

Coordination Chemistry and Reactivity of f Elements

TD5

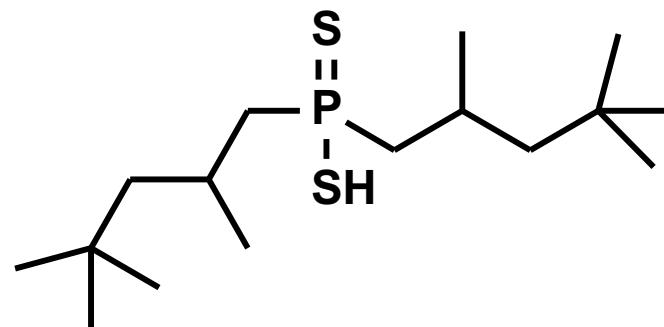


EPFL

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

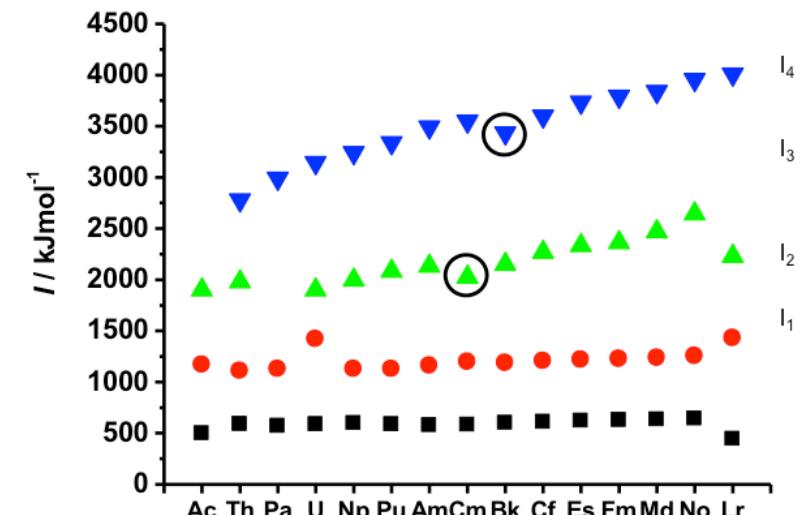
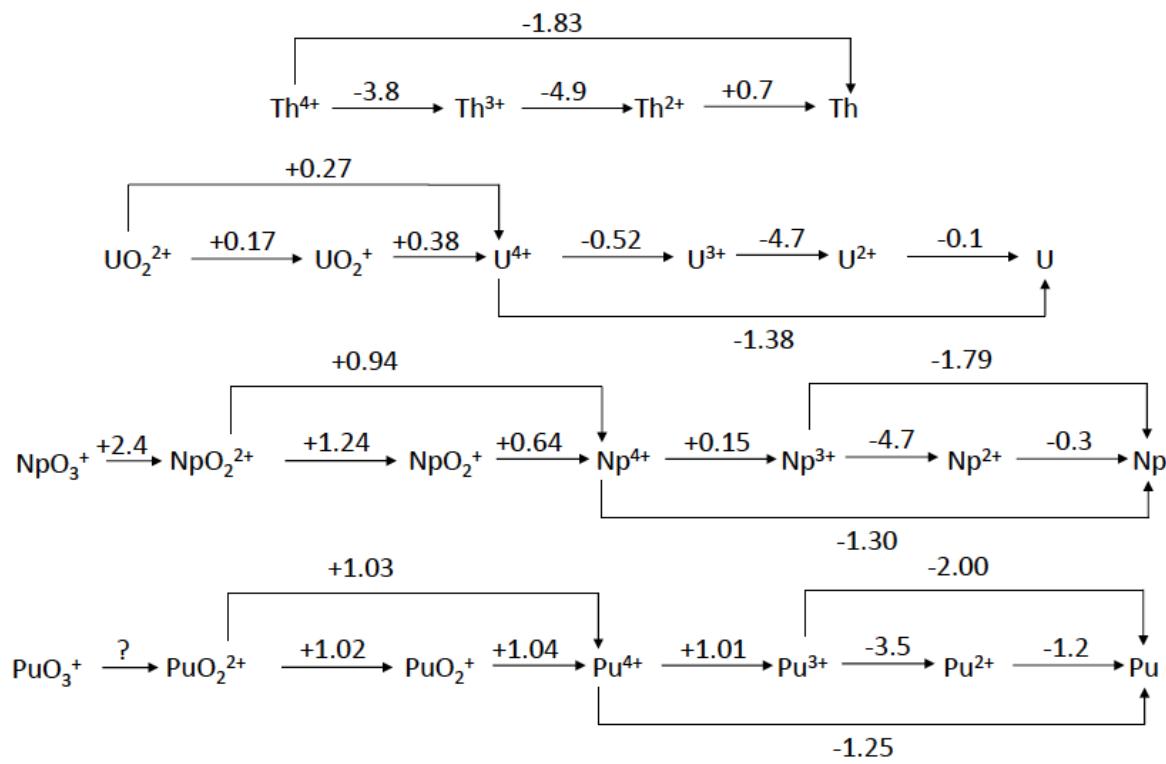
- a) Give the ground state for a U(IV) ion
- b) Calculate the magnetic moment for a U(IV) complex using the Russel-Sanders spin for spin orbit coupling scheme.
- c) Compare the value to measured value for measured for $[\text{U}(\text{NCS})_8]^{4-}$: $2.9 \mu_B$
And explain the difference
- d) Explain 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 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.

