1) Give the products of the following reactions and draw any isolable intermediates. Carefully indicate stereochemistry where appropriate (30 points).

A) \[ \text{Br} \quad \text{Pd(PPh}_3)_4, \text{Na}_2\text{CO}_3 (aq), \text{1,4-dioxane, 80}\,\text{°C} \]  
\[ \text{B) } \quad \text{1) LDA, HMPA then TMSCl} \]  
\[ \text{2) heat} \] 

B) \[ \text{Thienyl-B(OH)_2} \quad \text{O} \]  

C) \[ \text{MesN} \]  
\[ \text{Cl} \]  
\[ \text{NMe_2} \]  
\[ \text{RuC} = \text{Ph} \]  
\[ \text{P(Cy)_3} \]  
\[ \text{MeO}_2 \]  
\[ \text{S} \]  
\[ \text{O} \]  
\[ \text{N} \]  
\[ \text{S} \]  

D) \[ \text{i. LiHMDS, THF} \]  
\[ \text{-78}\,\text{°C to -20}\,\text{°C} \]  
\[ \text{ii. } \text{CHO} \text{CHO} \]  
\[ \text{H} \]  
\[ \text{O} \text{Bn} \]  

E) \[ \text{NaBH}_4, \text{MeOH} \]  

F) \[ \text{heat, xylenes} \]  

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

A) \[ \text{B) } \]  

B) \[ \text{Et} \]  
\[ \text{Et} \]  
\[ \text{Et} \]  
\[ \text{Et} \]  

C) \[ \text{D) } \]  

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

4) In the following synthetic route, **provide the missing reagents, intermediates, and mechanisms** as indicated (40 points).

Please provide reasonable reaction mechanisms for the Sml₂ mediated transformation to give Intermediate B (Mechanism A) and the reaction involving diphenyl phosphoryl azide (Mechanism B).
5) **Propose an efficient racemic synthesis of Prozac starting from benzaldehyde.** Hint: your synthesis should be less than 9 steps. **(20 points)**