

# PACE Science Forum Kit

This kit contains the materials you will need to complete a satisfactory Science Forum project. Included are the following:

Science Forum Description	This section describes what the Science Forum is, what the goals are, what you have to do, and when.
Judging Criteria	This describes the criteria by which your project will be judged.
Project List	This section has a description of Science Forum projects from which you may choose. You may also choose to do a project not listed in this section.
Registration Form	To sign-up for the Science Forum each project team or individual must fill-out and submit a Registration Form.
Development Plan	Each project team or individual must submit a development plan, which outlines the steps of the project.
Project Checklist	The Project Checklist is a sign-off sheet that records your progress in completing each step of the Science Forum process.

# Science Forum Description

The PACE Science Forum is an annual student showcase. It's a chance for you to demonstrate a project that you've worked on, on a topic that you're interested in. In preparing a project for the Science Forum you will get to work with a member of the PACE staff and learn how to do scientific or engineering type research. You may work on a project by yourself or in small teams under the direction of a staff advisor. Your project can be from any of several different areas: math, science, engineering, social science, or others. There are lots of options. Your project need only employ principles of scientific or engineering investigation.

## **Science Forum Goals**

The goal of the Science Forum is to teach you how to do scientific or engineering research. The process makes it possible for others to duplicate and validate your work and to ensure the integrity of your results. Emphasis should be on following the process rather than on producing a particular outcome. So, projects put together at the last minute will not be accepted.

To be successful

1. You must follow the process outlined in the Scientific Method or Engineering Method. (See the Instructional Series section below.)
2. Your project must have Scientific Content. (See the Judging Criteria page.)

## **Project Steps**

The first step is finding a project. Staff advisors have several project ideas that you may choose from, or you may suggest your own idea. Then, work begins. Here's what you'll do:

Pick a project	You may pick from among several projects suggested by the staff advisors, or, you may pick one of your own. A list of projects is on the next few pages.
Fill out and submit a registration form	After picking a project you will fill out a form with a project title, a sentence or two describing your project, and information about you and anyone else you may be working with. This registration form, which is due on <b>September 27</b> , is included in this kit.
Jointly develop a project plan	If you pick a project from the Project List, you can work with the project advisor to develop a detailed project plan. The project plan outlines the steps you need to follow to complete your project.
Submit a development plan	After a few weeks, you will hand in a more detailed description of your project. It will include a schedule and, if you're working on a team, the division of responsibilities among your team members. Much of the information in the development plan can be taken from the project plan.
Submit periodic progress reports	You <b>must</b> report your progress to your staff advisor on the date given on page 14. You must do this even if you have not accomplished anything since the previous report. When you make your report (it is very informal – verbal, written, e-mail are all OK) the staff advisor will sign-off on your project checklist. It is an absolute requirement that you get sign-off on all items on your checklist.

Present your project	You will present your project to an audience of other students, staff, and parents at <b>Science Forum 2009</b> . The date is <b>February 21, 2009</b> .
Submit a final report	Two weeks after the Science Forum you will hand in a final report that describes your project, the work you did and the conclusions you came to.

## ***Benefits***

### Requirement for the Book Grant

Participating in at least one Science Forum is a requirement for a PACE Book Grant. The Book Grant is an award given to qualifying seniors. (Information on the Book Grant is distributed to seniors early in the fall semester.) Otherwise, the Science Forum is not mandatory, although all are encouraged to participate.

### Prizes

Prizes for successfully completed projects are:

- Certificates of Accomplishment
- Gift Certificates

## ***Staff Advisors***

The staff advisors for this year are listed below. Feel free to contact any of them with any questions you may have.

Oswald Barrimond  
 Silvano Brewster  
 Courtney Pinnock  
 Michael Sligh  
 Patty Miller-Pittman  
 Jesus Batista

## ***General Schedule***

Dates are given on page 18.

Submit Registration Form  
 Start planning your project  
 Submit Development Plan  
 Project Update 1  
 Begin working on your Science Forum Project  
 Project Update 2  
 Science Forum Presentations  
 Begin working on your Final Report  
 Submit Final Report

## ***Project Notebook***

It is extremely important that you keep track of all your work. You should therefore keep a project notebook. In it you should keep this Science Forum kit, all handouts from the instructional series

sessions, results of any experiments or other work you do, and anything else associated with your project.

# PACE Science Forum Judging Criteria

PACE Science Forum projects will be judged against the following criteria:

## ***Development Plan***

The development plan is judged on whether it was handed in on time. It will not be scored on content although feedback will be provided for the information of the project team.

## ***Project Checklist***

You must have all items on your project checklist signed-off by a staff advisor. You will not be allowed to present your project at the Science Forum if you have not met all the checkpoints.

## ***Scientific Content***

Your Project will be judged on its Scientific Content. This is defined by the following questions:

- Is the problem well stated?
- Does it follow logical, appropriate, and accepted scientific methodology?
- Are the results valid and reasonable?
- Are the conclusions supported by the findings?

## ***Science Forum***

The Science Forum itself will be judged by the display and presentation.

The display must be readable, must represent the project, and must be informative.

The project participants must do a ten-minute oral presentation. The presentation will be judged on the following criteria:

- Appropriate dress for a formal presentation
- Maintenance of proper eye contact
- Loud and clear speech
- Appropriate use of visual aids
- Fitting the presentation within the time limit. The time limit does not include the question and answer period
- A clearly identifiable subject
- Support for the main points
- Organization of the presentation into an introduction, body, and conclusion

Both the display and the presentation must demonstrate the Scientific Content of the project.

## ***Final Report***

The final report is a required deliverable. Those not submitting a final report by the due date (one week before the Science Forum) will not be allowed to present their project.

The final report must contain the following: title, date, "PACE Science Forum 2009", names of participants.

It must be on a permanent media (paper, floppy disk, videotape, etc.).

The report must contain the following sections: Abstract, Introduction (includes background, overview), Materials and Methods, Results and Discussion (analysis, evaluation), Conclusion, References

The final report will be judged on several criteria including grammar, neatness, and Scientific Content.

# Project List

The following projects are available for you to choose from. Once you have chosen a project you must get a project plan from your staff advisor. If you are not interested in any of the projects in this list, you may pick your own project or you can ask a member of the committee to help you pick another project from an area of your choosing. Once you have a project, your staff advisor will put together a project plan for you.

Physics

## **Subject Area: Physics**

Project Title: Egg Drop

Project Size: 1 student (freshman or sophomore only)

Prerequisites: Basic math and Science

Optional: physics, material science

Description: Construct a container that will protect a raw egg from cracking when dropped from 20 feet. The egg container must have a volume of at least  $x \text{ in}^3$  and must weigh at least 15 pounds. Try different container shapes, sizes, and packing materials. Demonstrate.

Project Advisor: Silvano Brewster

## **Subject Area: Software Engineering**

Project Title: Web Design

Project Size: 1-2 students

Prerequisites: None.

Description: Design and build a web site. Topic is up to the student.

Project Advisor: Silvano Brewster

## **Subject Area: Software Engineering and Math**

Project Title: Linear System Solver

Project Size: 1-2 students

Prerequisites: Algebra II or Precalculus.

Description: Write a computer program to solve a system of linear simultaneous equations ( $n$  equations in  $n$  unknowns).

Project Advisor: Silvano Brewster

## **Subject Area: Mathematics**

Project Title: Invent a Measuring System

Project Size: 1-2 students

Prerequisites: Algebra I and Geometry

Description: Measuring systems are based on agreements between people to use a particular word to indicate a particular amount. A single system of measurement would make it much easier to measure and calculate. A common system of units would allow you to communicate your needs faster. You are tasked to develop a single measuring system for length, volume, weight, and area. Your design shall include names of units, appropriate tools (rulers, scales, etc.), degree of accuracy, and conversion methods. The items to be methods shall include solids and liquids in both regular and irregular shapes.

Project Advisor: Mike Sligh

**Subject Area: Mathematics**

Project Title: Design a Calculator to compute taxes on stock market transactions

Project Size: 1-2 students

Prerequisites: Algebra I

Optional: None

Description: The student is tasked to design a calculator system to automatically compute the federal and state taxes associated with the purchase and sale of common stock. The student shall research the appropriate tax regulations and design their calculator to make computations based on that research.

Project Advisor: Mike Sligh

**Subject Area: Mathematics**

Project Title: Design a Calculator to estimate future values of IRA contributions

Project Size: 1-2 students

Prerequisites: Algebra II

Optional: None

Description: The student is tasked to design a calculator system to automatically estimate the future value of Individual Retirement Account (IRA) contributions. The student shall conduct research to determine contribution restrictions and historical returns of stocks and fixed interest investments. The student shall design their calculator to make estimates based on that research.

Project Advisor: Mike Sligh

**Subject Area: Astronomy**

Project Title: Sundial

Project Size: 1-2 students

Prerequisites: Geometry

Optional: Trigonometry, Astronomy

Description: How did people tell time before the invention of clocks? One method was by using a device called a sundial. A sundial is essentially a clock that uses the position of the sun to indicate the time. An indicator, called a gnomon, in the center of the sundial casts a shadow on its surface. Markings on the surface indicate the time by

the position of the shadow. Design and build a sundial. Demonstrate the accuracy of the sundial by comparing with clock time

Project Advisor: Patty Miller-Pittman, Oswald Barrimond

**Subject Area: Energy**

Project title: Solar Cooker

Project Size: 1-2 students

Description: Design and build a Solar Box Cooker capable of cooking a meal. No prerequisites are required, however, students are expected to perform basic research.

Project Advisor: Courtney Pinnock

**Subject Area: Software Engineering**

Project Title: Design a Donation Database for PACE

Project Size: 1-2 students

Prerequisites: None

Description: Design a database for keeping track of donations to PACE. The database system will store information about donors, their donations, create summary reports, and thank-you letters.

Project Advisor: Silvano Brewster

**Subject Area: Robotics**

Project Title: Lego Robot

Project Size: 1-2 students (Seniors only)

Prerequisites: Basic knowledge of engineering principles and computer science

Description: Construct and program a robot to complete a specified task.  
The complexity of the task would depend on the number of students and their level. The robot would show the students knowledge of engineering principles and programming would show the students knowledge of computer science.

Project Advisor: Courtney Pinnock

**Subject Area: Engineering**

Topic: Electronic Seismograph

Project Size: 2-3 students

Prerequisite: None

Description: Design and build an electronic seismograph capable of measuring the intensity of a small earthquake.

Project Advisor: Ernest Heath

**Subject Area: Engineering**

Project Title: Electromagnetic Crane

Project Size: 1 students (freshman, sophomore or junior only)

Prerequisite: None

Description: Design and build a model electromagnetic crane that can lift metallic objects.

Advisor: Courtney Pinnock

**Subject Area: Science**

Project Title: Are safe homemade cleansers as effective as commercial cleansers?

Project Size: 1-2 students (freshmen or sophomores); 1 student (junior or senior)

Prerequisites: None.

Description: Determine experimentally whether homemade cleansers clean as effectively as commercial cleaners.

Project Advisor: Patty Miller-Pittman

**Subject Area: Engineering**

Project Title: Nuclear Power Station Report

Project Size: 1-2 students

Prerequisite: None

Description: Compile a report describing the design and construction of a Nuclear Power Station. The engineering principles that are used to generate the electricity should be described.

Advisor: Courtney Pinnock

**Subject Area: Engineering**

Topic: Hydroelectric Power Station Report

Project Size: 1-2 students

Prerequisite: None

Description: Compile a report describing the design of a Hydroelectric Power Station. The engineering principles that are used to generate the electricity should be described.

Advisor: Courtney Pinnock

**Subject Area: Science, Math, Medicine**

Project Title: Volumetric Measurement of Tumors

Project Size: 1-2 students (adaptable to any level)

Prerequisites: Basic math and Science

Optional: physics, algebra, calculus, computer science

Description: Research the basic science behind either an MRI or CT Scan. Describe how measuring the volume of a tumor on a scan can be used to accurately monitor tumor growth. Develop a method for calculating the volume of a tumor.

Project Advisor: Patty Miller-Pittman

**Subject Area: Electrical Engineering**

Project Title: LSM Powered Train

Project Size: 1-2 students

Prerequisites: Basic math and Science

Description: Design and build a model train powered by a linear synchronous motor (LSM). LSM is the technology using permanent magnets and electromagnets that accelerates the world's fastest roller coaster.

Project Advisor: Silvano Brewster



# SCIENCE FORUM REGISTRATION FORM



Project Title: \_\_\_\_\_

**Project Description:**

*A brief description of the project stating the scientific or mathematical principle to be investigated.*

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Project Participants:**

Name \_\_\_\_\_ Telephone \_\_\_\_\_

Address \_\_\_\_\_

High School \_\_\_\_\_ Grade \_\_\_\_\_ E-mail \_\_\_\_\_

Name \_\_\_\_\_ Telephone \_\_\_\_\_

Address \_\_\_\_\_

High School \_\_\_\_\_ Grade \_\_\_\_\_ E-mail \_\_\_\_\_

Name \_\_\_\_\_ Telephone \_\_\_\_\_

Address \_\_\_\_\_

High School \_\_\_\_\_ Grade \_\_\_\_\_ E-mail \_\_\_\_\_

I understand that

- Successful completion of a Science Forum project requires a commitment to work on my project during the week outside of PACE hours.
- I must keep my Science Forum advisor informed of my progress.
- I will have to attend short instructional sessions on a few Saturdays outside PACE class hours.

Signature of Participant(s):

\_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_ Date \_\_\_\_\_

Staff Advisor:

Name \_\_\_\_\_ Signature \_\_\_\_\_

Date \_\_\_\_\_



## STUDENT DEVELOPMENT PLAN FOR SCIENCE PROJECT

Title of Project \_\_\_\_\_

Date \_\_\_\_\_

### STATEMENT OF PROBLEM:

*A brief description of the project stating the purpose or principle involved.*

### HYPOTHESIS:

*What is it that you expect to prove or demonstrate (i.e. how does something work or behave).*

### PROJECT DESIGN:

*How will the project be implemented*

I. Describe the procedure by which the experiment or model will be built in order to demonstrate the principle.

II. List the materials or equipment that will be required.

STUDENT DEVELOPMENT PLAN FOR SCIENCE PROJECT

III. List the purpose of any surveys or questionnaires (leave blank if not applicable).

IV. List the type of data that will be collected and how it will be used.

V. Give a schedule for completing the components of the project.

PROJECT PARTICIPANTS:

Name \_\_\_\_\_ Telephone \_\_\_\_\_

Name \_\_\_\_\_ Telephone \_\_\_\_\_

Name \_\_\_\_\_ Telephone \_\_\_\_\_

Name \_\_\_\_\_ Telephone \_\_\_\_\_

Project Advisor \_\_\_\_\_

STUDENT DEVELOPMENT PLAN FOR SCIENCE PROJECT

SCIENCE FORUM COMMITTEE USE ONLY

COMMENTS:

SUGGESTIONS:

REVIEWER: \_\_\_\_\_ DATE: \_\_\_\_\_

Approved

Declined

STUDENT DEVELOPMENT PLAN FOR SCIENCE PROJECT

# Project Checklist

Item	Due Date	Staff Sign-off	Date
Submit Registration Form	27-Sept-08		
Submit Development Plan	18-Oct-08		
Project Update 1	2-Dec-08		
Project Update 2	27-Jan-08		
Submit Final Report	14-Feb-09		
<b>Science Form Presentation</b>	<b>21-Feb-09</b>		