

SMART 2009 (7/9~7/15)

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Science, Mathematics And Research Training 2009

Woodlawn High School Science Education Outreach

Our program in 2008

For Educators
[SMART Proposal](#)
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For Students
Outreach supporting videos:
[Our Secretary of Energy](#)
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[Solar energy](#)
[Wind power](#)
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[Tides](#)
[Hydroelectric](#)


Science
[Calculate local magnetic field](#)
[Calculate local gravity \(in US\)](#)

Welcome to S.M.A.R.T.!

Who are we?
...We are a group of researchers and educators from the Department of Physics of the University of Chicago.

What are we doing here?
...We are setting up this website and share with you the secrets and excitement about science and mathematics research.

How do you explore the website?
...Try the links on the left. If you know any other interesting websites, please tell us. We will include more interesting websites.



Windmills

Our Goals This Year

- Energy and its manifestations in natural phenomena and in human activities
- Energy conversion and conversion efficiency
- Impact of conventional energy sources to the environment
- Understand the need to develop new energy sources

Supporting personnel

- **Organizers:**

(UC) CC, Heinrich Jaeger, Eileen Sheu

(UCW) Assata Moore and Mike Metz

(Argonne) Patricia Canaday

- **Outreach activity leaders:**

Van Bistrow, Zosia Krusberg, Athena Frost, Kathy-Anne Soderberg,
Nathan Gemelke

- **Research assistants:**

Chen-Lung Hung, Arjun Sharma, Kara Lamb, Peter Scherpelz, Skyler
Degenkolb, Jia Hong Ray Ng

Sponsor: UC MRSEC, NSF

Program (1/4)

Thursday, 7/9	Exp. 1	(Van, Mark, K.A., Arjun, Athena)	Location
• 9:45 am:		Arrival	5720 S. Ellis Ave.
• 10:00 ~ 10:30 am:		Welcome and breakfast	KPTC 213
• 10:30 ~ 12:15 am:		Lecture and discussion	KPTC 213
• 12:15 ~ 1:00 pm:		Lunch	KPTC 213
• 01:00 ~ 4:00 pm:		Experiment and discussion	KPTC 208
• 4:15 pm:		Departure	5720 S. Ellis Ave.
Friday, 7/10		Heinrich lab tour (Heinrich)	
• 9:45 am:		Arrival	5720 S. Ellis Ave.
• 10:00~12:00 pm:			KPTC 213
• 12:15~1:00 pm:		Lunch	KPTC 213
• 1:00~4:00 pm:			KPTC 116
• 4:15 pm:		Departure	5720 S. Ellis Ave.

Experiment 1: sample page of the lab manual

Your Name (Please print): _____

Lab Partner's name _____

Date _____

SMART PROGRAM, 2009

A Bright Idea

Laboratory Exercise

Goal

We wish to study the electrical energy usage of two common types of light bulbs, the old incandescent bulb and the newer compact fluorescent bulb.

How the bulbs work

The incandescent bulb works by passing an electrical current (electrons) through a wire, making it so hot that it glows. The problem is that much of the energy the bulb uses goes into producing heat and not light.

Experiment 1: sample page of the lab manual

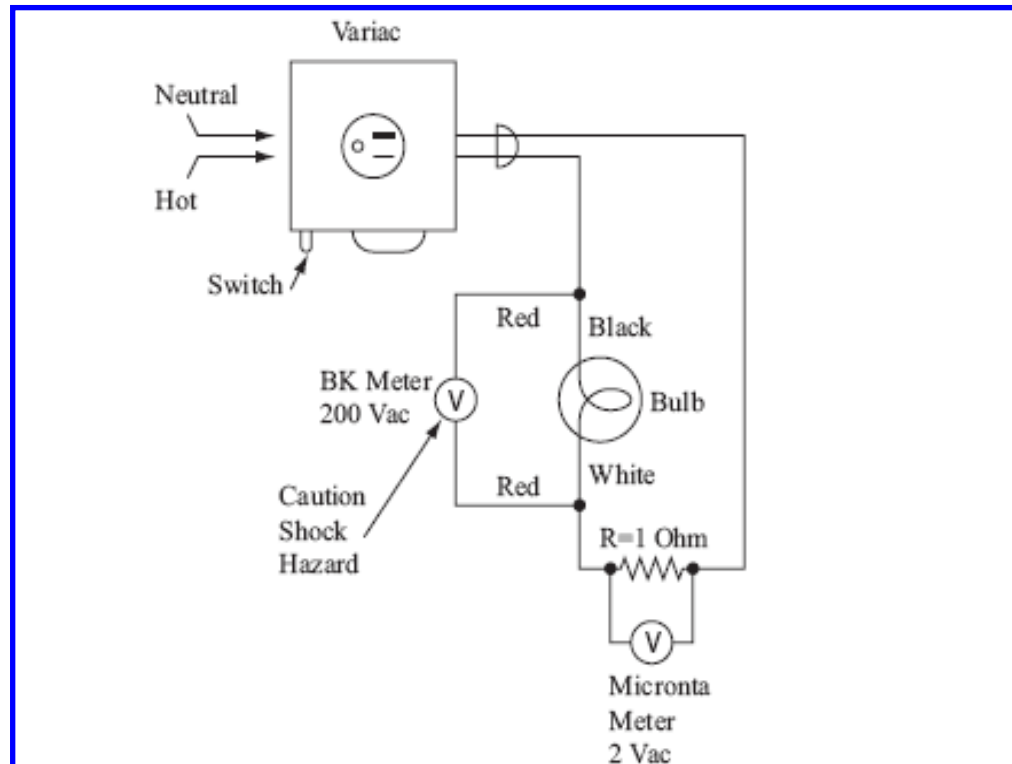


Fig. 2 Circuit diagram for measuring light bulb I and V

8. Screw the CF bulb into the socket. Do not turn on the Variac until an instructor checks your wiring.
9. Turn the BK meter to the 200 Vac range. Set the Micronta meter to the 2Vac range.
10. When the instructor approves, set the Variac knob to 120V and turn on its switch. Let the bulb warm up for about two minutes for maximum brightness.

Program (2/4)

Saturday, 7/11	Museum tour (Athena, Assata, Joe Cattral, Ray)
1:30 pm	Meet at 57th and University to board bus to Adler Planetarium & Astronomy Museum
2:00-5:10 pm	Adler with science talk and Night Sky Live! Show
5:10-5:45 pm	Dinner
6:00-8:00 pm	Load bus and travel to Yerkes
8:00-10:00 pm	Tour and viewing
10:00-12:00 pm	Return to campus

Adler Planetarium: 1300 S Lake Shore Dr Chicago, IL 60605-2489 - (312) 922-7827

Yerkes Observatory: 373 W. Geneva St, Williams Bay WI 53191

Program (3/4)

Monday, 7/13

- 9:45 am: Arrival 5720 S. Ellis Ave.
- 10:00~12:00 pm: Lecture and discussion KPTC 213
- 12:00 ~ 12:45 pm: Lunch KPTC 213
- 01:00 ~ 4:30 pm: Experiment and discussion KPTC 116
- 4:15 pm: Departure 5720 S. Ellis Ave.

Exp. 2 (Eileen, Zosia, Kathy-Anne, Arjun, Skyler)

Tuesday, 7/14

- 9:45 am: Arrival 5720 S. Ellis Ave.
- 10:00~12:00 pm: Lecture and discussion KPTC 213
- 12:00 ~ 12:45 pm: Lunch KPTC 213
- 01:00 ~ 3:30 pm: Experiment and discussion KPTC 116
- 3:30 pm: BBQ Parents & teachers are welcome! KPTC 206
- 5:00 pm: Departure 5720 S. Ellis Ave.

Exp. 3 (Nate, Zosia, Chen-Lung, Kara, Peter)

Experiment 2: sample page of the lab manual

Some Like It Hot: An exercise in temperature, energy transfer, and energy conservation

Zosia A. C. Krusberg and Christopher Thom

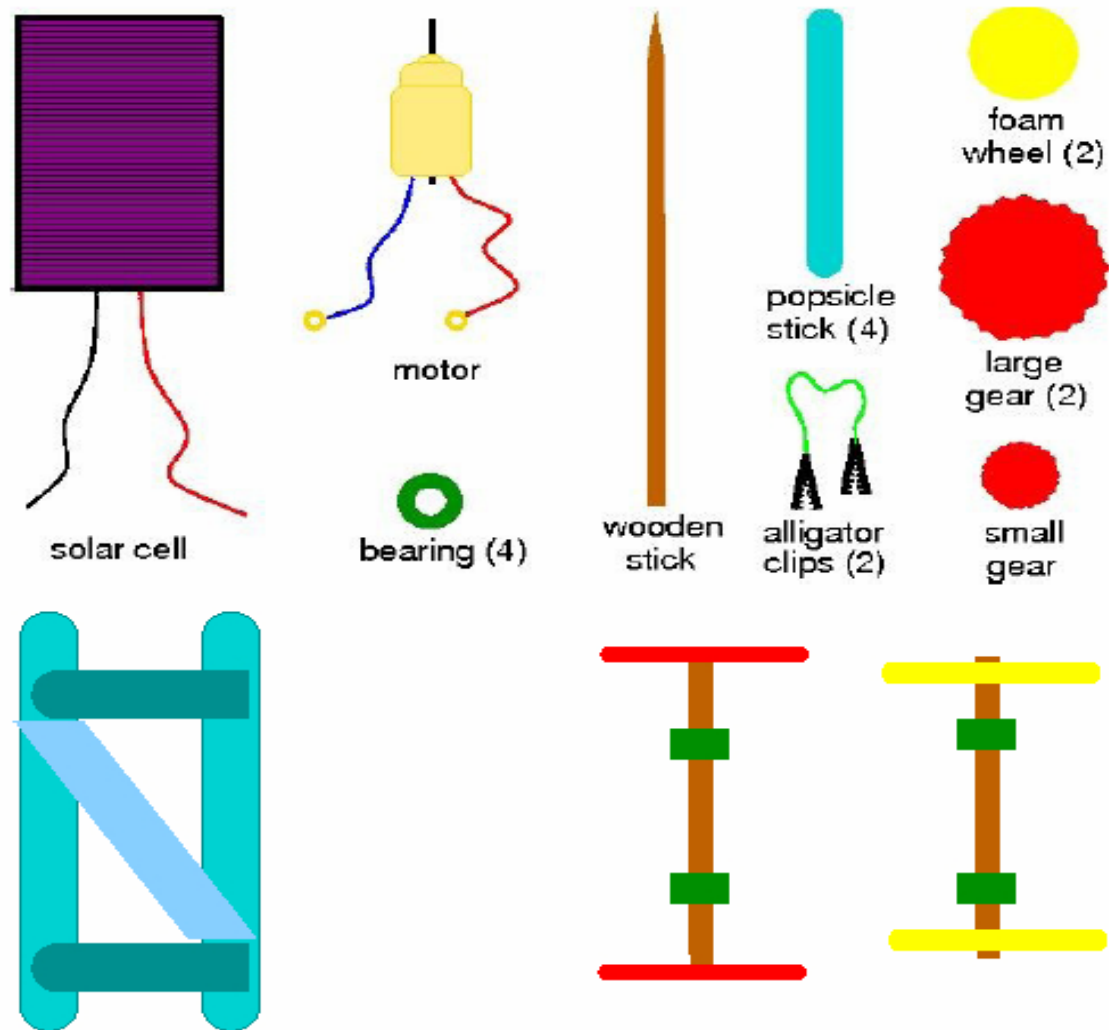
Temperature and heat: An introduction

Place a pot of cold water on the hot burner of a stove: eventually the temperature of the water increases and the water boils. Go out to the South Lawn on a sunny day: in the Sun, you will very quickly get warm, but if you stand in the shade, you will feel cooler. Place a cold fever thermometer into a sick patient's mouth: soon the temperature of the thermometer will be equal to the temperature of the sick person's mouth.

In each of these cases, we say that heat flows from the hot object (the burner, the Sun, the lamp) to the cool object (the water, you, the sick mouth). In fact, we use the word *heat* a lot in everyday life, but because it has a very specific scientific meaning – and is often used incorrectly in its everyday use – it is important that we define the term accurately before going on to explore some of the phenomena associated with temperature and heat.

At the fundamental level, all materials consist of particles – atoms and molecules – that are constantly in motion. In what physicists call *kinetic theory*, the macroscopic (large-scale) properties of materials, such as temperature, pressure, and volume, are explained using the microscopic (small-scale) properties, such as what types of atoms or molecules make up the material and how individual particles are moving. So, using kinetic theory, we can try to clarify exactly what we mean by temperature, heat, and another property of materials called the *internal energy*.

Construction of a solar power car



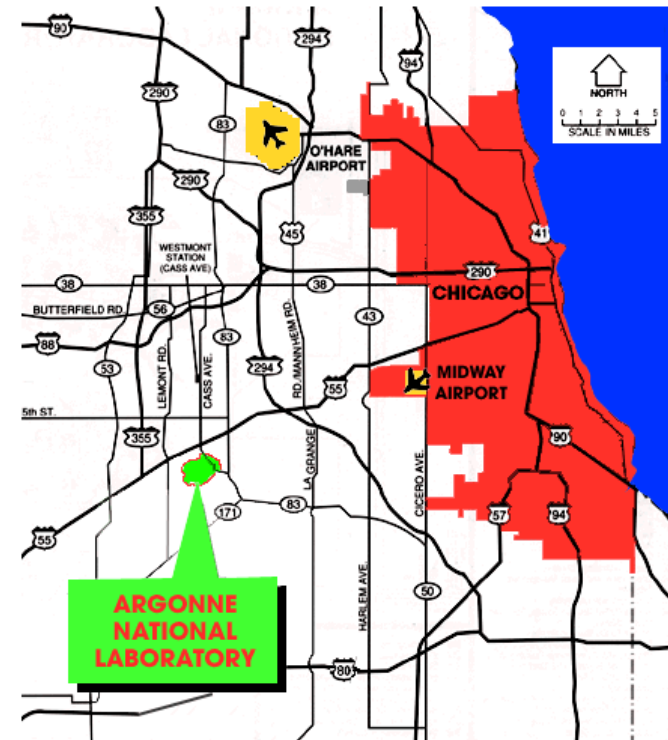
Step 1: Cut one popsicle stick in half, and glue the halves across the ends of two other popsicle sticks, as shown on the left. Glue a fourth popsicle stick along a diagonal for support. Next, cut the wooden stick in half, and cut each section to be about half an inch longer than the width of the frame, as shown on the right. Glue two bearings onto each axle, spaced so that they can fit on the frame. Glue gears to one axle and wheels to the other.

Program (4/4)

- **Wednesday, 7/15** **Argonne tour (Pat, Peter, Skyler)**
 - 11:30 ~ 12:15 pm: Arrival and lunch
 - 01:00 ~ 04:00 pm: Tour
 - 4:00 pm: Departure
- 5720 S. Ellis Ave.
Argonne National Laboratory
Argonne National Laboratory

ANL regulations: Please note required attire for tour: everyone should wear flat, closed toe shoes, no sandals; no shorts. Your bus or van will be needed on site the entire time of your visit. Please complete and return the attached transportation form.

Your tour escort, Mr. Dan West, will meet everyone at our Argonne Information Center/Visitor Reception Center. A photo I.D., such as driver's license or student I.D., is required for everyone 16 years and older. Original passport and visa, or permanent resident card is required for any non-U.S. citizen 18 years and older. Gate passes will not be issued without a photo I.D. or the documents required for any non-U.S. citizens.





ANL tour

The Advanced Photon Source (APS) at the U.S. Department of Energy's Argonne National Laboratory is one of the most technologically complex machines in the world. This premier national research facility provides the brightest x-ray beams in the Western Hemisphere to more than 5,000 (and growing) scientists from around the United States and the world. These scientists come to the APS from universities, industry, medical schools, and other research institutions. They bring with them ideas for new discoveries in nearly every scientific discipline, from materials science to biology, chemistry, environmental and planetary science, and fundamental physics. They bring their ideas to the APS because the x-ray beams provided by this remarkable facility enable the collection of data in unprecedented detail and in amazingly short time frames. The knowledge researchers gain here promises to have real and positive impact on our technologies, our health, our economy, and our fundamental understanding of the materials that make up our world.

ATLAS – The Argonne Tandem Linac Accelerator System (ATLAS) is the world's first superconducting ion accelerator ever built. It is capable of accelerating ions of all natural elements from hydrogen to uranium for research into the properties of the nucleus, the core of matter, the fuel of stars.

Nuclear Engineering Exhibit showcases Argonne's rich heritage in the development of nuclear reactors and its current role in the development of next generation reactors and fuel cycle technologies.

The Argonne Information Center (AIC) is filled with more than 30 exhibits about science and technology and Argonne's current research programs.

Reservations are required. Call 630-252-5562 or e-mail tours@anl.gov to schedule.

Logistics:

Woodlawn High contacts:

Assata Moore assatamoore@ucw.uei-schools.org

Mike Metz mmetz@ucw.uei-schools.org

UC contacts:

Cheng Chin cchin@uchicago.edu

Eileen Sheu ecs@uchicago.edu

Students: 4 returning, 8 new students

Breakfast and lunch: **UC MRSEC (Eileen)**

Experiment supply: **UC Physics Department (Van Bistrow)**

Shuttle 7/9, 10, 11 (museum tour), 13, 14, 15 (ANL tour): **UCW**

Museum fees: **UC MRSEC (Eileen)**

UCW students (From Director Linda Wing)

4 Returning students (team leaders):

Dana Brooks (11)
Brittany Gant (11)
Chelsea McCarthy (11)
Shannon Jackson (11)

8 New Students:

Isaac Brown (9)
Vernon Fleming (9)
Quentin Wilson-Chappell (9)
Tevin Jones (9)
Eva Delt (9)
Shaiesha Moore (10)
Rozjolei Jackson (10)
Carneal Rivers (9)
Ariel Cotharn (10)
Joel Brown (9)