

University of Canterbury

End-of-year Examinations 2009

Prescription Number(s): CHEM 362

Paper Title: Organic Chemistry

Time Allowed: 2.5 hours

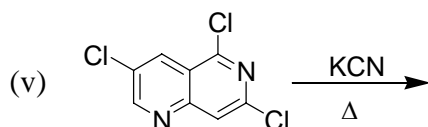
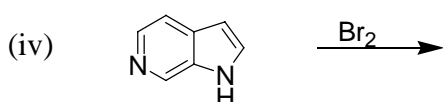
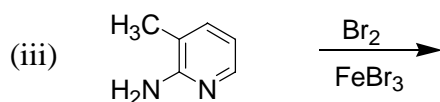
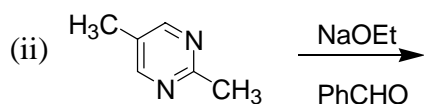
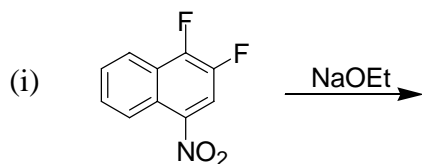
Number of pages: Eight

Answer **ALL** questions.

TURN OVER

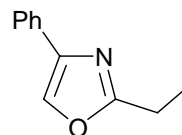
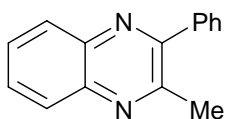
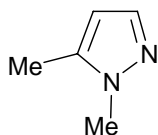
1. (a) (5 marks)

Predict the products of the following reactions.



(b) (6 marks)

Show how each of the following compounds could be prepared by reaction between a binucleophile and a bielectrophile.



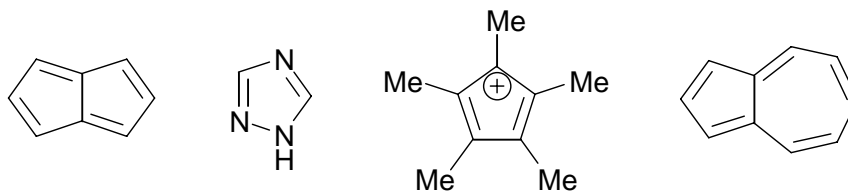
(c) (5 marks)

Some aromatic heterocyclic compounds undergo addition reactions. Discuss this statement using examples.

TURN OVER

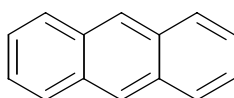
2. (a) (5 marks)

Discuss the aromaticity or otherwise of the following compounds and suggest a reason why the last one (azulene) has a large dipole moment.



(b) (4 marks)

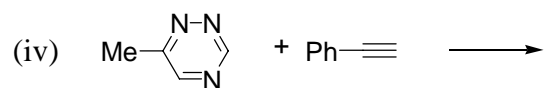
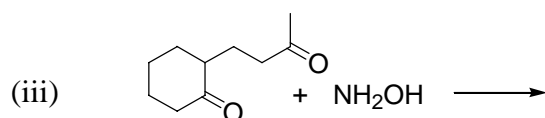
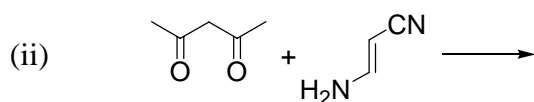
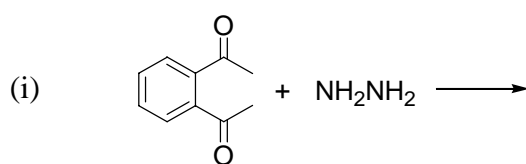
Anthracene undergoes some addition reactions. Predict which ring would react, giving reasons.



anthracene

3. (a) (8 marks)

Predict the structures of the heterocyclic products of the following reactions.



Question 3 continued on following page

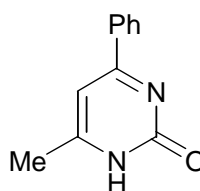
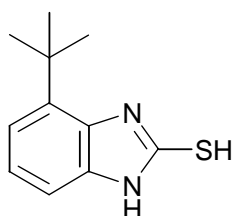
Question 3 continued

(b) (5 marks)

Pyrrole is sometimes described as π -excessive. What does this mean and how is it reflected in the properties of pyrrole?

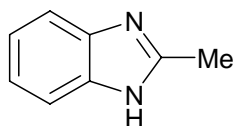
(c) (6 marks)

For each of the compounds shown below draw two other tautomers and comment on their relative stabilities.



(d) (6 marks)

The structure of 2-methylbenzimidazole is shown below.



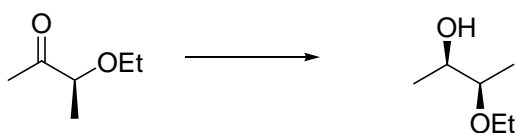
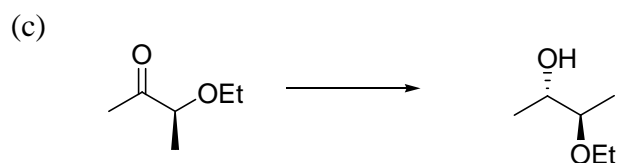
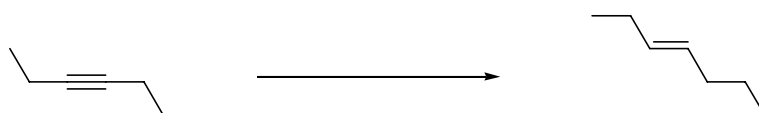
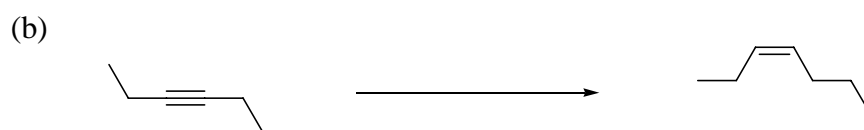
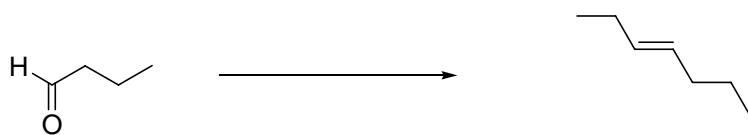
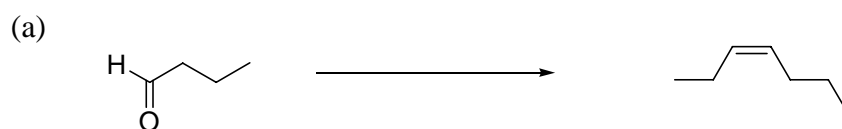
- (i) How many signals would you expect to see in its ^{13}C NMR spectrum? Explain your answer.
- (ii) Explain why this compound is both acidic and basic.
- (iii) Suggest a synthesis of this compound.

TURN OVER

4. (26 marks)

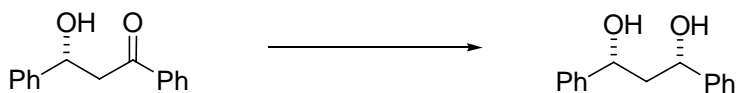
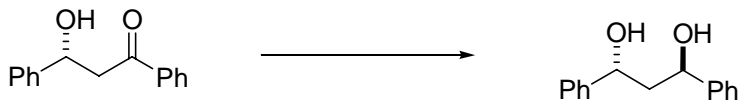
Answer **FOUR** of the following (a) – (e):

Using clear diagrams and mechanistic explanations, provide reagents that will achieve the contrasting stereochemical outcomes of the following pairs of reactions:

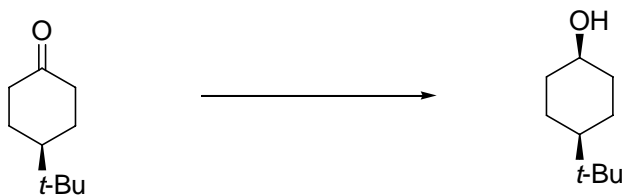
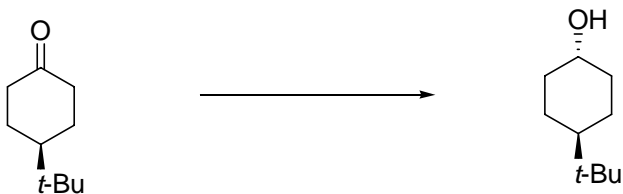
*Question 4 continued on following page*

Question 4 continued

(d)



(e)



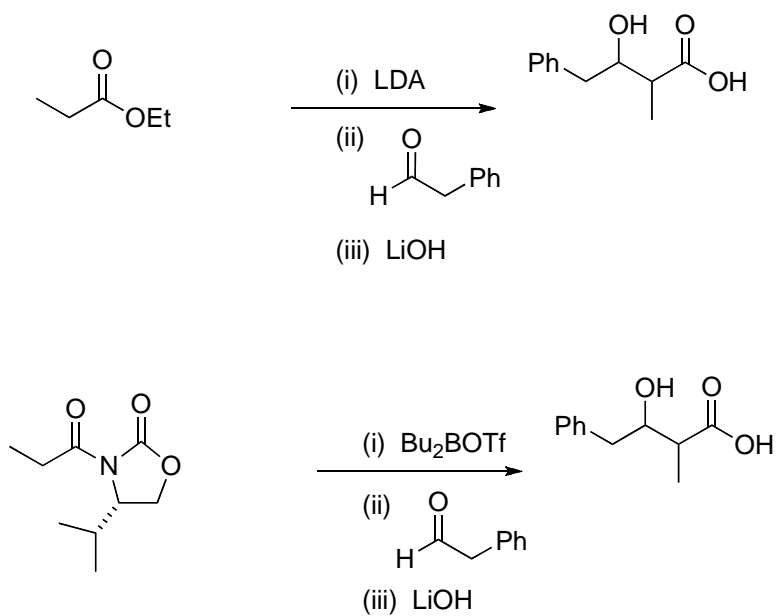
5. (12 marks)

- (a) Use frontier molecular orbitals to explain why [2+2] cycloaddition reactions are thermally disallowed yet Diels-Alder reactions are allowed.
- (b) Explain why electron withdrawing groups are usually required on the dienophile in a Diels-Alder reaction.
- (c) Diels-Alder reactions are described as being regioselective, stereospecific and stereoselective. Explain each of these terms clearly with reference to the following reaction.

*TURN OVER*

6. (12 marks)

Using clear diagrams predict, and compare and contrast the stereochemical outcomes of the following reactions. Explain why different conditions are used for enolate generation in each case.

**END OF PAPER**