1. Rank the heats of hydrogenation for the following, 1 being most heat released and 4 being least heat. (Think: will the more stable isomer release more heat or less heat when it is hydrogenated?)

2. Rank the rate of reaction of the following toward SN1 substitution (AgNO3/CH3CH2OH), 1 being most reactive and 4 being least reactive. (Think: what determines the rates for SN1 reactions?)

3. Products A and B combine to make up over 90% of the product mixture. Products A+B come from one common intermediate. Draw the intermediate and explain why products A/B dominate over products C/D. (Think: what determines the rate of reaction for an HCl addition reaction to alkenes?)

4. Draw the mechanism for formation of products A and B above.

5. 1,4-pentanediene is much more acidic than pentane. Explain why. (Think: what determines acidity?)

\[
\begin{align*}
\text{H} & \quad \text{vs.} \quad \text{H} \\
\text{low acidity} & \quad \text{a million billion times more acidic}
\end{align*}
\]
6a. Which is more stable, C or P?
b. What is the overall hybridization of the N atom in C?
c. What is the hybridization of the N lone pair in C?
d. What is the overall hybridization of the N atom in P?
e. What is the hybridization of the N lone pair in P?
f. Given that amines with sp³ lone pairs are more basic than amines with p lone pairs, which is more basic, C or P?

\[ \text{C} \quad \text{N} \quad \text{H} \quad \text{C} \quad \text{N} \quad \text{H} \]

7. Diels-Alder Reactivity: Explain why diene A is more than a million times more reactive than diene B.

Diels-Alder diene needs to react via a "cisoid" (or "s-cis" conformation). Diene A is always that way, and always ready to react. Diene B is rarely that way, and only has a small population of reactive cisoid diene.

8. Give the reactants (including stereochemistry) that would give the following D-A product.

9. Draw the major Diels-Alder product.

Depending on class coverage, you may or may not be responsible for the distinction between the two structural isomer product options in this problem.