



NJAAPT

NEWSLETTER

New Jersey Section American Association of Physics Teachers
Dedicated to the improvement of physics teaching

Glassboro State College

All The News That's Physics To Print

September, 1991

Antarctic Icebreaker

Five high school seniors will join science teams in the Antarctic aboard a new icebreaking research ship later this year. The seniors, selected from 5000 students in the National Science Foundation's Young Scholars Program, will participate in a variety of marine science education activities and observe construction of the ship before departing for the Antarctic.

The ship, the 308-foot Nathaniel B. Palmer, is being built for the Foundation's U.S. Antarctic Program by Edison Chouest Offshore Inc., of Galliano, Louisiana. It will support science in and near antarctic sea ice, where ordinary research ships cannot operate.

Each student will be accompanied by a teacher of his or her choice on the trips to Louisiana. The teachers will be assisted in developing curriculum materials to share their experiences with students in home schools.

(Continued on page 2, col. 1)

WELCOME BACK WITH WEIRD SCIENCE

WHEN: Saturday, September 28, 1991 AT 10:00 PM

WHERE: Princeton University Plasma Physics Lab
James Forrestal Campus
Route 1, just north of Princeton

On Saturday, September 28, NJAAPT will be co-sponsoring, in conjunction with the Princeton University Plasma Physics Laboratory's Science Education Program, a delightful morning of demonstrations and discussion called "Weird Science." Presenters will be Lee Marek, Bob Lewis and DeWayne Lineman, talented chemistry and physics teachers from Illinois.

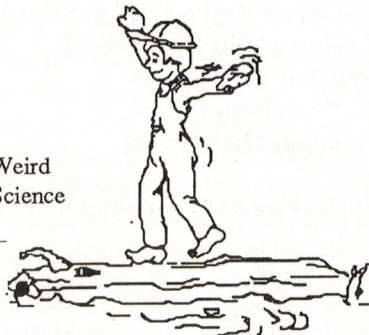
When asked to describe the program, Lee replied that he considered it the "MTV of Chemistry and Physics." How exciting will it be? Well, suffice it to say that the presenters requested a blast shield for the demonstration!

The program is open to NJAAPT members, other teachers, guests and students. Bring the chemistry and physical science teachers in your school. They'll love it!

Please preregister by calling Yvette Van Hise at the High Technology High School (908-842-8444) by September 24. This will save time when you check in at the gate to the Plasma Physics Lab. Request a map when you preregister and/or call the Plasma Physics Lab at 609-243-2107.

INSIDE ➡ ➡ ➡

Weird
Science



Weird Science.....	1
Antarctic Icebreaker	1
AAPT NE Regional Conference	2
President's Message	2
NJAAPT Physics Olympics Results ...	2
Demos.....	3

Liberty Science Center News	4
Membership Form	5
Physics Fun Problems.....	5
Call for Papers.....	6
Fermi Questions	7
Camden Cnty. Coll. Program	7

(Continued from page 1, col. 1)

In Antarctica, three of the students will join researchers studying biological productivity in the Gerlache Strait, an area of Antarctica south of Chile: Michelle Naomi Darling, 17, of Holliston, Massachusetts; Brett Castillo, 17, of Escondido, California; and Robert Swayer, III, 17, of Winnsboro, Louisiana.

Two of the students will join U.S. and Soviet scientists studying the drifting ice of the Weddell Sea in the southernmost reaches of the Atlantic: Carolyn Rose Griffith, 16, of Torrance, California; and Elizabeth Morales, 17, of El Paso, Texas.

NSF's Directorate for Education and Human Resources established the Young Scholars Program in 1988 to give students entering grades 8-12 opportunities to work with research scientists.

After being nominated by their project directors, the five students were selected by NSF based on their interest in science, their scholarship, and their leadership.

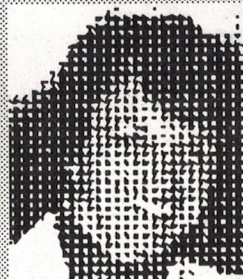
Further information may be obtained from Cheryl Dybas at 202-357-9498.

From the President

"I think I'll drop Quantum Mechanics," Robin insisted. "I'm not doing very well. I'll try it again next year."
"You'll do no such thing.

You're doing every bit as well as the men in this class. You belong in it. If you want to work on any ideas, I'm always here, but you are too good to walk away," her professor responded. In that moment, Robin did not become another statistic.

In late May, this was just Robin's story, a happy ending for one of my favorite students. But in late June, as I sat through paper after paper on Women in Physics at the AAPT meeting in Vancouver, it became instead a theme, a classic



Barbara Wolff

(Continued on page 6, col. 3)

The AAPT Northeast Regional Conference

Date: Friday - Sunday, October 18 - 20, 1991
Place: Brookhaven National Laboratory, Upton, NY

Highlights include:

The Physics of Dance
Kenneth Laws, Dickinson College
author of The Physics of Dance

Demonstration Show
The Renowned
Dick Minnix and Rae Carpenter
Virginia Military Institute

President Elect of AAPT
Jim Stith, West Point Military Academy

Blackboard Cartooning Workshop
Paul Hewett, San Francisco City College
author of Conceptual Physics

Current Research at Brookhaven Lab
Brookhaven Lab Researchers

Inexpensive housing will be available at the Lab for individuals and their families. There is also housing available at local motels. During the day on Saturday, a local tour company will be offering a sightseeing trip to New York City or to the local Long Island Wineries for conference attendees or their families.

See page 6 for a Call for Papers --->

NJAAPT Physics Olympics Results

The Annual NJAAPT Physics Olympics was held at Trenton State College on April 13, 1991. Twenty-one teams competed in seven events throughout the day. Ten trophies went to eight different schools at the awards ceremonies. The awards were as follows:

- 1st Place OverallLakewood High School
- 2nd Place Overall.....Montclair High School
- 3rd Place OverallLawrenceville School
- Bridge Building EventLacey Township High School
- Slow Bicycle Race West Essex Regional High School
- Target Shoot West Essex Regional High School
- Zero Impact Vehicle Watchung Hills High School
- Fermi Questions Montclair High School
- Egg Drop Event.....Marlboro High School
- Paper Tower Event Whippany High School

Each team is to be congratulated on their fine showing and sportsman-like conduct. Plan to bring your physics class next year.

Slow Bicycle Race



J.J. Fink
F.T. Pregger
Trenton State College

DEMO S

Swinging 2 Balls into a Block Demonstration

According to the law of conservation of momentum, when two balls having equal momenta collide successively with a block, the one that recoils with greater momentum imparts more momentum to the block, demonstrated by the fact that only this ball knocks the block over.

Equipment

A 4x4-in. block of wood; a large Super Ball, made by Wham-O; a lead (or steel) ball embedded in a piece of clay, having the same mass as the Super Ball; some string; and some wire. The proper height of the 4x4 block depends on the mass of the balls: It should be tall enough so that the Super Ball is capable of knocking it over when swung through a 90-degree arc at the end of a 0.5-meter-long string.

Construction

Using the wire, make a holder that tightly encloses the Super Ball so that it can be attached to the string and swung without coming loose. (An alternative would be to glue the string directly onto the Super Ball.) Connect one end of a 1.5-meter-long string to the Super Ball, and connect the other end to a ball of equal mass made from the lead or steel ball embedded in a spherical clump of clay. Make a loop in the center of the string to put your finger in.

Comment

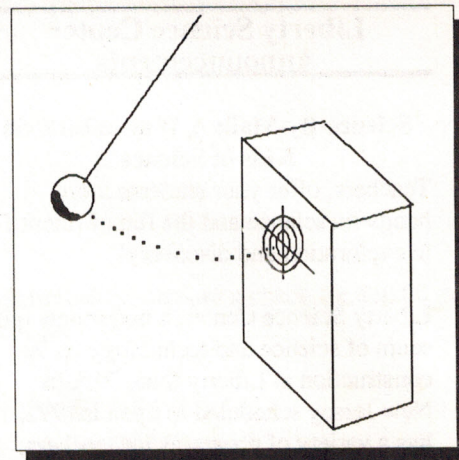
You should demonstrate that the two balls have equal masses by hanging them from the ends of a meter stick while balancing the stick on your finger at the 50-cm mark. Now hold the string loop with your finger and release the Super Ball from a 90-degree angle, swinging it into the block (see illustration). By trial and error, find out at what height on the block the Super Ball must strike in order to barely knock the block over, and make a "bull's eye" there. When you swing --->

the clay ball (starting with the same 90-degree angle) toward the bull's eye, it will give the block only half the momentum of the Super Ball and will not knock it over. The factor-of-two difference in momentum for balls with equal mass and velocity arises because the Super Ball changes its momentum from $+mv$ to $-mv$ (a change of $-2mv$), while the clay ball changes its momentum from $+mv$ to 0 (a change of $-mv$). If the clay ball tends to stick to the block, you may want to wrap it with tape or aluminum foil, so that no one will think the reason the clay ball doesn't knock the block over is that it sticks to it. Another common misconception is thinking that the clay ball doesn't knock the block over because the force on the block is reduced owing to the shock-absorbing quality of clay. It is true that the force F exerted by the clay ball is less, but the collision time dt is greater, and it is the product $F \times dt$ (the impulse) that determines the momentum given to the block. As noted previously, the Super Ball gives twice as much momentum to the block as the clay ball, so the impulse is also twice as great for the Super Ball.

An alternative way to conduct this demonstration, which works just as well, is to use a toy Ping-Pong-ball gun fired at a point near the top of a wooden beam balanced on one end. If you tape a sponge near the top of the beam, you can observe what happens when you shoot the ball into the sponge, and then see what happens when you shoot the ball against the beam itself, with the sponge flipped out of the way. Obviously, you need to use a wooden beam of such a length that the Ping-Pong ball shot against the beam (with the sponge flipped out of the way) barely knocks it over.

— Robert Ehrlich

(From the book, "Turning the World Inside Out and 174 Other Simple Physics Demonstrations" by Robert Ehrlich, Princeton University Press, 1990)



Radiometer

Demonstration

The turning vanes of a radiometer placed in a bright light illustrate the pressure due to molecular recoil.

Equipment

A radiometer (also called a pyrometer) and a light source.

Comment

The radiometer, which has vanes that are mirrored on one side and black on the other, has been evacuated to a pressure of approximately 0.01 mm of mercury. The mean free path of gas molecules at this pressure is about the size of the radiometer bulb, which allows for a particularly efficient transfer of momentum between the molecules and the vanes. When the light is exposed to a bright light, molecules incident on the hot black side gain more momentum than those incident on the cooler mirrored side, causing the black side to recoil.

An incorrect explanation often given for the rotation of the vanes is based on the different pressure of light photons on the black and mirrored sides. But this would require the vanes to rotate in the direction opposite to that actually observed, since the momentum imparted by rebounding light photons striking the mirrored side is twice that imparted by the absorbed photons striking the blackened side. In fact, this effect is negligible.

(Continued on page 6, col. 1, bottom)

Liberty Science Center Announcements

Science-By-Mail: A Way to Interest Kids in Science

Teachers, offer your students more hands-on science and the fun of scientific exploration and discovery!

Liberty Science Center, a major new museum of science and technology under construction at Liberty State Park in New Jersey scheduled to open in 1992, has a variety of programs for teachers, students, and family groups. One program, **Science-By-Mail**, gives children innovative challenges, puzzles and a central problem to solve. Liberty Science Center sends their solutions to a pen-pal scientist who replies with words of encouragement, and fosters understanding and enjoyment of science. Comments from participating scientists, teachers and students indicate that Science-By-Mail increases children's interest in science, especially when motivated teachers or parents get involved with the kids, and the groups are linked with a caring, actively participating scientist.

So get involved. This year more than 1500 children in grades 4-9 throughout New Jersey took part in this international program. Science-By-Mail will enrich your school's science curriculum or provide activities for a science club. Brochures for registration in next fall's program are available now. For more information, or an application, please phone Liberty Science Center's Education Department at 201-451-0006.

Become one of Liberty's STARS!

Liberty Science Center has asked the National Science Foundation to support STARS (Student and Teacher Access to Real Science), a program of teacher internships at the Center. Apply now to spend a sabbatical year with us learning and working alongside our staff of educators, scientists, and designers to: help create exciting science and technology exhibits, activities, and demonstrations >

for our visitors; teach informal hands-on science to visiting school groups; manage after school student science clubs and research projects. Your knowledge base will increase, your science skills multiply, and your teaching techniques change radically. You'll return to your school district to share your new-found abilities with colleagues and students. If you are an elementary or middle school educator who wants to grow professionally into someone who loves to teach science and motivates children to love science too, then contact Dr. Dana Levine, Liberty Science Center, 75 Montgomery St., Jersey City, NJ 07032, 201-451-0006.

Liberty Science Center: An Interactive Adventure for You and Your Students

The adventure kicks off at the annual New Jersey Science Teachers Convention on October 1st and 2nd. Check out the **Center's** live science demonstrations and workshops, get a behind-the-scenes glimpse of our construction site, take an imaginary visit to the **Center** as seen through the eyes of a youngster, and be sure to pick up a packet on how to arrange for a class trip. And don't forget to learn about our **Science Design**

Partnership, a project that asks you and your students to create science and technology exhibits that we will feature at our opening. You'll have a chance to win cash prizes to be redeemed for science equipment, free class visits to the **Center**, and a **Liberty Science Center** T-shirt. For more information, stop by our exhibit booth at the convention.

Science Sampler

Liberty Science Center would like to announce the second year of Science Sampler. Science Sampler is a series of ten hands-on science workshops for elementary and middle school educators. This program will be held at Jersey City State College once a month from 4:00-6:00 PM beginning September 26, 1991. Following >

is the title of each session together with its date and a brief description:

Sounds Around.....Sept. 24, 1991
Build simple musical instruments. Discover how sounds are created and travel through the air.

Light FantasticOct. 15, 1991
Make a pinhole camera to find out how our eye works. Construct a spectroscope to see how light separates into the visible spectrum.

KaleidoscopesNov. 12, 1991
Investigate how light travels and why mirrors reflect light. Build a kaleidoscope and learn how it works.

Circuit CircusDec. 3, 1991
Discover the many ways we use electricity in our lives. Investigate how electrical energy can be converted into light, heat and sound.

More than Magnifiers.....Jan. 21, 1992
Build several optical instruments to explore to explore the property and functions of lenses.

Amazing Magnets.....Feb. 11, 1992
Demystify magnetism by looking at what a magnet is, then carry out experiments with magnets.

Rain or ShineMar. 3, 1992
Learn how air, water and heat combine to generate our weather. Build simple weather instruments to investigate meteorology.

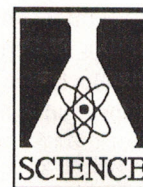
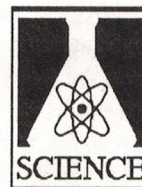
Up, Up and AwayMar. 24, 1992
Find out why an airplane flies by examining air's buoyancy. Build a windmill and use the power of the wind to generate work.

Heaven's AboveApr. 7, 1992
Learn more about our solar system and the stars in Starlab, Liberty Science Center's portable planetarium.

Mystery MatterApr. 28, 1992
Investigate the properties of a strange substance from a distant "planet." Convert another little-known substance from a liquid to solid.

For a more complete description of the workshops, contact Levelle Alexander, Education Department, Liberty Science Center, 75 Montgomery St - Fifth Floor Jersey City, NJ 07302 or call 201-451-0006. You may also contact CATALYST at Jersey City State College, 201-547-3094 and ask for a registration form.

Registration fee is \$15 per workshop. All workshops are limited to twenty people. Workshops will be cancelled if there is insufficient registration. Academic credit possible, if you participate in the entire series.



American Association of Physics Teachers
New Jersey Section

1990-91 NJAAPT DUES
DUE AT THIS TIME

NJAAAPT MEMBERSHIP FORM

Check your mailing label. If it doesn't say 91-92, then your dues are due! Please fill out the form below, enclose a check for \$10.00 (3-year membership, \$25) made out to NJAAAPT and mail it to:

CHARLES BRESNAHAN
1396 RATZER ROAD
WAYNE, NJ 07470

YOUR NAME _____ EMPLOYER'S (school) NAME _____
HOME ADDRESS _____ EMPLOYER'S (school) ADDRESS _____
_____ ZIP _____ _____ ZIP _____

COUNTY _____ COUNTY _____

CHECK AS APPROPRIATE: INDUSTRY _____ FOUR YEAR COLL./UNIV. _____ COMMUNITY COLL. _____
PRE-COLL. _____ RETIRED _____

Please list courses you teach and level _____

HOME PHONE (____) _____ SCHOOL PHONE (____) _____
(If you would rather not have your phone number included in the directory (expected in December), check here _____)

If you would be interested in joining a mini-workshop/sharing group (new teachers are particularly welcome), please check one or more of the following locations: 1. No. Hunterdon _____ 2. Madison _____ 3. Monmouth _____ 4. Dumont _____
5. Voorhees _____ 6. Lawrenceville-Princeton _____ 7. Rutgers University _____ 8. Toms River _____ 9. Randolph _____
10. Stockton State College (Pomona) _____ Other (specify) _____

(It may be desirable to check two choices in case your first choice does not get started)

Please list the names and schools of other teachers who should be contacted: _____

PHYSICS FUN PROBLEMS

By Dan Kraft, West Deptford High School

Dan Kraft's Physics Fun problem is unavailable today, so we have substituted two problems chosen, almost at random, from H.E. Dudeney's book entitled, "Amusements in Mathematics." The book was first published by Dover in 1958, but it "is an unabridged and unaltered republication of the work originally published by Thomas Nelson & Sons, Ltd., in 1917."

A boy, recently home from school, wished to give his father an exhibition of his precocity. He pushed a large circular table into the corner of the room, so that it touched both walls, and he then pointed to a spot of ink on the extreme edge. "Here is a little puzzle for you, pater," said the youth. "That spot is exactly 8 inches from one wall and 9 inches from the other. Can you tell me the diameter of the table without measuring it?" Can you help out the boy's father?

In a much abbreviated form, the second problem states that four 5's can represent 100 by using simple arithmetic signs as follows $(5+5) \times (5+5) = 100$. You can also use four 9's by writing $99 + 99/99 = 100$. But can you write 100 with four 7's using only simple arithmetic signs??

Call for Papers


Take advantage of this opportunity to attend a regional conference and meet with other teachers from the Northeast Region. Having such a large conference, allows us to bring in speakers we would not normally invite. We have some exciting things going on in physics and physics education in the Northeast. Come out and hear some of these ideas and why not share some thoughts of your own? Those wishing to present a 15-minute paper at the conference should submit an abstract to the address listed below. The deadline for abstracts is July 30, 1991. (Too late now since this newsletter was scheduled to go out in September! However, check with one of the people named below just in case they can still use your abstract.) Suggested topics include (but are not limited to) the following: Physics of War, Current Research, Computers in the Classroom and Lab, AP Physics, Independent Science Research Ideas, Physics in Industry, Problem Solving During Recitation Sessions.

Anyone wishing to present a workshop should send the information to the address listed below. Workshops will be held on Sunday morning.

Abstracts and workshop ideas should be sent to:

Marty Schnittman
P.O. Box 2653
Huntington Station, NY 11746-0508


If you have any questions, call one of the following: Jane Schoch, 516-226-7936; Carole Escobar, 516-588-3365; or Marty Schnittman, 516-351-4887.

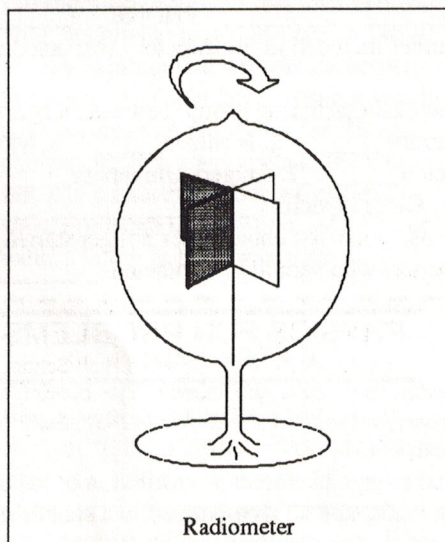
This event is sponsored by: Long Island Physics Teachers Association; New Jersey Section; South Eastern Pennsylvania Section; New York Physics Club. 

(Continued from page 3, col. 3)

ble, because although the photons carry a lot of energy, they carry little momentum compared to the gas molecules. Photons carry little momentum for their energy compared to molecules because the momentum-to-energy ratio of photons is $1/c$ (where c is the speed of light), while for molecules of velocity v much less than c , the ratio is $2/v$.

— Robert Ehrlich

(From the book, "Turning the World Inside Out and 174 Other Simple Physics Demonstrations" by Robert Ehrlich, Princeton University Press, 1990) 




story which all too often did not have a happy ending. We, all of us, female as well as male, high school as well as college must become sensitive to the special mental set that too often prevents women from staying in physics. Too much is known for us to claim innocence. We are now making an active choice in letting women go.

At the conference, there were 23 major problems for women in physics that were discussed. The most obvious was sexual harassment by teachers and peers, psychological as well as physical. Far more insidious, however, are a female student's inner doubts which are so different from male classmates. As we talked after the session, almost every teacher suddenly had a story of a student who was ready to drop out, feeling she was unable to master physics well enough to major in it, while male classmates doing far worse had no such qualms.

Time and energy will no doubt be spent on the whys. I propose, rather, that we focus on what to do **NOW** to protect and retain the young women in our classes. In a way, it is like confronting a burning house. We can immediately focus on what fault in the wiring caused the blaze or we can first put out the fire and save what we can. Intellectually, women tend to look at the cup half empty rather than the cup half full. They focus not on the 70% they have mastered, but rather worry that the missing 30% indicates that they are out of their depths. We must develop the skills to connect to them specifically. We must choose to take the time to reach out to our women and assure them that 70% is enough, that perfect mastery of the concepts on first try is not not what their male classmates are experiencing and is not an indicator of their ability to be a physicist. We must make time to talk to them, one on one, and tell them that what they are experiencing is not singular, but common to many women and must be overcome for our sakes as well as theirs.

Is it "fair" to give women this extra attention? "Fair" is an interesting con-

(Continued on next page, col. 1)

cept. To a 9-year old it means everyone gets the same. It's not "fair" if an older sister drives or a younger brother gets a rattle. Hopefully, we have arrived at a more mature and realistic definition of "fair" without a special awareness on our part and unless we act on that awareness, our women will leave. They will be deprived of a career in physics. We will be deprived of teaching them, and the young men in their classes might well be deprived of the very colleagues they need to help them reach their fullest potential. Perhaps it is only "fair" to all of us if we do make sure we retain our women in physics. 

— Barbara Wolff

Fermi Questions

A set of ten "Fermi Questions" was included as an event in this year's New Jersey Olympics at Trenton State College on April 13. Each team had 50 minutes to answer the ten questions. They were not permitted to use calculators nor reference material other than what was given with the set of questions. Therefore they were forced to round off numbers, work with powers of ten, and make estimates in order to get results to the correct order of magnitude.

Five of the ten questions we used are given below. Try them on your students and see how well they do. After that, invent your own questions as we did these. Estimating in this way is a very useful skill in many fields of endeavor, not just physics.

F.T. Pregger
J.J. Fink
Trenton State College

Editor's note: Answers will appear in the next issue of this newsletter. If you can't wait and would like a copy of all ten answers, please send a stamped self-addressed envelope to: Judson J. Fink, Physics Department, Trenton State College, P.O. Box 4700, Trenton, NJ 08650-4700.

Take no more than 25 minutes for the five questions and put your answers in order of magnitude format:

(Continued on last page, col. 1)

Opportunity for Members of NJAAPT

On Friday, November 8, coincident with the NEA conference being held in Atlantic City, the Physics/Lasers faculty, staff, and adjunct faculty of Camden County College in Blackwood, NJ will host a program for Physics Teachers, their friends and guests. Workshops will take place in the new LITER (Laser Institute for Technological Education and Research) building.

These workshops are designed to pre-acquaint registrants with activities and demonstrations that student groups would expect to encounter on a field trip to the Laser facility at CCC. The physics teacher that clues these guys before they arrive on what to observe and why, will (naturally) become a hero(ine) to them.

A nominal cost for "Lunch and Lab" is anticipated. Please watch for further details and a pre-registration sheet. The Physics faculty, staff, and adjunct faculty at CCC hopes that you will set aside the date and will plan to visit us in November.

For further information, contact Michelle L. Brill, Camden County College- Room Taft 203, P.O. Box 200, Blackwood, NJ 08012. (609-227-7200, ext. 474). Please leave a message if no answer.

Preliminary Schedule

- 10:45 AM..... Registration in the lobby of the LITER building
- 11:00 Welcoming address by Dr. Fred P. Seeber, CCC Laser Curriculum Coordinator and Physics Department Chair
He will speak on "Lasers in the 21st Century." Dr. Seeber is nationally known as an LIA Board member and Course Developer.
- 12:00 noon Lunch Break. Lunch will be provided in the Lounge Area.
- 1:00 PM First Workshop
Registrants select a "hands-on" workshop to attend at one of the following "stations":
 - A. Optics in the "Freshman" wing
 - B. Lasers in the "Hi Power" wing
 - C. Fiber Optics in the "Fiber Optic Area"
 - D. To be announced (possibly CIM related)
- 2:00 Second Workshop
Registrants attend a second choice from above listing
- 3:00 Wind-up and Open House
- 3:30 End



I LOVE lasers and fiber optics!

(Continued from page 7, col. 1)

Given Information:

- Surface area of a sphere $-4\pi r^2$
- Volume of a sphere $-\frac{4}{3}\pi r^3$
- Radius of earth -----6278 km or 3962 mi
- Radius of earth's orbit ---149,600,000 km or 93,000,000 mi
- Population of USA -----250,000,000
- Length conversion -----39.37 in = 1. meter

1. How many square feet of astroturf is needed to cover a major league baseball playing field?
2. What fraction of an average lifetime do you spend in watching a half-hour TV show?
3. There are ten stars within ten light years of us. How many stars are within 2000 light years of us?
4. The interior dimensions of the cargo section of a truck are 20 feet long, 8 feet wide and 7 feet high. How many tennis balls could it hold? ----->

NJAAPT NEWSLETTER
 Editor: Leon P. Goldberg
 Contributors: Lucelle Alexander, Michelle Brill, Robert Ehrlich, Judson Fink, Susan Greenberg, Yvette Van Hise, Dana Levine, Fred Pregger, Barbara Wolff

NEW JERSEY SECTION
AMERICAN ASSOCIATION OF PHYSICS TEACHERS

President: Barbara Wolff, Livingston High School
 Vice President: David Maiullo, Rutgers University
 Treasurer: Charles Bresnahan, Pequannock H.S.
 Recording Secretary: Jessie Blair, Monmouth Regional H.S.
 Corresponding Secretary: Peter Lindenfeld, Rutgers University
 Mailing List Co-Ordinator: James Green, Stockton State College
 Section Representative to AAPT: Harold Lefcourt, Morris Knolls H.S.

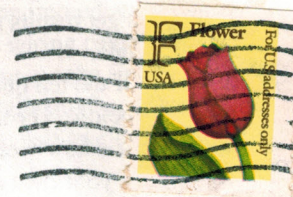
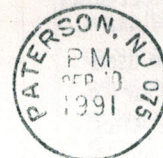
5. What is the weight of the earth's atmosphere in pounds?

Remember, answers in order of magnitude format: e.g., 10^4 , not 3×10^4 .



Pay your dues. Use form on page 5.

NJAAPT
Charles Bresnahan
1396 Ratzler Road
Wayne, NJ 07470



TO

