



# NATIONAL SOCIETY OF BLACK ENGINEERS



Think Green! Please do not print unless absolutely necessary

2014-2015 NSBE Jr. Explorer Technical Innovations Competition

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Due to the nature of our programming and the partnerships involved, this rulebook is subject to change at any time. Changes may include but are not limited to rules, implementation, awards criteria/categories and procurements on behalf of the participants. NSBE will remain to be diligent in providing necessary information for our programming and limit any inconveniences that may occur.

## **INTRODUCTION**

Welcome to the wonderful world of science! For over 30 years the National Society of Black Engineers (NSBE) has supported the endeavors of talented Black engineering students and professionals. The mission is to “increase the number of culturally responsible Black engineers who excel academically, succeed professionally, and positively impact the community.” We as a society know that, in order to accomplish this mission, we must raise the awareness of pre-college students to opportunities in science and technology. Science fairs are an excellent venue for pre-college students to display their creativity and scientific abilities.

The National Society of Black Engineers presents the NSBE Jr. Explorer Technical Innovation Competition (formerly known as the science fair), an annual national program. This program is tailored to allow pre-college students the opportunity to compete and explore the many applications of science utilizing projects, competitions, and science fairs. The NSBE Jr. Explorer Technical Innovations Competition (TIC) will occur at the Annual Convention.

## **ELGIBILITY**

Students in grades 6-12 are eligible for the NSBE Jr. Explorer’s Technical Innovation Competition. Participants must be PAID NSBE Jr. members.

The fair will be divided into two classifications:

Middle School (Junior): 6<sup>th</sup>- 8<sup>th</sup> grade students  
High School (Senior): 9<sup>th</sup>-12<sup>th</sup> grade students

In the terms of awards, Team Projects will be judged separately from individual projects.

## **CRITERIA**

1. A chapter may have as many participants as desired.
2. Each student is only allowed to enter one project. The project may include no more than 12 months of continuous research.
3. All participants must submit an unofficial transcript to NSBE World Headquarters either electronically via email and/or by mail prior to the registration deadline in order for your registration to be complete (email is highly recommended). The mailing and email address is provided below:

NSBE World Headquarters  
205 Daingerfield Road  
Alexandria VA 22314  
scholarships@nsbe.org

## **TEAM PROJECTS**

1. Team projects compete and are judged in their scientific category of research.
2. Teams may have two or three members. Teams may not have more than three members. Teams may not substitute members in a given research year.
3. Team members cannot be changed during a given research year, including converting from an individual project to a team project, or vice versa.
4. Each team is encouraged to appoint a team leader to coordinate the work and act as spokesperson. It is recommended that each member of the team be able to serve as spokesperson, be fully involved with the project, and be familiar with all aspects of the project. The final work should reflect the coordinated efforts of all team members and will be evaluated using similar rules and judging criteria as individual project.
5. Full names of team members must appear on the abstract, formal report, display and all forms.

## **OVERVIEW OF COMPETITION STRUCTURE**

Each individual and team is awarded a numerical score in each of the three events. At the end of the competition the total points earned is computed by the following rubric listed below. The individual and team with the highest point total is the winner. There is a first and second place winner for each division (high school and middle school, team and individual) of the competition. There will also be one overall winner designated for each segment of the competition.

The rules for each portion of the competition are outlined in detail in the corresponding section in the rule book. In the event of a change to any of the rules, the National PCI Chairperson will be responsible for communicating the rule changes to participating NSBE Jr. chapters as well as host NSBE Professional chapters.

NEW THIS YEAR!!

In order to qualify for an award, each team must meet the minimum qualification points total in each category. No individual or team will be eligible for a prize if the minimum point totals have been awarded by the judges. If no teams or individuals meet the minimum, awards will not be awarded in that category.

<b>Event</b>	<b>Total Points</b>	<b>Weighted Point Total</b>
<b>Abstract and Technical Paper</b>	200 (160 Minimum)	30
<b>Oral Multimedia Presentation</b>	100 (85 Minimum)	35
<b>Poster Display</b>	100 (85 Minimum)	35

# **PROJECT REQUIREMENTS**

Projects must fit within one of three categories:

1. **Biological/Life and Earth Sciences** (Botany, Ecology, Geology, etc.) - A Biological/Life Science project examines some aspect of the life or life style of an organism or rocks.

*Example: The Effect of Sound on Plants, The Correlation of History Discovered in Rocks*

2. **Physical Sciences (Physics, Chemistry, etc.)** - A Physical Science project studies an abiotic phenomenon in order to understand the relation of identified factors, perhaps including a cause and effect relationship.

*Example: Observation of Freezing Rates of Water for Different Starting Temperatures, The Environmental Impact of Global Warming*

3. **Engineering (Electronics, Robotics, Mechanics, etc.)** - An Engineering project applies physical science knowledge to solve a problem or achieve a purpose.

*Example: Design Considerations for Solar-Cell Powered Homes, The Power of Programming and Electronics, Bridge Experiments & Analysis*

## **Ethics Statement**

Scientific fraud and misconduct are not condoned at any level of research or competition. This includes plagiarism, forgery, use or presentation of other researcher's work as one's own, and fabrication of data. Fraudulent project will fail to qualify for competition in the competition. NSBE reserves the right to revoke recognition of a project subsequently found to have been fraudulent.

## **Safety**

The safety of our members and the public is of the utmost importance. Precautions must be taken to prevent the possibility of personal injury, property damage, and the legal action that could result from a lack of concern for safety.

Exhibits must be sturdy, with moving parts firmly attached and approved for safety. Each exhibit must be self-supporting. Electricity (AC I 10 volt cycle) will be supplied, if requested; however, no gas or water outlets will be provided. Switches and cords must be of the approved variety and fuses or circuit breakers must protect circuits. Cell or battery- fed circuits should be both safe in design and operation.

All sharp edges or corners on prisms, mirrors, enclosures, and glass and metal plates must be removed or otherwise protected.

The length of hoses or extension cords is to be kept to a minimum and out of the way to eliminate tripping hazards. Use tape for securing.

Aisles and exits should not be obstructed.

Moving exhibits (e.g. radio-controlled vehicles, robots) should be restricted to the regulated display space. The Host Committee will try to provide an exhibition area to safely demonstrate projects that require more space than the regulated exhibit display space.

In addition to the regulations noted here, there may be local municipal or provincial regulations, which must be followed. The Host Committee shall share any such restrictions preceding the fair.

### *Fire Safety*

Restrictions have been defined on the construction of displays to reduce the possibility of accidental fire during the fair. The Host Committee will be responsible for ensuring that fire extinguishers of proper size and rating are available in the exhibition area, as well as evacuation guidelines in case of an emergency.

- Combustible material must not be used near a heat source.
- Open flames must not be used.
- Smoking is not permitted in the exhibit area.
- Packing material must not be stored in the exhibit hall.

### *Chemical Safety*

No containers of toxic or flammable chemicals are allowed. Dangerous chemicals are not allowed-this includes prescription drugs and over-the-counter medication. Substitutes for toxic and corrosive materials must be used. Common salt, for example, can be used to simulate chemicals such as ammonium nitrate. Water may be used instead of alcohol, ether, and other highly flammable liquids. When chemicals are simulated, they should be labeled with the names of the substance they represent preceded by the word "simulated." No project will be penalized because the key (but potentially dangerous) components were not on display.

### *Electrical Safety*

Electrical exhibits shall use as low a voltage as possible. At the end of the viewing period, all electrical exhibits must be disconnected, and power bars switched off. Where practical and necessary, it is recommended that pilot lights be used to indicate that the voltage is on.

Cord-connected electrical appliances should have a 3-wire conductor with ground. Electrical devices must be protectively enclosed as far as it is practical. Any enclosure must be non-combustible. All non-current carrying metal parts must be grounded. No exposed live parts over 36 volts are allowed. Current (amperage) must be low so as not to cause any discomfort or danger if touched. Wet cells shall not be used because of the hazardous chemicals involved.

### *Structural and Mechanical Safety*

Exhibits must be of a safe design with adequate stability to keep from tipping. Dangerous moving parts such as belts, gears, pulleys, and propeller blades must be suitably guarded. Pressurized vessels or compressed gas cylinders are not allowed.

## NSBE JR. EXPLORER TECHNICAL INNOVATION COMPETITION

### WRITTEN TECHNICAL RESEARCH PAPER

#### ABSTRACT

All registered NSBE Jr participants must submit a 500-word maximum abstract to NSBE at [pci@nsbe.org](mailto:pci@nsbe.org) with the subject heading as follows *Abstract\_FirstName.LastName\_DivisionLevel* (EffectsofRecycling\_John.Doe\_MiddleSchool). It should briefly describe the objective, the experimental procedure, and expected results of the project.

Abstracts must be received no later than 11:59PM January 30, 2015 for the *National* NSBE Jr. Explorer Technical Innovations Competition. Abstracts will be judged on creativity, originality, scientific content, and clarity. Please adhere strictly to these deadlines as there will be **NO EXCEPTIONS** for late submissions.

#### **GUIDELINES FOR ABSTRACTS**

An abstract is a shortened version of the main ideas of your research paper. An abstract is one-page paper that is written after you have completed your research paper. It should be easy to read, saving time from reading the entire research paper, and is used by the judges to check your research and reasoning. It must provide the necessary information to understanding what the research paper and project is about. Follow these instructions when writing the abstract.

The abstract should include the following:

- A. Purpose of the experiment
- B. Procedure
- C. Data
- D. Conclusions

It may also include any possible research applications. Only minimal reference to previous work may be included.

An abstract must not include the following:

- A. Acknowledgments (including naming the research institution and/or mentor with which you were working, or self-promotions and external endorsements)
- B. Work or procedures done by the mentor

## **RESEARCH PAPER**

This is a report in which you summarize everything you have read about the topic for your science project. The size of the font should be no larger than 12 in Times New Roman or Arial. The entire research paper should contain no more than 10 pages when you include the title page, table of contents, abstract, body of the paper (about 5 pages), picture page, and bibliography. The report will be submitted via email by 11:59 PM February 22, 2015. **No late submissions will be accepted.**

## **ORDER OF THE REQUIRED SECTIONS OF THE RESEARCH PAPER**

1. Title Page
2. Abstract
3. Table of contents
4. Introduction
5. Materials & Methods
6. Results
7. Discussion
8. Conclusion
9. References

- ❖ Acknowledgements—where this section is included may vary
- ❖ Images and charts can be integrated within the body of the research paper or included in an appendix.

**RESEARCH PAPER RUBRIC**

Criteria for Evaluation	4 POINTS	3 POINTS	2 POINTS	1POINT
<b>Title Page and Table of Contents</b> 4	Title Page and Table of Contents contain all of the required components, are clear, in order and complete.	Title Page identifies most of the components and most the TOC subtopics are identified. Both are in the correct format.	All of the required components of the title page are present and most of the subtopics of the TOC are present, however they are not organized well.	Missing some required components. TOC and /or Title page are not properly formatted.
<b>Abstract</b> 5	Abstract is 500 words or less and it includes the required sections (e.g. purpose, procedures, data, conclusions). It is well written, succinct and gives a clear picture of the experiment or design project from conception to final product.	Abstract is 500 words or less and it includes the required sections. The structure of the abstract gives the reader a clear understanding of the project from beginning to end.	Abstract is 500 words or less and it includes the required sections. However the writing makes it hard to connect each of the elements and is missing crucial information.	Abstract is more than 500 words and/or it only provides a summary that includes a few of the details from the research study or design project.
<b>Introduction</b> 8	The introduction includes the purpose, hypothesis, and goals of the study or design project. The narrative is complete and it thoroughly ties all of the elements together.	The introduction includes the purpose, hypothesis, and goals of the study or design project. The narrative is complete and ties all of the elements together, but it could be a bit more thorough.	The introduction includes the purpose, hypothesis, and goals of the study. The narrative does not complete tie all the elements together it is brief but succinct.	The introduction is incomplete and/or is incoherent.
<b>Materials and Methods</b> 8	The methods used to collect data, design the device, or make observations are described in detail. Writing is so detailed that project can easily be repeated. Includes images, sketches and schematics of the experiment or design process.	The methods used to collect data, design the device, or make observations are described in detail. Writing is detailed enough that it could be repeated. Includes images, sketches and schematics of the experiment or design process	The methods used to collect data, design the device, or make observations are described. Writing is clear but not detailed enough to be repeated exactly--images or drawings are included.	Methods are incomplete and/or difficult to follow. There are no schematics, sketches, or images of the setup or device.
<b>Results and Discussion</b> 12	The results include the data and analysis--all statistics, graphs and pages of raw data. It is organized and well-conceived and presented. Discussion includes limitations and what you would do differently if you repeated this experiment. Quality of writing is high and reflective	Data analysis is present and complete with no errors. Discussion possible errors, limitation, and what you would do differently if you repeated the experiment. Quality of writing is good and show moments of deep reflection.	Data analysis is present and complete, but not presented well. Data contain minor errors. Discussion possible errors, limitations, and what you could do differently next time is included. Writing needs some revision and further reflection.	Discussion is incomplete--need more details and reflection to be considered a complete body of work. Data analysis is incomplete and/or not well presented.
<b>Conclusions</b> 6	Conclusion includes a detailed summary of the experiment or design process. Discusses whether goals were met and hypothesis was proven. Uses data to back up conclusion.	Conclusion includes a brief summary of the experiment or design process. Discusses whether goals were met and hypothesis was proven. Uses data to back up conclusion.	Conclusion includes a brief summary of the experiment or design process. Discusses whether goals were met and hypothesis was proven. Uses data to back up conclusion, but may not be the best representation.	Incomplete conclusion lacking data, a sufficient summary and a firm conclusion. Does not discuss if goals are met or hypothesis has been proven.
<b>References</b> 4	Bibliography should be complete, properly formatted in MLA or APA style and exceed 5 sources.	Bibliography should be complete, properly formatted in MLA or APA style and be at least 5 sources--a mixture of academic and reputable sources.	Bibliography includes 3-4 sources formatted in MLA or APA style. References will be mostly reputable sources and minority of academic sources.	Paper does not include any references or in text citations.
<b>Grammar and Punctuation</b> 3	Standard English grammar, sentence structure, and/or punctuation appropriate for the grade level are used throughout the paper.	Standard English grammar, sentence structure, and/or punctuation appropriate for the grade level with only a few errors.	Inconsistent use of standard English grammar, sentence structure, and/or punctuation appropriate for the grade level.	Standard English grammar, sentence structure, and/or punctuation appropriate for grade level are missing.

**RESEARCH PAPER GRADING RUBRIC**

Name(s)	
Chapter	
Region	
Project Topic/Title	

Criteria For Evaluation	Rating	Category Score
Title Page and Table of Contents		_____ X 4 =
Abstract		_____ X 5 =
Introduction		_____ X 8 =
Materials and Methods		_____ X 8 =
Results and Discussion		_____ X 12 =
Conclusions		_____ X 6 =
References		_____ X 4 =
Grammar and Punctuation		_____ X 3 =
	<b>Total Score</b>	

## **PROJECT DISPLAY/VISUAL PRESENTATION**

Information must be complete, clear, and logical. Color and contrast will add to the overall creativity of the display. The display must maintain an accurate experimental journal that shows all of the data observed during the experiment. Data entries should include:

1. Date of observation
2. Time of the observation
3. Accurate description of the observation
4. Note other observations like weather conditions, mistakes, expectation, etc.
5. Name

Use your creative skills to design a display that will catch the eye of judges and other observers. Your poster must stand alone (three panel or glossy single panel posters are acceptable), and display the required components of your project in the order listed below. They consist of the following:

- Title
- Abstract
- Purpose: State what will be determined by completing your experiment
- Hypothesis
- Materials: List everything that was used to complete the experiment.
- Methods
- Results: Include all pertinent data in graphs, data table or charts.
  - ❖ Tables, graphs, and charts may be used to display your collected data
- Conclusion: Write a statement that summarizes the results of your data, and based on your hypothesis.
- Acknowledgements
  - ❖ If you use pictures, drawings, and/or photographs: Make sure captions and description are included.

A copy of the abstract should be maintained at the Project Display.

***Reminder: Bring a hard copy of your report to the competition site***

All exhibits, including all accessories, must be confined to a table or floor space not to exceed 36 inches front to back; 48 inches side to side; and 120 inches maximum height from the floor. All measurements will be made from the outermost points, including framework and appendages, and will be checked by the Host Committee. Exhibits exceeding these dimensions must be modified or risk rejection from the competition.

**RESEARCH PROJECT AND DISPLAY RUBRIC**

Name(s)	
Chapter	
Region	
Research Topic/Title	

- 4 – Clearly meets these criteria evaluated
- 3 – Makes a serious effort to meet the criteria evaluated and is fairly successful
- 2 – Makes some effort to meet the criteria evaluation but with little success
- 1 – Does not achieve the criteria evaluated

<b>Evaluation Criteria</b>	<b>Indicators</b>
<b>Research Question or Research Problem</b>	Question/Problem is clearly defined Clear and focused purpose or clear description of a practical need or problem to be solved. Defines criteria for solution to problem and discusses constraints
<b>Design and Methodology</b>	Well-designed plan and data collection methods or exploration of alternatives to answer need or problem Variables and controls defined, appropriate and complete Identification of a solution and/or development of a prototype or model
<b>Execution:</b> Data collection, analysis, and interpretation or Design, construction and testing	Systematic data collection and analysis Reproducibility of results Appropriate application of mathematical and statistical methods Sufficient data collected to support interpretation and conclusions <i>OR</i> Prototype demonstrates intended design Prototype has been tested in multiple conditions/trials Prototype demonstrates engineering skill and completeness
<b>Creativity</b>	Project demonstrates significant creativity in one or more of the above criteria
<b>Display</b>	Logical organization of material Clarity of graphics and legends Supporting documentation displayed

<b>Evaluation Criteria</b>	<b>Rating</b>			
Research Question or Research Problem	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Design and Methodology	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Execution	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Creativity	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Display	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>

**Total:**  
**Final Score:** Total X 5 =

Comments:

## **ORAL PRESENTATION**

Each science fair participant will be given 10 minutes to complete an oral multimedia presentation. There will also be a five minute question and answer session at the end of the presentation. During the oral presentation, the participant should go through each of the major sections of the project (namely, the problem/research question, hypothesis, procedures/methods and materials, results, and the conclusion).

Participants must be ready to answer all of the judges' questions related to their project. A well organized multimedia presentation will give the judge most of what they are looking for. However, the judges will often ask questions simply for the purpose of finding out whether the participant understood what he/she was doing.

### **SAMPLE STRUCTURE OF PRESENTATION**

1. Introduction
2. Purpose
3. Methods & Materials
4. Results
5. Conclusion
6. Reflections and Future Work/Plans
7. Acknowledgments

A student's ability to efficiently articulate their research is an important part of their presentation. Students should be aware that they are representing themselves, schools, and NSBE to the public and should be dressed appropriately. Chewing gum, listening to music and cellular phones are strictly prohibited during competition. Students should be respectful of other students and judges.

## Oral Presentation Rubric

Student Name:

A PowerPoint or other multimedia presentation along with your oral presentation is encouraged, but not mandatory. Limit to a *maximum* of **ten** slides.

Category	4	3	2	1
<b>Content (7)</b>	Thoroughly and clearly states the purpose of the study or defines the problem to be solved or addressed. Provides a thorough explanation of the methods used during the study as well as the results and conclusions.	Adequately states the purpose of the study or defines the problem to be solved or addressed. Provides a good, but not heavily detailed explanation of the methods used during the study as well as the results and conclusions.	States most of the main points, but does not clearly define the problem or state the purpose of the study. Provides a minimal explanation of the methods used during the study as well as the results and conclusions. May include some unnecessary information.	States few main points and details that focus on the research study or design project, but does not really explain the purpose and/or methods. Presentation includes information does not relate to topic. Conclusion may be missing.
<b>Organization (5)</b>	Clearly organized into a logical sequence. Excellent use of an outline. Excellent introduction and conclusion.	Adequate evidence of a logical sequence of information. Good use of an outline. Satisfactory introduction and conclusion.	Fair evidence of a logical sequence of information. Some use of an outline. Weak introduction and conclusion.	Minimal or no outline followed. No logical organization; some digressions. Unclear, confusing. No introduction or conclusion.
<b>Delivery (8)</b>	Effectively and creatively delivers the information while staying on the topic and considering the audience. Uses voice variation; Interesting and vivid to hear.	Adequately delivers the information while staying on the topic and considering the audience. Speaks clearly and confidently.	Delivers the information but does not stay on the topic. Little consideration of audience. Uses incomplete sentences.	Little or no attempt is made to stay on the topic. Does not consider audience. Difficult to understand.
<b>Preparation (5)</b>	Presentation shows detailed preparation and practice in delivery including use of voice, posture, eye contact, gestures, pacing, and use of pictures, graphs, computer models, etc. Interesting and vivid.	Presentation shows satisfactory preparation as well as practice of delivery (including use of voice, posture, eye contact, gestures, and pacing.) Some use of images, charts, etc.	Presentation shows some preparation as well as some practice of the delivery (including marginal use of voice, posture, eye contact, gestures, pacing). Marginal use of images, charts, etc.	Presentation is lacking in preparation and in practice of delivery (including use of voice, posture, eye contact, gestures, and pacing). Has little or no use of images, charts, etc. Difficult to hear. Appears tense. Fidgets often.

\*\* To compute the final score multiple the number in the applicable column by the number value under a particular category. For example if a student earns a score of 3 for **delivery**, they will receive 24 points (3 x 8= 24). Total score is the summation of the rows.

**ORAL PRESENTATION GRADING RUBRIC**

Name(s)	
Chapter	
Region	
Research Topic/Title	

Criteria For Evaluation	Rating	Category Score
Content		_____ X 7 =
Organization		_____ X 5 =
Delivery		_____ X 8 =
Preparation		_____ X 5 =
	<b>Total Score</b>	

Comments: