Reflections

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Thoughtful Curricula Developing Thinking Students

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Using Vernier Temperature Probes to do Distillations in Introductory Physical Science

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Typically, at some point in a physical science course, students collect time and temperature data for the heating or cooling of various liquids. They then follow this up with the preparation of temperature vs. time graphs. This activity allows students to, among other things, identify the "plateau", or leveling off of the temperature curve, at the boiling point. These learning activities are a key component of the *Introductory Physical Science* (*IPS*) course, originally developed under a National Science Foundation grant and currently (in its 9th edition) published by Science Curriculum Inc.

Students in our 8th grade physical science course at St. Paul Academy and Summit School use laboratory activities as an integral part of their learning process. They use temperature probes from Vernier Software & Technology to help them to simultaneously collect and graph the data. Using Vernier *Logger Pro* software and temperature probes that are fitted through a typical distillation apparatus such as the one shown in Figure 1. Figure 2 shows that the temperature probe is

Figure 1
The distillation apparatus fitted with a Vernier temperature probe.

Figure 2
The placement of the temperature probe in the flask.

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Distillations (from page 1)

placed high in the flask to measure the temperature of the vapor, rather than the liquid in the flask.

To assemble this apparatus, one can use a two-hole #5 stopper, which will fit into a 125 ml Erlenmeyer flask. Into one of the two holes, the typical bent glass tubing/rubber hose assembly is inserted. The Vernier temperature probe is inserted into the other hole. Care must be taken to use duct tape or some other adhesive/liner so that there is a full seal in the hole through which the Vernier probe has been inserted. *Caution – if this assembly is exposed to very high heat over a long time, the adhesive/tape could melt.* Though this could be a concern, we have not found it to be an issue while doing the distillations that are typical of our science course.

Using this apparatus, students are able to obtain graphs such as the one shown in Figure 3.

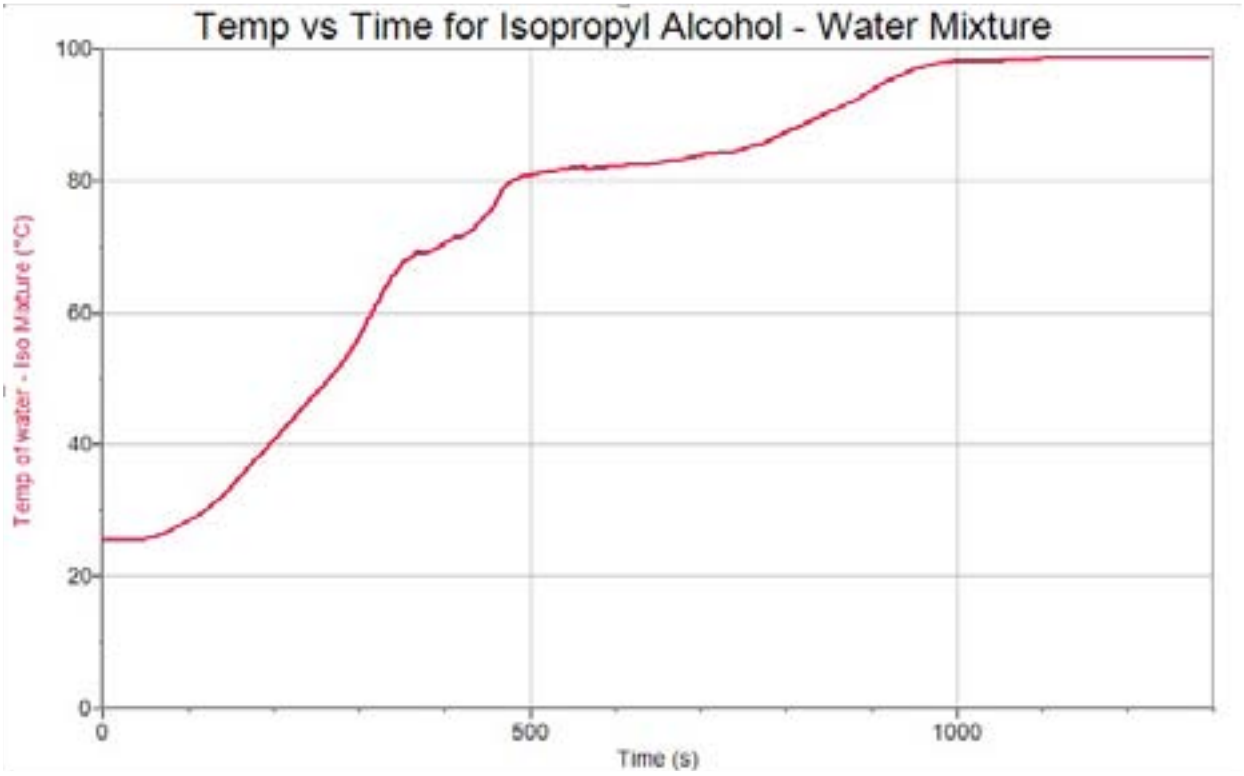

Figure 3
A typical temperature vs. time graph obtained using the temperature probe.

See Distillations on page 3

Do you have an article related to IPS you'd like to share?

Let us know!

It could be published in one of our newsletters!

Distillations (from page 2)

One advantage of using Vernier's *Logger Pro* software and temperature probe in this apparatus is that multiple graphs can be generated. This allows for comparison with a "control", such as pure water. For instance, Figure 4 shows temperature vs. time curves for regular water and salt water. By comparing the curves, students are able to attribute the increase in boiling temperature to the dissolved salt and not to thermometer uncertainties.

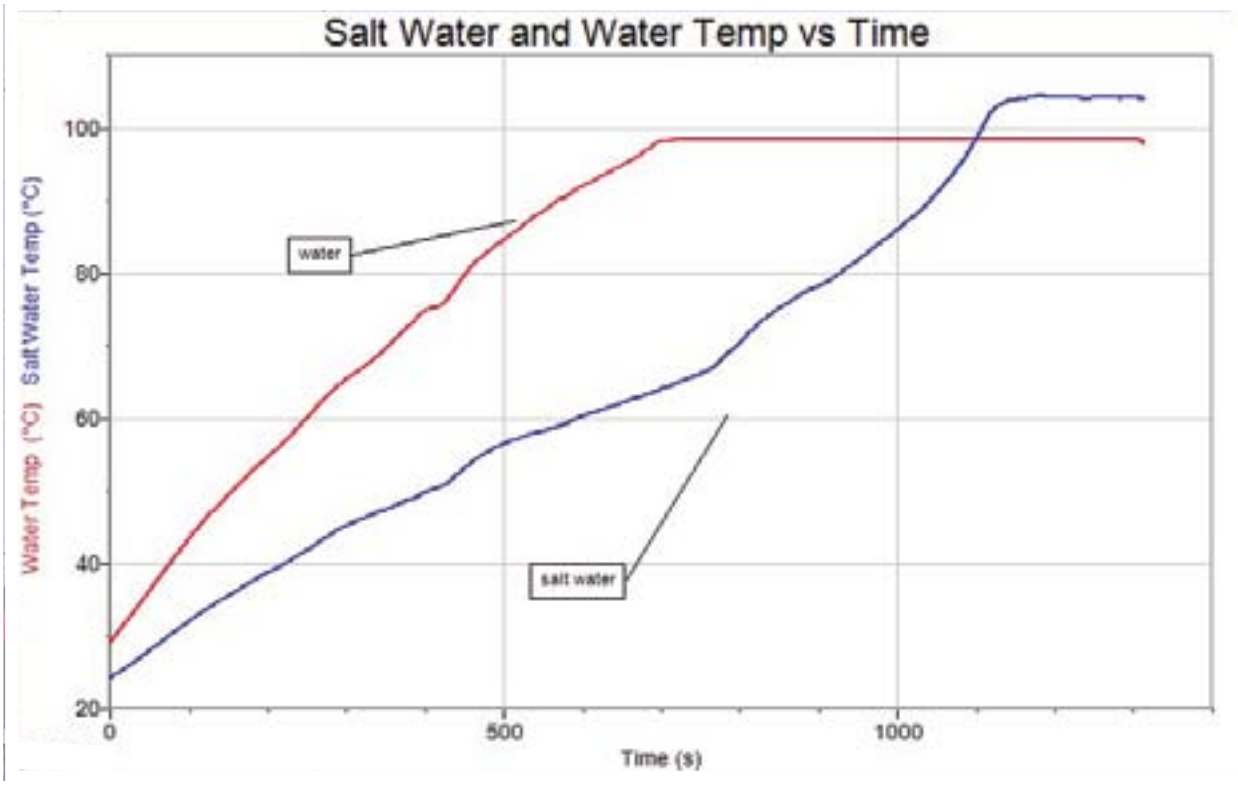

Figure 4
Multiple curves allow students to compare data and draw conclusions.

Care should be taken in planning classroom use of this equipment. In some cases, given logistical, equipment, or space constraints, it may be best to do a teacher demonstration. Other options include having some students use traditional thermometers while others use the Vernier equipment. Use of the Vernier probe/distillation apparatus described above is also good for individual student use during the *IPS* Sludge Test!

Acknowledgements

Special thanks to co-teacher Stacy Overgaard for helping to plan for the use of this equipment in distillation labs in the classroom.

Thanks also go to John Gastineau of Vernier Software and Technology for his technical assistance in preparing this article. For additional information about Vernier's data-gathering probes, visit www.vernier.com.

Additional information about *Introductory Physical Science* (*IPS*) textbooks and ebooks can be found online at www.sci-ips.com.

2015 *IPS* Summer Workshops

Earn college credit as you enhance your teaching skills in a beautiful setting at the base of the Rockies. Attend the 2015 *IPS* National Workshops at Colorado School of Mines!

***IPS* Part 1: Properties of Matter** – July 12-17, 2015
***IPS* Part 2: Atoms and Molecules** – July 19-24, 2015
***IPS* Part 3: Energy and Forces** – July 19-24, 2015

Visit sci-ips.com for more information, or scan the code at the right.

For your convenience, a workshop registration form is included at the end of this newsletter.

Registration for the Science Curriculum Inc.

Introductory Physical Science (IPS) National Workshops

Colorado School of Mines

July, 2015

Course selection - please check the appropriate workshop(s):

___ ***IPS* Part 1 – Properties of Matter** **July 12–17, 2015**
___ ***IPS* Part 2 – Atoms and Molecules** **July 19–24, 2015**
___ ***IPS* Part 3 – Energy and Forces** **July 19–24, 2015**

Tuition cost: The tuition cost is $380 for each one-week workshop.

For maximum benefit, it is highly recommended that the* IPS Part 1 *workshop be taken prior to the* Part 2 *and/or* Part 3 *workshop.

NOTE: Since* IPS Parts 2 *and* 3 *meet concurrently, it is not possible to enroll in both.

NAME _____

GENDER *(for lodging purposes only - please circle one)* M F E-MAIL_____

HOME ADDRESS _____

HOME PHONE _____

SCHOOL NAME _____ PHONE _____

SCHOOL ADDRESS _____

SCHOOL DISTRICT NAME _____

In what area of science teaching do you teach the most classes? (please check one)

Physical Science ____ General Science ____ Earth Science ____ Other (please specify) _____

What was your major in college? _____ Graduate concentration, if any _____

Have you attended a previous *IPS* or *Force, Motion, & Energy* (*FM&E*) workshop or summer program? Yes No

Have you previously taught *IPS* or *FM&E*? Yes No

If yes, which program and for how many years? _____ At what grade level(s)? _____

Credit: Credit is awarded by Colorado School of Mines as graduate-level semester hours in continuing education. Each one-week workshop can be taken for 2 semester hours credit.

I do ___ do not ___ plan to take the workshop for credit.

NOTE: The tuition amount is the same with or without credit, and all registrants are expected to complete and submit all assignments.

LODGING AND MEALS *(Please complete this section <u>even if you will not be staying on campus</u>.)*

Lodging preference: ***(All accommodations are single bedroom in 2-4 bedroom suites.)****

___ I will be staying off-campus and will not need on-campus accommodations.

___ One week: $258.00 (6 nights: check-in Sunday; check out Saturday)

___ Two weeks: $559.00 (13 nights-includes weekend between workshops: check-in Sunday; check out Saturday)

Meals:* ***(It is recommended that participants have lunch together to facilitate the informal exchange of ideas.)***
<u>Commuters – please complete the lunch line even if arranging for your own lunch.</u>

Breakfast (Monday-Friday)	____One week ($43)	____Two weeks ($86)	____ I will arrange for my own breakfast.
Lunch (Monday-Friday)	____One week ($53)	____ Two weeks ($106)	____ I will arrange for my own lunch.**
Dinner (Monday-**Thursday**)	____One week ($48)	____ Two weeks ($96)	____ I will arrange for my own dinner.

* The prices quoted for lodging and meals include 7.5% tax.

** Please be aware that workshop participants who bring their own lunch are not admitted to the dining hall.

PARKING (Prices are set by Colorado School of Mines at $4 per day.)

Like many universities, Colorado School of Mines now charges for parking anywhere on campus, including streets. Whethe you will be commuting or staying on campus, if you bring a vehicle with you, you will need a parking permit. Please selec one of the following:

___ I will <u>not</u> have a vehicle on campus and will not need a parking permit.

___ I'll be commuting or staying on campus and will need a parking permit for <u>one</u> Monday–Friday workshop.

___ I'll be commuting and will need a parking permit for <u>two</u> Monday–Friday workshops.

___ I will be staying on campus for two weeks. I need a parking permit for two weeks, including the intervening week end.

DEPOSIT AND FINAL PAYMENT

A non-refundable deposit of $100 (payable to Science Curriculum Inc.) must accompany this application.

Please mail both to:

Coordinator of School Services
Science Curriculum Inc.
13701 W. Jewell Ave., Suite 204
Lakewood, CO 80228

A confirmation of your registration and deposit will be sent to you, along with an invoice for the remaining balance.

Due to planning and commitment deadlines at Colorado School of Mines, *all outstanding balances will be due and must be paid in full* ***by May 25, 2015.***

Signature _____ **Date** _____

If you have any questions, please contact us at 303-988-5041 (toll-free 888-501-0957) or email workshops@sci-ips.com .