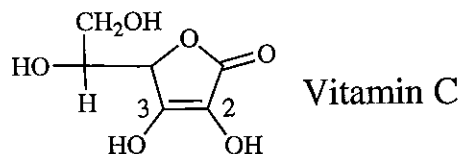
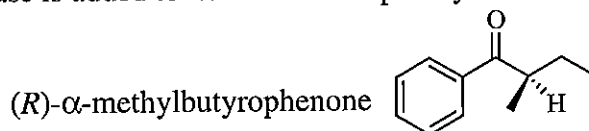


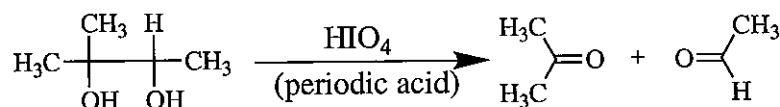
- 10% 1) (a) The  $pK_a$  values of nitro-substituted benzoic acids are shown here: *ortho*-nitrobenzoic acid ( $pK_a = 2.17$ ), *meta*-nitrobenzoic acid ( $pK_a = 3.49$ ) and *para*-nitrobenzoic acid ( $pK_a = 3.44$ ). Explain these relative acidities.  
 (b) Although vitamin C does not have a carboxylic acid group, it is an acidic compound. Is the C-2 OH group of vitamin C more acidic than the C-3 OH group? Explain your reason.



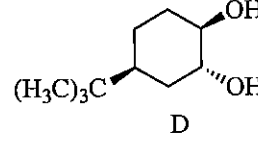
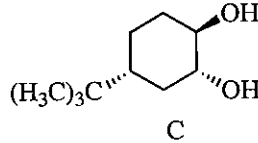
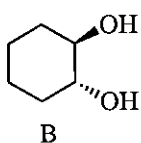
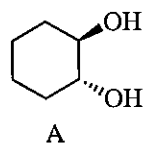
- 10% 2) Can an optically active solution of (*R*)- $\alpha$ -methylbutyrophenone lose its optical activity when either dilute acid or base is added to its solution. Explain your reason.



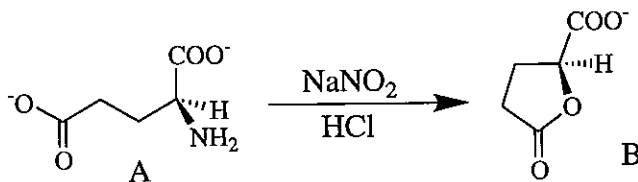
- 10% 3) (a) Draw a stepwise mechanism for the following reaction.



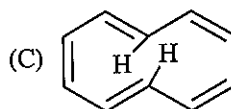
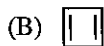
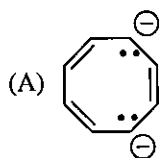
- (b) Which one of the following four compounds can not be cleaved by periodic acid? Explain.



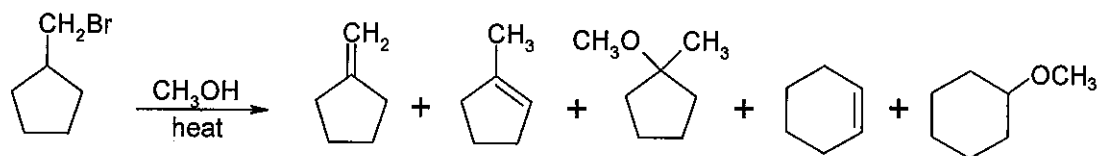
- 10% 4) (a) Label the asymmetric carbon as (*R*) or (*S*) for the compound A and B.  
 (b) Propose a mechanism for the following reaction that explain why the configuration of the asymmetric center in the reactant is retained in the product.



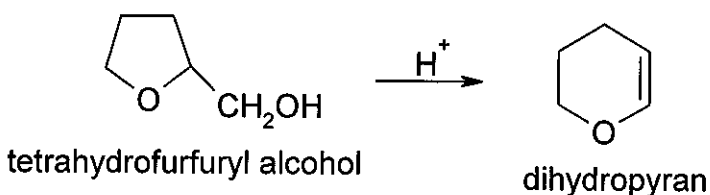
- 10% 5) (a) Describe the specific properties that are required for a compound to be aromatic.  
 (b) Classify A, B and C as aromatic, antiaromatic, or nonaromatic. Explain.



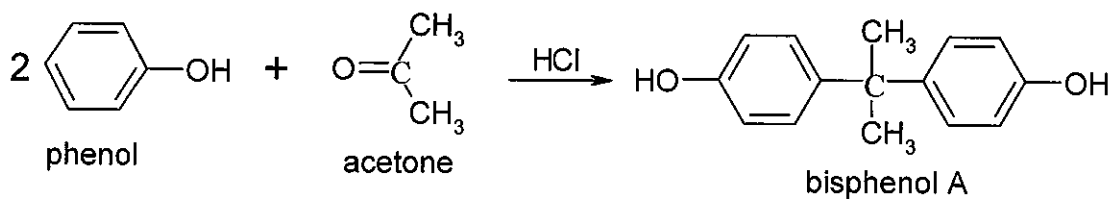
6. Solvolysis of bromomethylcyclopentane in methanol gives a complex product mixture of the following five compounds. Propose mechanisms to account for these products. (10 %)



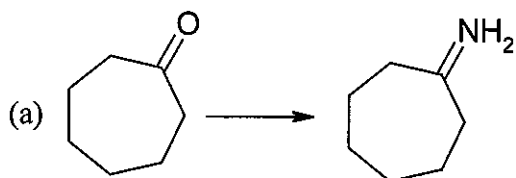
7. Under acid catalysis, tetrahydrofurfuryl alcohol reacts to give surprisingly good yields of dihydropyran. Propose a mechanism to explain this useful synthesis. (10 %)

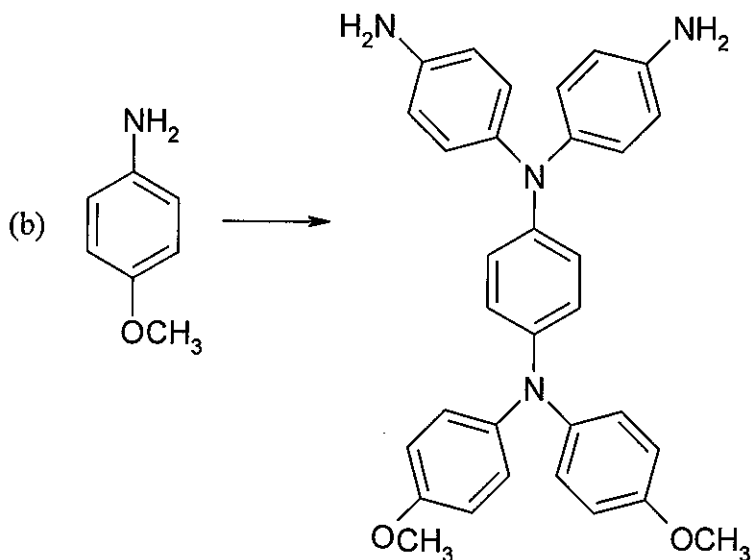


8. *Bisphenol A* is an important component of many polymers, including polycarbonates, polyurethanes, and epoxy resins. It is synthesized from phenol and acetone with HCl as a catalyst. Propose a mechanism for this reaction. (10 %)



9. Using any necessary reagents, show how you would accomplish the following syntheses. (10 %)





10. Predict the products of the following reactions. (10 %)

