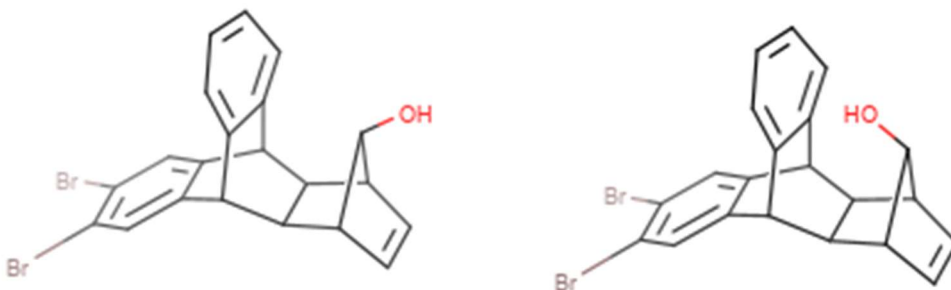
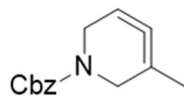


- Alkenes and alkynes are commonly reduced with a metal catalyst and hydrogen gas. However, a new method of reduction is metal free and uses *in situ* generated diazene (N_2H_2).
 - Draw the structure of diazene.
 - Draw the mechanism of reduction of either an alkene or alkyne with diazene.
 - Propose a method for the *in situ* generation of diazene.
 - Does diazene preferentially reduce alkenes or alkynes? Justify your answer.
- Adenosine is a nucleotide that is found in DNA.
 - Draw the complete structure of adenosine, including the sugar involved.
 - There are exactly two protons on the aromatic ring of adenosine. Which one has a more downfield proton NMR shift? Justify your answer.
 - Using NMR, how would you differentiate between a solution of adenosine diphosphate and adenosine triphosphate?
- Electrophilic bromination is a common reaction used to introduce bromine to aromatic rings, with either elemental bromine or NBS, plus a suitable Lewis acid catalyst. Below, we have two similar molecules. They are both subject to electrophilic bromination, and the same aromatic ring is brominated in both molecules. However, one of the compounds reacts significantly faster than the other.



- What is the structural relationship between the two molecules?
 - Which aromatic ring is brominated? Justify your answer; draw relevant mechanisms if necessary.
 - Which molecule reacts faster? Justify your answer; draw relevant mechanisms if necessary.
- The Garg group at UCLA has been developing the use of cyclic allenes for synthesis of many organic natural products. They are strained molecules where one double bond of the allene selectively undergoes a [4+2] cycloaddition with a suitable coupling partner.
 - Are 6-membered cyclic allenes chiral?
 - Draw ALL potential products resulting from the reaction of furan with the molecule below.



(Cbz = $-CO_2CH_2C_6H_5$)

- In their investigation, the group generated the above molecule *in situ* by treating a compound **A** with formula $C_{21}H_{30}F_3NO_5Si$ with CsF. Draw a plausible structure for **A**.
Hint: This molecule contains an OTf, $SiEt_3$, and Cbz group.