



“Integration of Scale into Physical Chemistry and College Chemistry”

Weijie Lu and Princilla Evans-Morris, Fisk University Department of Chemistry, Nashville, TN 37208
R. P. H. Chang, Northwestern University, Dept. of Materials Science & Engineering, Evanston, IL 60208

Introduction

In the traditional undergraduate chemistry courses, the chemical and physical properties of matter are discussed at the atomic and molecular and the macro-scale levels only. The nano-modules such as “scale” and “size” from the NCLT can be perfectly fitted in the gap of the nano-meter scale, and integrated into these courses. From the viewpoint of the scale, the properties of matter are discussed from three levels: the atom/molecules, nano-meters, and microns.

Courses

Physical chemistry: the fundamental concepts and principles that are applied in all aspects of chemistry and related fields, and emphasize the connection between microscopic models and macroscopic phenomena.

College Chemistry I and II: Fundamental principles of chemistry, including atomic theory, molecular concepts, stoichiometry, gas laws and elementary thermo-chemistry.

Why we add nano?

In the physical chemistry, there is a “nano-scale” gap between the macro-properties by thermodynamics and the micro-properties by statistical thermodynamics and quantum theory.

In the college chemistry, there is a “nano-scale” gap between atomic/molecular structures and solution/solid structures.

How to add the nano?

In the Physical Chemistry course, low-dimensional carbon nanostructures (C60, nanotubes, and graphene) are introduced to demonstrate material structures from the atomic scale, to nano-meter, and to micron scale. Quantum dots are applied as the example to explain the relationships of structures-properties. The nano-science lectures are inserted after the introduction of quantum mechanics.

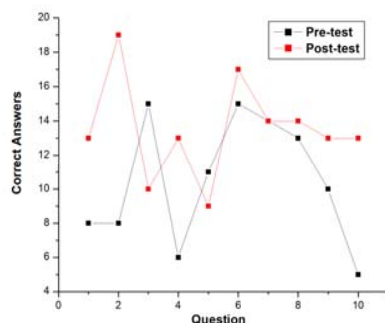
In the College Chemistry course, two NCLT modules “Surface area and volume”, and “Powers of 10 and Scales” are inserted after the atomic and molecular structures.

What is removed?

In Physical Chemistry, traditional “chemical equilibrium” is reduced, so quantum, atomic and nano-structures can be increased.

In College Chemistry, traditional element chemistry is reduced, the basic concepts of nano-structures and properties can be inserted.

Evaluations



Course: Chem114, at Fisk University, Spring 07.

Pre-test: 21 students
Ave. score: 10.5/21

Post-test: 20 students
Ave Score: 13.5/20

Conclusions and concerns

- The nano-sciences are welcomed by students at all levels
- There are many nano-modules and nano-teaching materials available.
- Nano-science perfectly fits in these chemistry courses.
- It is easy to add nano-topics at the courses, but difficult to remove some topics. The impacts on the tests, GRE, MCAT, etc, must be considered.
- Vertical integration is concerned. The existing modules may be further developed into different levels? i.e., the same module with different versions for different courses will be developed?