

**PHS 581: STRUCTURE OF MATTER AND ITS PROPERTIES** is a 3-credit course for high school teachers offered by Arizona State University (ASU) during second summer session. The course is suitable for physics, chemistry and physical science teachers.

The prerequisite is 2 semesters of algebra-based college physics. Although a semester of calculus is listed in the ASU catalog as a prerequisite, this course will not be strongly focused on mathematics. Instead, we will strive to develop a conceptual picture in each of the many topics.

PHS 581 is taught by Robert Culbertson, a regular faculty member in the Department of Physics. He is a skilled researcher in materials science, and he is committed to good teaching. Dr. Culbertson has taught this course before, and teachers rated it excellent!

See <<http://modeling.asu.edu>> for registration information.

Description:

The appearance of new materials over the past few decades has had a dramatic impact on all of our lives. These new materials are incorporated in applications that range from biologically-compatible implants to heat-resistant space shuttle tiles to high-speed electronic components in computers and cell phones. However, the general public's understanding of how these new materials are conceived and developed is relatively limited. Thus, the theme of this new course, Structure of Matter and Its Properties, will be to show the correlation between the structure, properties, and function of modern materials. This correlation is based upon the application of principles of chemistry and physics to understand and control the properties of materials. The families of materials that will be studied include metals, ceramics, polymers, semiconductors and composites.

The plan for the course is to incorporate together, lectures and discussions, classroom activities, and laboratory experiences, including demonstrations of advanced materials characterization techniques. The background useful for the course includes introductory college chemistry and physics with some application of algebra and geometry. The course will build a simple model for understanding materials by scaling the structure of matter from the atomic to the macroscopic level. The components of this model will include atomic structure, atomic bonding, crystal structure and defects, microstructure, and simplified band structure for electronic and optical properties. An important outcome will be the development, evaluation, and sharing of new resources that could be used in the classroom.

A tentative listing of topics to be studied includes:

- 1) Size and scaling of structure of material.
- 2) Families of materials and their applications
- 3) Atomic, structure, bonding and property correlations
- 4) Crystal structure and properties
- 5) Defects and microstructure in materials
- 6) Ceramic material systems
- 7) Metal and alloy systems
- 8) Polymer material systems
- 9) Composite material systems
- 10) Advanced materials and applications
- 11) Modern materials characterization techniques

The **textbook** is *Materials in Today's World*, second edition, by Peter A. Throrer (McGraw-Hill, ISBN 0-07-050711-2). Textbook information is on the PHS 581 website, <<http://phy.asu.edu/phs581-culbertson>> . In 2004, Amazon.com has new copies (special order) and some used copies. Half.com and other places are also worth checking.