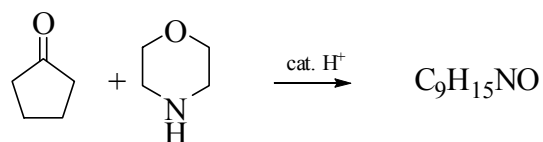
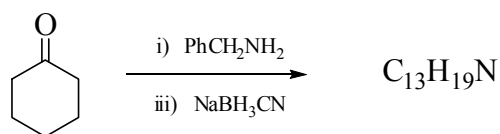
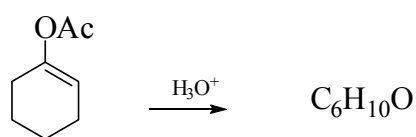
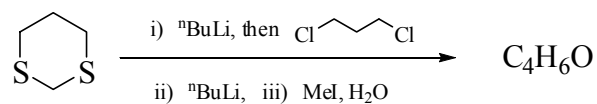
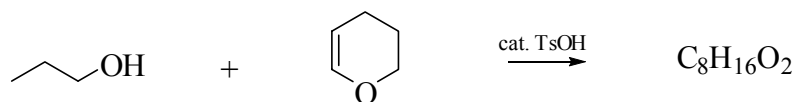


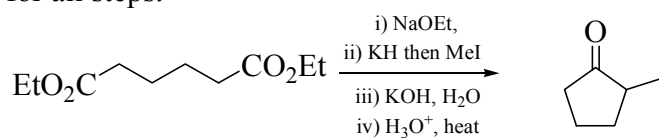
## TUTORIAL TEN: REVISION

Revise your previous tutorial problems and the notes you have made before attempting the following problems.

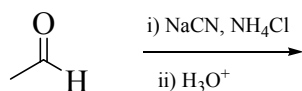
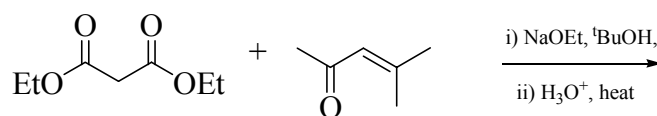
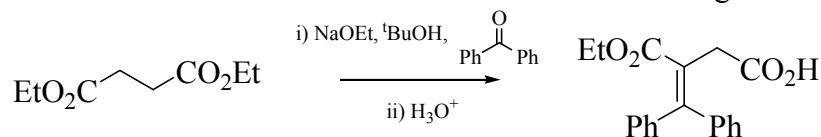
1. Predict the structure of the products and give mechanisms for the following reactions:



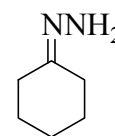
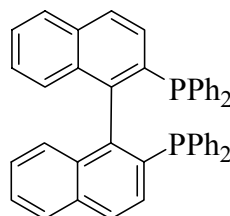
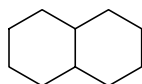
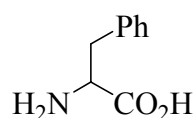
2. Identify the intermediates in the following reaction sequence, giving mechanisms for all steps.



3. Provide a mechanistic rationalisation for the following reaction sequences.

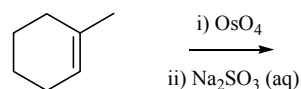
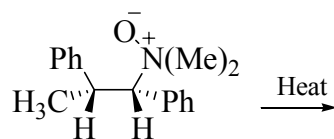
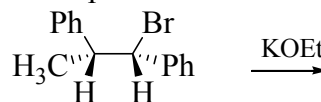
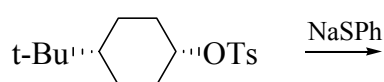


4. Draw out all the stereoisomers of three of the following compounds and then use these stereoisomers to illustrate the meaning of the terms: enantiomers, diastereoisomer and racemic mixture.



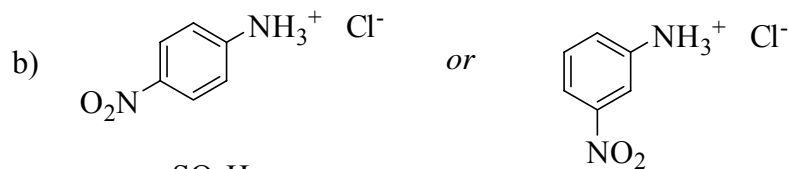
5. Explain why the measured optical rotation of a sample of (*S*)-2-iodobutane falls from an initial value of  $+32^\circ$  to zero when stirred in acetone with sodium iodide.

6. Predict the structures of the products formed in the following reactions, using a mechanistic argument to explain the stereochemistry of the product.

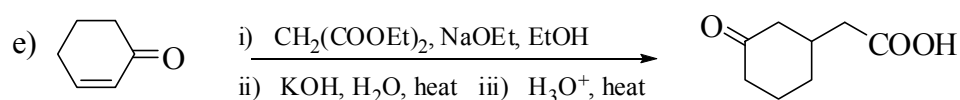
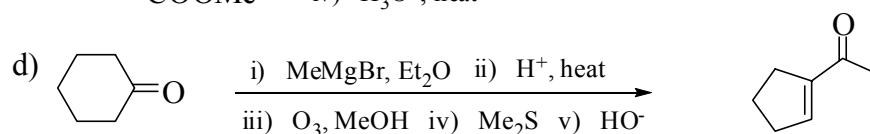
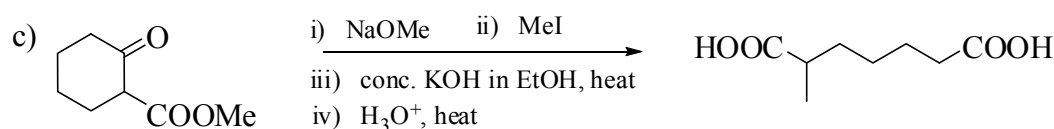
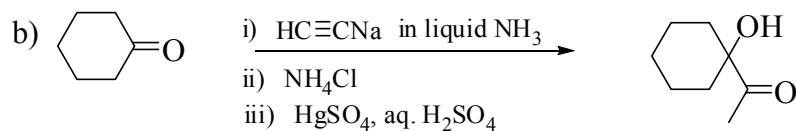
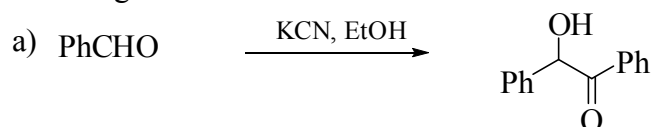


7. The  $\text{pK}_a$  of ethanoic acid,  $\text{CH}_3\text{COOH}$  is 4. For a dilute aqueous solution of ethanoic acid, at what pH is the concentration of  $\text{CH}_3\text{COOH}$  equal to the concentration of  $\text{CH}_3\text{COO}^-$ ? State the approximate relative concentrations of  $\text{CH}_3\text{COOH}$  and  $\text{CH}_3\text{COO}^-$  at: i) pH 5 and ii) pH 7.

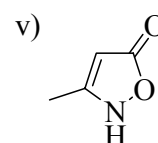
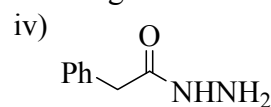
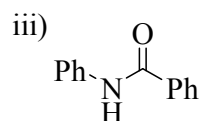
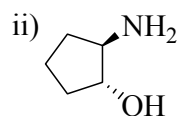
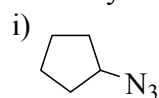
8. For each of the following pairs of compounds, indicate clearly with reasoning, which is the *stronger acid* in water;



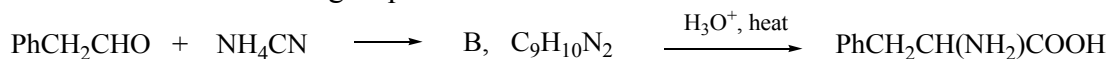
9. Identify probable intermediates in and suggest possible mechanisms for the following transformations:



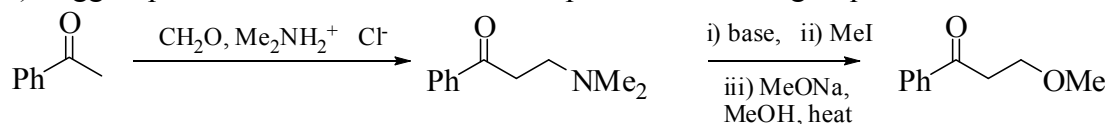
10. a) Suggest a plausible synthesis for each of the following compounds starting from any compound which does not contain a carbon-nitrogen bond:



b) Give a structure for B and indicate a plausible mechanistic pathway for its formation in the following sequence:

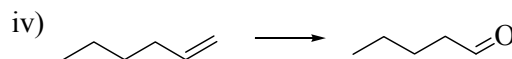
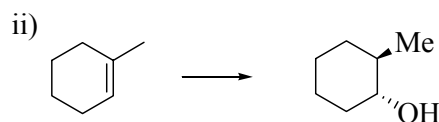
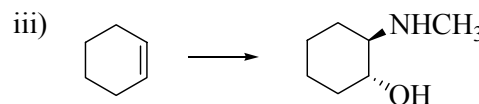
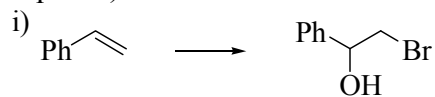


c) Suggest plausible mechanisms for the steps in the following sequence:

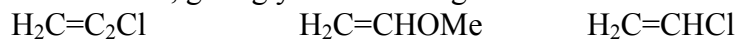


11. a) Using addition reactions to alkenes as your examples, explain the meaning of the following terms: i) Stereoselectivity, ii) Regioselectivity.

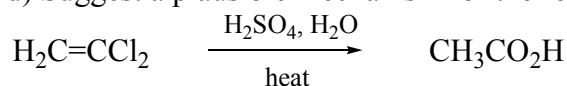
b) Suggest reagents for the following transformations (more than one step may be required):



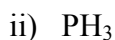
c) Arrange the following alkenes in expected order of *increasing* rate of addition of HBr under polar conditions, giving your reasoning:



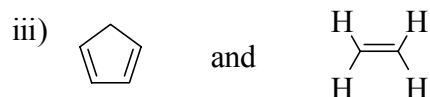
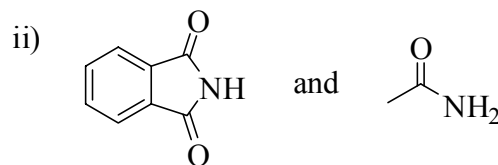
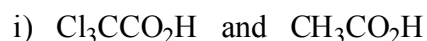
d) Suggest a plausible mechanism for the following reaction:



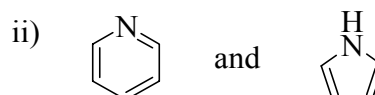
12. a) State, with reasons, whether the following are Brønsted acids, Lewis acids or both:



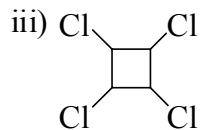
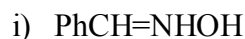
b) Explain, with reasoning, which member of the following pairs of compounds is the stronger acid:



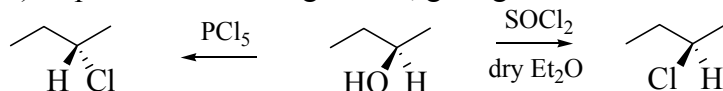
c) Explain, with reasoning, which member of the following pairs of compounds is the stronger base:



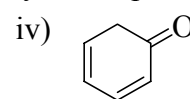
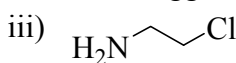
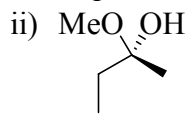
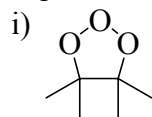
13. a) Draw representations of all stereoisomers of the following compounds:



b) Explain the following results, giving mechanisms:

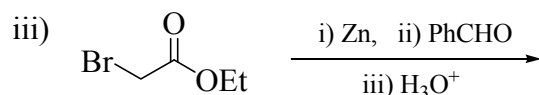
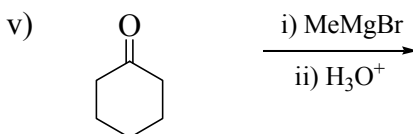


c) All of the following compounds are too unstable to isolate under normal conditions. Explain why each compound is unstable and suggest likely decomposition products:



14. a) Using your own examples, outline the scope and limitations of the use of Grignard reactions for the formation of carbon-carbon bonds.

b) Propose plausible mechanisms for the following reactions and indicate the structure of the reaction products:



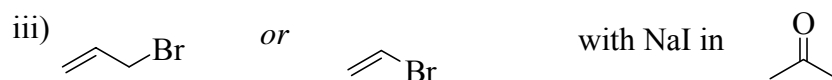
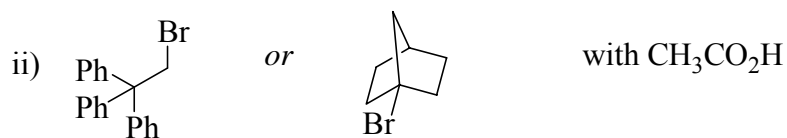
15. a) Outline the mechanisms of  $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$  reactions, including stereochemical aspects.

b) Indicate how the following factors may affect the relative rates of nucleophilic substitution reactions:

i) Solvent,

ii) Nature of nucleophile.

c) For each of the following pairs of substrates indicate, with reasoning, which will react faster under the given reaction conditions. In addition, indicate whether you expect each reaction to follow either a  $S_N1$  or  $S_N2$  mechanism.



16. Suggest suitable reagents for performing all of the transformations (a) to (k); more than one step may be necessary for some of these transformations:

