I. Materials provided

This module contains the following materials:

- A set of 6 lesson manuals, in the folder "Lesson Manuals"
- A number of lab forms, in the folder "Labs". These are both specific labs, and two general lab forms. The general forms are for students to design their own lab reports.
- Resource files for each lesson, in the folder "Resources". These contain both archived web pages and a number of public domain simulation programs.

II. Scope and content of lesson manuals

Content

The lesson manuals contain the following sections

I. New Concepts: a set of new terms that students need to memorize
II. Main Points: A summary of the main content of the lesson.
III. "Fill in the blank" and multiple choice versions of a reading quiz.
IV. Suggestions for lecture demonstrations.
V. Suggestions for student activities.
VI. Suggestions for labs.
VII. A summary of main stages in the history of the lesson topics
VIII. A list of online resources, including webpages and simulation programs, some of them archived in the "resouces" folder.

Textbook and Copy Right Disclaimer

The manuals do not require or favor any particular text book. As instructor, you can either choose your own text, or let students work with online resources. We have included number of archive files from sites, which did not post explicit copyright restrictions. These are for your personal information only, and you should not assume that they can be distributed to students without obtaining permission. All included simulation programs have either been licensed for free distribution, or have been published with complete source or executable files.

Quizzes

Most of the multiple choice questions come in two versions. One version gives a name, and asks for a description, the other version gives a description, and asks for a name. Instructors can mix both versions, and use one set for a reading quiz, and a corresponding set for the conceptual component of an exam.

Student Activities and Labs

The distinction between activities and lab is somewhat ambiguous, in that the suggested topics can be use in both categories. A lab would require more time and student contribution. We found it to be better if students are involved in designing their own lab strategy and lab reports, rather than following a detailed lay out of procedures and computations. The latter approach can be used initially, to teach students about format requirements and good practice in reporting. Once students have seen one or two detailed lab reports, they will learn more and take more interest if they are expected to come up with their own procedure and reports.

For this reason, we have provided two general lab forms, which have general sections for experiment purpose, theory, procedure, data, plots and evaluation. Students are also asked what they found most interesting, and what they would like to understand better.

Both the specific and the general forms are spreadsheets. This allows the instructor or students to embed formulas, and to automatically plot data and results, if desired. This will be useful for more advanced students. If students still need to master basics of processing data, and making simple plots, we find it to be better to have them use calculators and pencils.

Some labs already contain embedded formulas, in a special tab named "Calc." All labs have both a form to print out, and a key, in tabs named "Form" and Key".

III. Curriculum philosophy and additional resources

Our philosophy in choosing the sequence and topics of these lessons has been to expose the students to as many different approaches to quantum phenomena as possible. For this reason, we have attempted to include as many aspects and applications of quantum phenomena as possible. This approach has also been implemented in the Visual Quantum Mechanics Project from the Physics Education Research Group at Kansas State University. We have included links to their on-line simulations in most of our activities, and some labs. We recommend to use their Visual Quantum Mechanics CD, which also contains worksheets and additional instructional resources.

As has been emphasized by Aaron, the introduction of concepts from the early stages of quantum physics provides a rich field to consolidate knowledge of classical concepts, and to foster critical thinking. We have decided, however, not to follow that approach, because it severely limits the range of phenomena that can be dealt with. We would rather foster familiarity with quantum concepts on their own, through visualization and applications.

For this reason, the Bohr model is mentioned only very briefly, because it fosters thinking in inappropriate terms about bound electrons in an atom. Rather, we have attempted to reinforce the wave concept, in the choice of topics and visualizations. A collection of online resources is listed in every lesson manual. Wherever there appeared to be no copyright issue, the corresponding resource has been archived and stored in the folder "Resources".