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.

In addition you will add the following materials to your kit:

Project Plan	This is a step-by-step description of the project you have chosen.
Instructional Series Materials	During the course of the Science Forum process you will receive instructional materials that cover various aspects of completing a project. You will add materials from these sessions to your kit. The topics to be covered are: • The Scientific Method/Engineering Method • How to Plan a Project • How to Do an Experiment/How to Develop a Product or Service • How to Do a Presentation/How to Produce a Final Report

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 **October 20**, 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 **must** report your progress to your staff advisor on the date given on page 15. 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 **Science Forum 2008**. The date is **February 23, 2008**.

Submit a final report	On the day of 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

You will be working with a staff advisor. Some staff have agreed to supervise specific projects listed in this package. However, these or others may be willing to help you with your own project idea or propose something not listed. Feel free to approach a staff member you might want to work with.

General Schedule

Dates are given on page 15.

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

Project Notebook

It is extremely import 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 (two weeks after the Science Forum) will not be given credit for successfully completing a Science Forum project.

The final report must contain the following: title, date, "PACE Science Forum 2002", 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 Scientific Content.

The report will be judged on grammar and neatness

Science Forum Tips

Here are some important tips concerning the Science Forum:

- Some projects allow you to work with another person. If you choose to do so, pick your partner carefully. Make sure it is someone you can meet with outside of PACE
- If you work with a partner, choose someone that you can rely on to do his or her share of the work
- If you are a freshman, sophomore or junior, seriously consider doing a Science Forum before your senior year. You'll find it hard to make time during senior year as you apply to and visit colleges
- If you sign up to do a project, get an early start. The time you have to do your project is much shorter than it seems.

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 Bungee Jump

Project Size: 1 student (sophomore, junior or senior)

Prerequisites: Basic math and Science

Optional: physics, material science

Description: Attach rubber bands to an egg and observe, study, calculate, graph , and predict the elastic deformation of common rubber during egg bungee jumps.

Project Advisor: Courtney Pinnock

Software Engineering or Computer Science

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

Mathematics

Subject Area: Software Engineering and Math

Project Title: Linear System Solver

Project Size: 1-2 students

Prerequisites: Algebra II or Precalculus; Computer Programming

Description: Write a computer program to solve a system of linear simultaneous equations (up to 6 equations in 6 unknowns) using matrix algebra.

Project Advisor: Courtney Pinnock

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 write a computer program that automatically estimates the future value of Individual Retirement Account (IRA) contributions. The student shall conduct research to determine contribution restrictions and historical returns of a portfolio of at least ten stocks and fixed interest investments. The student shall design their program to make estimates based on that research.

Project Advisor: Mike Sligh

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: Mathematics and Operations Research

Project Title: Linear Programming

Project Size: 1 or 2 students

Prerequisites: Algebra II or higher

Description: Solve a linear programming problem given to you by your advisor. You may use any method that you wish. Linear programming is finding the best solution given a set of constraints or rules that the solution must obey.

Project Advisor: Courtney Pinnock

Science

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: 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

Engineering

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: Electrical 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: Electrical Engineering

Project Title: TV Game Show Buzzer

Project Size: 1 student

Prerequisite: PACE EE class

Description: Design and build a set of TV game show buzzers. These are the devices when hit by a contestant will sound a buzzer, light up their name tag and lock out the buzzers from the other contestants. Thus, it indicates which contestant buzzed in first and gets the right to answer the question. This is an enhancement of the final PACE EE class project from 2006-07. This version must support a bigger more durable switch, bigger and brighter lights, and must accommodate three contestants who are spaced comfortably apart.

Advisor: Silvano Brewster

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

Operations Research

Project Title: Optimal Elevator Dispatcher (Very Challenging)

Project Size: 1-2 students

Prerequisites: Strong understanding of probability and statistics; Good programming skills

Description: Write a computer program to control a bank of elevators using rules (that you determine) to minimize the overall waiting time for people riding the elevators.

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

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 _____

Project Advisor _____

STUDENT DEVELOPMENT PLAN FOR SCIENCE PROJECT

SCIENCE FORUM COMMITTEE USE ONLY

COMMENTS:

SUGGESTIONS:

REVIEWER: _____ DATE:_____

Approved ☐

Declined ☐

Project Checklist

Item	Due Date	Staff Sign-off	Date
Submit Registration Form	20-Oct-07		
Submit Development Plan	10-Nov-07		
Project Update 1	1-Dec-07		
Project Update 2	26-Jan-08		
Science Form Presentation	**23-Feb-08**		
Submit Final Report	23-Feb-08		