HOTLINE

PRINCETON PLASMA PHYSICS LABORATORY

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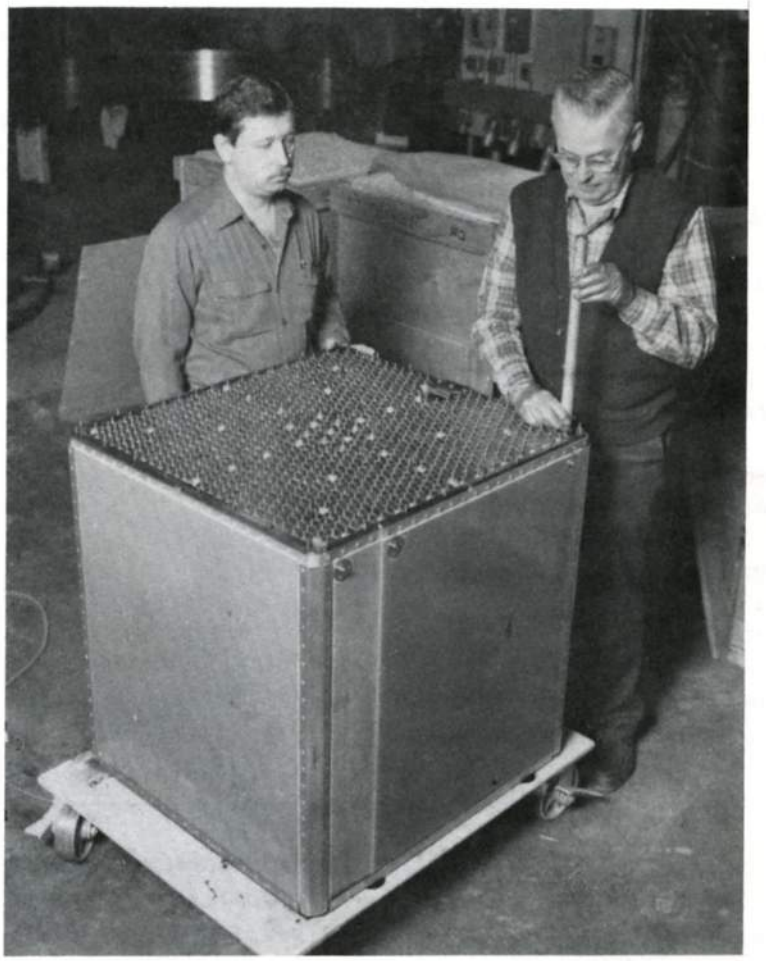
LITHIUM BLANKET MODULE ARRIVES AT PPL

The Lithium Blanket Module (LBM) recently arrived at PPL for acceptance testing.

The LBM experiment, funded by the Electric Power Research Institute (EPRI), will examine a method of breeding tritium from lithium for use as fusion reactor fuel. Although tritium is rare in nature, lithium is plentiful. One way of converting it into tritium is by creating a lithium "blanket" around a reacting tokamak plasma. The blanket would be bombarded by the high-energy neutrons produced in the fusion process. Reactions between the lithium atoms and the neutrons would produce tritium, which could then be extracted from the blanket and used to fuel the reactor.

The LBM was fabricated by GA Technologies Inc. (GA) in San Diego. The unit contains over 900 stainless steel tubes, filled with cylindrical pellets of lithium oxide. A number of these tubes, located in the center of the array, contain pellets clad with aluminum. It is from these center tubes that tritium bred by neutron irradiation of the aluminum-clad pellets will be extracted.

In-plant testing of the LBM was conducted at GA in early March. The unit was then dismantled, leaving GA for its four-day trip to PPL on March 14. The unit was shipped disassembled in specially prepared crates to protect the rods from damage during their cross-country road trip.



Workmen carefully installed rods containing lithium oxide pellets into the Lithium Blanket Module (LBM), which arrived at PPL in mid-March. The module, which will be installed on TFTR next year, was shipped disassembled to prevent damage to the rods.

The 920 rods each fit into the LBM in a particular sequence and location. Once the unit arrived at PPL, the rods were reinstalled within the LBM. The entire two-ton assembly was then lifted by crane and mated to the Engineering Test

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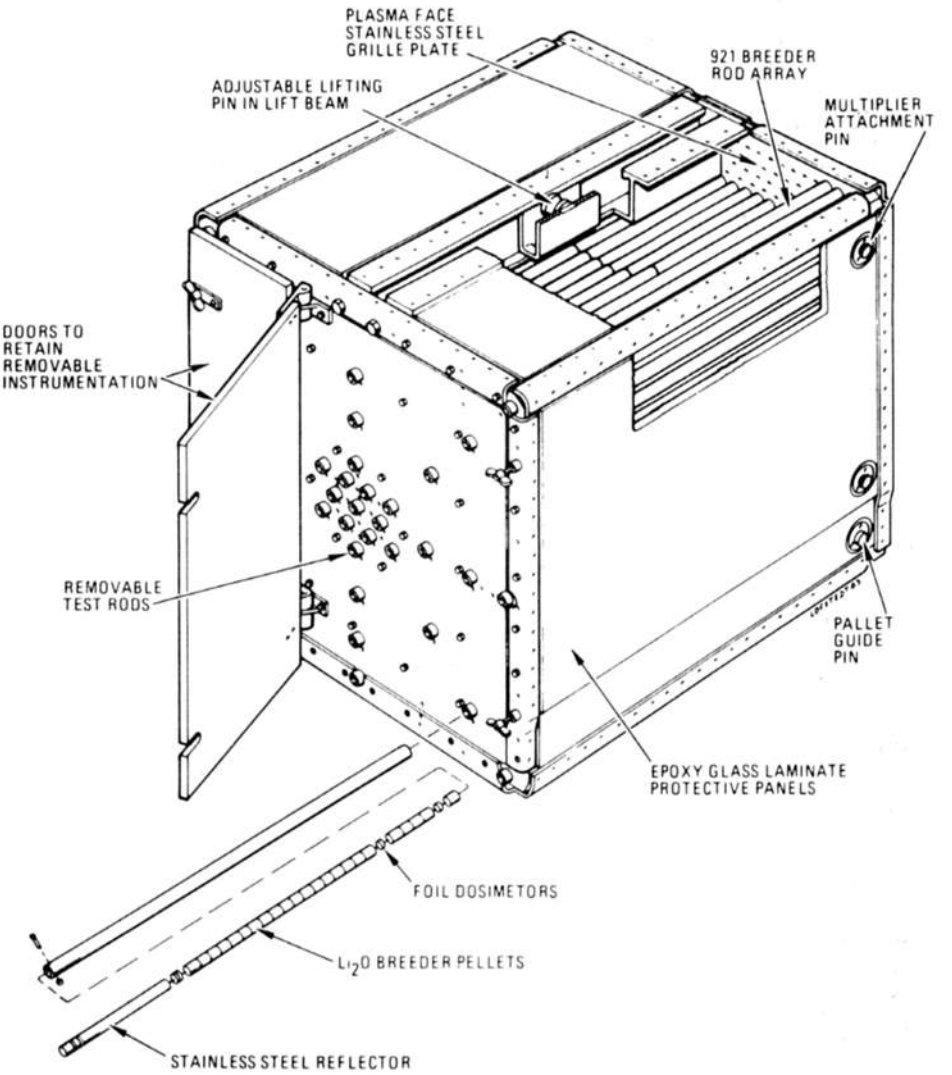
Station (ETS) for fit checking.

The ETS consists of a fiberglass and stainless steel girder supported by a stainless steel base. During TFTR operation, the LBM will slide forward on the ETS until the front face of the unit is adjacent to a vacuum vessel port. The DOE has paid for the fabrication of a special "neutron-transparent" port cover. High-energy neutrons released by the TFTR plasma will enter the LBM rods, interacting with the lithium atoms within them to form tritium. After each run producing large neutron fluence (either deuterium-deuterium or deuterium-tritium), several of the central rods will be removed from the LBM. The rods will be sent to the PPL Chemical Engineering laboratory, where the amount of tritium bred within them can be measured.

Preliminary acceptance testing of the unit was conducted in the 1-H Building at the end of March. In late 1986, the LBM and ETS will be installed in TFTR Bay D.

Rather than putting the LBM into storage until that time, the unit may be shipped to the École Polytechnique Fédérale in Lausanne, Switzerland, for approximately one year. That institution has a well-defined point-neutron source facility especially designed for neutronics experiments with blanket modules, and has offered to do experiments with the LBM. Testing would involve removing pellet samples after neutron irradiation and assaying them at PPL for tritium content. The master comparison code for comparing neutronics



Cutaway view of the Lithium Blanket Module (LBM)

predictions with measurements would also be tested out using data obtained in the Lausanne facility. In late 1986, the unit would be reassembled and returned to PPL for installation on TFTR.

First Aid Course

If a co-worker or family member gashed a hand, or was badly burned, would you know what to do? You would if you had taken the basic first aid course now being offered to all PPL employees.

The course provides employees with the training and equipment necessary to handle emergency situations until the Emergency Services Unit (ESU) arrives. At the completion of their training, students should be able to recognize the difference between an injury requiring simple first aid treatment, and an emergency requiring ESU intervention.

The course, taught by Scott Larson of the ESU, consists of three two-hour classes. Students use the book "The First Minutes: What to Do Until the Ambulance Arrives" as their basic text. They learn what

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Handling foot injuries is just one of the topics that will be covered in the basic first aid course now being offered to all laboratory employees.

constitutes an emergency, as well as how to treat injuries such as shock, bleeding, burns, convulsions, or possible heart attack. Readings are supplemented with audio-visual and practical instruction in emergency procedures, such as cardiopulmonary and artificial resuscitation.

Classes are open to all employees on a first come, first served basis. Course sessions are repeated monthly, and usually begin during the third week of each month. The next course session begins April 8; upcoming course schedules will be listed in future issues of the HOTLINE.

For more information about the course, call Scott Larson at ext. 3166.

Safety Training

The following Health and Safety training courses are scheduled for April:

Course	Responsible Instructor	Date Scheduled
Fork Lift Operators	R. Jeanes Ext. 2532	April 9 8:45 a.m.-4 p.m.
Fire Extinguisher Training	S. Larson Ext. 3166	April 9 and 23 2-3:30 p.m.
Self-Contained Breathing Apparatus	S. Larson Ext. 3166	April 17 9:30-11:30 a.m.
Capacitor and Capacitor Bank Safety	F. Beane Ext. 2530	April 19 9:30-11:30 a.m. and 1:30-4 p.m.
Basic Electrical Safety	R. Bergman Ext. 2223	April 19 1-2:30 p.m.
Cardiopulmonary Resusitation (CPR)	S. Larson Ext. 3166	April 22, 24, and 26 9 a.m.-noon OR 1-4 p.m.
Oxygen Deficient Spaces	K. Semel Ext. 2531	April 23 9-11 a.m.

Employees must obtain permission from their immediate supervisor to attend these classes. Supervisors must call the responsible instructor to enroll their employees.

Security Checkpoints

The development of local businesses has caused an increase in the volume of traffic on U.S. Route 1. It should also be apparent that the possibility of motor vehicle accidents increases with the growing number of vehicles. The New Jersey Motor Vehicle laws were established to prevent accidents and protect individuals using public roadways.

Recently, more and more motorists have been misusing the outer shoulder lane on Route 1 as a third lane of traffic. When vehicles on Route 1 are approaching off ramps, drivers frequently pull over to the shoulder, traveling down the shoulder to the off ramp. This particular procedure is illegal; you must remain in the proper lane until you reach the appropriately marked off ramp. By riding on the shoulder, you risk being cited with a motor vehicle summons that can add two points to your motor vehicle driving record and subtract a $60 fine from your wallet.

Not only is riding the shoulder of the roadway illegal, it is also very dangerous. Information from local police departments has shown this illegal act to be the cause of many serious accidents which have recently occurred on Route 1.

The Traffic Division of the Plainsboro Police Department is asking for your help in preventing such serious accidents. Let's all try to make our crowded highways a little safer.

For those of you who do not use seat belts: New Jersey's mandatory seat belt law (which requires the driver and all front seat passengers to wear seat belts) took effect March 1, 1985. The law is being enforced, so remember to buckle up.

Anyone with questions about either of these motor vehicle laws should contact Security at ext. 2894 or 2895.

Intramural Softball

Heavy hitters are still in demand by PPL's co-ed intramural softball league. Teams will compete every Wednesday night during the 10-week season, scheduled to begin at the end of May.

Last year's league champions, the Warehouse team, will be returning, as will the CICADA and Engineering squads. Three more teams, with a minimum of 10 players each, are still being sought. Interested individuals can call Ed Bush at ext. 3309 or Frank Wasiowicz at ext. 3568 to be placed on a team.

TRANSITIONS

The HOTLINE offers its congratulations to the following employees, who recently became proud parents:

Doug Bucknum of the MG Room and his wife Chris, whose daughter, Lacey, was born February 19;

Rosemary Fuchs of the Theory Division, whose daughter Alecia Jennifer was born March 6.

Congratulations are also due to Ken Wakefield, who retired from laboratory service on March 1.

OSHA Violations

The following safety reminders are drawn from a list of common OSHA (Occupational Safety and Health Administration) violations:

- Exits and exit accesses shall be located and arranged to make exits readily accessible at all times. Where exits are not immediately accessible from an open floor area, safe and continuous passageways, aisles, or corridors leading directly to every exit must be provided. Access to at least two different exits should be maintained for each area occupant.

- Exits and exit pathways should remain free of all obstructions that would prevent full, instant use of the exit in case of fire or other emergencies.

- Every exit sign shall be lighted, either by internal illumination or by artificial lighting. If artificial lighting is used, translucent lenses of red (or another specifically designated color) should be installed to show red (or another specifically designated color) on the approach side of the exit sign.

For Sale

FOR SALE: Eico 460K oscilloscope, 5 MHz vertical bandwidth, recurrent sweep. Works; $25. If interested, call ext. 2036.

Invention Update

PPL has a Patent Awareness Program designed to recognize creative inventors, and to raise the patent-mindedness of laboratory staff. A Committee on Inventions, consisting of chairman John Johnson, secretary Nancy Jones, and members Frank Bennett, Peter Bonanos, Schweickhard von Goeler, and Richard Rossi, make cash awards to inventors for their new or novel ideas. Additional monies are awarded if DOE files a patent application on the discoveries.

Invention disclosures filed since December include:

- High Voltage High Current RF Bushing, by G. Grotz
- Z Pinch Modified by Helical Coils, by H. Furth and D. Monticello
- Penetration Fire Seal, by S. Cavalluzzo
- Method and Apparatus for Ramp-Up of Tokamak Current Using RF Waves Together with Inductively Driven Relativistic Electrons, by N. Fisch, C.F.F. Karney, and A. Boozer
- CAMAC Link Data Monitor, by P. Sichta
- High Current Capacity Electrical Joint, by P. Bonanos
- Arc Suppressors for Waveguide Grills, by R, Motley and W. Hooke
- Compact Waveguide Power Divider with Multiple Isolated Outputs, by C.P. Moeller
- Poloidal Flux Transformer for Spheromak Current Drive and Heating, by A. Janos, M. Yamada, and H. Furth
- Flux-Amplifying Inductive Spheromak Gun (Generator), by M. Yamada, A. Janos and T. Uyama
- Annular X-Ray Laser Target, by H. Milchberg
- Axial Thick-Fibre Target for X-Ray Laser Production, by H. Milchberg, S. Suckewer, and D. Voorhees
- Trimmable Limiter, by R. Budny and D.K. Owens
- Disc-Blade X-Ray Laser Target, by S. Suckewer, C. Skinner, and D. Voorhees
- Soft X-Ray Laser, by S. Suckewer
- High Temperature Brazing of Al_2O_3 to Ti 6242, by R. Walls and H. Evans
- Radio-Frequency Coupler for Enhanced Production of Runaway Electrons to Stabilize MHD Instabilities and Reduce Transport Loss in Toroidal Plasmas, by T. Chu
- Anomalous-Viscosity Current Drive, by T. Stix and M. Ono

For further information about invention disclosures or the patent process, contact Meg Harmsen at ext. 2659.

United Way Wrap-Up

The Princeton University United Way campaign accomplished a little bit more with a little bit less in 1984.

According to final campaign figures, 12 percent of all Plasma Physics Laboratory employees contributed to the University's United Way fund drive. A total of $78,749 was raised University-wide, constituting 93 percent of the $84,400 goal set at the start of the campaign. The figure represents an approximately eight percent increase in total dollars contributed this year, despite almost 90 fewer donors participating in the drive.

Employee participation in the campaign throughout the University totaled 22 percent, as compared with United Way contribution rates of 78 percent from the Squibb Corporation, 74 percent from RCA Labs, 72 percent from McGraw-Hill, and 55 percent from Cornell University.

United Way campaign coordinator "Bud" Vivian offered his thanks to all those who volunteered to organize the fund drive in their areas. PPL volunteers included Arthur Allen, Mike Anderson, Jim Bates, Tim Bennett, Olga Bernett, Joyce Bitzer, Debra Breza, Mike Brooks, Betty Carey, Dottie Conner, Bobbie Cruser, Robert Cutler, Joe Davenport, Kathy Dunn, Gary Estepp, Jim Faunce, Janet Felt, Elsie Ferreras, Meryl Finkelstein, Carolyn Foster, John Gennuso, Mel Gensamer, Carol Gill, Jean Hurley, George Kalesky, Charles Kircher, Elaine Kozinsky, Scott Larson, Joyce Lawton, Carl Lindenmuth, Robert Longmuir, Milt Machalek,

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Marie Maruso, Dolores Mazalewski, Ann McKee, Pat Melsky, Madge Mitas, John Mount, John Pacuta, Bill Pointon, Gloria Pollitt, Sheryll Poris, Kim Prutky, Dottie Pulyer, Sheryl Robas, Barbara Sarfaty, Heidi Schmitt, Walter Schwarz, Nadirah Shakir, Claire Siflinger, Gail Stevens, Grace Taliaferro, Louise Tindall, Edna Willis, Sandy Winje, Roseann Wurst, and Ginny Zelenak.

Beverages can not only quench our thirst, but can also provide energy and nutrients. We often forget, however, that drinks can contain lots of calories. Juices are often the most surprising calorie culprits. Take a look at the following fruit and vegetable juices and try ranking them in order of their calorie content (with one indicating the lowest in calories, and seven the highest -- there is one tie):

( ) Apple juice
( ) Cranberry juice cocktail
( ) Tomato juice
( ) Unsweetened grape juice
( ) Unsweetened grapefruit juice
( ) Unsweetened orange juice
( ) Unsweetened pineapple juice
( ) Vegetable juice

(Answers on Page 8)

New APS Fellows

Three PPL staff members -- Michio Okabayashi, Samuel A. Cohen, and John A. Krommes -- have recently become Fellows in Division of Plasma Physics of the American Physical Society (APS).

In notifying the three of their selection, the APS Fellowship Committee cited Dr. Okabayashi for "outstanding contributions to the theoretical and experimental study of the magnetohydrodynamic equilibrium and stability of hot plasmas." Dr. Cohen's citation commended his "pioneering research on plasma-wall interactions, impurity transport in tokamaks, and the advancement of surface physics in tokamaks." Dr. Krommes' "fundamental contributions to the description and understanding of plasma turbulence and nonlinear statistical physics" were commended by the Committee.

Candidates for APS Fellows are nominated by Society members, and chosen by a selection review committee.

United Way Agencies Fighting Alcoholism

Slurred speech or lack of coordination are often among the most obvious physical symptoms of alcoholism. However, there are other clues to the presence of the disease, such as a hoarse voice, nicotine-stained fingers, and changes in skin and hair texture.

The United Way-Princeton Area Communities notes that misconceptions about alcoholism abound. Many people erroneously believe that to be an alcoholic, one must drink during the day every day, get drunk frequently, or drink hard liquor. None of these assumptions are necessarily true. Alcoholics may not drink daily, and may drink only beer or wine. And the alcoholic is more likely to be able to drink a great deal without getting drunk than is the nonalcoholic.

Behavioral changes in the alcoholic may be even more noticeable. Alcohol reduces inhibitions, and has been implicated in many cases of violence, homicide, and suicide across the United States.

There is evidence that the disease has biological roots, and can be passed on genetically from parents to children. This fact does not mean that the child of alcoholic parents is destined to be an alcoholic; rather, it indicates that the child may be prone to develop the disease.

Alcohol, which poisons human cells, is also related to premature death and disease. Experts still do not understand all the ways alcohol causes its damage, but they do know it can cause scarring to liver tissue, and death to brain cells.

If the brain cell damage is extensive enough, Korsakoff's syndrome--an irreversible dementia--develops. With signs of memory loss, loss of communications skills, and an inability to make rational judgments, Korsakoff's syn-

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drome can be as difficult for families to deal with as Alzheimer's disease.

For answers to questions about alcoholism, call a counseling agency and seek professional help. The professional rule of thumb is: if you are concerned, there is probably a problem. The sooner help is sought, the sooner wounds can heal.

The United Way funds two agencies--the Family Service Agency of Princeton and Crawford House--based on their work with the victims of alcoholism. Family Service offers counseling sessions to assist people dealing with alcoholism. The groups include education for new clients, especially those who have been arrested for drunk driving; an early sobriety group; and groups for women from families where alcohol has been abused. The Alcoholism Unit of Family Service can be reached at 609-924-2577.

Crawford House is a halfway house offering a program for women recovering from alcoholism. Its goal is to ease the return of women to their home communities, with support from Alcoholics Anonymous. It provides a transitional experience between detoxification, initial recovery, and reentry as a functioning member of the community. Women can stay at Crawford House for two to six months. The agency can be reached at 201-874-5153.

The Princeton Area Council of Community Services, also a United Way agency, can be reached at 609-924-5865 or 609-799-6033 for additional information on other programs that are available.

Einstein Explained (by Dr. Ernst de Haas)

At the end of each month, I always gratefully remember the late Albert Einstein, whose $E=mc^2$ permits the University to send me a paycheck. And when I act as a tour guide, the visitors often know the same formula. Since the square of the speed of light is such an enormous number, they figure out that the destruction of one kilogram of matter could keep all of Public Service humming for decades. But Einstein did not mean it quite that way. What he really said was more subtle and more elegant:

> "Every package of energy E has a mass m associated with it according to $E=mc^2$. If a reaction develops energy and that energy leaves the scene, it takes its mass with it."

Take, for example, the chemical or nuclear reaction A+B --> C+ Energy, where A, B, and C are single atoms or nuclei.

At the moment of the reaction, the energy is usually kinetic, i.e., C is moving at high speed. It bounces around, heating up the surrounding material as it slows down. Eventually C is just lying still or moving very little, and the energy leaves the immediate reaction area.

According to Einstein: $m_A + m_B = m_C + m_E$. But since the energy has left, the associated mass has gone too. Therefore, $m_C < m_A + m_B$.

Because c^2 is so large, the "mass defect," $m_C - (m_A + m_B)$, is impossible to measure in chemical reactions. It does show up in nuclear reactions, however. The masses at rest for all isotopes are accurately known; a comparison yields the mass defect.

For fusion of deuterium and tritium, the equation is:

$$_1D^2 + {}_1T^3 \rightarrow {}_2He^4 + {}_0n^1 + \text{Energy}$$

and the mass numbers are:

$$_1D^2 = 2.014735 \text{ AMU (Atomic Mass Units)}$$

$$_1T^3 = 3.016997 \text{ AMU}$$

$$\text{TOTAL} = 5.031732 \text{ AMU}$$

$$_0n^1 = 1.008982 \text{ AMU}$$

$$_2He^4 = 4.003873 \text{ AMU}$$

$$\text{TOTAL} = 5.012855 \text{ AMU}$$

Comparing both totals yields a mass defect of 0.018877 AMU. So the energy package carried approximately 0.38% of the original.

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If we fuse 1 kilogram of fuel, i.e., 400 grams of deuterium and 600 grams of tritium, the actual mass that is converted to energy (heat) is 3.8 grams. If we apply $E = mc^2$ at this point, the result is 3.4 x 10^{14} J (Joules), or 95 million kWh (kilowatt hours) of heat. An electric power plant can turn this into 33 million kWh of electricity, worth about $3.5 million in the retail market.

If we had burned the deuterium and tritium with oxygen, the resultant heat would be 58 x 10^6 J, or 16 kWh. The corresponding electricity would retail for 60 cents. Thus, the ratio of nuclear to chemical energy is about six million to one.

Similar calculations were made in the 1920's and 1930's for uranium. The results were similar; what was unknown back then, however, was whether fission or fusion reactions could ever be created in the laboratory.

In 1938, when Hahn and Strassman discovered that uranium could actually fission, many people realized that here was a source of energy millions of times greater per unit of mass than regular chemical reactions. This led to military interest in bombs, and civilian interest in nuclear power plants.

The military effort got started in 1939 through a letter from Einstein to President Roosevelt. It is interesting to note that he was asked to sign the letter, not because of his $E = mc^2$, but because he was the best known physicist in the country at that time.

HEALTH QUEST

Answers

Each 6 oz. glass of fruit or vegetable juice contains the following calories:

1. Vegetable (30)
2. Tomato (35)
3. Unsweetened grapefruit (75)
4. Apple (85)
5. Unsweetened orange (90)
6. Unsweetened pineapple (105)
7. Cranberry juice cocktail (125)
8. Unsweetened grape (125)

Volunteers: People People

The following volunteer listings were provided to the HOTLINE by the Princeton Area Council of Community Services, a member agency of the United Way-Princeton Area Communities. For further information on any volunteer position, contact each agency directly.

- The Mercer County Chapter of the American Diabetes Association needs volunteers to serve as program chairpersons, typists, or general office workers. Health care professionals are also being sought to serve on the Association's speaker's bureau. Call 609-392-1810 to offer your assistance.

- The Children's Home Society of New Jersey is a private, non-sectarian child care and placement agency. The Society provides counseling, temporary foster family care, and adoption services. Assistance with library and clerical work would be greatly appreciated, as would drivers to transport foster parents and children. To lend a hand, call the Society at 609-695-6274.

- Eden A.C.R.E.s has three private, non-profit group homes for autistic adolescent boys and adult men. Caring individuals are needed for the weekday and weekend recreation programs, as well as to help out with emergency care. To volunteer your time, call 609-448-6400 or 609-921-1198.

The next three volunteer positions were furnished by the United Way of Somerset Valley. Details of each position are available by contacting each agency directly.

- The Somerset County Unit of the American Cancer Society is seeking volunteers to work as drivers, or to participate in the Unit's residential, public education, and special events programs. Office workers are always welcome. Call 201-469-8666 to offer your aid.

- The Arthritis Foundation needs volunteers to serve as speakers, public information assistants, and assistant program coordinators. Help is also needed with bulk mailings and public relations. Call 201-388-0744 to help out.

- Catholic Charities volunteers work closely with adolescents in recreation and other activities. Volunteers organize, plan, and supervise various club activities. For the details, call 201-722-1881.

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