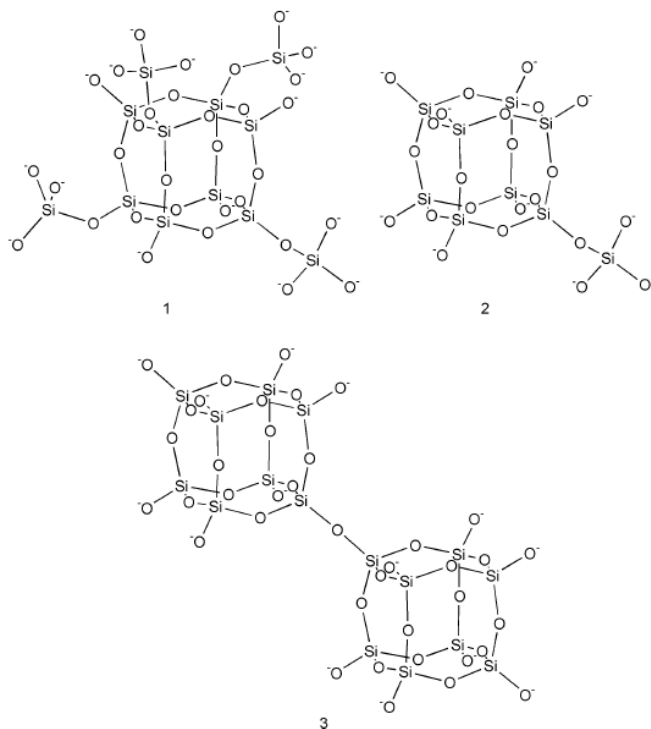
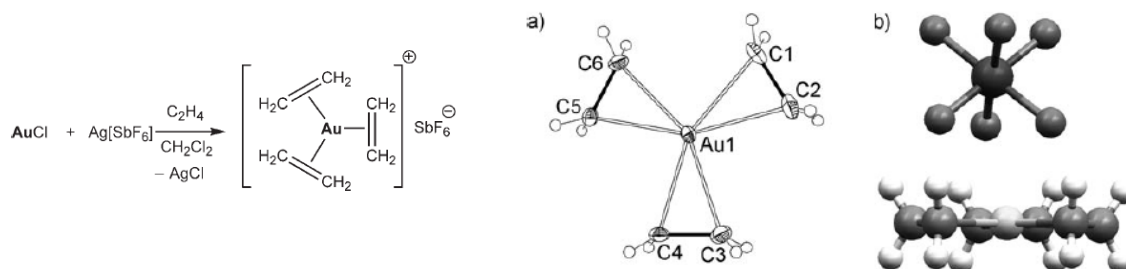


HW 2	Multinuclear NMR	Name:	
Points:	C6800	Date:	
Max. 100 points	Spring 2011	Version A	

1. Predict the number and relative intensity of the signals in the ^{29}Si NMR spectra of molecules **1–3**. For **1** and **3** give the symmetry point groups.



2. Gold(I) tris(ethylene) complex $[\text{Au}(\text{C}_2\text{H}_4)_3][\text{SbF}_6]$ was prepared by the following reaction and was structurally characterized.

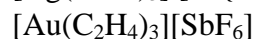


- Draw clearly all symmetry elements present in the cation.
- Give the symmetry point groups of the cation and the anion.
- Is this complex diamagnetic or paramagnetic?
- How many resonances (signals) do you expect in the ^1H and ^{13}C NMR spectra.
- These resonances are significantly upfield relative to the free ethylene (5.28 / 123.2 ppm). What causes this shielding effect?

$$\Delta\delta(^{13}\text{C}) = \delta(^{13}\text{C})_{\text{complex}} - \delta(^{13}\text{C})_{\text{ethylene}}$$



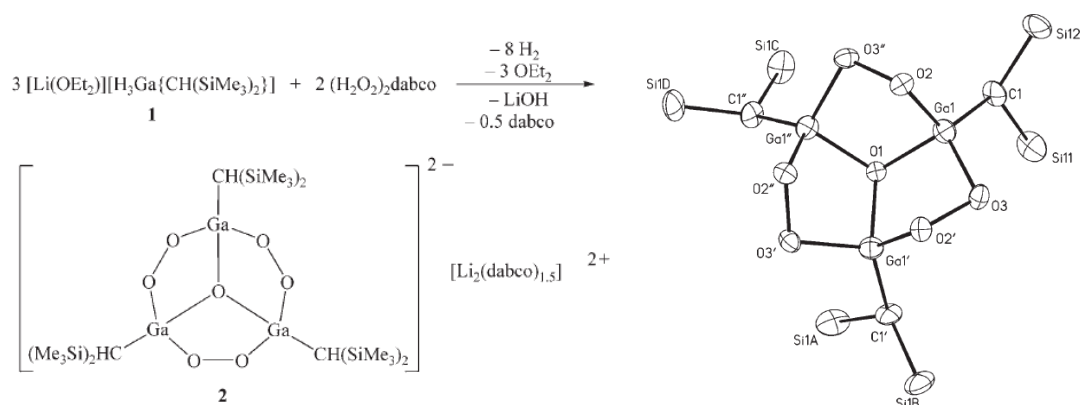
$$-7.0 \text{ ppm}$$



$$-30.7 \text{ ppm}$$

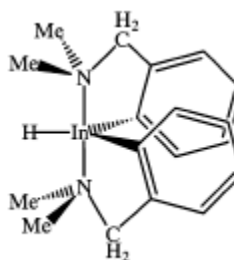
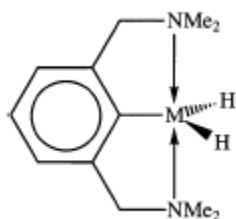
- What are the ^{13}C NMR chemical shifts of the two complexes?

3. Alkyl gallium peroxide anion was synthesized by the following procedure:



- Draw clearly all symmetry elements present in the anion.
- Give the symmetry point group of the anion.
- Are there any geminal groups? Assign them as Homo-, enantio-, or diastereotopic.
- How many resonances (signals) do you expect in the ^1H , ^{13}C , and ^{29}Si NMR spectra.

4. How many signals of the NMe_2 and CH_2 groups do you expect in the following compounds:



5. How many signals do you expect in ^{19}F and ^{31}P NMR spectra of the following compound:

