3 Yr. Degree/4 Yr. Honours 5th Semester Examination, 2025 (CCFUP)

Subject : Chemistry

Course : CHEM 5012 (MAJOR)

(Organic Chemistry)

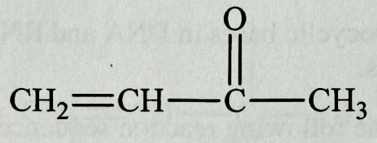
Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any five* questions from the following: 2×5=10

(a) Draw the HOMO and LUMO of 1, 3-butadiene.

(b) Give the synthon for 

(c) Pyrrole is a weaker base than Pyridine.—Explain.

(d) Use a chemical reaction and physical method to differentiate D-erythrose and D-threose.

(e) Name a Sulphur-containing essential amino acid with structure.

(f) Draw the structure of Piperine.

(g) What is a co-enzyme? Give an example.

(h) Draw the structure of anthracene and phenanthrene with numbering of all carbon atoms.

2. Answer *any two* questions from the following: 5×2=10

(a) (i) What is isoelectric point of amino acid?

(ii) How would you establish that the isoelectric point of any neutral amino acid is equal to half of the two pKa values, one obtained as a conjugate base (pKa_1) and other as a dipolar ion (pKa_2)?

(iii) Which amino acid on reaction with HNO_2 forms Lactic acid? 2+2+1

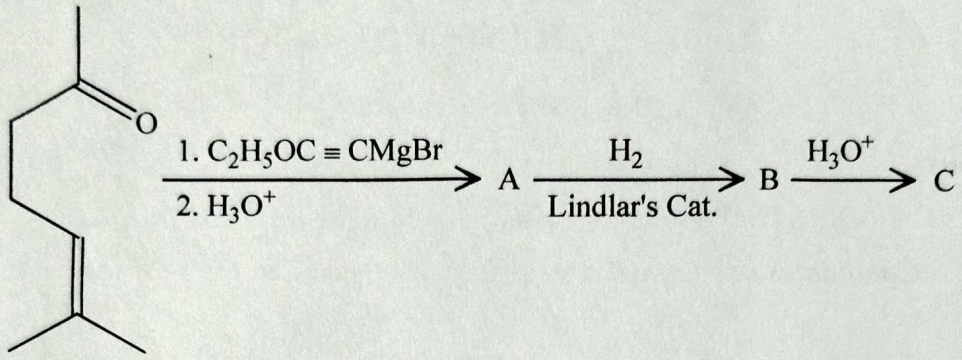
(b) Define synthon. Give a synthesis of sulphaguanidine through retrosynthetic analysis. 1+4

(c) (i) Why does D-glucose exhibit mutarotation?

(ii) What do you mean by 'anomeric effect'?—explain. 2+3

(d) (i) Designate the geometrical isomers of citral in E, Z system of nomenclature.

(ii) Identify A-C in the following reaction sequence: 2+3

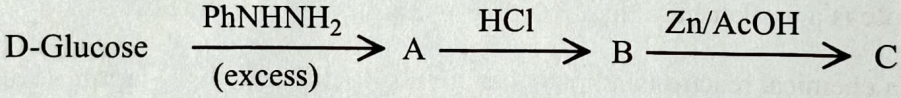


3. Answer *any two* questions from the following: 10×2=20

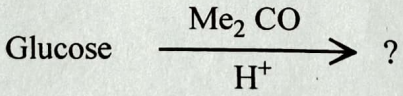
(a) (i) Why is D-glucose called dextrose but D-fructose laevulose?

(ii) There are five heterocyclic bases in DNA and RNA. Write the names of those bases and draw their structures.

(iii) Identify A to C in the following reaction sequence:

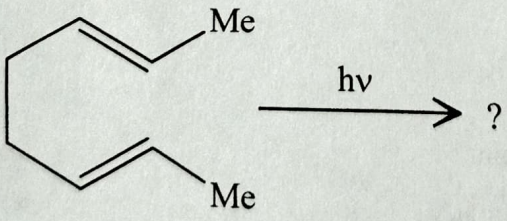


(iv) Predict the major product of the following reaction with justification: 2+3+3+2

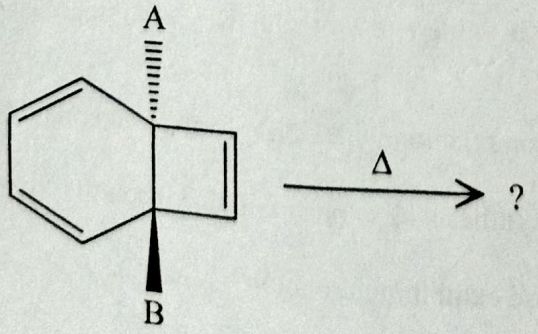


(b) (i) Predict the Products:

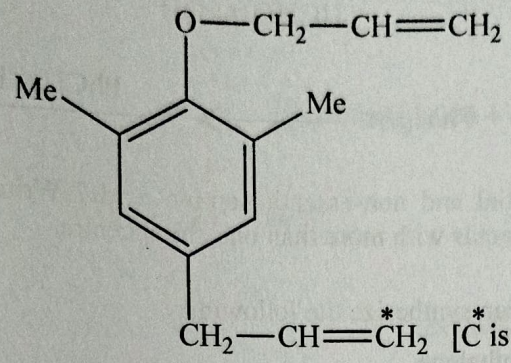
(A)



(B)



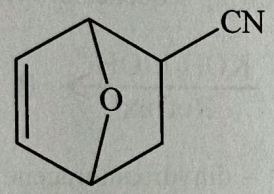
(ii) What happens when the compound (A) is heated at 160°C? Explain.



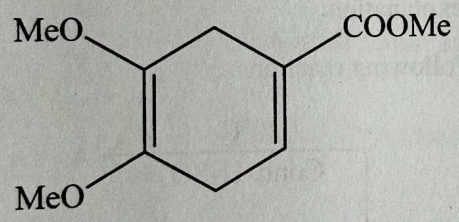
(iii) Identify diene and dienophile in each of the following Diels-Alder Product:

(2+2)+2+(2+2)

(A)

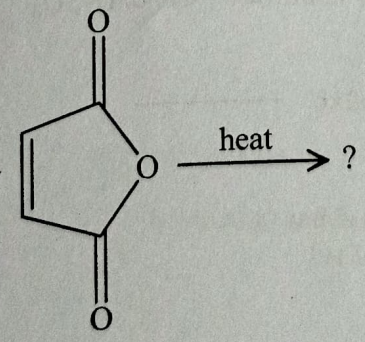


(B)

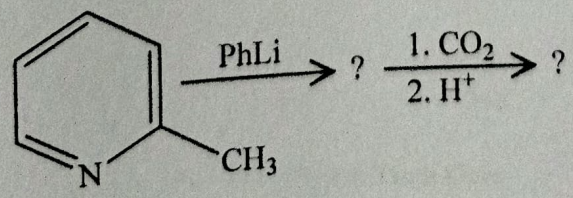


(c) (i) Suggest which products might be formed in each of these reactions:

(A) Furan +



(B)



(C) N-Methyl pyrrole $\xrightarrow[HCHO/AcOH]{Me_2NH}$?

(D) Pyrrole + PhMgBr $\longrightarrow$? $\xrightarrow{PhCH_2Cl}$?

(ii) What are essential and non-essential amino acids? Write down the structure of two common amino acids with more than one chiral centre. 6+(2+2)

(d) (i) Write how you can synthesize the following:

(A) 2-nitronaphthalene

(B) 9-Methyl Anthracene

(ii) Identify the products A and B in the following sequence of reactions:

$$\text{phenanthrene} \xrightarrow[HOAc]{CrO_3} A \xrightarrow[Reflux]{KOH/EtOH} B$$

(iii) Reduction of anthracene yields 9, 10 – dihydroanthracene and not 1, 4-dihydro-anthracene — Give the explanation.

(iv) Identify A and B in the following reactions: (2+2)+2+2+2