



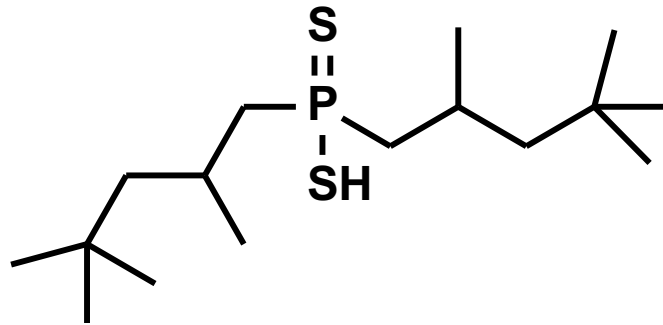
# Coordination Chemistry and Reactivity of f Elements

TD5

**EPFL**

# Question 1

- 1) Indicate the main steps of spent nuclear fuel reprocessing.
- 2) Indicate in which step the molecule below has been used and why.



## Question 2

- 1) Uranyl (V) is not stable. Indicate why and indicate the intermediates involved in the decomposition.
- 2) Explain how to stabilize uranyl(V).

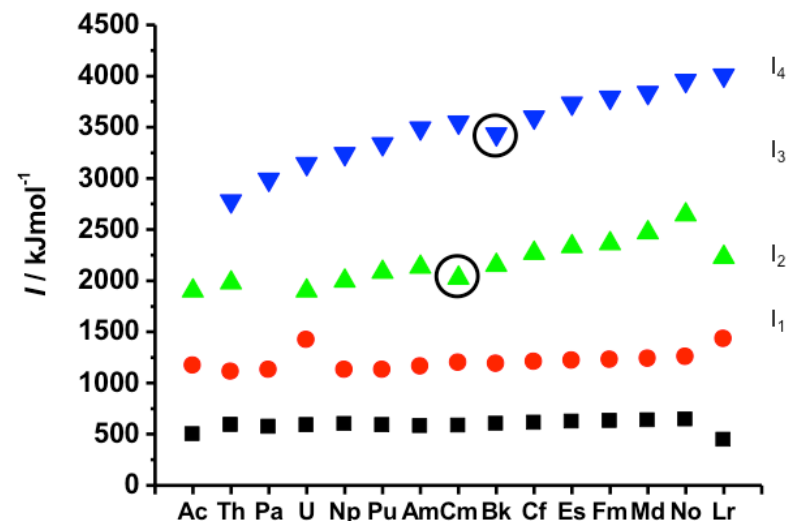
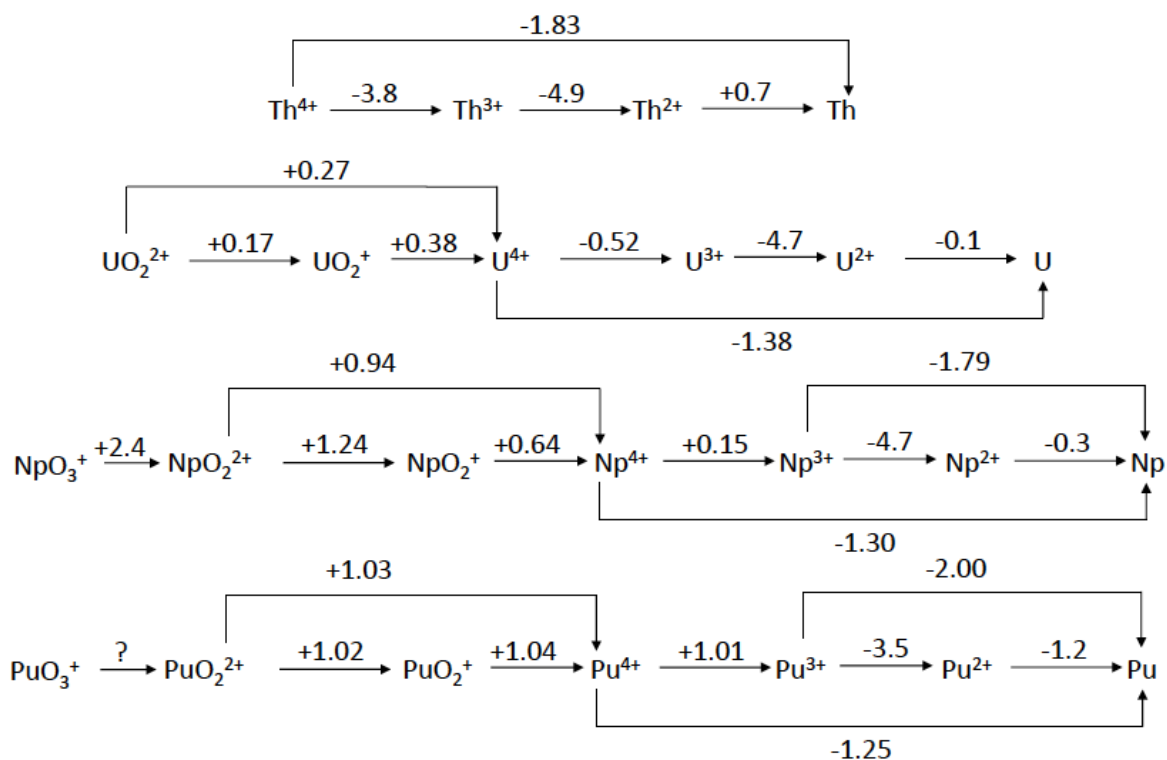
## Question 3

- a) Give the ground state for a U(IV) ion
- b) Calculate the magnetic moment for a U(IV) complex using the Russel-Sanders spin for spin orbit coupling scheme.
- c) Compare the value to measured value for measured for  $[\text{U}(\text{NCS})_8]^{4-}$ :  $2.9 \mu_B$   
And explain the difference
- d) Explain why complexes of uranyl(VI) are not diamagnetic but show a weak paramagnetism
- e) The room temperature magnetic moment cannot be used to identify the +IV, and +III oxidation states of uranium. How can they be differentiated?

## Question 4:

89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lw

- a) Recall the most common oxidation states of actinides and rationalize their stability using the provided information on ionization energies and redox potentials.
- b) Indicate the oxidation states stable in ambient conditions.



## Question 5

**Describe common precursors of U(III), U(IV) and U(VI) and their synthesis**



## Question 6

- A) If you had to prepare a neutral siloxide U(III) complex would you choose the salt metathesis of the or the protonolysis method ? Justify.
- B) Draw the reaction schemes to prepare the U(III) complexes using both methods.
- C) Why tripodal ligands are particularly efficient in stabilizing highly reactive U(III) complexes ? Draw an example of such a ligand.

## Question 7

- A) Explain why M-L multiple bond is more common in 5f elements than 4f.
  
- B) Describe common synthetic strategies to form U=O terminal bond and draw the reaction schemes.



## Question 8

**Draw the structure of the reaction products for the following reactions and explain.**

