

Task 1

Bicyclic Nitrogen Compounds and their Syntheses

This task deals with derivatives of tropane, the so-called tropane alkaloids. Tropane is a bicyclic amine and is named 8-Methyl-8-aza-bicyclo[3.2.1]octane.

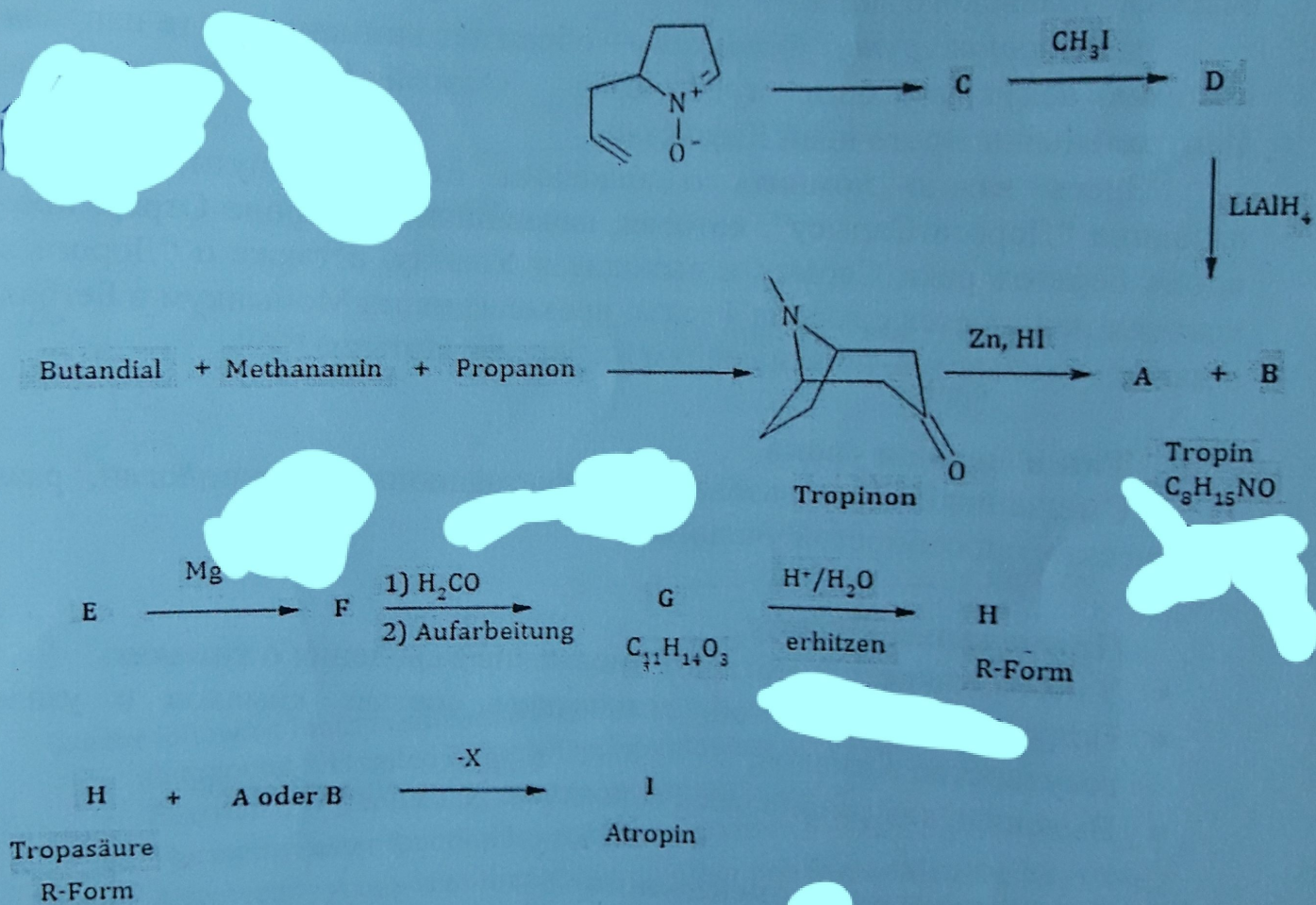
These natural compounds are formed by plants, especially by Solanaceae, as a protection against natural enemies.

Tropane alkaloids have a wide range of pharmacological activities, thus science has been involved in various syntheses of these compounds for around 100 years.

The first part of the task deals with the synthesis of atropine, the poison of deadly nightshade.

The second part is about ferruginine, an agonist of nicotinic acetylcholine receptors.

A. Synthesis of atropine

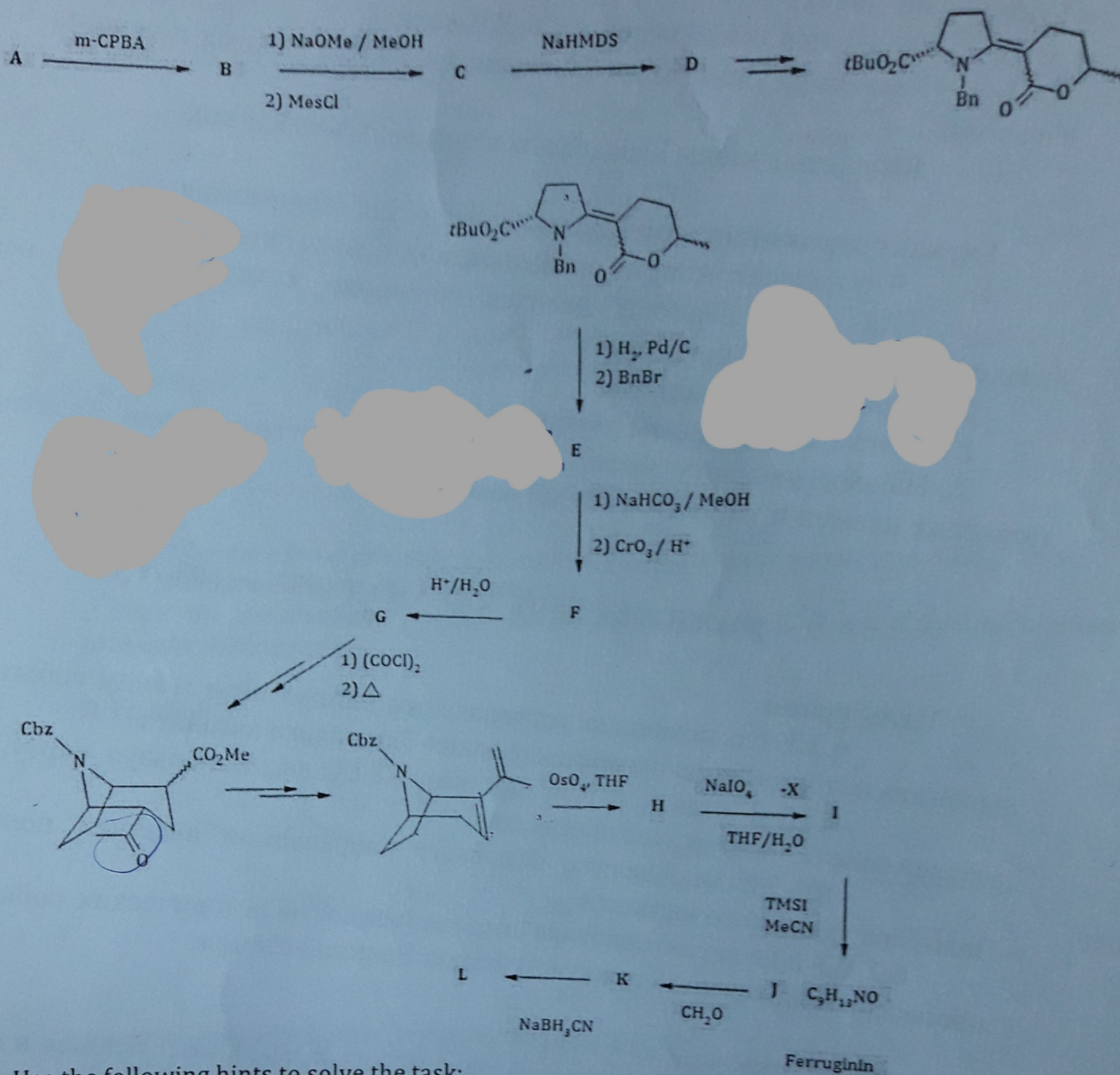


Use the following hints to solve the task:

- Compound E is called Ethyl-2-bromo-2-phenylethaneoat.
- A und B are stereoisomers.

a. Draw the configuration formulae of the compounds A, B and H and the constitutional formulae of the compounds C, D, F, G, I and chemical formula of X.

B. Synthesis of ferruginine



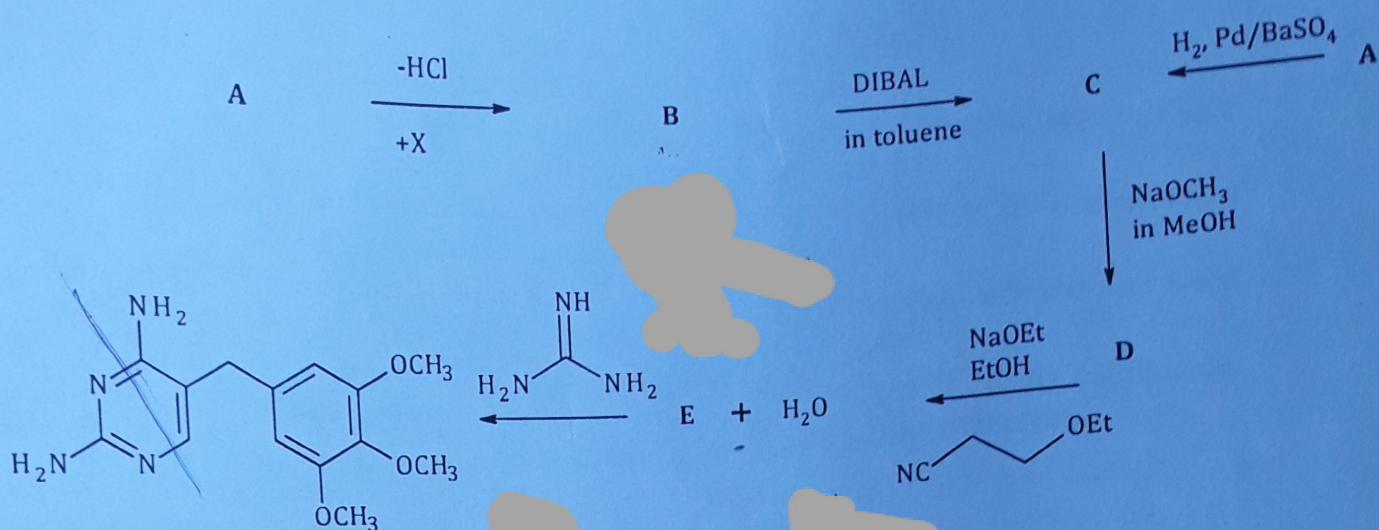
Use the following hints to solve the task:

- Compound A is called 2-Methylcyclopentaneon according to IUPAC.
- Reaction C \rightarrow D is leading to a reactive intermediate.
- The methyl ester function is retained in reaction F \rightarrow G.
- A protecting group is exchanged for another one in step G to the bicycles.
- There is no reaction within the cyclus in step H \rightarrow I, the replaced molecule X has a molar mass of 30.03 g/mol.
- Abbreviations:
 Bn = benzyl, Cbz = benzyl (benzyloxycarbonyl), Mes = mesyl = methanesulfonat,
 TMSI Trimethylsilyliodid, NaHDMS = $[(\text{CH}_3)_3\text{Si}]_2\text{NNa}$

b. Draw the configurational formulae of A, B und H and the constitutional formulae of the compounds C, D, E, F, G, I, J, K, L and X.

C. Trimethoprim

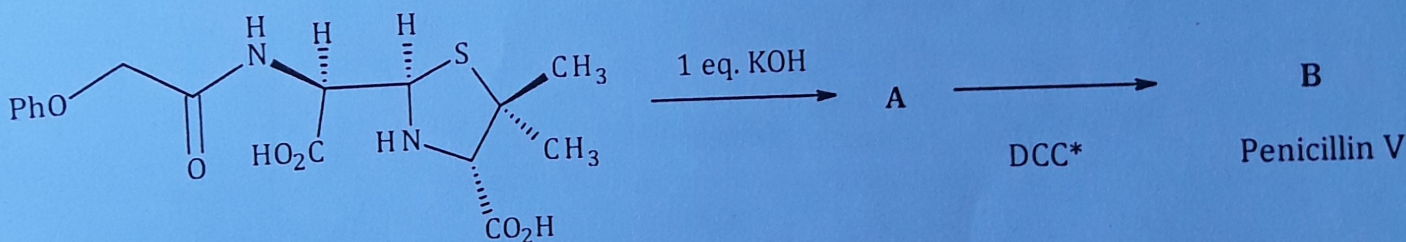
EXAM - 2



Hints:

- Substance B has the name 3,4,5-trihydroxybenzenecarboxylic acid methyl ester.
 - Substance E is a mixture of isomers.
- c. Draw the constitutional formulae of the compounds B, C, D and E and write down the molecular formula of X.

D. Penicillin V

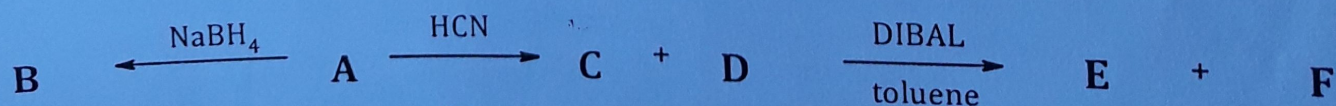


* dicyclohexylcarbodiimide (cyclohexyl-N=C=N-cyclohexyl)

d. Draw the configurational formulae of the compounds A and B.

Task 2 Birch sugar

Monosaccharide A is a xylose. This name derives from the Greek word for wood and indicates the occurrence of this sugar in bark (wood sugar). A modified substance (xylitol or birch sugar) is found in birch trees. Xylitol has won relevance for diabetics as a sugar replacement (E 967).



Hint: Substance F is idose and its name according to IUPAC is (2S, 3R, 4S, 5R)-2,3,4,5,6-pentahydroxyhexanal.

2.1. Draw the structural formulae of A - F in Fischer projection.