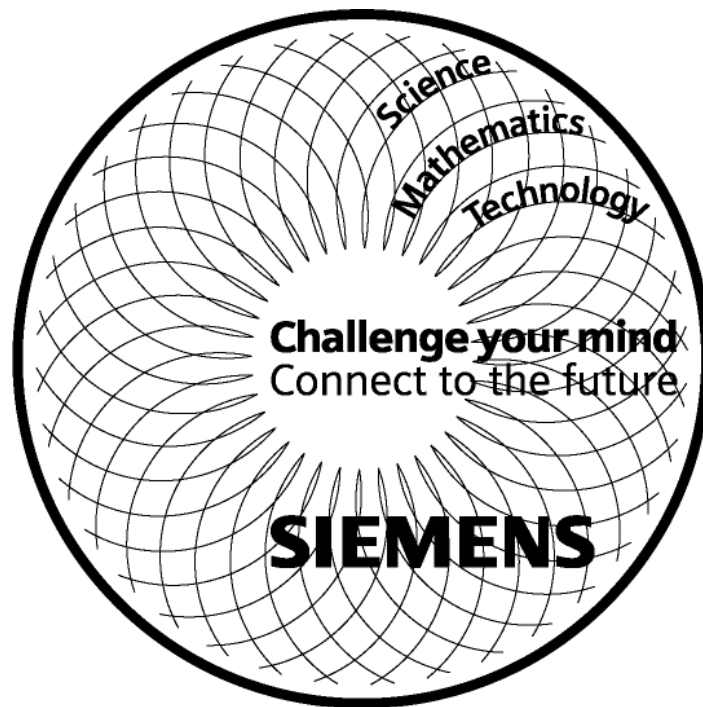


# SIEMENS COMPETITION

## Math : Science : Technology



## 2011 RESEARCH PROJECT INSTRUCTIONS

**Siemens Competition**  
**Math : Science : Technology**

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# Siemens Competition Math : Science : Technology

## 2011 Research Project Instructions

**DEADLINE: ALL COMPETITION MATERIALS MUST BE RECEIVED BY  
OCTOBER 3, 2011, 5 P.M. ET**

### I. OVERVIEW

In partnership with the College Board, the Siemens Foundation established the Siemens Competition in Math, Science & Technology and the Siemens Awards for Advanced Placement. The Foundation is a not-for-profit corporation dedicated to providing scholarships and increasing access to higher education for talented mathematics, science, engineering, and technology students in the United States.

The Siemens Competition seeks to promote excellence by encouraging students to undertake individual or team research projects. It fosters intensive research that improves students' understanding of the value of scientific study and informs their consideration of future careers in these disciplines.

You can compete as an individual or as a member of a team. Individual projects promote independent research. Team projects foster collaborative research efforts, as well as individual contributions to the cooperative endeavor.

Scholarships for winning projects range from \$1,000 to \$100,000.

#### A. The Advantage of Participating

Participating in the leading science and mathematics research-based competition for high school students in the United States:

- Furthers your research skills
- Opens new doors in pursuit of your educational and career objectives
- Provides the opportunity to meet other students who share your interest in research
- Allows you to talk with distinguished scientists
- Offers you a chance to win a college scholarship

### II. ABOUT THE COMPETITION

#### A. Scholarship Awards

College scholarships are awarded to all students attending the regional and national events.

<b>Regional Awards (in six regions)</b>		
<b>Category</b>	<b>Individual</b>	<b>Team</b>
<b>Finalists</b>	\$1,000 and a bronze medal	\$1,000 and a bronze medal for each team member
<b>Winners</b>	\$3,000 and a silver medal	\$6,000 divided equally among team members and a silver medal for each member

The winners of the individual and team regional awards move on to compete at the national level. The national awards are announced at a special event hosted by the Siemens Foundation in Washington, D.C.

<b>National Awards</b>		
<b>Standing</b>	<b>Individual</b>	<b>Team (divided equally among members)</b>
<b>1st Place</b>	\$100,000	\$100,000
<b>2nd Place</b>	\$50,000	\$50,000
<b>3rd Place</b>	\$40,000	\$40,000
<b>4th Place</b>	\$30,000	\$30,000
<b>5th Place</b>	\$20,000	\$20,000
<b>6th Place</b>	\$10,000	\$10,000

Scholarship award money is sent directly to the accredited undergraduate or graduate college or university the winning students select. In order to continue receiving the scholarship, students must be enrolled full-time and making satisfactory academic progress toward a degree.

Your scholarship can be used for:

- Tuition and fees required for enrollment
- Fees, books, supplies, and equipment required for all courses of instruction at the school that are required for graduation
- On-campus room and board
- Costs associated with your participation in scientific or mathematical research (only) at the institution in which you are enrolled, within, or beyond your regular courses of curriculum

Students should be prepared to participate in all aspects of the Competition. This includes being available to attend regional and national levels of the Competition if you are selected as a finalist.

## **B. Competition Schedule**

<b>Monday, October 3, 2011, 5 p.m. ET</b>	Deadline for receipt of Research Report materials
<b>October 21, 2011</b>	Announcement of Regional Finalists and Semifinalists
<b>Regional Competition</b>	
<b>November 4-5, 2011</b>	<b>Georgia Institute of Technology</b> , Atlanta <b>California Institute of Technology</b> , Pasadena
<b>November 11-12, 2011</b>	<b>The University of Texas at Austin</b> <b>Massachusetts Institute of Technology</b> , Cambridge
<b>November 18-19, 2011</b>	<b>Carnegie Mellon University</b> , Pittsburgh, Pennsylvania <b>University of Notre Dame</b> , Notre Dame, Indiana
<b>National Competition</b>	
<b>December 1-5, 2011</b>	<b>The George Washington University</b> , Washington, D.C.

## C. Student Eligibility

- The Siemens Competition is open to high school students who are citizens or permanent residents (green card holders) of the United States. Students must be in good standing, enrolled in and attending one of the following:
  - High school (grades 9-12) in the United States, Puerto Rico, Guam, U.S. Virgin Islands, American Samoa, Wake and Midway Islands, or the Marianas
  - Department of Defense Education Activity (DoDEA) school, or overseas American or international school
  - Foreign school as an exchange student or because your parent or guardian lives and works abroad
  - Homeschool, provided that signatures are obtained from the school district responsible for such programs on the student's Confirmation Page. If your state does not require district supervision, the parent or guardian responsible for the homeschooling must sign it.
- Students submitting **individual projects** must be in good standing, enrolled in and attending their last year of high school (grade 12). Students must complete all high school courses required for college admissions no later than September 1, 2012.
- **Team projects** may have two or three members and do not need to include a senior. All team members must be in good standing, enrolled in and attending high school (grades 9-12), although you may be from different schools. Each team must designate a team leader who serves as the communication liaison between the Siemens Competition and the other members of the team.
- Children of employees of the Siemens Foundation, Siemens Corporation, and Siemens operating companies and affiliates ("Siemens Employees") **are eligible** to participate in the Competition.
- Competition entrants who have parents, guardians, or Competition mentors employed at, or otherwise affiliated with, the Siemens Foundation's university partners (Carnegie Mellon University; Georgia Institute of Technology; Massachusetts Institute of Technology; The University of Texas at Austin; California Institute of Technology; and University of Notre Dame) **may enter** the Competition but may **not be permitted** to compete at the partner university where the parent, guardian, or mentor is employed or otherwise affiliated. Furthermore, if lab or research work for the project was performed at any of these six universities, students may enter the Competition but may not be able to compete at that university site.
- Children of employees of either the College Board or the Educational Testing Service **are not eligible** to enter the Competition.

## D. Registration

Every individual or team entering a research project in the Competition must register online prior to the project submission deadline date of October 3, 2011 at [www.collegeboard.com/siemens](http://www.collegeboard.com/siemens).

- Follow the instructions carefully when registering.
- For team projects, the team leader must register online for each of the other team members.
- You are strongly encouraged to register several weeks prior to the deadline date. This allows you sufficient time to obtain the signatures required on the Confirmation Page.
- Research Reports must have a signed Confirmation Page; otherwise, they are not accepted.
- If you do not have access to the Internet, experience technical difficulties, or have questions, please contact the College Board at (877) 358-6777.

You need the following to begin your registration. If you are a team leader, you need the information for each team member:

- Name, address, home telephone number, cell phone number, and email address
- Date of birth
- Citizenship Status (U.S. Citizen or Permanent Resident). For Permanent Residents, Alien Number is required.
- Official high school name, address, telephone number, and principal's name
- Mentor's name, address, telephone number, and email address
- Permission to release information concerning future educational and career opportunities

## 1. Confirmation Page

Once the registration is reviewed and submitted, a Confirmation Page immediately appears online. It lists all the registration information submitted by the individual or team leader.

- **Print out the Confirmation Page**, review it for accuracy, and use a pen to make any corrections directly on the printed copy. This is your original copy.
- Submit the original and two copies of the Confirmation Page. Attach one to each of the three original copies of the Research Report.
- Signatures are required from:
  - Each student participant
  - Parent or guardian of each student participant
  - School administrator of the individual's or team leader's high school.
- For homeschooled students, obtain the signature of the school district official responsible for such programs. If your state does not require district supervision, the parent or guardian responsible for homeschooling must sign the Confirmation Page.
- If you lose your Confirmation Page, or need to reprint it for any reason, log back into your registration. Select the red "Print Confirmation Page" link in the upper right-hand corner of the screen.

## E. Competition Alumni Network

The Siemens Foundation may create and maintain a Competition alumni network, offering certain opportunities to Semifinalists, Regional, and National Finalists. Such opportunities may include:

- Alumni newsletters
- Leading-edge technological and scientific innovation updates
- Invitations to participate in future recruiting activities
- Internship programs of Siemens affiliate companies
- Participation in future research and other programs or initiatives of the Siemens Foundation, its affiliates, or partner universities

To receive this information, grant the Siemens Foundation permission to include you by **completing the authorization section when you register**. This also allows the partner universities and relevant Siemens affiliates to notify you of these types of opportunities.

### III. ABOUT YOUR PROJECT

#### A. Project Eligibility

Before you begin, determine that your project is eligible for the Competition.

- Each student can submit **only one** research project, either as an individual competitor or as a member of a team.
- You may submit a project that has been or will be submitted to other science competitions.
- You may submit a research paper that has been or will be published, as long as you retain the rights.
- To resubmit a project that already has been submitted to the Siemens Competition in the past, you must be able to demonstrate how the research has been advanced. This information is required during registration.
- Projects that violate laws or school regulations--or place any student, judge, or observer in danger--are not eligible.

#### B. Project Topics

Research Reports may be submitted on projects in the fields of mathematics, engineering, biological, and physical sciences. They may also involve combinations of disciplines such as:

- Astrophysics
- Biochemistry
- Bioengineering
- Biology
- Biophysics
- Botany
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Science
- Earth and Atmospheric Science
- Electrical Engineering
- Environmental Science and Engineering
- Genetics
- Geology
- Materials Science/Nanoscience
- Mathematics
- Mechanical Engineering
- Microbiology
- Nutritional Science
- Physics
- Toxicology

Social and behavioral science research projects are not eligible. Social science is considered to be the study of society or social behavior. Behavioral science is considered any project that involves the study of the actions and reactions of humans and animals through observation and experimental methods.

Neuroscience projects - based on the underlying sciences of biology, chemistry, and physics - are allowed.

#### C. Projects with Human Subjects and Other Vertebrates

The Siemens Competition recognizes that laboratory research using animals and/or human subjects has led to important discoveries. Because this is a high school competition, however, the program has set guidelines as to what is and is not allowable for purposes of entering this competition. Therefore, students must understand and follow the guidelines below.

For the purpose of this Competition, **live vertebrates** include humans, mammalian embryo or fetus, bird eggs within three days (72 hours) of hatching, and all other vertebrates at hatching or birth. Section V of the Mentor Form, **Human Subjects or Other Vertebrate Certification**, must be completed by the advisor, mentor, or supervising

scientist. In addition, the student must answer the **Qualification Questions for Vertebrate Animals/Human Subjects** as explained under Additional Required Materials.

Projects that involve in any way, including testing and questioning, the use of **live human subjects or other live vertebrates or the fluids, cells, tissues, or organs from vertebrates** are accepted only under the following conditions:

- The research project is conducted in a registered institution or laboratory in the United States where human or animal experimentation is authorized. The mentor(s) is required to provide the following information on the certification form:
  - Name of the research institution
  - Title of the study
  - In the case of human subjects, Institutional Review Board (IRB) approval number and approval date; a high school IRB **is not permitted**
  - In the case of other vertebrate animals, Institutional Animal Care and Use Committee (IACUC) approval number and approval date
- The vertebrate animals **cannot be euthanized** for the sole purpose of the student's research project. Fluids, cells, tissues, and organs may be used only if the animals were euthanized for another purpose.
- NOTE: Projects using established human or animal cell lines do not require IACUC or IRB approval.

Research projects conducted outside of the United States must follow the same guidelines listed above when using **live human subjects or other live vertebrates or the fluids, cells, tissues, or organs from vertebrates** in accordance with the following:

- The research must be done in an institution that is affiliated with a U.S. registered institution or laboratory. The mentor must provide an IRB or IACUC approval number, or
- The country where the research is done must have, at a minimum, guidelines equivalent to the United States. The mentor must provide evidence of this. In place of an IRB or IACUC approval number, the mentor must provide a copy of the official certification used in that country and specifically for that research project. If the country or affiliate institution has a federal-wide assurance number, please provide. The documentation must be in English.

## D. Academic Integrity

Academic integrity is a fundamental value of the Siemens Competition and scientific research. We expect the research report, presentation slides, and poster to be your own work. If you are using text or images from someone else, you are expected to ensure that all facts, techniques, images, and information (including the Internet) are properly cited. It is not sufficient to simply modify the words of an original source. If you have used the essential idea, you must properly cite the source.

**Violations of academic integrity will result in disqualification.** The Competition uses specific procedures, as part of the judging process, to detect plagiarized materials. If a Research Report is found to have improper citations or if citations are omitted, intentionally or unintentionally, the College Board and the Siemens Foundation will disqualify you from the Competition and notify your high school about the disqualification.

## E. Sharing Your Results

Research projects and findings are the property of the students. However, the Research Reports submitted to the Competition are not returned.

Students selected as Regional or National Finalists grant the Siemens Foundation nonexclusive, nonroyalty bearing worldwide rights to showcase the project design, results, and findings, as well as the student(s) themselves who worked on the project.



## F. Research Report

The Research Report enables the judges to evaluate the scientific work completed as part of the Competition. Semifinalists and Regional Finalists are selected on the basis of their Research Report. To ensure that the judges focus on the quality of the work completed, rather than on the manner of presentation, strict requirements for the Research Report must be followed. **Research Reports that do not adhere to these guidelines may be disqualified from the Competition.**

### 1. Overall Report Requirements

The Research Report must be written by the student(s). To ensure fairness, Research Reports are initially evaluated without reference to any personal information about the students.

**Absolutely no** student names or references to gender ("he" or "she"), high schools, school officials, advisors, mentors, affiliated research organizations, or acknowledgements of the entrants are to appear anywhere in the Research Report. These references may only appear on the Supplemental Form and Confirmation Page.

Three original copies of the Research Report must be submitted, so that all graphics and colors are clear on all copies. The abstract, Research Report, and references must also be saved to a CD-ROM as ONE Word or PDF document and mailed along with your paper copies. The individual or team leader's name and the project confirmation number must be noted directly on the CD-ROM. Please print legibly with a permanent marker or affix a typed label.

### 2. Format Requirements

The Research Report must:

- Be written in English.
- Adhere to an 18-page limit. This limit includes the introduction, text, tables, data, illustrations, and appendices. **References are not included in the 18-page limit.**
- Be submitted on 8-1/2 X 11 inch single-sided sheets of paper, double-spaced, with page numbers at the bottom.
- Have page margins of at least 1 inch.
- Use 12 point or larger **Arial or Times New Roman** font for the body of the report. Captions accompanying pictures and graphs, as well as citations for references, may be single-spaced and in a smaller point size.
- Contain reference pages in the same size font as the body of the research paper (12 point or larger). Each individual reference should be single-spaced with a double space between references.
- Ensure that citations and references are complete and in correct standard format for the discipline. Examples from the Mayfield Handbook of Technical & Scientific Writing are available on the Siemens Foundation website ([www.siemens-foundation.org](http://www.siemens-foundation.org)).

### 3. Content Requirements

These guidelines are provided to help you understand the goals of each section of the research paper. While the specifics stated below may vary slightly from one discipline to another, the overall paper should provide the content as outlined under the following headings. Subheadings should be used in Methods, Results and Discussion to clarify the content. A suggested page length is provided for each section. The paper may be 18 pages maximum.

### **Introduction: the "why" section (2-3 pages)**

- Start with a broad picture of the problem you have chosen to study and why it is interesting. Provide a brief review of pertinent scientific literature, describe what information is missing and how your work addresses this gap in the literature. Previous relevant publications and patents must be properly cited in the text of the Research Report and included in the Reference section of your report.
- Describe the specific problem to be solved, the research question to be answered, the hypothesis(es) to be tested, or the product to be developed (if any). Provide a brief rationale for the research, and why the work is important.

### **Materials & Methods: the "how" section (2-5 pages)**

- Describe how you performed your work, giving sufficient detail so that someone trained in the field is able to understand what you did and can replicate it.
- Include the methods you used, written in a format commonly used in publications in your field of study. Do not merely restate a protocol or copy blocks of text; instead, use your own words to describe what you did, referencing key papers where appropriate.
- Explain your personal role in the work and the roles played by others in supporting this work. Include, for example, acknowledgments to others in the laboratory for running key instrumentation or other protocols. You may refer to others who assisted you by title but do not include any specific names in the body of your research paper.
- Mention common procedures but there is no need to describe them in detail; provide references to where the method is published. All modifications of existing methods should be described.

### **Results: what did you find? (4-5 pages)**

- Present your findings in sufficient detail so that the reader understands the results that were obtained or can follow each step of a mathematical proof.
- Describe how the results address the problem to be solved, the research question to be answered, or the hypothesis to be tested.
- Present all experiments, controls and statistical tests that show that the results are reliable and statistically significant. In theoretical work, present the experimental findings against which the work was tested, the extent to which it was validated, or both.

### **Illustrations: documenting your findings (2-4 pages)**

- Use illustrations to document the textual description of your results. Each illustration should be numbered in sequence and should be accompanied by its own legend. The illustration plus its legend should stand alone — the reader should understand it without having to read the text of the paper.

### **Discussion: what do your results mean? (3-4 pages)**

- Provide readers with an interpretation of the results, enabling them to understand the implication(s) of your findings.
- Describe what makes your work unique in the context of published findings and what distinguishes it from that of others in the field, or in your laboratory. In other words, put the work in context with other reports that ask the same or related questions, and address whether or not your observations are consistent with or enhance other findings in the field.

## Conclusions and Future Work: what did you learn and what's next? (1-3 pages)

- Recap briefly what was learned from your research and how your work addresses the unanswered question(s) that you posed in the introduction.
- Assess the validity of the conclusions, which is an important component of any scientific report. In particular, are your conclusions fully supported by the results described in the report alone or in conjunction with prior literature? Are there alternative explanations for your observations that cannot be ruled out?
- Determine what experiments could be performed in the future to refine your conclusions.
- Indicate what would you do next if you had more time, and what would you do differently if you were to start the work today.
- Consider what questions still remain to be answered.

## G. Additional Required Materials

You are required to register before the deadline and then submit these items along with your Research Report. You need **three copies** of each item listed below (except the Mentor Form and CD-Rom). Attach one to each of the original copies of your Research Report. For the Mentor Form, one original and three copies are required and only one CD-ROM is required. Further details are provided below.

### 1. Confirmation Page

This is the page you printed out during your online registration. Make any necessary corrections (spelling of names, etc.) on the original and submit it with your Research Report.

### 2. Abstract

The Research Report must include an abstract. The abstract is a technical synopsis of the problem, methods, results and conclusions. It should be double-spaced using 12 point or larger Arial or Times New Roman font, 100-200 words long, include the research project title, and be printed out on its own page.

No identifying information, such as name, high school, or references to gender or research facilities should be included in the abstract. The abstract is **not included** in the 18-page limit for the Research Report.

Sample abstracts from previous winners can be found on the Siemens Foundation website ([www.siemens-foundation.org](http://www.siemens-foundation.org)).

### 3. Executive Summary

An executive summary must be submitted with the Research Report. Do not simply replicate what you wrote in your abstract. The executive summary presents the question asked, the methods used and the lessons learned. The summary on its own, separate from the Research Report should convey the essence of your project and should be understood by someone without scientific expertise.

The difference between the abstract and the executive summary is that the executive summary must be written in layperson (non-specialist) language. The summary will be used to explain your project to the general public and in preparing press releases for the media.

The executive summary must be double-spaced and use 12 point or larger Arial or Times New Roman font. No identifying information, such as name, high school, or references to gender or research facilities should be included. The executive summary may not exceed one page and is **not included** in the 18-page limit for the Research Report.

## 4. Supplemental Form

The purpose of the Supplemental Form is to collect the identifying information that students are not permitted to provide in the body of the report. This form includes student name, high school, information on publications, and acknowledgements of all people and affiliated research institutions involved with your project. The accuracy of this document is vital to the academic integrity of your research paper.

You are required to complete the Acknowledgements section and must include the name, title, institution, and role of any individuals who assisted with the research project, including family members. Receiving assistance from family members does not affect the judging in any way, but you must acknowledge their support.

The Supplemental Form is **not included** in the 18-page limit for the Research Report.

## 5. Qualification Questions for Vertebrate Animals/Human Subjects

If your research project uses vertebrate animals or human subjects, please complete this form. Your response provides you an opportunity to describe your use of vertebrates to the judges. Similar to the Research Report, the responses must be written by the student(s) and **no** student names or reference to gender, high schools, school officials, advisors, mentors, affiliated research organizations, or acknowledgements of the entrants are to appear anywhere in the answers below. The form asks the following questions:

- Why was it necessary for you to use live animals and/or humans or fluids, cells, tissues or organs from vertebrates in your research? Justify the species used.
- Describe how you used the animals and/or humans in the research. Further, describe whether the animals were euthanized before or after your experiments and for what purpose.

This form is not included in the 18-page limit.

## 6. Mentor Form

Individuals and teams must have their mentor complete the Mentor Form. The mentor is the person most closely associated with the research project, such as the student's research supervisor or another qualified scientist who gave support throughout the course of the research project.

**If a student or team does not have a mentor, a teacher or other high school administrator must complete the form.** Additionally, if any of the research was conducted at a university or other registered laboratory facility, the signature of the lab director is required.

If the research project involves vertebrates (including human subjects), Section V of the Mentor Form, **Human Subjects or Other Vertebrate Certification**, is required and must be completed and signed by the advisor, mentor, or supervising scientist. This section of the form is carefully reviewed to determine the project's eligibility, in accordance with the rules of the Competition.

You are required to submit **one original and three copies (four total)** of the Mentor Form. They may be submitted separately from the Research Report or placed in a sealed envelope and mailed with it. If mailed separately, they must be received by the deadline for the Competition.

## 7. CD-ROM

A copy of your Abstract, Executive Summary, Research Report with references, and Qualification Questions for Vertebrate Animals/Human Subjects (if applicable), must be saved to a CD-ROM and submitted with your report. Save all required items as ONE Word or PDF document. The individual or team leader's name and the project confirmation number must be noted directly on the CD-ROM. Please print legibly with a permanent marker or affix a typed label.

## H. Sending Your Project to Us

Your Research Report must be **received** by Monday, October 3, 2011, 5 p.m. Eastern Time. **Submissions are not accepted by fax or email.** We highly recommend that you mail your submission at least 10 days before the deadline or use special courier services to ensure timely delivery.

If sending a project via regular mail, the U.S. Postal Service provides a tracking service—called Delivery Confirmation—for a minimal fee. The student is responsible for providing proof of delivery in the event the research project is not received. Due to the large volume of projects received, confirmation of receipt of Competition documents is not possible by telephone or email.

### Address for regular mail:

Siemens Competition  
Educational Testing Service  
P.O. Box 6730  
Princeton, NJ 08541

### Address for overnight mail or hand delivery:

Siemens Competition  
Educational Testing Service  
1425 Lower Ferry Road, Room Q220  
Trenton, NJ 08618\*  
Phone: (609) 771-7878  
Hours: 8:30 a.m.-5 p.m. Eastern Time, Monday-Friday

\*The zip code 08618 may list Ewing or Trenton. Both cities are correct.

## IV. JUDGING

The Siemens Competition recognizes student research projects that display originality, creativity, academic rigor, and clarity of communication. The College Board assembles a panel of research scientists to conduct the initial review of all project submissions.

Judges identify projects that exhibit not only scientific excellence, but also the collaborative teamwork that is often characteristic of successful scientific and technological endeavors.

Students should consider the audience who is judging the Research Reports. For the initial review and for the national level of the Competition, judges are selected by their field of expertise and come from both academic and laboratory settings. For the regional level, judges are selected by the Siemens Foundation's partner universities.

Team projects are evaluated separately from individual projects, using the same criteria. Additional attention is given to the collaboration among team members and to each team member's contribution to the project effort.

### A. Judging Process

#### 1. Initial Judging

During the initial judging, only the Research Reports are evaluated. These Reports are judged solely on project merits. These initial judges do not have any information about you (name, gender, school, age, or state).

#### 2. Semifinalists

Up to 300 outstanding projects are selected as finalists. From those 300 projects, up to 60 will advance to the Regional Finalist stage of the competition and the others will be honored as Semifinalists. Students chosen as semifinalists receive a special recognition package; their names are announced in an advertisement in *USA Today* and posted on the Siemens Foundation website ([www.siemens-foundation.org](http://www.siemens-foundation.org)).

### 3. Regional Finals

Up to 10 projects (up to five individual and up to five team projects) from each of six geographic regions are selected to compete at the regional level of the Competition.

At the regional and national levels of the Competition, judges evaluate the Research Report, the references cited in the Research Report, poster display, oral presentation, and private question-and-answer session. Factors such as knowledge of the science involved, your role in the project, and ideas extending from the work are also considered.

Judges expect to hear concise presentations and responses to their questions during the question-and-answer session. You must also be able to describe further aspects of your project, including the fundamental science behind what you have done. All aspects of the projects and presentations inform the final decisions of the judges.

### 4. National Finals

The six individual and six team regional winners compete at the national level. National Finalists are required to display their posters, make oral presentations, and respond to questions before a national panel of judges.

## B. Judging Criteria

The regional and national judges use these criteria to evaluate all aspects of the projects and presentations.

- **Creativity:** Is the project original and imaginative? What is the origin of the student's interest in the topic? Did the student develop new solutions or procedures? To what extent were the student's talent and insight incorporated into the project? How did the student address any surprising or unforeseen developments?
- **Field knowledge:** Does the student demonstrate strong knowledge of the area of inquiry and the underlying scientific or mathematical issues?
- **Comprehensiveness:** Are sufficient details given so that others can replicate the work? If the work is experimental, are the variables and controls clearly defined? Did the student use the correct quantitative measures? Are the procedures well-defined? Were measuring tools chosen and used appropriately? Does the research report fully explain the project itself or is further explanation needed?
- **Interpretation:** Has the student stated the interpretations and conclusions clearly? How scientifically reasonable and credible are the data, interpretations, and conclusions? Do the conclusions and interpretations follow from the results presented? Can claims of novelty or improvement be justified? What are the limits of the interpretations and the conclusions? Are there alternative conclusions that fit the results?
- **Literature review:** Does the report reference appropriate related works and place the study in a proper context? Are all sources used in the research listed as references? Are the references cited within the text?
- **Scientific importance:** Does the project address an important scientific, technical, or mathematical question or major issue? Does the student's work demonstrate a high level of intellectual input, and is it innovative? Do the findings substantially add to the understanding of the area investigated?
- **Future work:** Is there a discussion of future or follow-up research? If so, what further data would be needed? What are possible applications of the work?
- **Clarity of expression:** Is the project understandable? Is the material presented logically and coherently? Are the key points, problems, and solutions stated clearly and precisely? Does the student use tables and figures appropriately? Was the Research Report carefully proofread for spelling and grammar?
- **Presentation:** Is the method of presentation consistent with the nature of the work and with scientific practice in the discipline involved?

#### Additional Criteria for Team Projects

- **Teamwork:** Is it clear how each member contributed? Was there an appropriate distribution of workload and responsibilities?

## V. REGIONAL AND NATIONAL FINALISTS

The College Board will assign students to compete at one of the six regional competitions. The Siemens Competition uses the regional structure shown in the regional map. This map can be viewed at [www.collegeboard.com/siemens](http://www.collegeboard.com/siemens) by clicking on the “Regional and National Finalists” tab. The Competition selects up to 10 projects (up to five individuals and up to five teams) from each of the six geographic regions. Finalists (including **all** team members) must attend and participate in all required Competition events.

If you are chosen, you receive an expense-paid trip, with a chaperone, to the campus of a university partner. A panel of judges appointed by the host institution reviews the projects.

Students who win at the regional level compete at the national level. The National Finalists receive an expense-paid trip, with a chaperone, to Washington, D.C.

### **Regional and National Finalists are required to:**

- Prepare a poster display of the research project.
- Deliver a 12-minute oral presentation about the research and findings.
- Participate in a private question-and-answer session with the judges (14 minutes at Regional Competition; 12 minutes at National Competition).

Finalists are evaluated on these items, in addition to the Research Report and references cited. The guidelines for oral presentations and posters can be found on the College Board’s Siemens Competition website ([www.collegeboard.com/siemens](http://www.collegeboard.com/siemens)) under the “Regional and National Finalists” tab.

## VI. FAQ’s

### **A. Abstract**

#### **How do I create an abstract?**

The abstract is a synopsis of the problem, methods, results, and conclusions in your Research Report. It should be 100-200 words long, include the project title, and stand alone on a page. Do not include identifying information, such as your name, high school, research facilities, mentors, or advisors. Do not use gender (“he” or “she”) in the abstract. The abstract is not counted as part of the 18-page report. Sample abstracts from previous winners are on the Siemens Foundation website.

### **B. Acknowledgements**

#### **Why can’t we use names or acknowledgements in our Research Report?**

This ensures that the projects are judged on the quality of your research. Do not include identifying information, such as your name, high school, research facilities, mentors, or advisors. Do not use gender (“he” or “she”). Research Reports that include identifying information may be disqualified.

Acknowledgements must be listed on the Supplemental Form. List any individuals that assisted you with your Research Report, including family members.

**I want to reference certain individuals or institutions in my Report. How can I do so without mentioning a name?**

You may use a generic expression to distinguish your references. For example, if you are citing the work you performed in a research institution, your Report could read "research facility." If you wish to cite an individual, such as your advisor, you may substitute the word "advisor." Specific names must only be listed on the Supplemental Form, under Acknowledgements, and on the Confirmation Page.

## **C. Categorization**

**I don't know how to categorize my project. Does this matter?**

Your research project must be categorized as accurately as possible, so the appropriate judges can be assigned. Consult a teacher in your science or math department, or your mentor, to help you. If your project crosses several disciplines, place it in the one where you feel it best belongs. If necessary, the judges reassign projects to ensure qualified judges review your work.

## **D. Citations and References**

**I don't know how to format my citations and references. What is acceptable?**

Citations and references should be in complete and correct standard format for the discipline. Consult a teacher in your science or math department, or your mentor. You may also refer to *The Mayfield Handbook of Technical & Scientific Writing*, on the Siemens Foundation website.

## **E. Eligibility**

**I am not a citizen of the United States and do not hold a green card. May I still apply for the Competition?**

No. You must be a U.S. citizen or permanent resident (holding a green card). The Siemens Foundation established this program to close the growing skills gap we have in math, science, and technology here in the United States.

**I have applied for a green card, but have not received it yet. Can I still enter the Competition?**

No. All individuals or team members must first obtain green cards or permanent resident status before registering for the Competition and submitting a Research Report. You need to obtain a green card before the Competition deadline in order to be eligible.

**Are exceptions made for non-seniors to submit individual projects?**

No, **exceptions are not made**. Students submitting **individual** projects must be in good standing, enrolled in, and attending their last year of high school. You must complete all high school courses required for college admissions no later than September 1, 2012. Team projects may include seniors, but are not required to do so.

**Are exceptions made for teams with more than three students?**

No, exceptions **are not made**. Teams may have only two or three students.

**Are we allowed to submit a research project again?**

Yes, you may resubmit a project. However, you are required to demonstrate that you have substantially advanced the project and must provide this information during registration.



## **F. Mentor Form**

### **What if I don't have a mentor or advisor?**

If you do not have a mentor or advisor, a teacher or high school administrator must complete the Mentor Form. If your project utilized any vertebrates, including human subjects, Section V of the Mentor Form, **Human Subjects or Other Vertebrate Certification**, must be completed by the supervising scientist at the lab where the experiment was performed.

### **When am I required to obtain the signature of the lab director on my Mentor Form?**

If you are doing your research at a university, or other registered laboratory facility, the signature of the lab director is required. If you are doing your research at your high school, you are not required to obtain this signature.

## **G. Online Registration**

### **I submitted my registration online and received my Confirmation Page. Then I realized that I had entered some incorrect information and misspelled words. How do I fix this?**

Use a pen to make your corrections directly on the Confirmation Page. Once you mail your Research Report, the changes are corrected for you.

## **H. Publications**

### **Can I submit my Research Report if I plan to submit it for publication or if it has already been published?**

Yes, as long as you retain the full rights to your research. Indicate where your research was submitted or published on the Supplemental Form. Your mentor should also include this information on the Mentor Form.

## **I. Research Report Requirements**

### **Are my graphs and charts included in the 18-page limit?**

Yes. The Confirmation Page, Supplemental Form, references, abstract, executive summary, and Qualification Questions for Vertebrate Animals/Human Subjects are the only parts of the Research Report that **are not included** within the 18-page limit. The remaining text, tables, data, illustrations, and appendices are counted as part of the 18-page limit.

### **How many graphics and illustrations are allowed?**

You may use as many as you would like. However, it is important to remember that all graphics are counted as part of the 18-page limit.

### **When should I start on my research project?**

Start early! There is no time limit on the period of time spent on the research project. The number one reason that students do not enter the Competition is they ran out of time.

### **When submitting the Research Reports, can the original signatures be photocopied?**

You do not need to get all copies signed with an original signature. Get one form signed and then photocopy it.

### **What type of project would be considered behavioral science and thus, ineligible?**

Any project that involves the study of the actions and reactions of humans or animals, through observation, experimental methods, or both is ineligible. Social science projects, the study of society or social behavior, are also ineligible.

## **J. Vertebrates**

**My research project involves working with live vertebrates (including human subjects). Is this allowed?**

Research projects involving live vertebrates are allowed **only** under the following conditions:

1. The project is **not** behavioral science.
2. The research must be approved by an Institutional Animal Care and Use Committee (IACUC) or Institutional Review Board (IRB); a high school IRB is not permitted.
3. The research must be conducted in a registered institution or laboratory.

**My research project involves examining tissue of a vertebrate that was initially collected for another research experiment. I was not involved in that experiment. Tissues were provided to me. Is my project allowed?**

You may examine fluids, cells, tissues, or organs if the materials were supplied to you by the supervising scientist and any animal was euthanized for a purpose other than your research. Your research must be conducted in a registered institution or laboratory where this type of experimentation is authorized. The supervising scientist is required to complete Section V of the Mentor Form. The form requires the Institutional Animal Care and Use Committee (IACUC) approval or Institution Review Board (IRB) approval, when applicable.

## **K. General Facts and Information**

**Is the deadline when the Research Report must be received or when it must be postmarked?**

October 3, 2011, 5 p.m. Eastern Time is when your project **must be received**.

**How many Research Reports are received each year?**

We receive approximately 1,400 projects from individuals and teams.

**How many finalists are chosen?**

Up to 300 outstanding projects (a maximum of 50 in each of the six geographic regions) are selected as finalists, including both regional and semifinalists.

**How many regional finalists are chosen?**

Up to 10 projects (five individual projects and up to five team projects in each of the six geographic regions) are selected to compete at the regional level of the Competition.

**Which university do I compete at if I advance to the regional level?**

The College Board will assign students to compete at one of the six regional competitions. The Siemens Competition utilizes the regional structure shown in the [regional map](#), which can be found on the [College Board website](#). Assignments will be based on a number of factors including the location of the student's school, where the student conducted his/her research, and/or whether there is any potential conflict of interest including if the parent or mentor works at or attends one of the partner universities. Students will not be reassigned due to personal schedule conflicts.

## VII. COMPETITION CHECKLIST

- Complete the registration online.
- Review the Confirmation Page online for accuracy. You are given an option to make corrections online prior to submitting.
- Once you have submitted your registration, print and proof the Confirmation Page, making any corrections in ink. Obtain the appropriate signatures from your high school (or relevant district official), parent(s), and team members on the original Confirmation Page.
- Complete the Supplemental Form.
- Complete the Abstract and Executive Summary for your project and be sure to include your project title.
- If your project used vertebrate animals (including materials from vertebrates) or human subjects, complete the Qualification Questions for Vertebrate Animals/Human Subjects.
- Review your Research Report to ensure you have not used names of student(s), high school(s), mentor/advisor(s), affiliated research organization(s), acknowledgements(s), or terminology that depicts your gender (e.g. "he" or "she").
- Review the citations and references to ensure proper format for the discipline.
- Review report for spelling and grammatical errors.
- Keep within the 18-page maximum limit that includes the introduction, data, illustrations, text, and appendices.
- Assemble three sets of your project (one original and two copies) of the following:
  - Confirmation Page
  - Supplemental Form
  - Abstract
  - Executive Summary
  - Research Report (all graphics and colors must be clear on all copies)
  - Qualification Questions for Vertebrate Animals/Human Subjects (if applicable)
  - References
- Staple each set in the upper left hand corner.
- Copy your Abstract, Executive Summary, Research Report, Qualification Questions for Vertebrate Animals/Human Subjects, and References to a CD-ROM. The individual or team leader's name and the project confirmation number must be noted directly on the CD-ROM. Please print legibly with a permanent marker or affix a typed label.
- Provide the Mentor Form to your mentor to complete. Be sure to give your mentor sufficient time to complete and submit the form. Inform your mentor to send **the original plus three copies (four total)** to be **received** by 5 p.m. Eastern Time on October 3, 2011. If you prefer, place the original Mentor Form and three copies in a sealed envelope and mail it with your project.
- Mail three sets of your project and the CD-ROM to be **received** by 5 p.m. Eastern Time on October 3, 2011.

## VIII. CONTACT US

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