Ion-molecule reactions with CF$_3$ radical$^1$ THOMAS M. MILLER, NICHOLAS S. SHUMAN, JUSTIN P. WIENS, JORDAN C. SAWYER, OSCAR MARTINEZ JR., SHAUN G. ARD, ALBERT A. VIGGIANO, Air Force Research Laboratory — The first measurements of reaction rate coefficients and products are reported for reactions of the radical CF$_3$ with Ar$^+$, Xe$^+$, O$_2^+$, NO$^+$, CO$_2^+$, and C$_2$F$_5^+$, at 300 K. The work was carried out in a fast flow of typically 1.5 Torr helium buffer gas (4% argon) using the variable electron and neutral density attachment mass spectrometry (VENDAMS) technique. CF$_3$ was produced via dissociative electron attachment to CF$_3$I, resulting in CF$_3$ concentrations that were well-quantified because the plasma diffusion rate, the electron concentration, and the rate coefficient for attachment to CF$_3$I were separately measured in the experiment. The Ar$^+$ + CF$_3$ reaction was found to proceed at nearly the calculated collisional rate coefficient, yielding 90% CF$_2^+$ along with CF$_3^+$. Reaction of CF$_3$ with C$_2$F$_5^+$ is slower and yields 75% C$_2$F$_4^+$ along with CF$_3^+$. CF$_3$ undergoes charge transfer reaction with Xe$^+$, O$_2^+$, NO$^+$, and CO$_2^+$, yielding CF$_3^+$. Arguments will be made regarding reaction mechanisms, including the role of spin conservation. Comparisons with Ar$^+$ and O$_2^+$ reaction with CH$_3$ will be made.

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