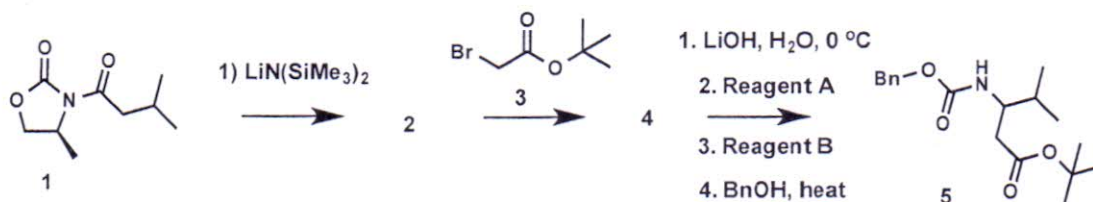


ROC Exam 2015, 19 January 2015

Problem 1

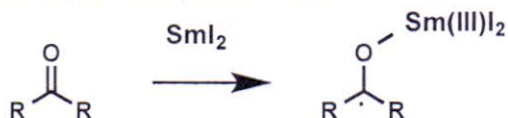
Below the synthesis of non-natural amino acid **5** is depicted.



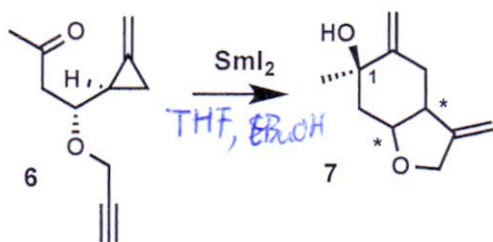
- Provide the structure of intermediate **2**, rationalize the stereochemistry in **2** by drawing the relevant transition state. Provide the structure of **4**, including stereochemistry and the mechanism of its formation.
- Compound **4** has been converted in a single enantiomer of **5** by the depicted reaction sequence. Give the required reagents **A** and **B** and provide the mechanisms of all transformations en route from **4** to **5**.
- t-Butyl ester remains intact under alkaline conditions. Give an explanation.

Problem 2

Samarium (II) iodide (SmI_2) is a well-known one-electron reducing agent and its reactivity is exemplified below.



Taking the reactivity pattern of SmI_2 into account provide the detailed mechanism of transformation of cyclopropane derivative **6** into bicycle **7**. Specify the stereochemistry of the indicated chiral centres in **7** and justify your answer. Explain why the configuration of the carbon-1 in **7** is as shown.

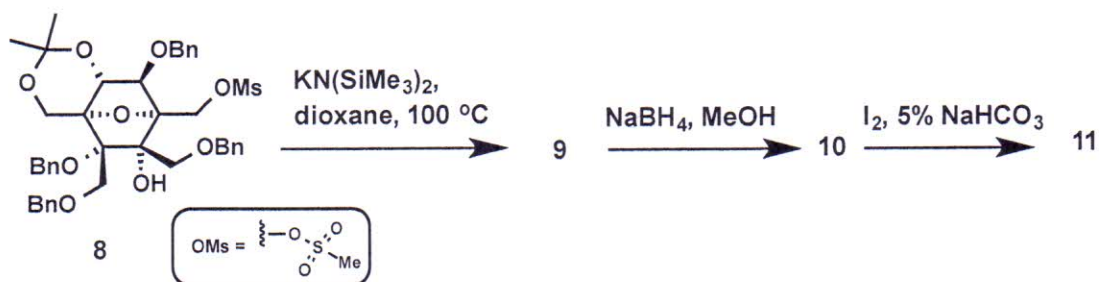


Problem 3

Part of a total synthesis towards Zaragozaic acid, a fungal metabolite with appealing cholesterol lowering potential, is depicted below. In a three-step sequence compound **8** is transformed into compound **11**. In the first step a strong base is used

at high temperature to give **9** (**9** contains a double bond). This compound is then treated with NaBH_4 to give a single product **10**, which is then exposed to I_2 in the presence of NaHCO_3 to give **11**.

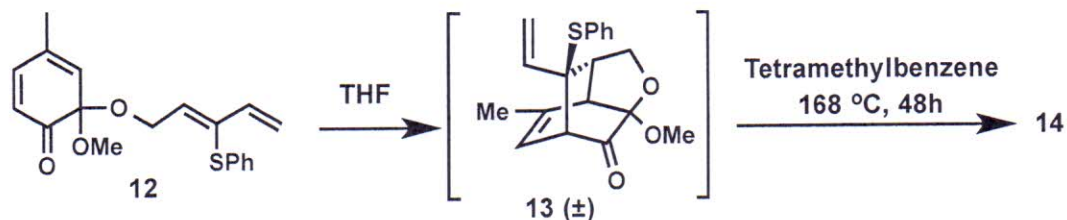
Provide the structures of the compounds as well as a mechanism for their formation. Where new chiral centres are formed, show which isomers are preferentially formed and give an explanation for the observed stereoselectivity.



Problem 4

During a synthesis of helenquinone the following transformation was achieved. Upon the generation of compound **12** (by an oxidative ketalisation) this compounds underwent a sequence of two reactions as depicted.

- Provide the mechanism of formation of **13** from **12**. Comment on the observed selectivity in this reaction.
- Provide the mechanism for the transformation of **13** to **14**.



Problem 5

Upon treatment of compound **15** with $\text{Rh}(\text{OAc})_2$ compound **16** is formed. Provide the mechanism for this transformation.

