

**Funding Proposal  
2007-2008 ASM International  
Materials Education Foundation Grant Program**

**Submitted by:  
Northwestern University  
ASM Student Chapter**

**February 12, 2007**

## **Project Description:**

Haven and Northwestern Discover Science (HANDS) is an educational outreach program run by graduate student volunteers from the Department of Materials Science and Engineering at Northwestern University. Our goal is to encourage middle school students to pursue science and engineering curricula by providing access to hands-on experience, university equipment, and a diverse set of role models. We attempt to cover topics not usually touched upon in the classroom, challenging students to formulate and test hypotheses while applying observational and analytical skills. Students join HANDS in the sixth grade and most continue with the program through seventh and eighth grades.

The general structure of the program is as follows: Haven Middle School science teachers nominate students to participate in HANDS, emphasizing diversity and teamwork. Materials Science and Engineering graduate students coordinate all other aspects of HANDS, holding an informational meeting for the nominated students and their parents, scheduling after-school sessions and fieldtrips, and preparing experiments and worksheets. Two hour long after-school sessions are generally held every other week during Haven Middle School's academic quarters. Each session starts with a general introduction to a scientific topic, and Haven students are encouraged think of real-world examples and form hypotheses about the topic. Students then perform related experiments, using observational and analytical skills to test their hypotheses and form theories. In addition, we take at least one fieldtrip each year to Northwestern University facilities and other places of scientific interest such as the Museum of Science and Industry in Chicago, IL.

Some of our recent activities include sessions on thermal conductivity; computer programming; electricity, magnetism, and circuits; caramelization and making taffy; rubber band-powered cars; and a field trip to the Northwestern University Electron Probe Instrumentation Center (EPIC). For the 2007-2008 academic year we would like to prepare activities based on photovoltaics and fuel cells, shape memory materials, and biomaterials. We are also planning two fieldtrips to Northwestern University laboratories and the Museum of Science and Industry or the Field Museum in Chicago, IL.

A detailed timeline and estimated budget are included below.

## **Timeline:**

### **October 2007** – Organizational Tasks

- Student nominations
- Student/parent organizational meeting
- Graduate student volunteer recruitment meeting

### **November 2007** – Two sessions on energy generation and storage

- Session 1: Power generation; renewable/nonrenewable resources; photovoltaics
- Session 2: Energy efficiency; power storage; fuel cells

### **December 2007** – Two sessions on composite materials and fieldtrip to Northwestern University

- Session 1: Material properties; material classes; produce particle-reinforced epoxy composites
- Session 2: Fieldtrip to Northwestern University Central Laboratory for Materials Mechanical Properties (CLaMMP) and Electron Probe Instrumentation Center (EPIC) facilities: Perform mechanical testing and scanning electron microscopy on epoxy composites from Session 1

### **January 2008** – Two sessions on thermal properties and shape memory materials

- Session 1: Thermal expansion; thermal shock; thermal conductivity in ceramics, metals, and polymers
- Session 2: Bimetallic strips; shape memory alloys and shape memory polymers

### **February 2008** – Two sessions on polymers and gels

- Session 1: Thermosets and thermoplastics; recycling of plastics
- Session 2: Produce polymer gels and shear-thickening material (oobleck)

### **March 2008** – One session on biomedical materials

- Session 1: Biomaterials for implants, bone grafts, and joint replacement; biodegradable sutures and glues

### **April 2008** – Two sessions on optics and electromagnetic waves

- Introduction to electromagnetic waves; diffraction; properties of lenses and prisms
- Optics obstacle course

### **May 2008** – One session on weather; one session on food science

- Session 1: Air pressure; cloud formation; pollution issues
- Session 2: Natural acids and bases; enzymatic breakdown in fruits and vegetables; sugars, carbohydrates, proteins, and calories

### **June 2008** – Final fieldtrip

- Fieldtrip to Museum of Science and Industry or other science-related place of interest

**Itemized Cost Estimate – Capital Expenditures:**

<b>Energy Generation and Storage Sessions</b>		<b>\$205</b>
Photovoltaic kit	\$55	
Fuel cell kit	\$150	
<b>Composite Materials Sessions</b>		<b>\$75</b>
Epoxy	\$20	
Load frame use	1hr @ \$25/hr	
SEM use	1hr @ \$30/hr	
<b>Thermal Properties Sessions</b>		<b>\$35</b>
Shape memory materials	\$35	
<b>Polymers &amp; Gels Sessions</b>		<b>\$25</b>
Borax, cornstarch, and other oobleck ingredients	\$25	
<b>Biomedical Materials Session</b>		<b>\$50</b>
Biodegradable polymers kit	\$50	
<b>Optics and Waves Sessions</b>		<b>\$50</b>
Standing wave generator	\$25	
Laser pointer	\$25	
<b>Weather Session</b>		<b>\$70</b>
Cloud Chamber	\$70	
<b>Food Science Session</b>		<b>\$80</b>
Food ingredients	\$25	
Calorimeter	\$45	
pH paper	\$10	
<b>Final Field Trip</b>		<b>\$210</b>
Transportation	\$60	
Admission	\$150	
<b>Total</b>		<b>\$800</b>

## **Contact Information:**

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