Isomerization reactions of glucose were catalyzed by different types of commercial zeolites in methanol and water in two reaction steps. The most active catalyst was zeolite Y, which was found to be more active than the zeolites beta, ZSM-5, and mordenite. The novel reaction pathway involves glucose isomerization to fructose and subsequent reaction with methanol to form methyl fructoside (step 1), followed by hydrolysis to reform fructose after water addition (step 2). NMR analysis with (13)C-labeled sugars confirmed this reaction pathway. Conversion of glucose for 1 h at 120 °C with H-USY (Si/Al = 6) gave a remarkable 55% yield of fructose after the second reaction step. A main advantage of applying alcohol media and a catalyst that combines Brønsted and Lewis acid sites is that glucose is isomerized to fructose at low temperatures, while direct conversion to industrially important chemicals like alkyl levulinates is viable at higher temperatures.