1. (25 pts) Complete the following reactions, clearly indicating stereochemistry where appropriate. If a mixture of diastereomers is formed, draw all the products. If a mixture of enantiomers is formed, draw one enantiomer only, and add the phrase " + enantiomer ".

a)
$$CO_2^{\bigcirc}$$
 C_6H_5COCI C_6H_5COCI C_6H_5COCI C_6H_5COCI C_6H_5COCI C_6H_5COCI C_6H_5COCI C_6H_5COCI C_6H_5COCI C_6H_5COCI

b)
$$N - O \longrightarrow 1$$
 Er_2 , $FeBr_3 \longrightarrow 2$. PCl_3

c)
$$H_3C$$
 $CH_2CH_3 + C_6H_5NH_2$ heat $(C_{13}H_{15}N)$

d)
$$H_3N$$
 H_3C H H O H H O heat

2. (5 pts). Draw a <u>Haworth Projection</u> of α -D-Mannose. Mannose is epimeric with D-glucose at C-2.