

IMPERIAL COLLEGE LONDON

**BSc and MSci DEGREES – JUNE 2010, for Internal Students of the
Imperial College of Science, Technology and Medicine**

**This paper is also taken for the relevant examination for the
Associateship**

ORGANIC CHEMISTRY I

Thursday 17th June 2010, 09:30-11:30

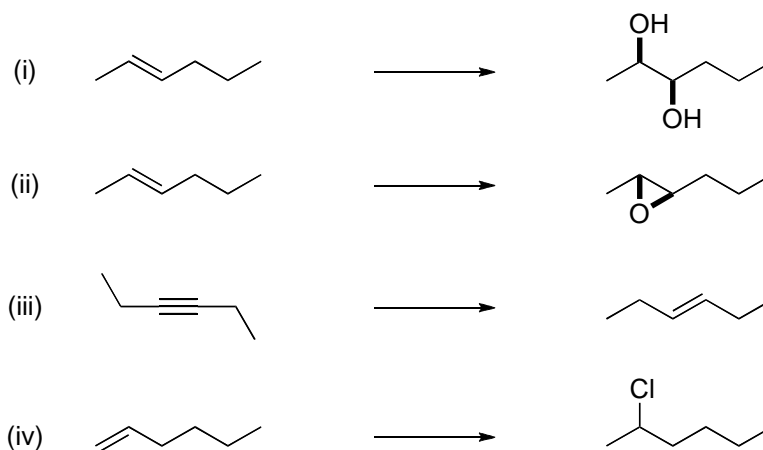
**USE A SEPARATE ANSWER BOOK FOR EACH
QUESTION. WRITE YOUR CANDIDATE NUMBER ON
EACH ANSWER BOOK.**

1.02 – Alkanes, Alkenes, Alkynes

Answer parts a), b), c) **AND** d)

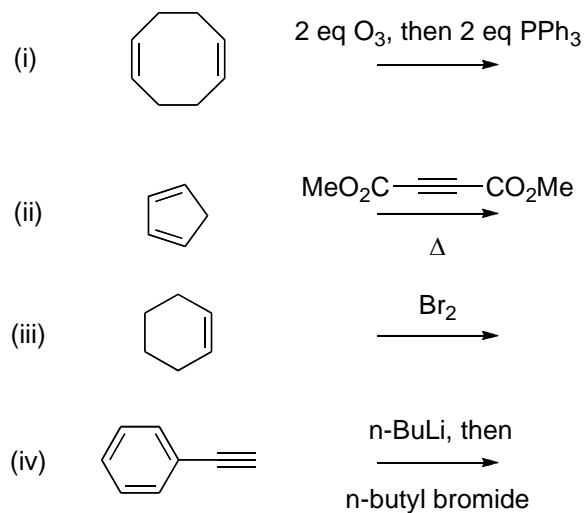
- a) Draw a diagram of cyclohexane in the chair conformation, and use Newman projections to explain why this is the preferred conformation. (5 marks)

- b) Suggest reagents for **THREE** of the following **FOUR** reactions.



(2 marks each)

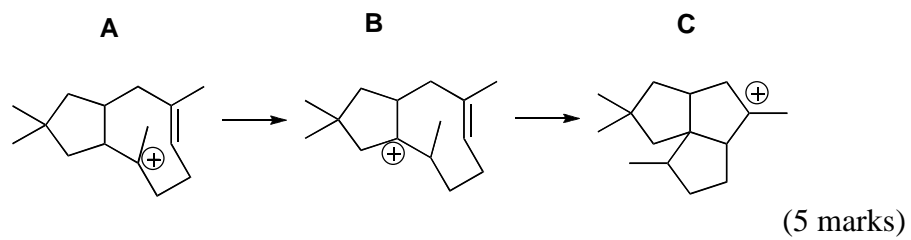
- c) Draw the structure of the products obtained for **THREE** of the following **FOUR** reactions.



(3 marks each)

QUESTION CONTINUED OVERLEAF

- d) Provide a curly arrow mechanism for the rearrangement of the cation **A** into **B**, and **B** into **C** and annotate your mechanism.



1.03 – Haloalkanes, Alcohols and Amines

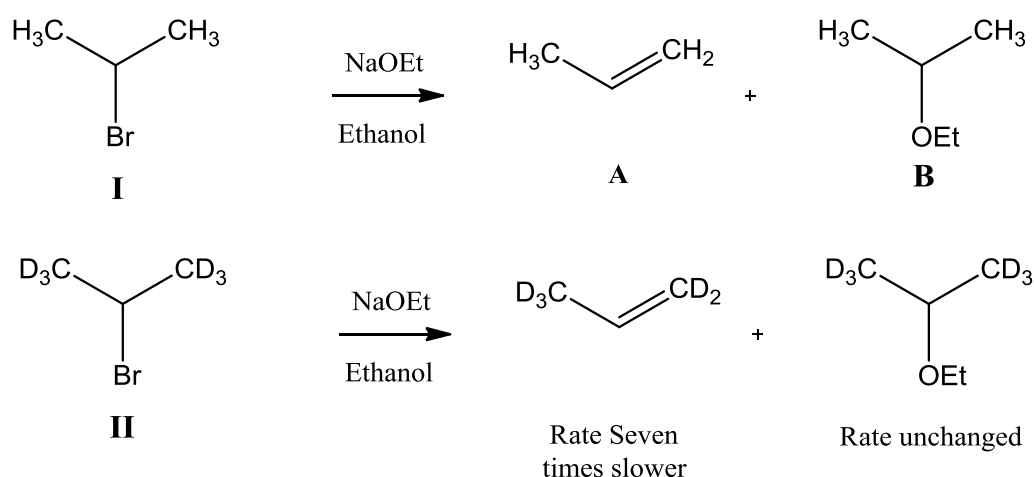
Answer parts a), b) **AND** c)

a) Consider the reaction below.

i)

1. Propose mechanisms to explain the formation of product **A** and **B** from starting material **I** in the reaction.
2. Explain why the rate of formation of the product **A** is slowed by seven times when a deuterated starting material (**II**) is reacted under the same reaction condition, whereas the rate of formation of product **B** is unchanged.
3. Explain the rate law which governs the formation of **A** and **B**.
4. How could you alter the conditions or reagents to favour the formation of product **A** over **B**?

(8 marks)



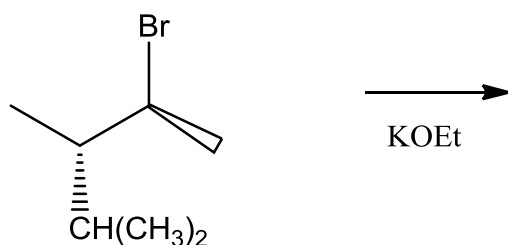
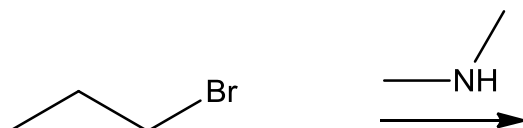
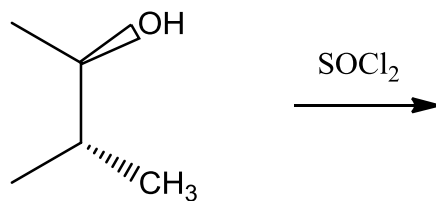
- ii) Upon heating the same alkyl halide **I** in ethanol in the absence of sodium ethoxide, the same products **A** and **B** are formed. In this case, use of deuterated starting material **II** was found to have a negligible effect on the rate of formation of **A**.
1. Explain this observation and propose mechanisms for the formation of **A** and **B** under these reaction conditions.
 2. What is the rate law that governs the formation of **A** and **B** under these conditions.

(6 marks)

QUESTION CONTINUED OVERLEAF

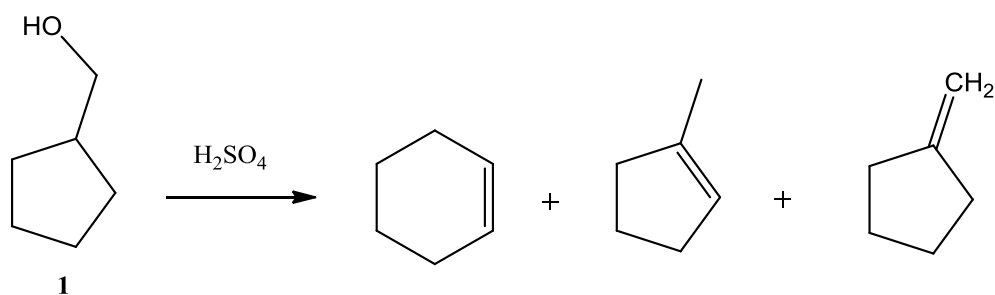
- b) For **TWO** of the following reactions, identify the favoured product, and provide a mechanism for its formation

(3 marks each)



- c) Reaction of cyclopentane derivative **1** with sulphuric acid affords a complex mixture of products. Provide an explanation and mechanism for the formation of these products.

(5 marks)

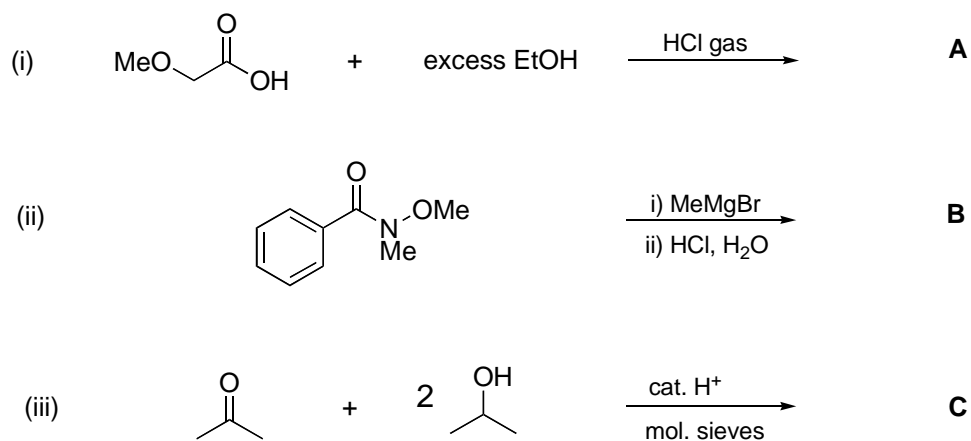


1.04 – Carbonyl and Carboxyl Groups

Answer parts a), b), c) **AND** d)

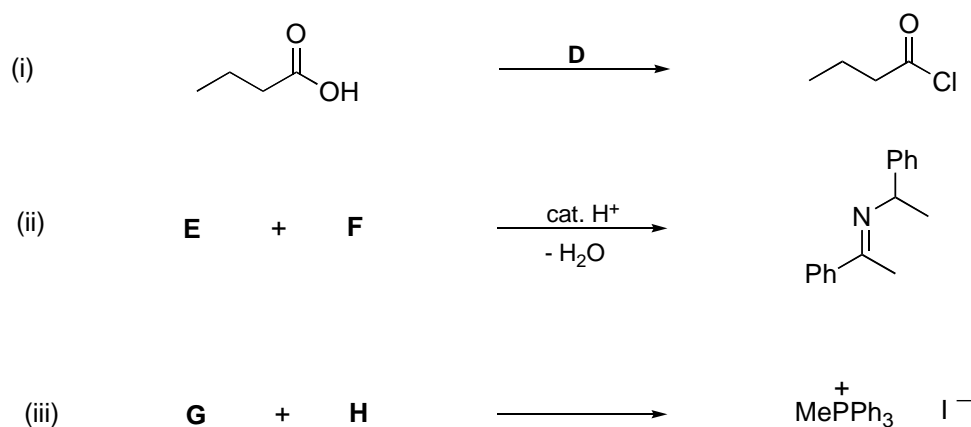
a) Draw the structure of the product obtained for **TWO** out of the following **THREE** reactions.

(6 marks)



b) Provide structures for the missing components of **TWO** of the following **THREE** reactions.

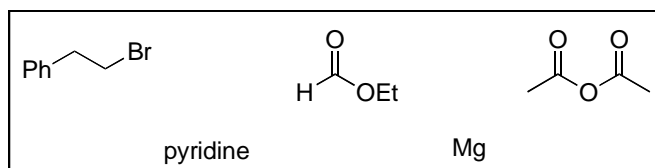
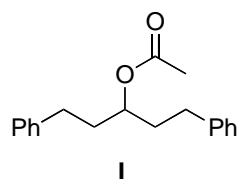
(6 marks)



QUESTION CONTINUED OVERLEAF

- c) Suggest a synthesis of ester **I**. Assume that you have access to the reagents shown in the box to the right of **I**.

(6 marks)



- d) Provide a curly arrow mechanism for the transformation shown below that is mediated by a catalytic amount of base. Represent the base as B^- in your mechanism.

(7 marks)

