Something to Think About

The ability to estimate is useful. Estimate the height of a twenty-story building.

Note from the Editor

Please send us items for future newsletters and share your teaching experiences with a note to us. If you know of anyone who would like to read the Newsletters, please inform them about the web address below. (You can use e-mail to stumpf@ohio.edu.) Your comments or suggestions are also welcome. Hard copies are no longer available. You can see the Newsletter on the web at www.phy.ohiou.edu/stnl. Look for it in September and January. It is listed in the Ohio University Department of Physics and Astronomy home page.

Why don’t you write or e-mail Burt Stumpf and tell me if these newsletters are helpful and how you use them? Any comments are welcome! Please let me know if you wish a previous newsletter.

Announcements

❖ The 2013 Southeast Ohio District Science Day will be held on Saturday, March 16, 2013. It will be held at Ohio University in Athens, Ohio. Judges are needed. Would you volunteer? Let Dr. Elizabeth Gierlowski-Kordesch know if you can help. Her email is gierlows@ohio.edu. The web address is www ohio edu/scifair/

❖ The 2013 State Science Fair will be held at Ohio State University in Columbus, Ohio, on Saturday, May 11, 2013.
- For the next **Women in Science and Engineering Workshop** at Ohio University in Athens, Ohio, please write to Dr. Tong or call him for information and application blanks. His number is 740-593-1733. [www.ohiou.edu/wise/](http://www.ohiou.edu/wise/)

- The **Ohio Chemistry Contest** will be held in October 2012. For information, call Dr. James Tong in the Ohio University Chemistry Department at 740-593-1733. [www.ohiou.edu/chemcontest/](http://www.ohiou.edu/chemcontest/)

- The **International Science and Engineering Fair** will be held in May 2013.

- The **AMERICAN ASSOCIATION OF PHYSICS TEACHERS APPALACHIAN SECTION** (Southeast Ohio, West Virginia and Western Maryland), will hold a **FALL 2012 MEETING at Ohio University in Athens**. All school and college physical science and physics teachers are welcome. Why don’t you consider joining this AAPT Section or the Ohio Section or the Southern Ohio Section? There are contributed and invited papers, tours, demonstrations, etc. that are included in the meeting. The meetings are an opportunity to meet colleagues (network) and to learn about new developments in physics and physics teaching. Call Ken Hicks at 740-593-1981 or use hicks@ohio.edu. He can provide information.

**Teaching Materials Available**

**Books and Publications**

- For the **Love of Physics**: by Walter Lewin and Warren Goldstein discusses topics such as: rainbows, astrophysics, x-rays, Newton’s Laws and others. It is published by Free Press at $26. A review is found in Science News, June 18, 2011.

- I recently came across a good book on sound and music. It is **The Physics of Sound** 3rd edition, by R.E. Berg and D.G. Stork. It is readable and doesn’t require much math. To order a copy you might try Amazon.
The May 2011 *The Physics Teacher* has a review of *The Logical Leap—Induction in Physics*, by David Harriman. It was published as a paperback in 2010 by Penguin Group at $16.

**Hitler’s Uranium Club:** The Secret Recordings at Farm Hall, 2nd edition is a book review in the April 2011 *Physics Teacher*. It is a paperback at $20 and has 384 pages. These recordings were made in England from the discussions among German scientists who were prisoners after the Second World War.

**The Information:** is a book that tells the history of information from the early alphabet. It also includes a discussion on bits and bytes. James Gleick is the author and Pantheon is the publisher in 2011. There are 526 pages at $29.95.

**Demonstrations, Equipment, Software, Conferences, Tours, etc.**

- There is an interesting article for physics labs in the May 2011 *The Physics Teacher* pages 295-297. The title is *Physics Labs with Flavor II*. It presents the ballistic pendulum, specific heat, and Newton’s Laws experiments and discusses forward and backward studies of each experiment. A similar article was written previously in the *Physics Teacher* 47, 297-301.

- **Lamda Scientific** offers a Universal Interferometer that contains the Michelson and Fabry-Perot interferometers. For information use www.lambdasys.com.

- The Undergraduate course *Powerful Ideas in Physical Science* is now available on a CD-ROM. AAPT offers it use www.thephysicsstore.com or use 301-209-3333.

- **PASCO** has a Magnetic Demonstration System. Some of the experiments are force on a current-bearing and magnetic wire. Use 1-800-772-8700 or www.pasco.com.

- There is a 90-minute seminar by Eric Mozur entitled “Confession of a Converted Lecturer” which is available. The seminar was held at the Perimeter Institute in Waterloo,

- Texas Instruments TI-Nspire Lab Station is available with the Vernier Data Quest app to take experimental data in the lab. See www.education.ti.com/us/labstation

- Tours for Middle and High School Students. The Department of Physics and Astronomy at Ohio University in Athens offers tours for classes and individual students (especially juniors and seniors visiting colleges to attend). Call Wayne Chiasson at 740-593-1712 or use chaisson@ohio.edu. We welcome teachers, parents, and students.

### New Developments in Science and Science Education

- Are you familiar with comPadre? With it, you can create, host, and maintain collections of information for use in physics and astronomy. It is an online physics library. Use www.compadre.org/portal/collections.cfm.

- PIPS (Powerful Ideas in Physical Science) is a course designed to train students who later wish to teach science in the elementary schools. For the course CD use www.aapt.org/store

- Web Assign provides: experiments that are customized, grading of the labs, and sending the grades to students. Use for information www.webassign.net/physics or 800-955-8275.

- Physics Careers Resource by The American Institute of Physics has resources for careers in physics. It includes information on employment profiles, employers, institutions, and fields. For example, it describes what B.S. physicists do. It lists what companies hired physics degree holders recently. In addition, it lists what colleges and universities have
physics degree programs. The different careers for physics are discussed. Use www.compadre.org/careers

- AAPT also has a career center. One of its purposes is to connect those who teach physics with teaching jobs. Use www.careers.aapt.org


**Feature Article**

This article was written by the Newsletter Editor Burt Stumpf, an emeritus professor of physics at Ohio University in Athens, Ohio. Burt is a member of the Acoustical Society of America and the American Association of Physics Teachers (AAPT). His B.S. in physics is from Kent State, M.S. from the University of Michigan and Ph.D. from the Illinois Institute of Technology in Chicago. He has taught both undergraduate and graduate courses in physics. Burt is the author of an advanced undergraduate text entitled Analytical Acoustics.

Here are described some earlier programs for teaching physics at the High School and University level. One might find information on them using the American Journal of Physics, The Physics Teacher, and the AAPT office at 301-209-3642 or www.aapt.org/tpt. Even though these are older programs, they have useful ideas and equipment for today.

**Earlier Innovations for Teaching Physics**

A. **For High School Physics** (Previous Programs)

In the 1960’s 70’s and 80’s there were new programs developed to teach high school physics. Two of these were PSSC Physics (Physical Science Study Committee) and Harvard Project Physics. They introduced helpful teaching philosophies and materials for teaching these.
1. **PSSC** – Physical Science Study Committee—this physics course was developed by a team of research physicists, professors, and high school teachers to emphasize the way a scientist gains knowledge and to stimulate the student to develop this method. It gives importance to experimental observation and analysis of results obtained by observation. A new textbook, lab book, films and film loops, kit-type experiments using common materials and doable at home, and enrichment books (Science Study Series) were developed. The Macalaster Scientific Company sold the materials for this complete learning package.

2. **Harvard Project Physics** – developed by Gerald Holton at Harvard, other physicists, experts on testing, teachers, and filmmakers. This course for high schools or junior colleges emphasizes the historical and cultural aspects of physics. It has a new textbook, readers, film (e.g. on the life and times of Fermi) and laboratory experiments. Its aims are: 1) to be a coherent tested course for use on a national scale; 2) to increase the enrollment in physics courses; 3) to provide teachers and students with a complete learning resources package; 4) to address itself to questions such as the philosophy of physics education, its technological aids, etc. the Holt, Rinehart, Winston Company provided the material for this course.

**B. For University Physics (Previous Programs)**

The following were developed in the past but elements of them may be useful today.

1. **R-Curriculum Physics** – among these developments is the R (Research) Curriculum giving a mature high-level approach to physics as a preparation for graduate school. It emphasizes strong training in mechanics, electricity, and magnetism, thermodynamics and statistical mechanics, and quantum physics. Reference- 2nd Ann Arbor Conference Report on college physics.

2. **S Curriculum Physics** – this curriculum is less rigorous and less analytical than the R curriculum. It is helpful for those: who wish to teach in a high school; who are peripherally interested because of their major; or who may not go to graduate school in physics. Reference- 2nd Ann Arbor Conference Report.
3. **Berkeley Physics Course** – “This is a two-year elementary college physics course for students majoring in science and engineering. The intention of the writers has been to present elementary physics as far as possible in the way in which it is used by physicists working on the forefront of their field. We sought to make a course, which would vigorously emphasize the foundations of physics. Our specific objectives were to introduce coherently into an elementary curriculum the ideas of special relativity, of quantum physics, and of statistical physics.” – Taken from Preface to the Berkeley Physics Course.

A laboratory was developed by Dr. A. Portis to go with this course. It emphasizes the principles of physics and has a basic set of electronic equipment used to illustrate principles from several areas of physics (mechanics, electricity, and magnetism, nuclear physics, etc.). This course was developed at the University of California at Berkeley.

4. **Feynman Lectures on Physics** – this is a set of textbooks at the general physics level based on lectures given by Professor Feynman at Cal Tech. There is also a once-a-week laboratory, which is part of the course. One of the purposes of the course is to maintain the enthusiasm of the more advanced students. It keeps the students’ interest up by treating physics from a modern viewpoint.

5. **Keller-Plan course** – here a student paces himself through a semester’s work e.g. made up of 15-20 units or modules. He passes a test at a given grade level before he goes to the next unit. There are study guides and review materials for each unit. Faculty and teaching assistants serve as tutors – there may be very few formal lectures. The student must complete a given number of modules at a set grade level. This system of instruction is associated with PSI (personalized system of instruction.).

**Current Innovations for Teaching Physics**

**Force Concept Inventory (FCI).** This can be used to determine the teachers’ effectiveness of their teaching. Some claim it is valid and reliable for testing what concepts these students learned in the course. See “Force Concept Inventory” *The Physics Teacher*, March 1992. The authors are David Hestenes, Malcolm Wells, and Gregg Swackhammer.
Force and Motion Conceptual Evaluation (FMCE) is another similar educational tool for evaluation of what concepts the students learned in a course.

Interactive Learning Demonstrations (ILD) go along with active learning classes. It highlights prediction, discussion before and after the demonstration and refining the conclusions from the demonstration. Ronald Thornton from Tufts University has developed these demos.

Real-Time Physics- Active Learning Laboratories is a book authored by David Sokoloff and Priscilla Laws. It complements active learning lectures and demonstrations.

Bill Reitz at Stark State College of Technology in Ohio teaches school physics using children’s literature.

Interactive Physics textbooks are now available for active learning courses. Perfection Learning is a company that publishes these.

Something to Think About-The Answer

Q. How high is a 20-story building?
A. If each floor represents the height of about 10 feet, then a 20-story building is about 200 feet tall.

Q. How many rows of bricks are in a 3-story building?
A. Since each brick is about 2 inches high we can estimate how many rows of bricks are used in a 3-story building. The height is 3 x 10 or 30 feet and each brick is 1/6 of a foot. Therefore, 30/(1/6) = 180 rows.

Note:
Give yourself some problems that involve estimation. Some who do research in learning feel that estimation is helpful for developing math skills. See for example page 68, *Time* December 12, 2011.