**1FLO: Perhalogenated Carba-*closo*-dodecaborate Anions as Ligand Substituents: Applications in Gold Catalysis**

In 2013, Lavallo and coworkers reported the synthesis and hydroamination activity of a carba-*closo*-dodecaborate ligated gold catalyst. This FLO focuses on the unprecedented catalytic activity of the complexes reported in the following communication: Lavallo, V.; Wright II, J. H.; Tham, F. S.; Quinlivan, S. *Angew. Chem. Int. Ed.* **2013**, *52*, 3172. DOI: <https://doi.org/10.1002/anie.201209107>.

In this LO, you are asked to interpret a table of data on the hydroamination reactions reported in the paper. To answer the following questions, draw upon your prior knowledge of catalysis and the information presented in Table 1 and its footnotes (page 3174).

For a review on the basics of catalysis, see Chapter 13.6 in *Chemistry: An Atoms Focused Approach, Third Edition*, **2020**, W. W. Norton and Co. and/or the ChemLibreTexts article on the fundamentals of catalysis: https://chem.libretexts.org/Bookshelves/General\_Chemistry/Map%3A\_Chemistry\_-\_The\_Central\_Science\_(Brown\_et\_al.)/14%3A\_Chemical\_Kinetics/14.07%3A\_Catalysis

1. What is a catalyst? Draw a reaction profile/ reaction coordinate diagram of a catalyzed vs. uncatalyzed reaction.
2. What is meant by a substrate in a catalytic reaction? Why does the catalyst appear over the reaction arrow in the reaction shown above Table 1?
3. What is catalyst loading? How is it calculated?
4. Define turnover number (TON).
5. What is the difference between turnover frequency (TOF) and turnover number (TON). Why might you use one metric versus another?
6. Calculate the TOF for the reaction with the highest absolute TON using data in the table.
7. Draw the specific reaction for reaction 6, including the relevant R groups.
8. Convert the catalyst loading of 0.001 percent to parts per million (ppm).

*Challenge Questions*

1. The Au in this reaction is activating the alkyne, by causing it to become more electrophilic. Using this information, provide a reason as to why 1-hexyne was a poor substrate (Entries 16-18)
2. Which alkyne is a better substrate (gives higher TON), internal or terminal?
3. Which amines provide the highest TON? Why do you think that is?
4. Does the reaction work better with bulky substrates (amine and alkynes) or smaller ones? Is there a discrepancy in the trends? Explain the trends keeping in mind that the alkyne must be activated before reacting with the amine.