

An aerial photograph of the EPFL campus in Lausanne, Switzerland. The image shows a large, modern, white building with a unique, organic shape and several circular openings. The building is surrounded by green spaces and other campus buildings. In the background, there is a large body of water (Lake Geneva) and a range of mountains under a dramatic, cloudy sky at sunset or sunrise. The overall scene is a mix of urban architecture and natural beauty.

Coordination Chemistry and Reactivity of f Elements

TD6

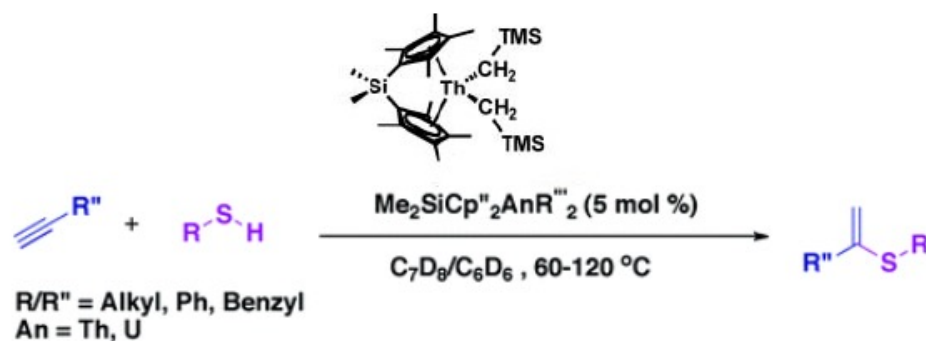
EPFL

Question 1:

- 1) Draw the reaction schemes of $[\text{Cp}_3\text{La}]$ and $[\text{Me}^4\text{Cp}_3\text{U}]$ with CO. Explain the origins of the observed differences in reactivity.
- 2) Describe the bonding between the metals and CO in the products of these reactions and suggest possible techniques that allow to elucidate the bonding in these complexes.

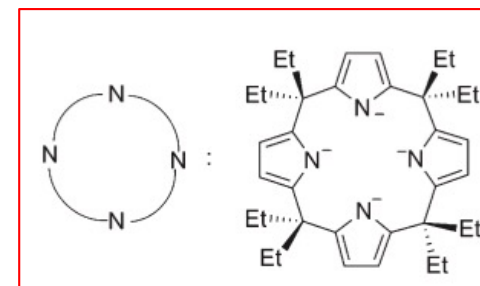
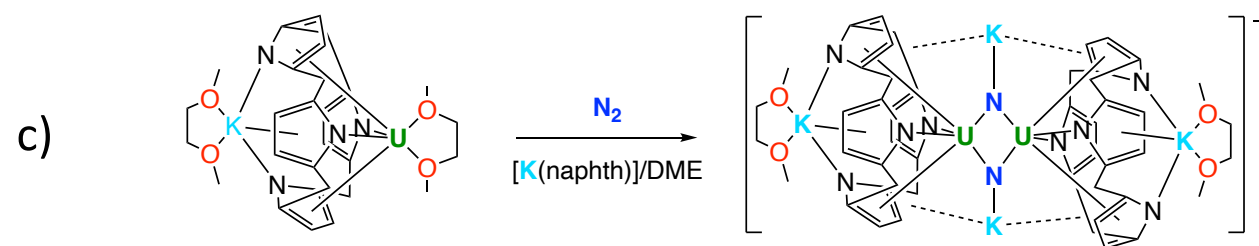
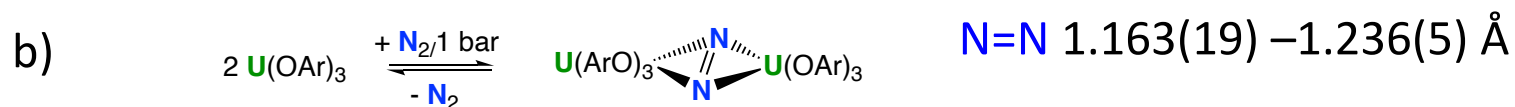
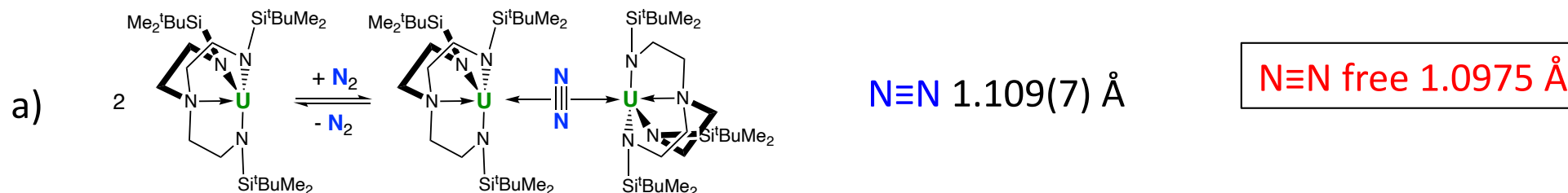
Question 2:

- 1) Indicate the two major reaction patterns in organometallic actinide chemistry
- 2) Draw a possible mechanism for the following catalytic reaction



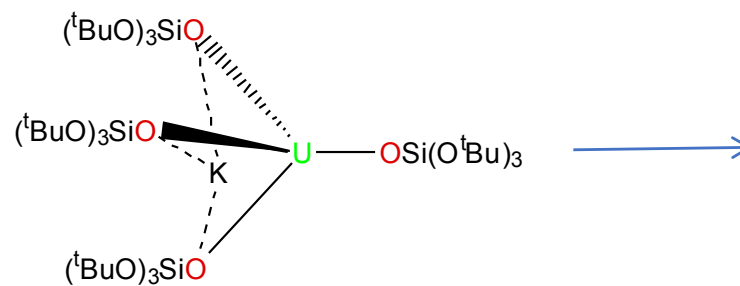
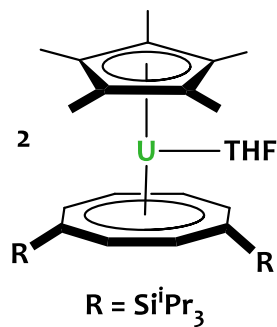
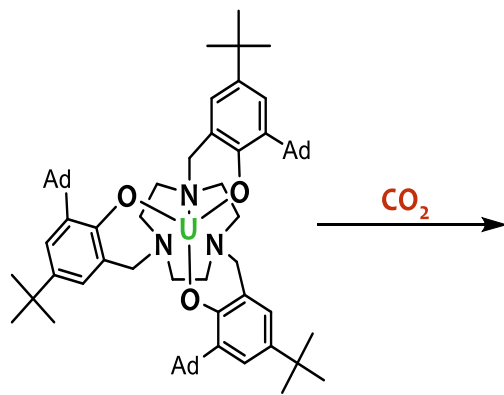
Question 3:

1) For the six complexes below assign the oxidation state of the uranium atoms and of the N atoms. Describe what type of reaction is occurring in each case.



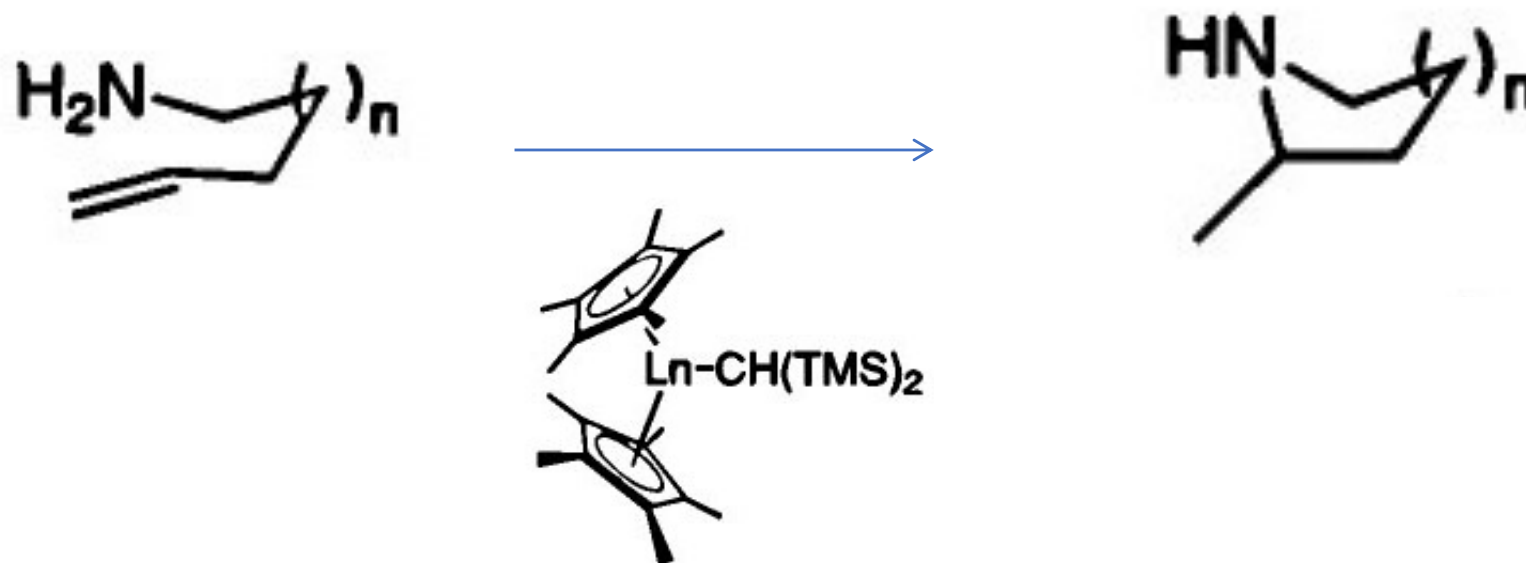
Question 4:

1) Identify the products of the reaction of the U(III) complexes represented below with carbon dioxide, describe the reaction and explain the difference in reactivity.



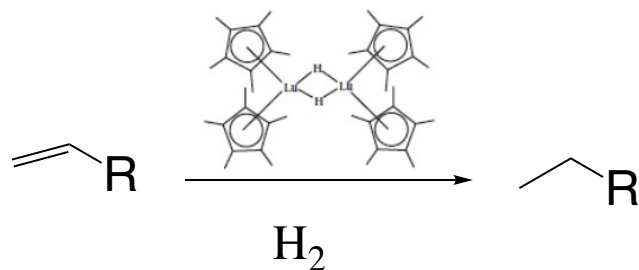
Question 5:

1) What type of reaction is shown below? Describe the catalytic mechanism of the reaction.



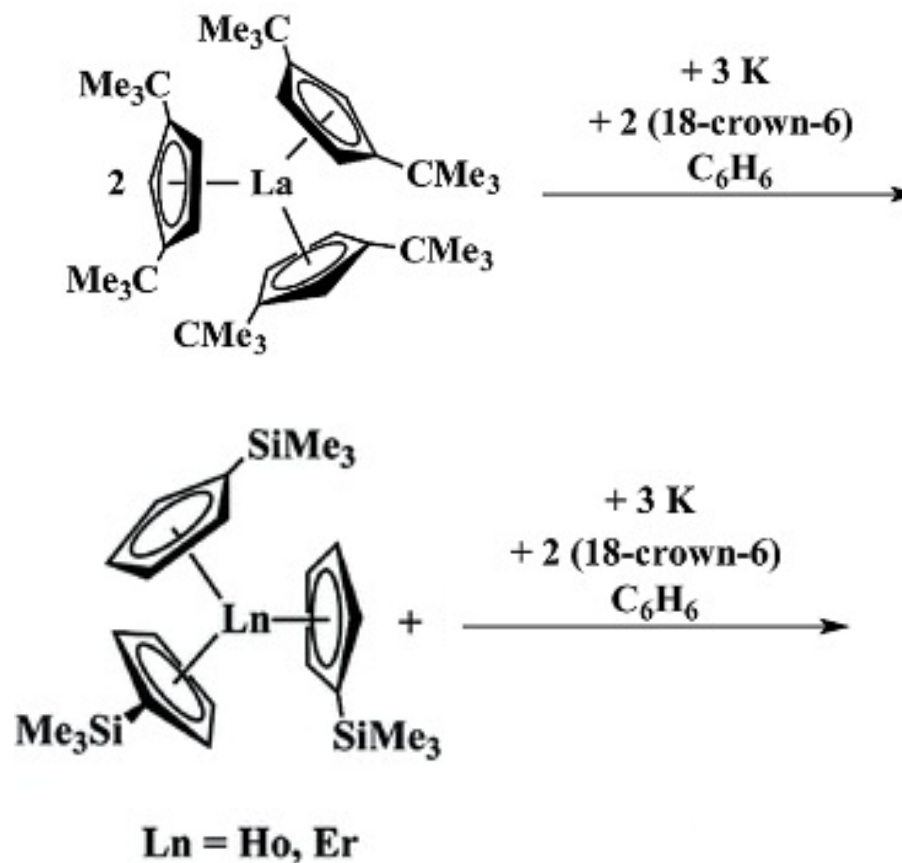
Question 6:

2) Identify the mechanism of the following lanthanide catalysed reaction



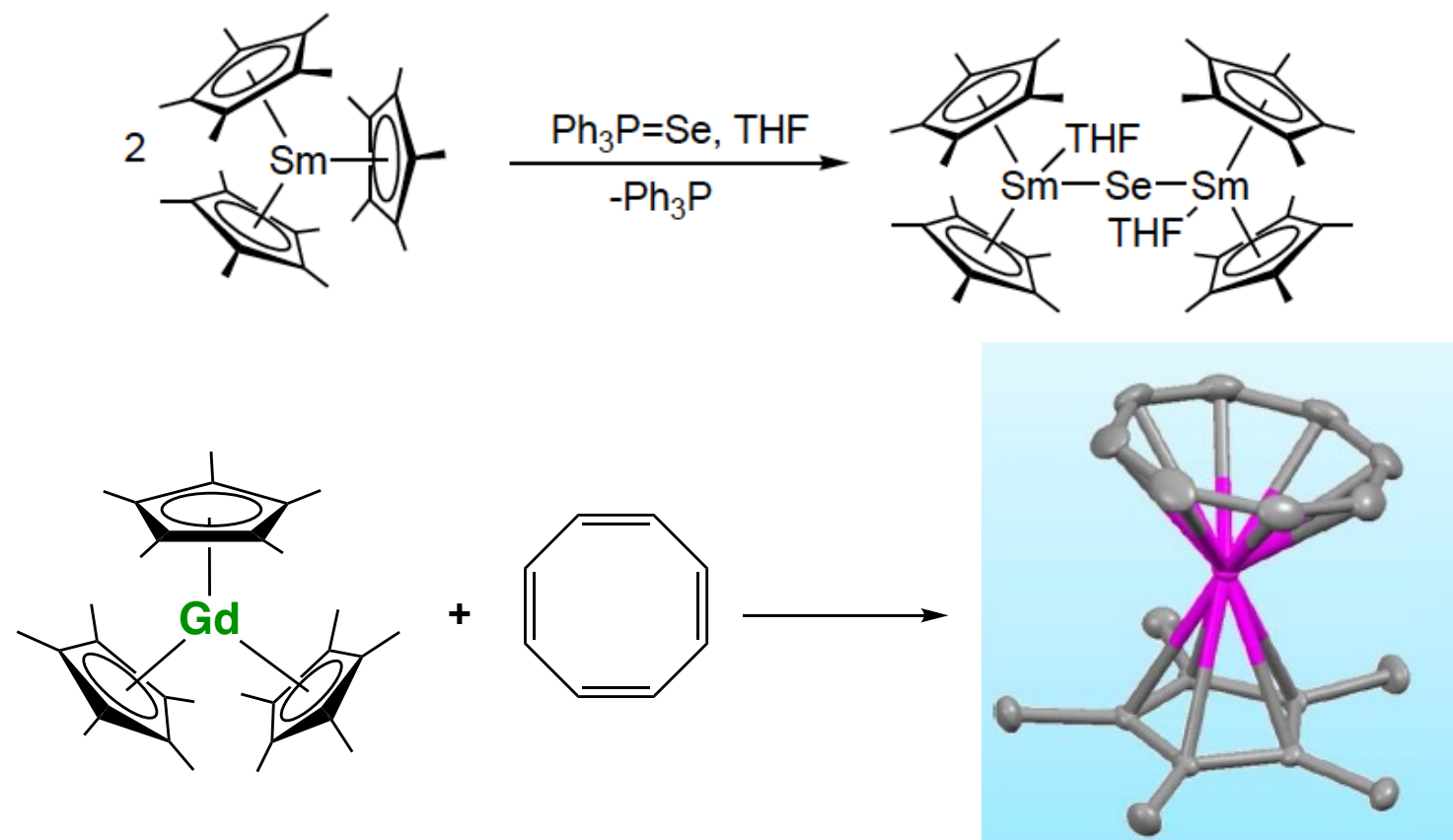
Question 7:

1) Draw the structures of the products of the following reactions and suggest possible reasons for different reactivity.



Question 8:

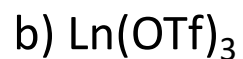
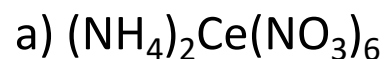
1) In the two redox reactions below the oxidation state of the metal is unchanged. Can you explain how is the substrate reduced?



Indicate the name of the type of reaction above and the additional product.

Question 9:

1) The following reagents are commonly used as catalysts in organic synthesis. Indicate for each compounds its activity as catalyst (oxidizing agent, reducing agent, Lewis acid, etc) and give an example of a reaction.





On the exam day you need a periodic table and a calculator but NO phones and NO access to internet is allowed

You can also bring a one side A4 page with your notes