

University of Canterbury

End-of-year Examinations 2009

Prescription Number(s): CHEM 322

Paper Title: Organic Chemistry

Time Allowed: 2.5 hours

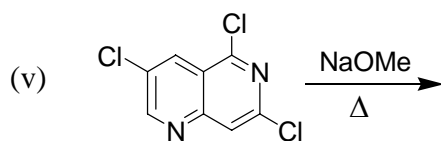
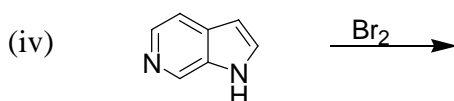
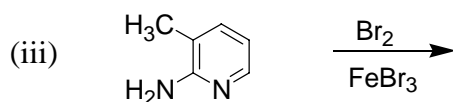
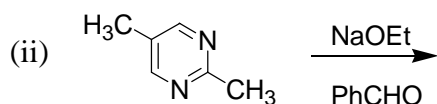
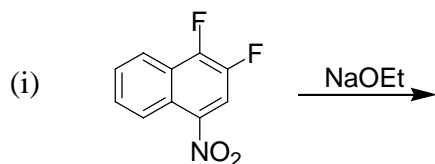
Number of pages: Eight

Answer **ALL** questions.

TURN OVER

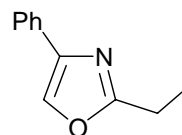
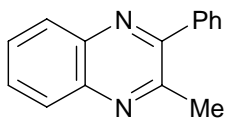
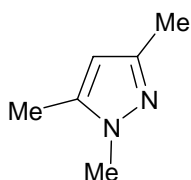
1. (a) (5 marks)

Predict the products of the following reactions. (No mechanisms required.)



(b) (6 marks)

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



(c) (6 marks)

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

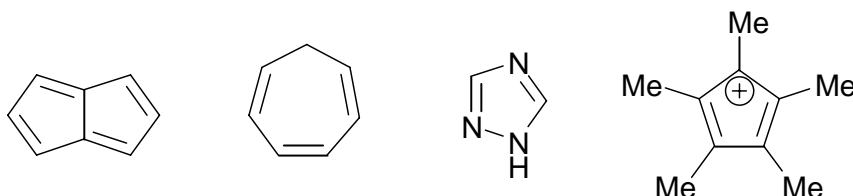
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2. (a) (4 marks)

List the criteria that an organic molecule must possess in order to be aromatic.

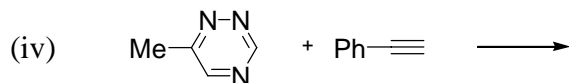
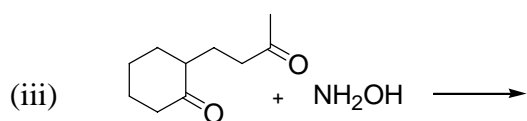
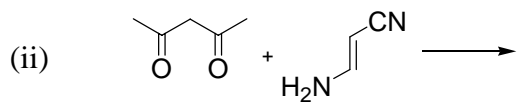
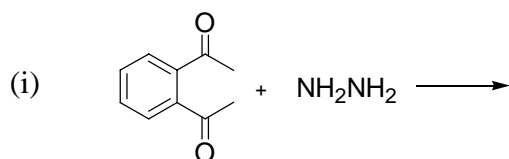
(b) (4 marks)

Discuss the aromaticity or otherwise of the following compounds.



3. (a) (8 marks)

Predict the structures of the heterocyclic products of the following reactions. (No mechanisms required.)



(b) (5 marks)

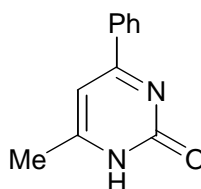
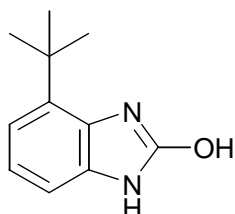
Pyrrrole is sometimes described as π -excessive. What does this mean and how is it reflected in the properties of pyrrole?

Question 3 continued on following page

Question 3 continued

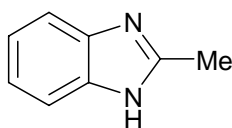
(c) (6 marks)

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.

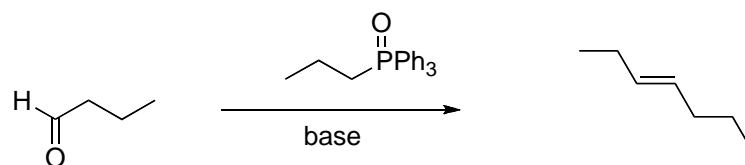
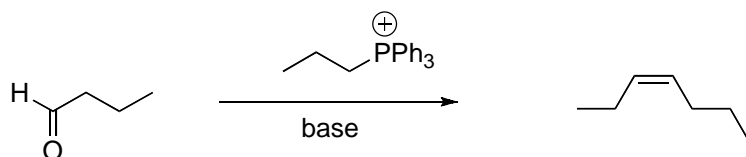
TURN OVER

4. (28 marks)

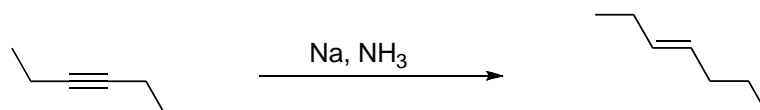
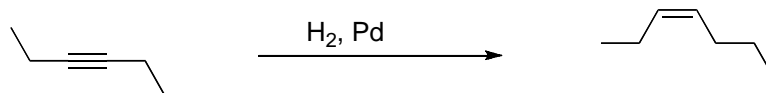
Answer **FOUR** of the following (a) - (e):

Using clear diagrams and mechanistic explanations, compare and contrast the stereochemical outcomes of the following pairs of reactions:

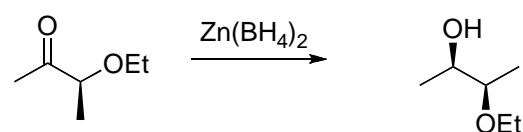
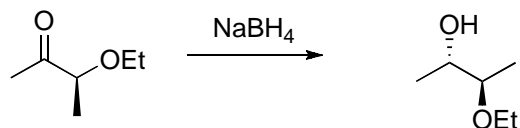
(a)



(b)

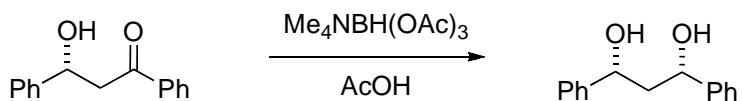
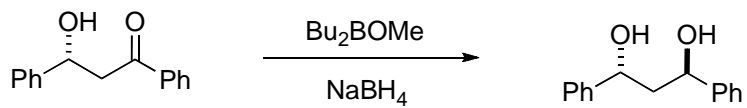


(c)

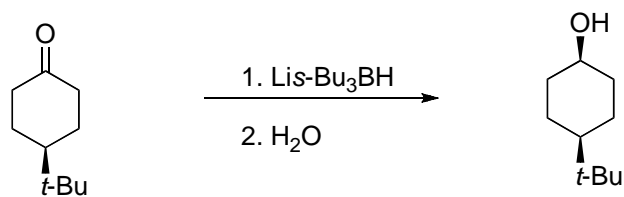
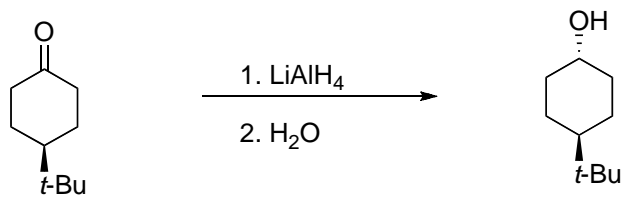
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Question 4 continued

(d)

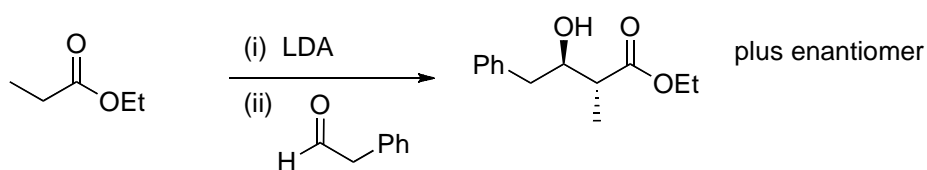
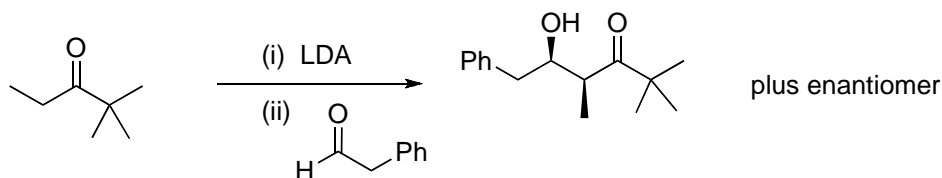


(e)



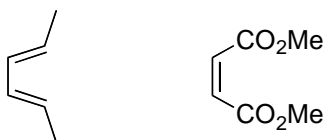
5. (10 marks)

Using clear diagrams compare and contrast the stereochemical outcomes of the following reactions.



6. (12 marks)

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



END OF PAPER