

We use the basic techniques of general relativity to introduce black hole thermodynamics and directly address its relationship with classical thermodynamics. We give as many results explicitly calculated or directly cited as possible to make this thesis useful as a reference work. These results include calculation of surface gravity for a general spherical black hole and evaluation of Euclidean action for simple spacetimes, with the latter enabling one to fix the Bekenstein–Hawking formula for black hole entropy. We then consider the black hole phase transitions and give novel results showing that under simplifying assumptions Schwarzschild-AdS black hole is the only possible static black hole obeying the abridged virial expansion equation of state in the extended phase space.