

Faculteit der Natuurwetenschappen, Wiskunde en Informatica

# Tentamen

## Organic Chemistry Bachelor Scheikunde (joint degree)

Versie 2

Hertentamen  
Datum: 13 January 2023  
Tijd: 9-12uur

Aantal pagina's: 4 (inclusief voorblad)  
Aantal open vragen: 7

Bij iedere vraag staat het maximaal te behalen aantal punten vermeld. Totaal aantal te behalen punten: 100

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### VOORDAT U BEGINT

- Controleer of uw versie van het tentamen compleet is.
- Schrijf **uw naam en studentnummer** en indien van toepassing **versienummer** op elk vel papier dat u inlevert en **nummer de pagina's**.
- Uw mobiele telefoon moet uit staan en in uw jas of tas zitten. Uw jas en tas moeten op de grond liggen.
- **Toegestane hulpmiddelen:** Scrap paper. Overige hulpmiddelen zijn niet toegestaan.

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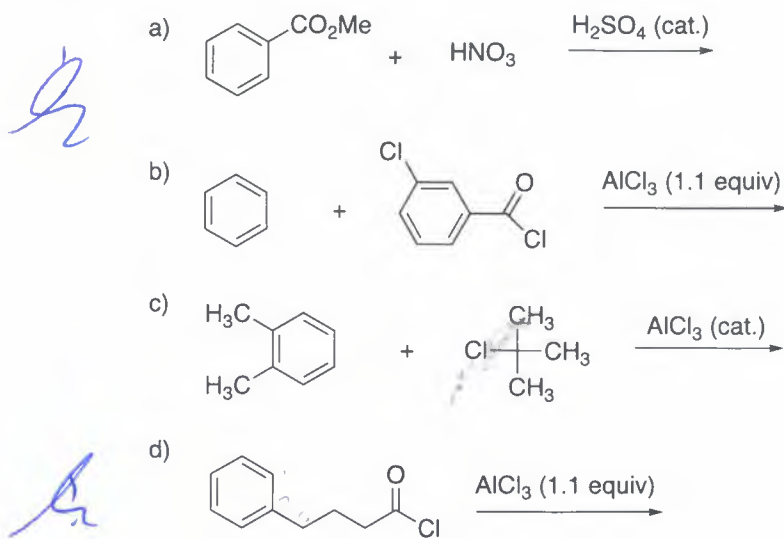
### HUISHOUDELIJKE MEDEDELINGEN

- De eerste 30 minuten en de laatste 15 minuten mag u de zaal niet verlaten, ook niet voor het bezoeken van het toilet.
- 15 minuten voor het eind wordt u gewaarschuwd dat het inlevertijdstip nadert.
- Vul na afloop van het tentamen het evaluatieformulier in, indien van toepassing.
- U bent verplicht zich op verzoek van de examinator (of diens vertegenwoordiger) te kunnen legitimeren met een bewijs van inschrijving en een geldig legitimatiebewijs.
- Tijdens het tentamen is toiletbezoek niet toegestaan, tenzij de surveillant hier toestemming voor geeft.
- Na afloop mag u dit tentamen meenemen.

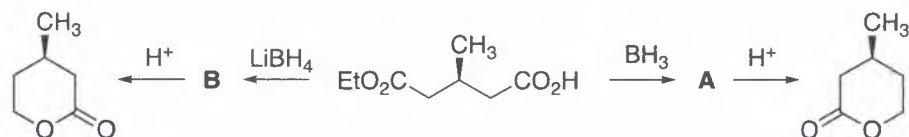
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**Succes!**

1. (16 pts) Please consider the four electrophilic aromatic substitution reactions drawn below.
- a) (4 x 2 = 8 pts) Draw the product of each reaction.
- b) (8 pts) Draw the full mechanism of the first reaction (a) showing how the electrophilic species is formed and also the origin of the regioselectivity.

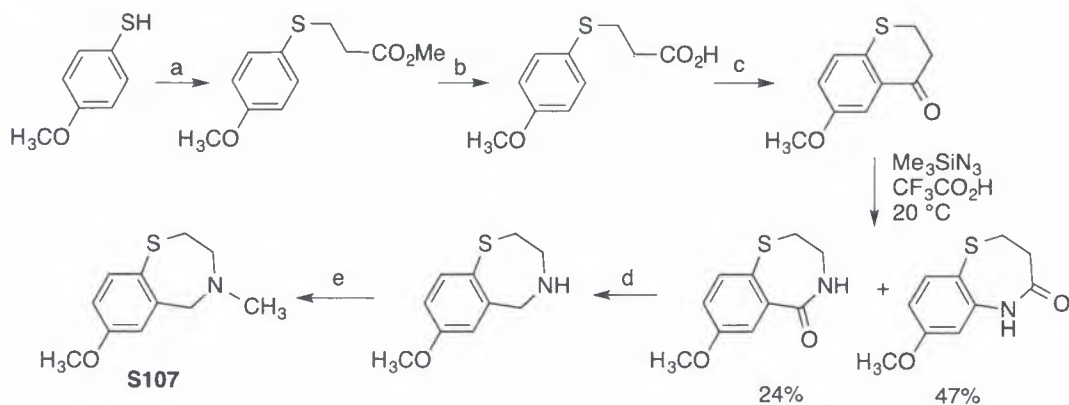


2. (14 pts) Below it is shown that the central enantiomerically pure compound can be selectively transformed in the enantiomeric lactones (cyclic esters) with the proper reducing reagent.

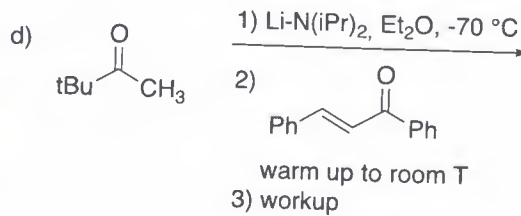
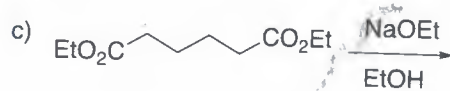
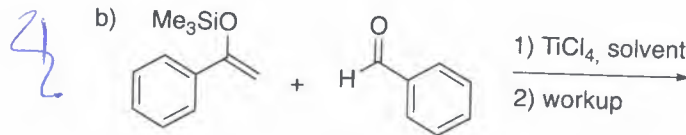
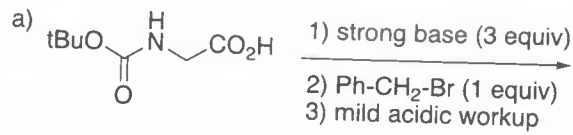


- a) (6 pts) Draw the structures of the intermediates **A** and **B**.
- b) (8 pts) Give a mechanistic explanation of the chemoselectivity towards **A** or **B**.

3. (12 pts) S107 is a compound that has shown to greatly improve the stamina (in Dutch: uithoudingsvermogen) of mice. The Scheme drawn below shows the syntheses of S107 (*J. Med. Chem.* **2013**, *56*, 8626-8655). Choose the right reagents for the steps a-e.



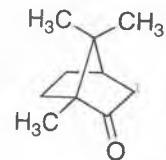
4. (4 x 5 = 20 pts) Give the products and the mechanisms of the following reactions:



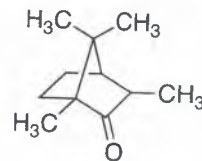
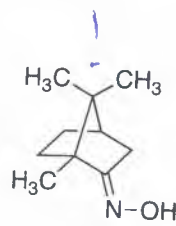
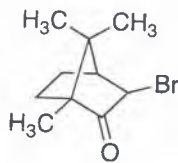
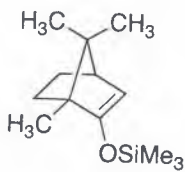
5. (10 ptn) Camphor is a bridged natural product with a characteristic smell.

a) Reduction of camphor with  $\text{NaBH}_4$  may give two stereoisomers. Draw them both and explain which one you expect to be formed in excess.

b) Show the reagents that are required to transform camphor into the products shown below:

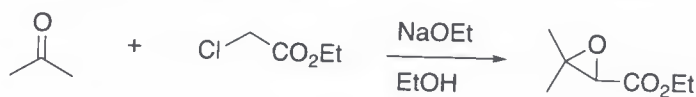


camphor

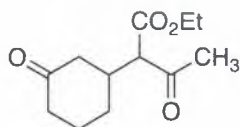


6. (2 x 6 = 12 ptn) Name reactions are popular in organic chemistry.

a) August Darzens (1867-1954) is a French chemist who invented the Darzens-condensation in 1904. Show the mechanism in the example of this reaction drawn below:



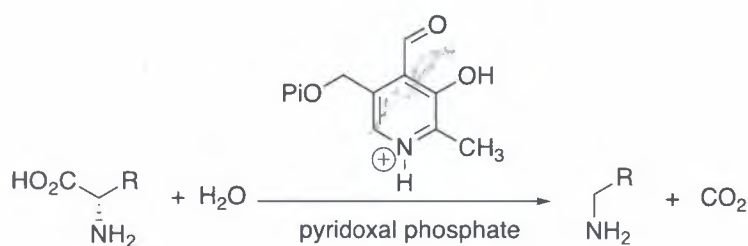
- c) The name of the American chemist Arthur Michael (1853-1942) is connected to the Michael-reaction, a conjugate addition using a soft nucleophile. Give two starting compounds to make the product drawn below using the Michael-reaction.



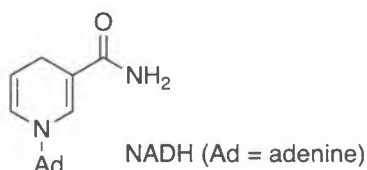
*Add carbon 3*

7. (only new curriculum students) (12 pts)

- a) (6 pts) Cofactor pyridoxal phosphate plays an important role in the catalytic decarboxylation of L-amino acids from  $\alpha$ -keto acids. Show the mechanism of this transformation.



- b) (6 pts) NADH is one of nature's reducing agents of, for example, aldehydes and ketones. Show the mechanism of this reaction and point out the role of the enzyme.



7. (only old curriculum students) (3 x 4 = 12 pts) Draw the products of the three Diels-Alder reactions drawn below. Show the correct stereochemistry in the products.

