 4.5. Why is a lower pH unsuitable for the reaction? (3 marks)
- (iii) Apart from the protonation of the O in step 4, identify one other site in the amino alcohol that may be protonated? What are the consequences of such a protonation for the overall reaction? (3 marks)
- (iv) What step could be taken to shift the equilibrium towards the imine product? (2 marks)
- (v) With the aid of the mechanism outlined above,
- show how secondary amines add to aldehydes/ ketones to generate enamines (4 marks)
 - explain why there is no reaction between trimethylamine, $(\text{CH}_3)_3\text{N}$ and propanone, $(\text{CH}_3)_2\text{C}=\text{O}$ (3 marks)
- (b) Name three other types of reactions which amines can undergo. (3 marks)

Q6.

- (a) Distinguish between monosaccharides, disaccharides & polysaccharides. Give an example of each. (4 marks)
- (b) What is *mutarotation*? Briefly outline the evidence for its existence in glucose solutions (5 marks)
- (c) A series of sucrose standards were prepared from a 50% w/v stock solution of sucrose. The refractive index of each standard was measured as well as the refractive index of a sucrose solution (solution A) of unknown concentration. The results are as shown in the table

Conc. (% w/v)	5%	10%	15%	20%	25%	Solution A
Refractive index at 20°C	1.340	1.347	1.355	1.361	1.368	1.362

- (i) Construct a fully labelled plot and determine the concentration of solution A (5 marks)
- (ii) What weight of sucrose is required to prepare 0.5L of the stock solution? Calculate the volume of the stock solution required to prepare 25cm³ of the 15% standard. Show your calculations (4 marks)
- (iii) Why is it not possible to determine the concentration of solution A using Tollen's, Fehling's or Benedict's reagent? (2 marks)