1) Give the products of the following reactions. Carefully indicate stereochemistry where appropriate (30 points).

A)  
\[ \text{Cyclic compound} \xrightarrow{1) \text{Cl}} \text{Me} \xrightarrow{2) \text{HNO}_3, \text{H}_2\text{SO}_4} \text{Me} \xrightarrow{3) \text{Pd/C, H}_2, \text{MeOH}} \]

B)  
\[ \text{Me} \xrightarrow{\text{heat}} \text{Et} \xrightarrow{\text{xylenes}} \]

C)  
\[ \text{Me} \xrightarrow{1) \text{PPh}_3} \text{Me} \xrightarrow{2) \text{nBuLi, THF}} \xrightarrow{3) \text{Me} \xrightarrow{4) (\text{Ph}_3\text{P})_3\text{RhCl, CH}_2\text{Cl}_2} \]

D)  
\[ \text{NH}_2 \xrightarrow{1) \text{NaNO}_2, \text{HCl}} \text{Me} \xrightarrow{2) \text{CuBr}} \xrightarrow{3) \text{Mg (0), THF}} \xrightarrow{4) \text{Me} \xrightarrow{5) \text{H}_3\text{O}^+} \text{THF} \]

E)  
\[ \text{O} \xrightarrow{1) \text{LiAlH}_4, \text{THF}} \xrightarrow{2) \text{H}_3\text{O}^+} \]

F)  
\[ \text{Cyclic compound} \xrightarrow{\text{CHO}} \xrightarrow{\text{heat, xylenes}} \]

2) Provide reaction conditions to selectively effect the following transformations (20 points).

A)  
\[ \text{Cyclic compound} \xrightarrow{\text{Phi, NH}} \]

B)  
\[ \text{Br} \xrightarrow{1) \text{NaNO}_2, \text{HCl}} \text{OH} \xrightarrow{2) \text{CuBr}} \text{Me} \xrightarrow{\text{Me}} \]

C)  
\[ \text{Ph} \xrightarrow{1) \text{LiAlH}_4, \text{THF}} \xrightarrow{2) \text{H}_3\text{O}^+} \]

D)  
\[ \text{Cyclic compound} \xrightarrow{\text{Me}} \xrightarrow{\text{Ph}} \]

E)  
\[ \text{Cyclic compound} \xrightarrow{\text{CHO}} \xrightarrow{\text{heat, xylenes}} \]

F)  
\[ \text{Cyclic compound} \xrightarrow{\text{CHO}} \xrightarrow{\text{heat, xylenes}} \]

G)  
\[ \text{Cyclic compound} \xrightarrow{\text{CHO}} \xrightarrow{\text{heat, xylenes}} \]

H)  
\[ \text{Cyclic compound} \xrightarrow{\text{CHO}} \xrightarrow{\text{heat, xylenes}} \]

I)  
\[ \text{Cyclic compound} \xrightarrow{\text{CHO}} \xrightarrow{\text{heat, xylenes}} \]
3) The following reagents are very useful for organic synthesis. **For each reagent, give its common name** (e.g., Wilkinson’s catalyst, Swern Oxidation) and **an example of the reagent’s use**. Select a substrate of your choice to best illustrate each transformation and the reagent’s selectivity (20 points).

![Reagents Diagram](image)

4) In the following synthetic route, **provide the missing reagents, intermediates, and mechanisms** as indicated (50 points).

![Synthetic Route Diagram](image)
5) Fexofenadine is an antihistamine used to relieve allergy symptoms. Propose an efficient synthesis of this drug from the given starting materials. (15 points).

6) Fentanyl is an opioid analgesic (painkiller). Propose an efficient synthesis of this drug from the given starting materials. (15 points).