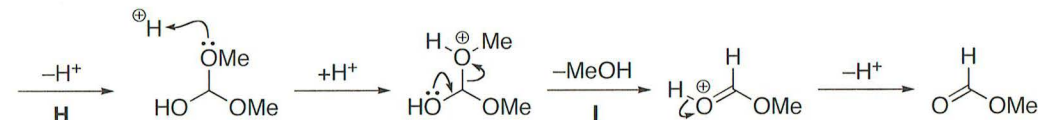
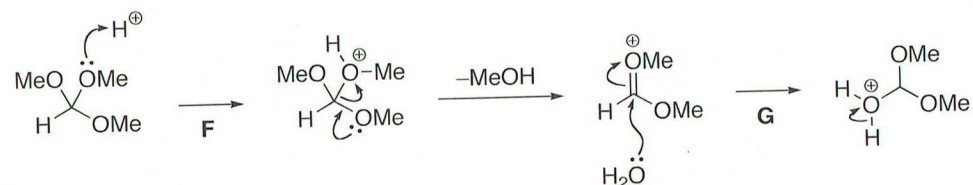
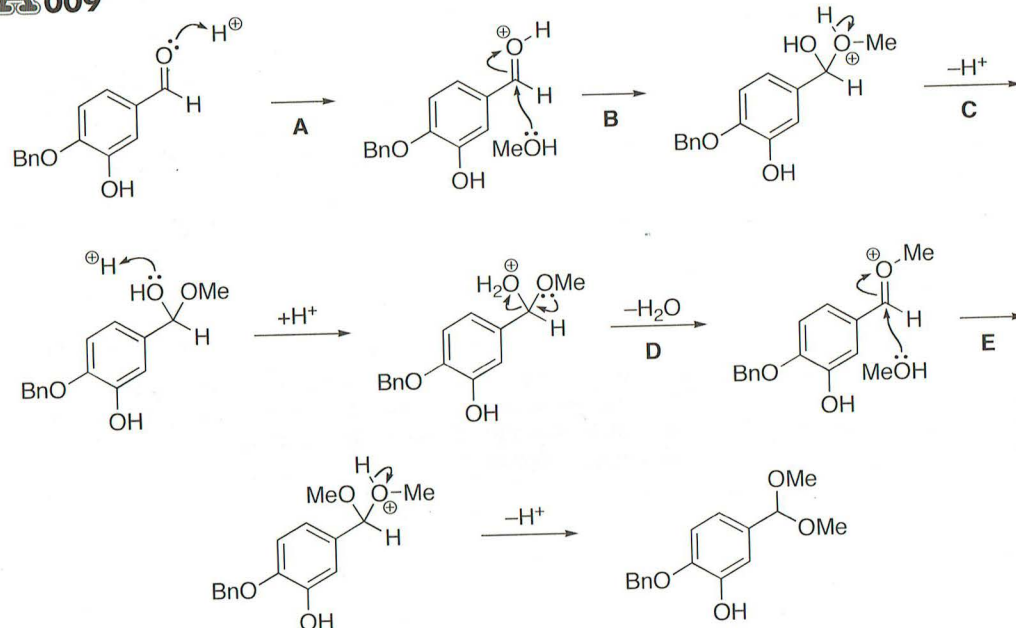


Daignault, R. A.; Eliel, E. L. *Org. Synth., Coll. Vol. V* **1973**, 303.

A: Activation of the carbonyl group by protonation. **B:** Addition of ethylene glycol to the activated carbonyl group. **C:** Proton transfer. **D:** Elimination of water helped by the oxygen lone pair. **E:** Intramolecular addition of the second hydroxy group.

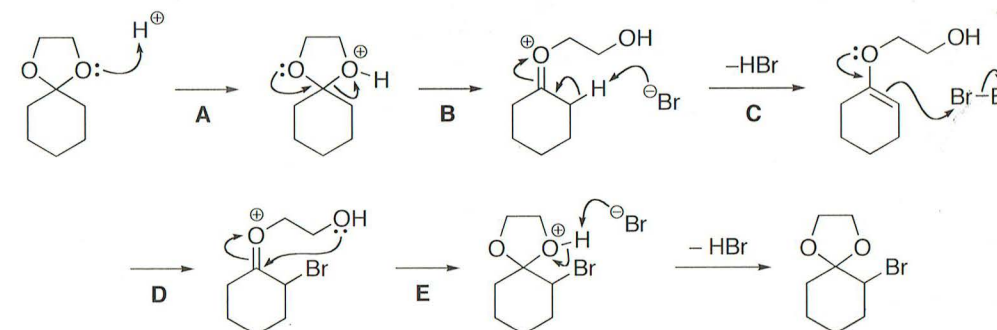
A009



Baker, R.; Cooke, N. G.; Humphrey, G. R.; Wright, S. H. B.; Hirshfield, J. *J. Chem. Soc., Chem. Commun.* **1987**, 1102.

A: Activation of the carbonyl group by protonation. **B:** Addition of MeOH to the activated carbonyl group. **C:** Proton transfer. **D:** Elimination of water helped by the oxygen lone pair. **E:** Addition of MeOH and deprotonation to form a dimethyl acetal. **F:** Trimethyl orthoformate serves as a scavenger of water to shift the equilibrium to the product side. Protonation followed by elimination of MeOH. **G:** Addition of water. **H:** Proton transfer. **I:** Elimination of MeOH followed by deprotonation to form HCO₂Me.

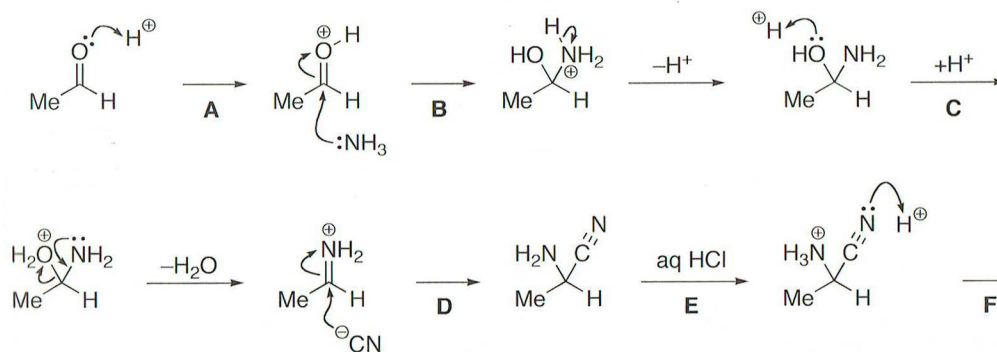
A010

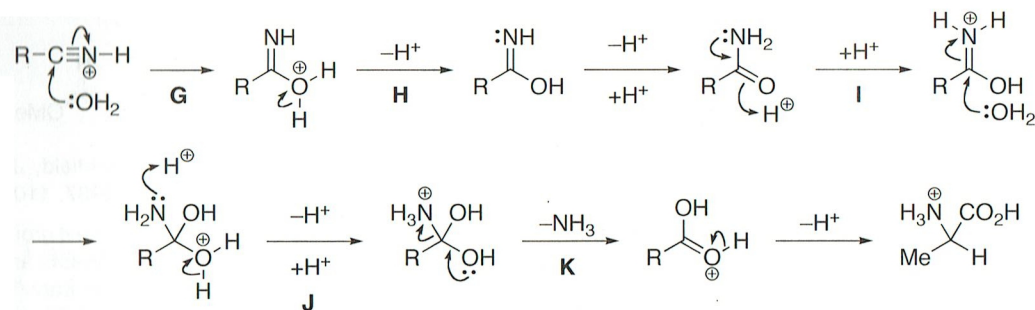


Aben, R. W. M.; Hanneman, E. J. M.; Scheeren, J. M. *Syn. Commun.* **1980**, 10, 821.

A: Protonation. **B:** Cleavage of the dioxolane ring helped by the oxygen lone pair. **C:** Deprotonation to form an enol ether. **D:** Bromination of the electron-rich enol ether. **E:** Intramolecular addition of the hydroxy group. Opening of the dioxolane ring of the product is more difficult because of the electron-withdrawing bromine atom.

A011

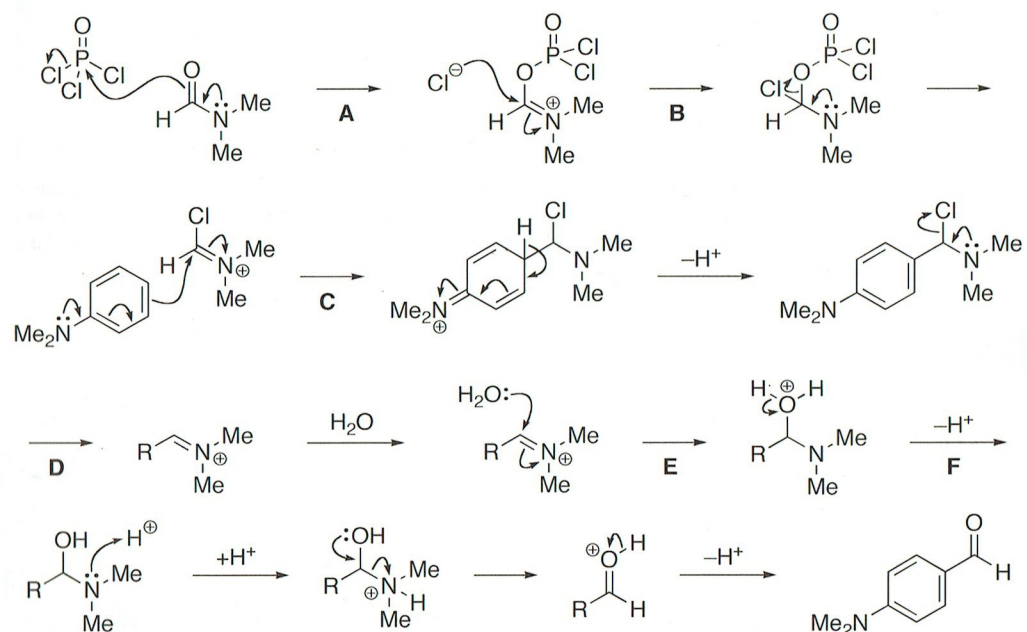




Kendall, E. C.; McKenzie, B. F. *Org. Synth., Coll. Vol. I* **1941**, 21.

Strecker amino acid synthesis. **A**: Protonation of the carbonyl group. **B**: Addition of NH_3 to the carbonyl group followed by deprotonation to form a hemiaminal. **C**: Protonation followed by elimination of water is helped by the nitrogen lone pair to form an iminium ion. **D**: Addition of a cyanide ion to form an aminonitrile. **E**: Acidic hydrolysis of the nitrile. The amino group is protonated throughout the reaction. **F**: Protonation of the nitrile to form a reactive nitrilium ion. **G**: Addition of water to the nitrilium ion. **H**: Deprotonation and tautomerization. **I**: Protonation of the resulting amide followed by addition of water. **J**: Proton transfer. **K**: Elimination of NH_3 followed by deprotonation to form the product.

A012

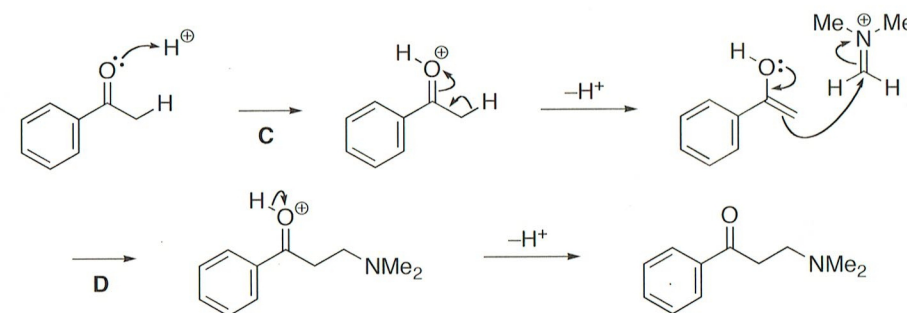
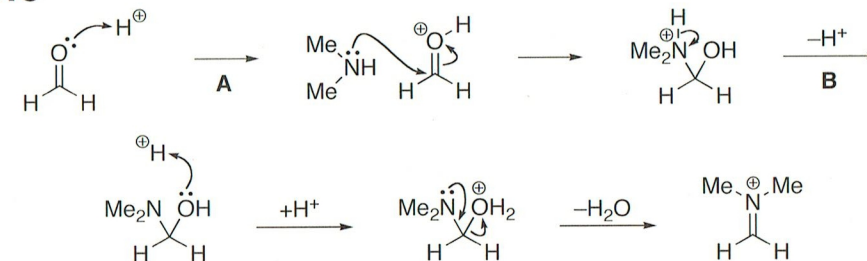


Campaigne, E.; Archer, W. L. *Org. Synth., Coll. Vol. IV* **1963**, 331.

Vilsmeier reaction. **A**: The electron-rich oxygen of DMF attacks POCl_3 (oxygen of amides is generally more reactive toward electrophiles under neutral conditions). **B**: Addition of chloride ion followed by

elimination of a dichlorophosphate ion to form the Vilsmeier reagent. **C**: Addition of an electron-rich aromatic ring to Vilsmeier reagent followed by rearomatization. **D**: Elimination of chloride ion helped by the nitrogen lone pair leads to the formation of an iminium ion. **E**: Addition of water to the iminium ion. **F**: Proton transfer followed by elimination of Me_2NH .

A013



Maxwell, C. E. *Org. Synth., Coll. Vol. III* **1955**, 305.

Mannich reaction. **A**: Protonation of formaldehyde followed by addition of Me_2NH to the carbonyl group. **B**: Proton transfer followed by elimination of water to form an iminium ion. **C**: Tautomerization of the ketone to form an enol. **D**: Attack of the electron-rich enol to the iminium ion.

A014

