

4.1 Introduction

Quantum ideas occupy such a pivotal position in physics that different notations and algebras appropriate to each field have been developed. In the spirit of this book, only those formulas that are commonly present in undergraduate courses and that can be simply presented in tabular form are included here. For example, much of the detail of atomic spectroscopy and of specific perturbation analyses has been omitted, as have ideas from the somewhat specialised field of quantum electrodynamics. Traditionally, quantum physics is understood through standard “toy” problems, such as the potential step and the one-dimensional harmonic oscillator, and these are reproduced here. Operators are distinguished from observables using the “hat” notation, so that the momentum observable, p_x , has the operator $\hat{p}_x = -i\hbar\partial/\partial x$.

For clarity, many relations that can be generalised to three dimensions in an obvious way have been stated in their one-dimensional form, and wavefunctions are implicitly taken as normalised functions of space and time unless otherwise stated. With the exception of the last panel, all equations should be taken as nonrelativistic, so that “total energy” is the sum of potential and kinetic energies, excluding the rest mass energy.