The rotational spectra of IO in vibrational states up to \( v = 13 \) in the \( X_1^2\Pi_{3/2} \) state and up to \( v = 9 \) in the \( X_2^2\Pi_{3/2} \) state have been observed in an O\(_2\) DC discharge over molecular I\(_2\). In addition, \(^{18}\)O\(_2\) has been observed for both the \( X_1 \) and \( X_2 \) states up to \( v = 5 \). All data have been analyzed simultaneously with fixed isotopic ratios among the constants. This provides the first high resolution data for the \( X_2 \) state and for \(^{18}\)O. vibrationally hot BrO has also been observed in an O\(_2\) DC discharge which contains a small amount of Br\(_2\). The BrO measurements are still in progress and have been extended to \( v = 6 \) for the \( X_1^2\Pi_{3/2} \) state and to \( v = 3 \) for the \( X_2^2\Pi_{1/2} \) state of the \(^{36}\)O species. Br\(^{18}\)O spectra for the vibrational ground state of both the \( X_1 \) and \( X_2 \) states as well as \( v = 1 \) of the \( X_1 \) state are included in a simultaneous fit of all eight isotopomers. Extensive sets of parameters have been derived for both IO and BrO. These will be interpreted in terms of the electronic structure and the interatomic potential and compared with those of related molecules.