Abstract Submitted
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The Chemical Potential THOMAS KAPLAN, Michigan State University — The definition of the fundamental quantity, the chemical potential (c.p.), is confused in the literature, there being at least three distinct definitions in various books and papers. Major differences among them can occur for finite systems. We resolve the situation by arguing that the chemical potential defined by the symbol μ conventionally appearing in the grand canonical density operator is the uniquely correct definition, the grand canonical ensemble being the only one of the various ensembles usually discussed (microcanonical, canonical, Gibbs, grand canonical) that is appropriate for statistical thermodynamics, whenever the c.p. is physically relevant. The derivation of the zero-temperature limit of this μ for rather general interacting-electron systems by Perdew et. al.,[1] is discussed and extended. The enormous finite-size corrections (in systems $>>$ a cm^3) for one rather common definition of the c.p., found by Shegelski [2] within the standard effective mass model of an ideal intrinsic semiconductor, are discussed. The quantum dot is mentioned as a small-system application.

1. J. F. Perdew et. al., Phys. Rev. Lett. **23**, 1691 (1982); J. F. Perdew, in *Density-functional methods in Physics*, edited by R. M. Dreizler and J. da Providencia, Plenum Press, 1985.
2. M. R. A. Shegelski, Solid State Commun. **38**, 351 (1986); Am. J. Phys. **72**, 676 (2004).

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