CARLETON UNIVERSITY

FINAL
EXAMINATION
APRIL 2000

427

DURATION: 3 **HOURS**

No. of Students: 105

Department Name & Course Number: Chemistry 65.224*, 226*, 228*

Course Instructor(s) G.W. Buchanan

AUTHORIZED MEMORANDA

NONE

Students MUST count the number of pages in this examination question paper before beginning to write, and report any discrepancy immediately to a proctor. This question paper has 6 **pages.**

This examination question paper may **be taken from the examination room.**

Marks (total=100)

10 1. (a) Describe the general features of protein structure with respect to their primary, secondary, tertiary and quaternary features.

(b) What is a denatured protein and how may it arise?

(c) Indicate the procedure used to sequence a protein using the Sanger method and appropriate enzymes.

(d) Proteins are composed of L-amino acids. Describe the L-configuration in this description of configuration and its relation to R and S.

10 2. (a) Delineate the structural differences between fibrous and globular proteins and their occurence in humans.

(b) What amino acid must be present in order to have disulfide linkages in proteins?

(c) Describe the chemistry of (i) hair darkening with " Grecian Formula" and (ii) "permanent hair styling" with respect to disulfide linkages in proteins.

(d) When hair is dampened and then redried, what interactions are perturbed and then reformed in the overall protein structure?

(e) Name the protein which comprises human hair.

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20 3. Provide structures for the products in each of the following reactions of carbonyl compounds:

(a) propanal + cyclohexylamine

(b) butanone + 2,4-dinitrophenylhydrazine

(c) cyclohexanone + 1,3-propandiol , with acid catalyst

(d) cyclopentane carboxaldehyde + $LiAlH_4$, followed by aqueous acid

(e) cyclopentane carboxaldehyde +$NaBH_4$, followed by aqueous acid

(f) 2-pentanone + diethyl amine

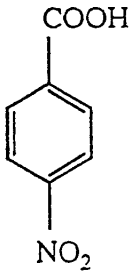
(g) cyclopentanone + phenyllithium, followed by aqueous acid

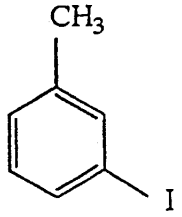
(h) ethylethanoate + excess phenylmagnesium bromide, then aqueous acid

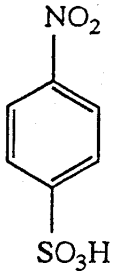
(i) butanone+ hydroxylamine (indicate possible isomers)

(j) 4-tertiary butylcyclohexanone + $LiAlD_4$, followed by aqueous acid (isomers possible?)

10 4. Provide synthetic schemes for the following "target" molecules **from benzene** NB. (i) Show your strategy, even if you do not know all the reagents to be used. (ii) Assume that ortho and para disubstituted products can be separated.

(a) 

(b) 

(c) 

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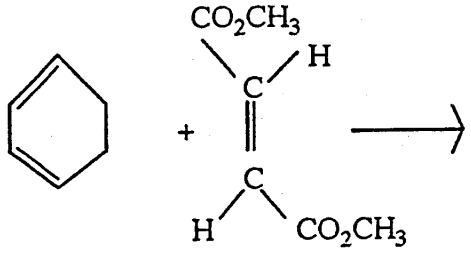
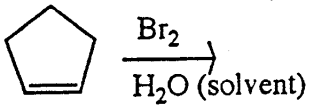
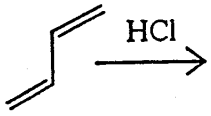
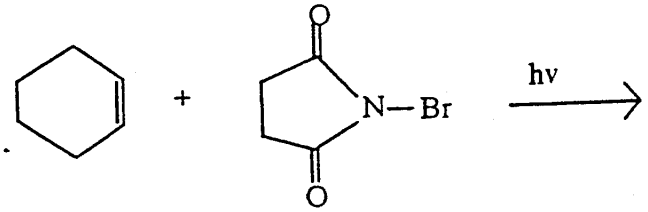
Marks

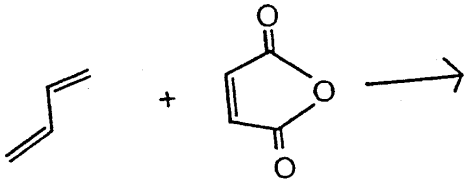
10 5. For each of the following reactions, provide the structures of the major products and a mechanistic rationale ("arrow pushing") for their formation.

(a) 

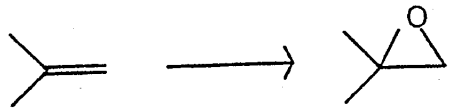
(b) 

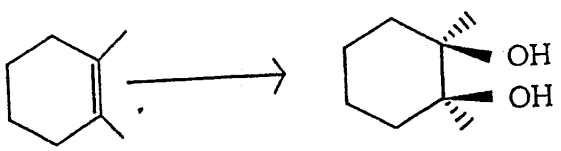
(c) 

(d) 

(e) 

10 6. Indicate the reagents needed to carry out the following transformations

(a) 

(b) 

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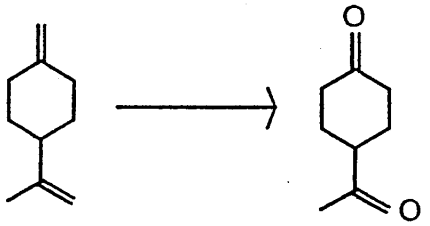
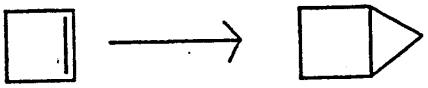
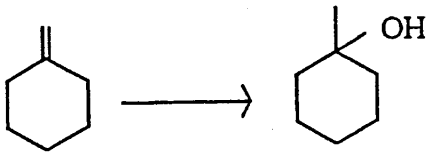
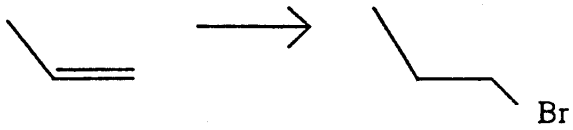
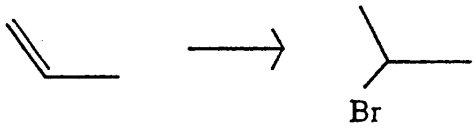
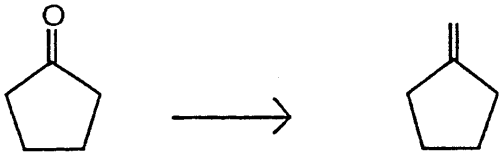
(c) 

(d) 

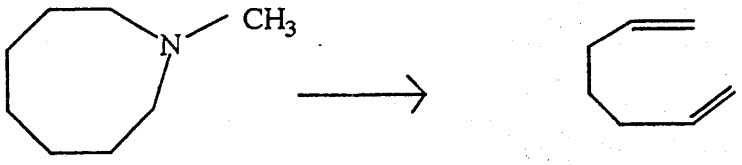
(e) 

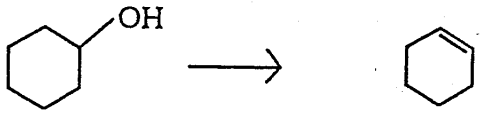
(f) 

(g) 

(h) 

(with no other isomers formed)

(i) 

(j) 

5 7. Draw the preferred conformations of the following molecules:

(a) trans-4-methylcyclohexanol (b) cis-1,3-dimethylcyclohexane

(c) cis-1-ethyl-2-methylcyclohexane (d) cyclopentane (e) cyclooctatetraene

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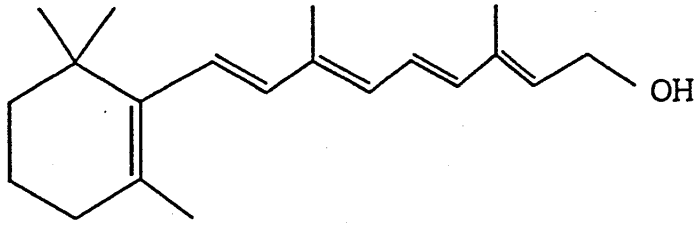
5 8. The structure of Vitamin A is shown below.

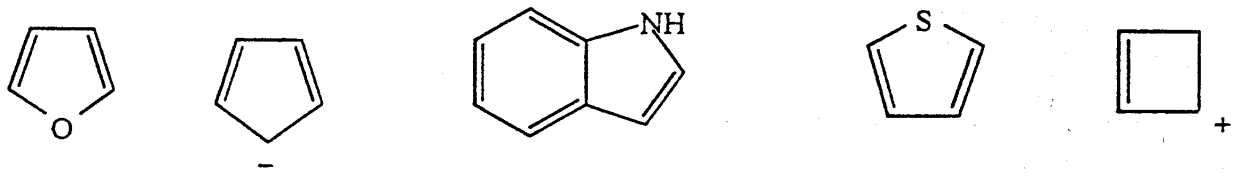
(a) Show a possible biosynthetic origin of this molecule based on isoprene units.



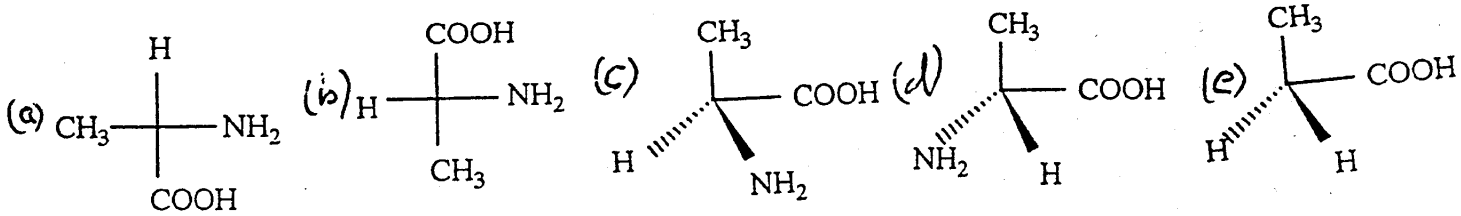
(b) Calculate the position of maximum UV absorption for Vitamin A using the data table shown below.

Base diene value	217
Each added alkyl group	+5
Each double-bond exocyclic in a six-membered ring	+5
Each additional conjugated double bond	+30

5 9. Indicate, with brief rationale, whether or not each of the following molecules will be aromatic.

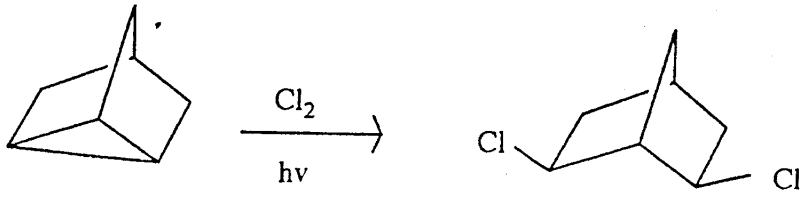


5 10. Describe each of the following stereochemical depictions as D or L and R or S, as appropriate.



10 11. Provide mechanisms (ie arrow pushing) to explain the following interconversions.

(a)



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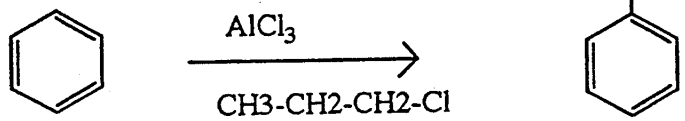
11. (b)



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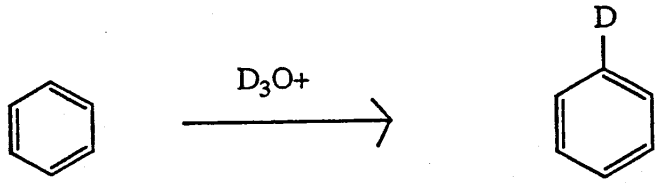

(d)