

先端薬科学プログラム (Pharmaceutical Sciences)

受験番号 (Examinee's No.)

科目名 (Subject) 外国語 (英語) (Foreign Language (English)) 氏名 (Name)

(全 1 枚中の 1 枚目)

(裏面にわたる場合は、この線より下に解答すること。)

(If your answer is longer than the space provided, you can write on the back of this page, but please write below this line.)

The following column is the first paragraph of "Preface: To the Student" of the text book titled "The Art of Writing Reasonable Organic Reaction Mechanisms (Third Edition)" written by Robert B. Grossman (Springer Nature Switzerland AG 2019).  
Read it and answer the following question in English.

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## Question

The author said that to draw reasonable mechanisms is similar to drawing the travel. You have traveled from your home town to Toyama when you came here.

Explain your travel from your home town to Toyama like as describing a reaction mechanism.

For example,

(the mechanism): This conversion includes 3 steps. The first step is from New York to Pennsylvania through New Jersey. The second step is .....

You should point out (an overall reaction), (the mechanism), (reaction conditions), (intermediates), (side reactions), and also the speed at various points and more than one way (alternative route) in your travel.

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(1) Read the following text and answer the questions:

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(Cited from Y. Matsuya, *et al.*, HETEROCYCLES 65 (2005) 1741–1749, the Japan Institute for Heterocyclic Chemistry, partially modified)

a) Summarize the biological activities of macrospinelides in English or Japanese.

b) Describe the importance of synthetic studies of macrospinelides including your own ideas in English.

先端薬科学プログラム (Pharmaceutical Sciences)

科目名 (Subject)

受験番号 (Examinee's No.)

小論文・適性検査 (Short Essay and Aptitude Test)

分野名 (Educational Area) Synthetic and Medicinal Chemistry 氏名 (Name)

（裏面にわたる場合は、この線より下に解答すること。）

(If your answer is longer than the space provided, you can write on the back of this page, but please write below this line.)

(1) Explain the following reactions and stereoselectivities using suitable examples in English or Japanese.

(a) Diels-Alder reaction and *endo* rule

(b) Wittig reaction and *E/Z* selectivity

(2) Describe your research plan during the 2-year master's course in English or Japanese.

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小論文・適性検査 (Short Essay and Aptitude Test)

分野名 (Educational Area)

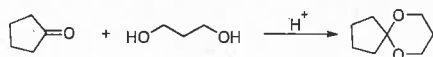
氏名 (Name)

分子合成化学 (Synthetic and Biomolecular Organic Chemistry)

(裏面にわたる場合は、この線より下に解答すること。)

(If your answer is longer than the space provided, you can write on the back of this page, but please write below this line.)

Q1 Draw a reasonable mechanism for the following organic reaction.



Q2 Aromatic compounds such as substituted benzenes can react with acyl chlorides or acid anhydrides to give acylated aromatic products.

1) This reaction is well known as a name reaction.

What is the name of this reaction?

reaction name: \_\_\_\_\_

2) This reaction needs an additive to proceed the desired reaction.

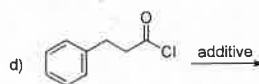
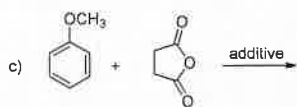
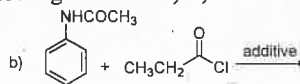
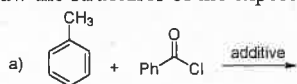
What is the most common additive for this reaction?

additive: \_\_\_\_\_

3) Draw a reasonable mechanism for the reaction of benzene with acetyl chloride in the presence of an additive.

4) The electronic nature of the substituents on an aromatic ring has a strong effect on the regioselectivity of the reaction.

Draw the structures of the expected major products in the following reactions a)-d).



5) This acylation reaction of benzene gives only mono-acylated product without any di- and tri-acylated compounds, while the similar alkylation of benzene affords poly-alkylated products as by-products. Explain the reason why this difference is observed, in English.

6) This reaction needs the excess amount of the additive, while the similar alkylation requires the only catalytic amount of the additive. Explain the reason why this difference is observed, in English.