IMPERIAL COLLEGE LONDON

BSc and MSci DEGREES – JUNE 2012, 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

Tuesday 19th June 2012, 09:30-11:30

PLEASE NOTE THAT IT IS DEPARTMENTAL POLICY THAT THESE EXAM QUESTIONS MAY REQUIRE UNDERSTANDING OF ANY PRIOR CORE COURSE.

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

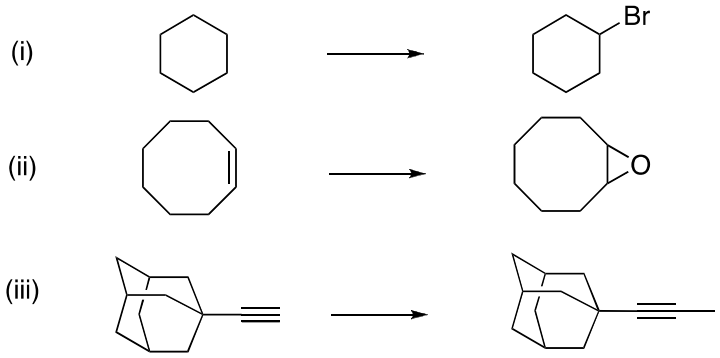
1.O2 – Alkanes, Alkenes, Alkynes

Answer **ALL** parts of this question.

a) Draw the boat conformation of cyclohexane and comment on its stability.

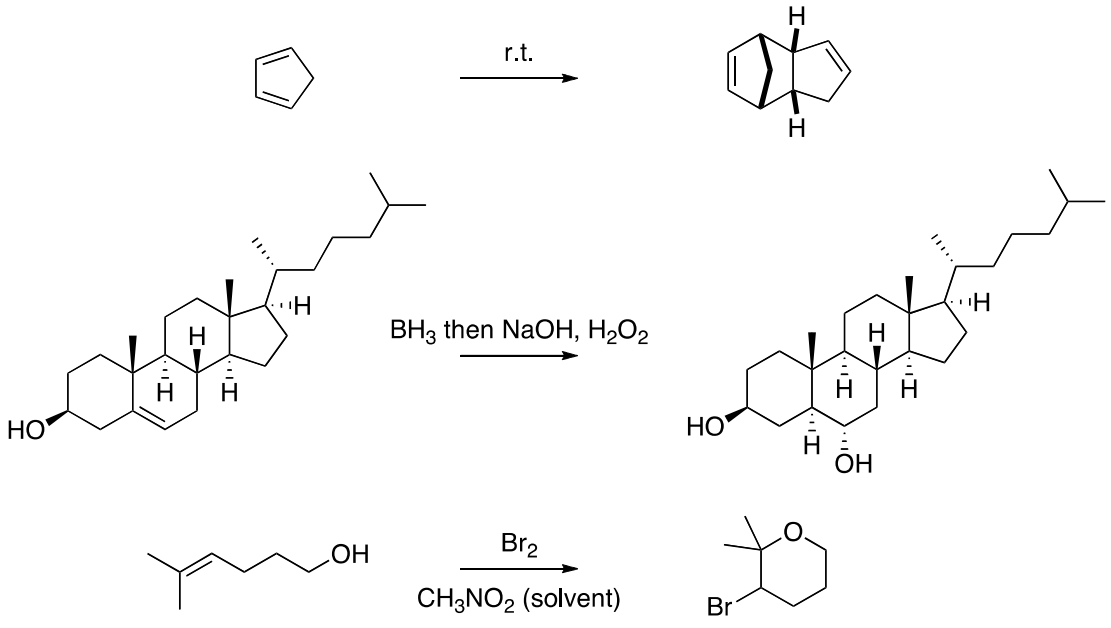
(5 marks)

b) Give suitable reagents for **TWO** of the following transformations.



(2 marks each)

c) For **TWO** of the following transformations provide annotated curly arrow mechanisms and explain any issues of selectivity.



(8 marks each)

1.O3 – Haloalkanes, Alcohols and Amines

Answer **ALL** parts of this question.

a) With reference to 3-bromopentane, discuss the mechanism by which alkyl halides undergo 1,2-elimination when treated with a concentrated solution of strong base. Include in your answer:

i) The rate law which describes the reaction,

(2 marks)

ii) The term used to describe the reaction,

(1 mark)

iii) The mechanism of formation of the product including clear drawings of any intermediates or transition states involved paying particular attention to any stereochemical issues.

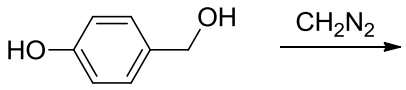
(5 marks)

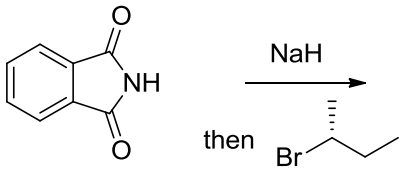
iv) Draw an energy profile diagram for the reaction.

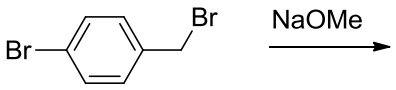
(2 marks)

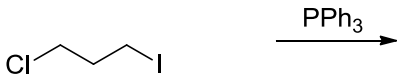
b) Give the products of **THREE** of the following **FOUR** substitution reactions, writing a clear mechanism for each case. Classify your mechanism as S_N1 or S_N2.

(9 marks)

(i) 

(ii) 

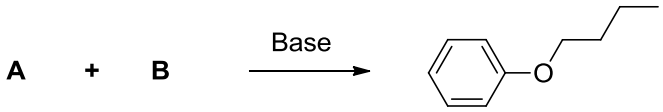
(iii) 

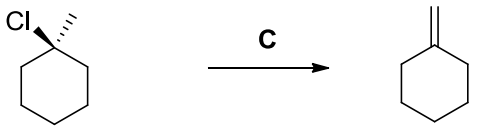
(iv) 

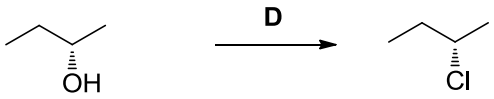
QUESTION CONTINUED OVERLEAF

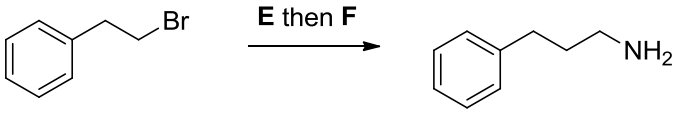
c) Provide structures for the missing components of **THREE** of the following **FOUR** reactions.

(6 marks)

(i) 

(ii) 

(iii) 

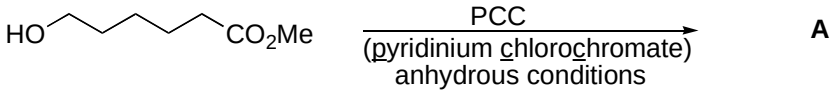
(iv) 

1.O4 – Carbonyl and Carboxyl Groups

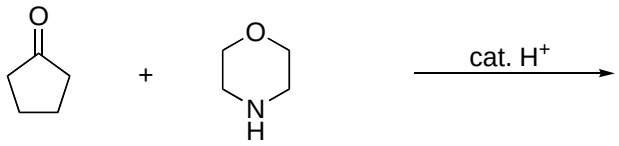
Answer **ALL** parts of this question.

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

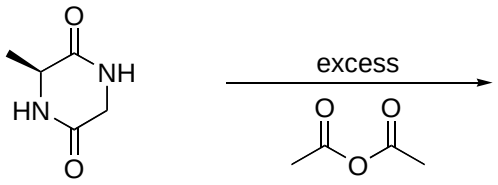
(6 marks)

(i) 

A

(ii) 

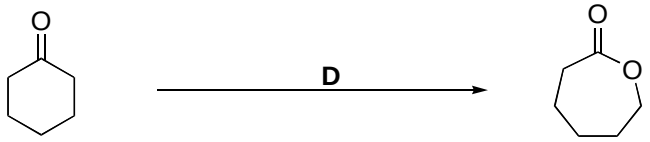
B

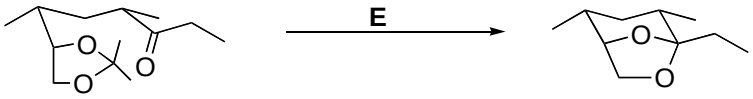
(iii) 

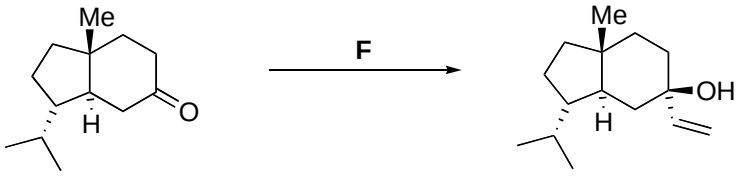
C

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

(6 marks)

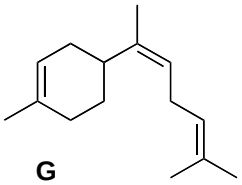
(i) 

(ii) 

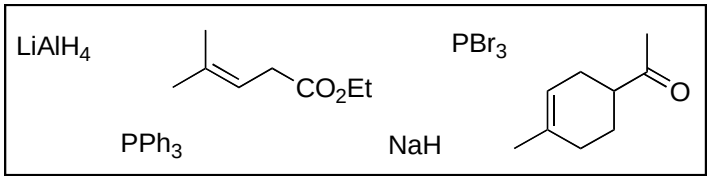
(iii) 

QUESTION CONTINUED OVERLEAF

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

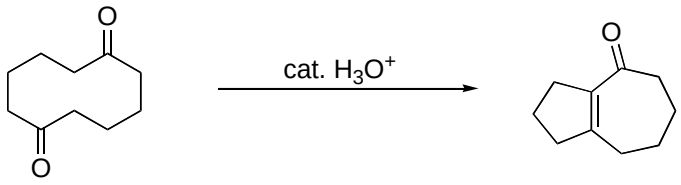


G



(7 marks)

d) Provide a curly arrow mechanism for the transformation shown below.



(6 marks)