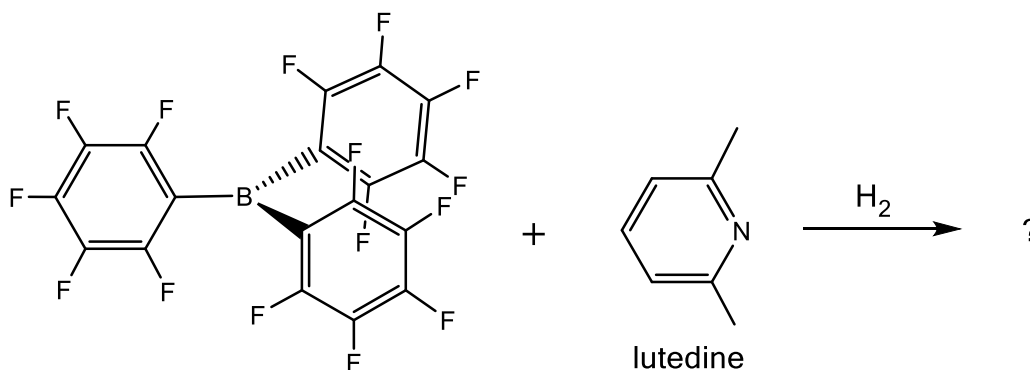


**Winter 2025 - Chemistry 3840**  
**Assignment #1**

1. How does a 3-centered, 2-electron bond differ from a 2-centered, 2-electron bond? Describe fully using figures and examples. (14 points)
2. Do you expect  $1,2\text{-C}_2\text{B}_{10}\text{H}_{12}$  to have the same cage structure as  $[\text{B}_{12}\text{H}_{12}]^{2-}$ ? Why or why not? Explain fully. (16 points)
3. a) When  $\text{H}_2$  is added to the following combination

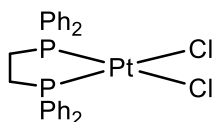


- a reaction takes place immediately, but when  $\text{H}_2$  is added to a mixture of  $\text{PMe}_3$  and  $\text{BMe}_3$  nothing happens. Why not? (12 points)
- b) Draw the product(s) for the reaction of  $\text{H}_2$  with  $\text{B}(\text{C}_6\text{F}_5)_3$  and lutidine. (12 points)
4. a) Suggest a likely structure for  $\text{B}_5\text{H}_9$  that is consistent with Wade's rules. Show your work and explain your reasoning. (12 points)
  - b) Classify  $\text{B}_5\text{H}_9$  as *nido*, *closo* or *arachno*. (6 points)

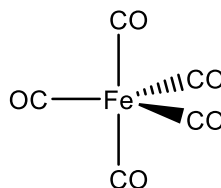
5. For the following structures give the oxidation state of each metal. Show your work. (16 points)

- i)  $[\text{RhCl}(\text{PPh}_3)_3]$
- ii)  $[\text{Pt}(\text{H})(\text{I})(\text{CH}_3)_2(\text{PEt}_3)_2]$
- iii)  $[\text{Ru}(\text{SiCl}_3)_2(\text{CO})_3(\text{PPh}_3)]$
- iv)  $[\text{Sc}(\text{CH}_2\text{SiMe}_2\text{Ph})_3(\text{THF})_2]$

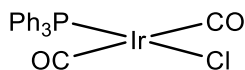
v)



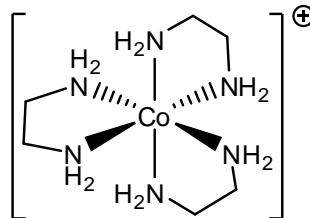
vi)



vii)



viii)



**Bonus** (and excellent practice for the midterm exam):

For the structures in question 5:

- a) Give the d-electronic configuration of each metal (2 points)
- b) Provide the electron count at each metal (show your work) (2 points)