Properties of low-pressure inductively coupled argon, oxygen, and Ar/O₂ mixture plasmas were investigated using optical emission spectroscopy (OES) and an rf-compensated Langmuir probe measurement. The electron energy probability function (EEPF), the electron density and electron temperature were obtained by using an rf-compensated Langmuir probe. The electron temperature was also obtained by OES models and compared with that measured by the probe. We evaluated the excitation temperature (T_{exc}) and electron temperature (T_e) in our plasmas by using the conventional and the modified Boltzmann plot method, respectively. We obtain two Boltzmann plots (conventional and modified) corresponding to plasmas with high argon content at low pressure, and show the change of T_e as functions of pressure, argon content, and power. The values of T_{exc} are found to be a little less than those of T_e. However, both the plots give a reasonable estimation of T_e and exhibit a similar trend of change with operating parameters. We have found that, in general, T_e decreases with growing pressure and slightly decreases with argon content and power. The electron temperature is observed to decrease with power and with pressure and also observed to decrease with the Ar content. The EEPF in pure Ar plasmas shows a nearly Maxwellian. The EEPFs of oxygen discharges exhibit a rapid change with pressure due to many molecular collision processes. From pure Ar to Ar/O₂ plasmas, the EEPF shows similar characteristics as in pure Ar plasmas, i.e. more depletion in the high-energy tail as the pressure increases. The Ar metastable density is also calculated based on the optical transition model. In Ar/O₂ discharges, the dissociation fraction of molecules is estimated using optical emission actinometry. The dissociation fraction is observed to increase with the Ar content.