Simulations of combustion and reactive flows often exhibit numerical stiffness in the equations governing chemical kinetics. Explicit solvers for these equations offer low computational expense, but typically cannot efficiently handle stiff systems of differential equations. In contrast, implicit methods demand greater expense but offer unconditional stability-as a result, most non-DNS reactive flow solvers rely on these methods by default. However, explicit or stabilized explicit methods can instead be used to reduce the computational expense while remaining stable and accurate if the chemical kinetics systems exhibit low-to-moderate stiffness. This study aims to investigate stiffness quantification metrics, with the goal of identifying one capable of efficiently and robustly determining the appropriate category of integrator required. Methods of measuring the stiffness of chemical kinetics states will be investigated and applied to simulations of hydrogen and carbon monoxide autoignition using initial conditions obtained from a partially stirred reactor simulation. The stiffness quantification metrics will be compared to the time required to integrate each time step using implicit methods, and the maximum allowable time step using explicit methods.