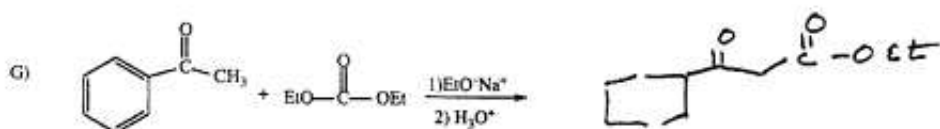
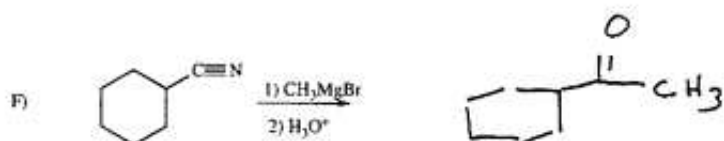
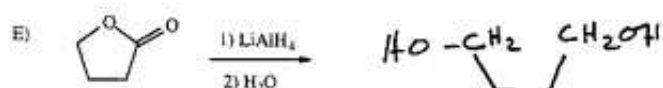
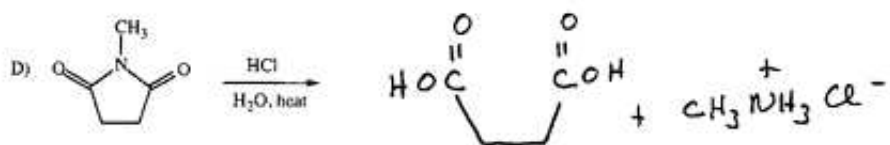
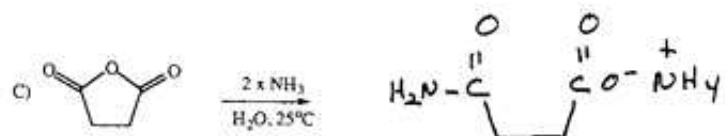
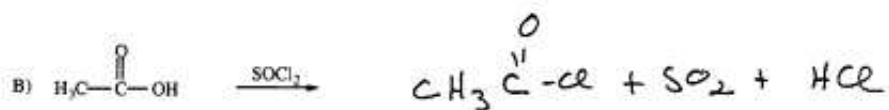
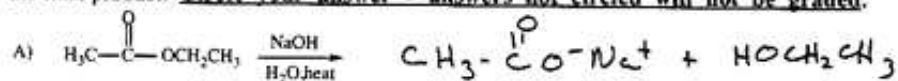
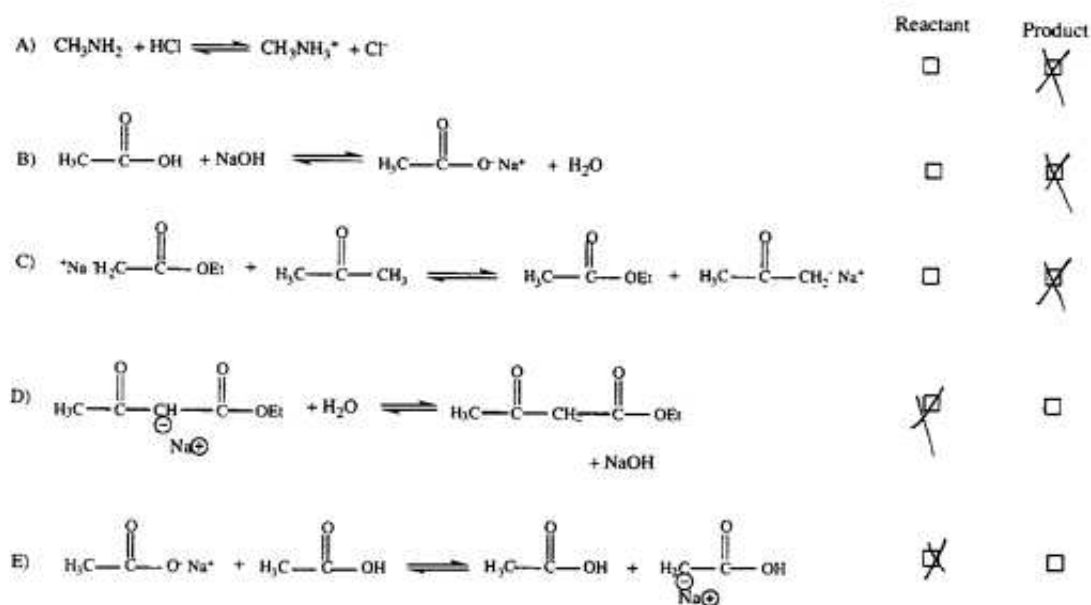


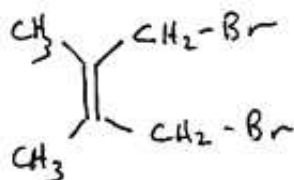
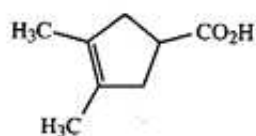
**Problem 1. (40 points)** Give the products for the following reactions. If there is more than 1 step, just give the final product. Circle your answer - answers not circled will not be graded.



**Problem 2. (10 points).** For the following reactions, check the following box to indicate if the equilibrium position lies towards the reactants or the products.



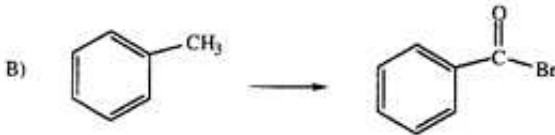
**Problem 3. (10 points)** Using the malonic ester synthesis, what compound would you add to diethylmalonate to give the following product - **you do not need to show the synthesis**. Circle the compound that you would use.



**Problem 4. (30 points)** What reagents would you use to carry out the following reactions. More than one step may be required but no more than 4 steps are required. If more than one step is required, number each step. Circle the reagents. Do not give intermediate products. Do not give the synthesis of the reagents.



- 1) Mg
- 2) CO<sub>2</sub>
- 3) H<sub>3</sub>O<sup>+</sup>
- 4) PBr<sub>3</sub> / Br<sub>2</sub>



- 1) KMnO<sub>4</sub>
- 2) PBr<sub>3</sub>



- 1) CH<sub>3</sub>MgBr (excess)
- 2) H<sub>3</sub>O<sup>+</sup>

**Problem 5. (10 points)** Show how you would carry out the following transformation.

