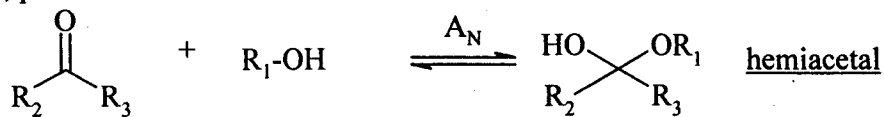


2. Nucleophilic addition of 1 mole of alcohol,  $R_1OH$ , to a carbonyl compound,  $R_2COR_3$ , produces a hemiacetal:



However, in the presence of excess alcohol, the hemiacetal reacts further to form an acetal:



Write a detailed, step-by-step mechanism for the conversion of the hemiacetal to the acetal, under acid catalysed conditions. Do not skip or abbreviate any steps. Make sure to use equilibrium arrows when necessary. (8 marks)

