PACE Science Forum Kit for 2017-18

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.
Science Forum Tips	These are a few tips to help you be successful
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 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 give you experience in doing 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 a structured process rather than on producing a particular outcome.

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.
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.
Submit periodic progress reports	You must keep your project advisor informed on the progress you are making on your project. How you do this is between you and your advisor.
Submit a final report	Your final report is due one week before the Science Forum. The due date is April 21, 2018. You must submit a report by this date to be allowed to present your project.
Present your project	You will present your project to an audience of other students, staff, and parents at the Science and Technology Day 2018. The date is April 28, 2018.

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 will be awarded at the annual banquet for successfully completed projects.

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

See the project checklist at the end.

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

Resources

You have numerous resources available to you. First, is your Science Forum advisor. He or she will work closely with you and advise you on what you need to do. Second, is the Scientific and Engineering Projects class. The class provides a wealth of information about what good research entails, why do it, and what you need to accomplish. There also the PACE – Monmouth web site. In particular consult the Science Forum page for information on the process, format criteria for your final report, judging criteria, links to outside web resources, and other things. Also consult the class page for the Scientific and Engineering Projects class. It contains all class handouts.

Make use of these resources. They will help you produce a high quality project.

PACE Science Forum Judging Criteria

PACE Science Forum projects are scored. The score you receive is used as a component of the Book Grant score. The overall score is the average of your final report and Science Forum presentation score. The criteria for each component are as follows:

Final Report

The final report is judged on

- Scientific Content
- Completeness
- Organization
- Grammar/Spelling

Science Forum Presentation

The Science Forum presentation will be judged on

- Content
- Visuals
- Presentation
- Questions and Answers

Requirements for the final report, format, required sections, etc., and for the presentation, are available on the Science Forum page at the PACE – Monmouth web site.

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. You may choose one from the list, come up with your own idea, or ask a staff member to suggest other ideas in an area you are interested in.

Projects may involve 1 or 2 students. Three student projects may be allowed with approval of a Science Forum advisor. Such projects must be organized in a way that each student has a clear area of responsibility.

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:

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

Subject Area: Software Engineering

Project Title: Java Calculator

Project Size: 1-2 students

Prerequisites: Previous knowledge of Java programming or current enrollment in PACE Computer Science calss

Description: Design a multifunction calculator including a visual interface.

Project Advisor: John Jones

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:

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:

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:

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:

Subject Area: Mathematics (Statistics)

Project Title: Accuracy of Weather Prediction

Project Size: 1 or 2 students

Prerequisites: Algebra II or higher

Description: Determine the accuracy of weather prediction as a function of lead time. For example, how accurate are predictions made a week before versus three days before or one day before. Collect data over time. Tabulate and analyze the data. Then draw conclusions.

Project Advisor: Silvano Brewster

Science

Subject Area: Astronomy

Project Title: Sundial

Project Size: 1 student

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:

Subject Area: Science

Project Title: Are safe homemade cleansers as effective as commercial cleansers?
Project Size: 1 students

Prerequisites: None.

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

Project Advisor:

Engineering

Subject Area: Energy

Project title: Solar Cooker Project Size: 1 student

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:

Subject Area: Electrical Engineering

Project Title: Model Traffic Signal

Project Size: 1 student

Prerequisite: PACE EE class (2015-16 school year or later) or PACE EE class (any year) and knowledge of computer programming

Description: Design and build a model traffic signal. This is a four-way traffic signal with red, green, and amber lights. It is envisioned that the student would design it as a computer or microprocessor controlled system. Requires programming.

Advisor: Silvano Brewster

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

Project Title: Fastest Travel Route

Project Size: 1-2 students

Prerequisites: Algebra; Computer programming

Description: Write a computer program to find fastest route between two points. Learn the algorithm that is at the heart of Google Maps and other software that determines the fastest or shortest route between two points.

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 complete online training of various aspects of the Science Forum.

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 ☐

Project Checklist

Item	Due Date	Staff Sign-off	Date
Submit Registration Form			
Submit Development Plan			
Submit Final Report			
Science Form Presentation			