Ontario Association of Physics Teachers

Volume X No. 3

Annual Conference
University of Toronto—Scarborough
June 26, 27, 28

The tenth annual conference of the OAPT will be held on the Scarborough Campus of the University of Toronto, June 26, 27 and 28. Here are the highlights confirmed to date.

Thomas Timusk, of McMaster University will kick off the formal proceedings on Monday morning with a lecture on one of the most talked-about discoveries of 1987: "High-Temperature Superconductivity". In addition to his talk, Prof. Timusk will demonstrate the Meissner and other effects at liquid nitrogen temperature. On Monday afternoon the second phenomenon of 1987 "Supernova Shelton 1987A" will be described by two astronomers of the U. of T. **Ian Shelton**, the man himself, will outline the responsibilities of a professional astronomer in the U. of T. observatory in Chile, and the hectic events surrounding the discovery of the supernova. **John Percy**, of the Department of Astronomy, will discuss the meaning of the supernova and provide an update of new findings. On Tuesday morning, **Ron Hancock**, Director of the Slo-Poke Reactor facility, will talk about something a little different, but no less interesting "The Chemistry and Physics of Archaeology".

Other activities should prove of equal interest. On Sunday afternoon a tour has been organized of the Darlington nuclear power station. This will be followed by a talk on power generation at Pickering. On Sunday evening, after the reception, a number of demonstrations of computer-related materials will be held in the Scarborough physics labs. A representative of **Apple Canada** will be on hand to demonstrate their new educational laser disk system. Our friends from **Merlan Scientific** will show off their Champ interface. Lab personnel of Scarborough College will demonstrate new software in physics and mathematics on a network of Macintosh computers.

But there is plenty of time left over in the schedule. We invite the membership to contribute to the exchange of ideas with a contributed talk on a subject of interest, a demonstration, or a poster. A poster can be an effective way to convey your ideas informally with lots of discussion and useful feedback.

Participate in your conference. Preregister early. See you at Scarborough.

American Association of Physics Teachers

ONTARIO SECTION

Agenda
Tenth Annual OAPT Conference
University of Toronto—Scarborough
26 - 28 June 1988

Sunday - 26 June

12:00 -	Registration at Scarborough College
12:30 - 4:00	Tour of Ontario Hydro Plant, Darlington, and talk at Pickering
7:30 - 8:00	Reception
8:00 -	Demonstrations of applications of computers in physics teaching, physics labs Scarborough. Participation by Apple Canada, Merlan Scientific

Monday - 27 June

7:30	Breakfast
8:45	Welcoming Remarks
9:00-10:00	**Thomas Timusk**, Department of Physics, McMaster University "High Temperature Superconductivity" (talk and demonstrations)
10:00-10:30	Refreshment break, publishers, displays, poster sessions
10:30-12:00	Contributed talks and "My Favorite Demonstrations"
12:30-2:00	Lunch
2:00-3:30	**Ian Shelton and John Percy**, Department of Astronomy, University of Toronto "Supernova Shelton 1987A"
3:30-4:00	Refreshment break, publishers, displays, poster sessions
4:00-5:00	Contributed talks and "My Favorite Demonstrations"
6:30	Reception
7:00	Annual Banquet

Tuesday - 28 June

7:30	Breakfast
9:00-10:00	**Ron Hancock**, Director, Slowpoke Nuclear Reactor, University of Toronto "Physics and Archaeology"
10:00-10:30	Refreshment break, publishers, displays, poster sessions
10:30-12:00	Contributed talks, "My Favorite Demonstrations", Results of the Prize test
12:00	Lunch

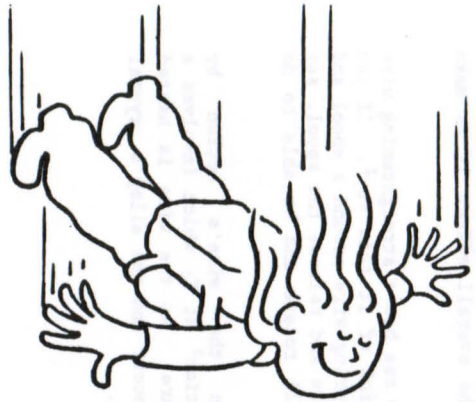
FIGURING PHYSICS

As she falls faster and faster through the air, her acceleration

a) increases

b) decreases

c) remains the same



FIGURING PHYSICS

As she falls faster and faster through the air, her acceleration

a) increases

b) decreases

c) remains the same

The answer is b:

Acceleration decreases because the net force on her decreases. Net force is equal to her weight minus her air resistance, and since air resistance increases with increasing speed, net force and hence acceleration decrease. By Newton's 2nd law:

$$a = \frac{F_{NET}}{m} = \frac{(mg - R)}{m}$$

where mg is her weight, and R is the air resistance she encounters. As R increases, a decreases. Note that if she falls fast enough so that $R = mg$, $a = 0$, then with no acceleration she falls at constant velocity.

Go an extra step in the equation for Newton's 2nd law (divide mg and R by m) and get

$$a = g - \frac{R}{m}$$

Note that the acceleration a will always be less than g if air resistance R impedes falling. Only when $R = 0$ does $a = g$.

THE DEMONSTRATION CORNER

The Thermobile and Icemobile

by **Peter Levan,**
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At last year's conference in Sudbury, Al Hirsch demonstrated his icemobile[1] and I mentioned the action of a thermobile[1]. Some people were interested in more explanation and information on these little toys and the physics behind them.

The secret is in the alloy of the wire that turns the pulleys. This alloy, Nitinol (Nickel Titanium Naval Ordnance Laboratory), has a curious property. It can retain an apparently plastic deformation if held below a critical temperature, T_C, but if it is heated above this temperature it returns to an earlier shape, a shape given to it by special heat treatment. For example, if a wire is manufactured straight, and T_C is 35°C, then at 20°C it might be quite flexible, while at 50°C it will straighten itself to its manufactured shape exerting some force in doing so.

Refer to the schematic diagram of the thermobile. The Nitinol is a continuous loop around two pulleys. The lower, brass pulley, is immersed in warm water at a temperature greater than T_C, while the upper pulley is at room temperature. The engine is given a turn to start it (in either direction). The pulleys of the engine now will continue to turn.

The power that runs this comes from the strong internal straightening force in the wire as the wire leaves the small pulley in the warm water. The wire "remembers" that it was originally manufactured to be straight. This power isn't balanced off by the power needed to bend the wire because the wire is bent at a temperature below T_C. The overall effect is to make the small pulley rotate.

Since it's not easy to see how a straightening wire makes a pulley rotate, think of it this way[2]. If you wrap a piece of ordinary spring wire around a spool and you hold one end of the wire and release the spool, say on a table, the spool will rotate and be able to do work.

Metallurgists explain the wire's action by describing a phase transition[3] at T_C which involves a change in crystal structure. As the wire is heated above T_C, lattice shears occur and the alloy's crystal type and dimensions change.

From the standpoint of physics teachers this is a super toy. Here is a device that easily illustrates the major principles of engines...the need for hot and cold reservoirs, and use of heat energy to do work. It can certainly be compared to other forms of engines in terms of efficiency, and work output. Perhaps this topic could make an interesting science fair project for your student.

References

[1] Both devices are produced by Innovative Technology International Inc., 10747-3 Tucker St., Beltsville, MD 20705, for about $30 US

[2] H. Richard Crane, Physics Teacher, 23, 238 (1985)

[3] Ahmad A. Golestaneh, Physics Today, 37, 62 (1984)

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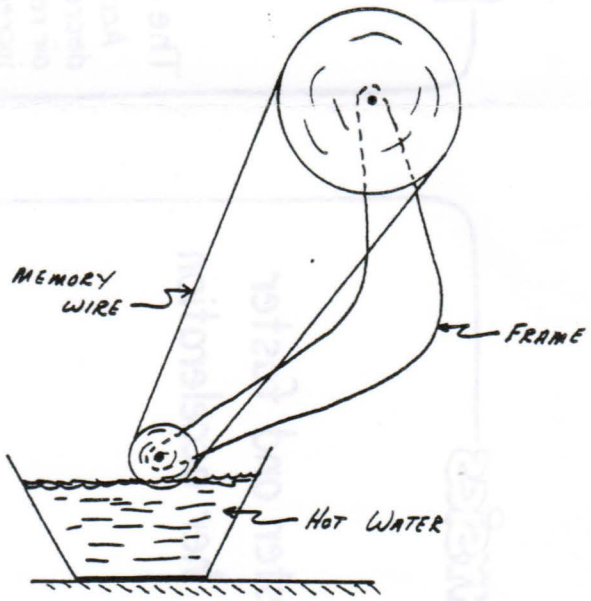
Submissions describing demonstrations will be gladly received by the editor.



Schematic diagram of a thermobile

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University of Toronto—Scarborough **June 26-27-28**, 1988

Abstract Form

Attendees are encouraged to make a short presentation at the conference. Your presentation could take the form of a short talk on a topic of interest to you, the form of a demonstration you use in teaching physics, or a poster. Let us know of your requirements for AV equipment and physics apparatus.

Participate in your physics conference!

[PLEASE PRINT]
Name (Mr/Miss/Mrs/Ms) _____
Surname First Name

Home Address _____
No. Street City Postal Code

Business Address _____
Institution

_____
No. Street City Postal Code

Home Phone _____ Business Phone _____

Session:

Oral Presentation ☐ (12 minutes + 3 minutes questions) Poster ☐

My Favourite Demonstration ☐ (5 minutes)

Title of Presentation: _____

Short Description or Abstract:

_____

_____

_____

_____

_____

Equipment Required: ☐ slide projector ☐ overhead ☐ 110 VAC

☐ other requirements, VCR etc.? _____

Please send this form by **May 20** to
Stuart M. Quick
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1265 Military Trail, Scarborough, Ontario, M1C 1A4 Tel: (416) 284-3231