



## Required Experimental Research

There will be significant changes in the scoring rubrics this year due to the obvious conclusion that has been drawn that “one size does not fit all.” Every project does not fit under what is typically called The Scientific Method whereby a student formulates a hypothesis, devises an experiment, identifies a variable and establishes controls, collects data. You know the drill. There are other kinds of projects which can be designated as “design” projects. These typically may fall under the category of mathematics, engineering, astronomy, and some others.

There are no identifiable controls and variables in a mathematical algorithm. A student may choose to use data collected by OSHA that is in the public domain and apply new meaning to it or may observe some astronomical phenomenon while working on a project using photos downloaded from the Hubble Space Telescope. Another student might fabricate a model of a new kind of heart valve material. None of these projects would lend themselves to the scoring rubric that is used for judging experimental projects.

Below are details how the two different types of projects will be judged. You will have to select whether your project is an Experimental Project or a Design Project.

### 1 Experimental Research Document

The Experimental Research Document is the grouping of all data pertinent to the investigation. It should include graphs, charts, a log of experiments, interviews with authorities, and an extensive explanation of the investigation. This document, which may number many pages, is the personal property of the researcher. This compilation of personal records is the source from which the Abstract and the Research Summary are developed

The design and arrangement of this document are left to the discretion of the researcher. Since this is a “one-of-a-kind” document, extreme care should be used in handling. It should be exhibited only when the researcher is present at his/her project.

### 2 Experimental Research Paper

**The Experimental Research Paper must be typed, it is to have no binder or protective cover** and must be securely stapled in the upper left corner. Students selected to participate in the STEM Exhibition will be assigned an exhibit number. The exhibit number must be written in the *upper left corner of each copy of the Abstract, Safety Sheet, and Title Page, The Experimental Research Paper* must be no longer than 30 pages (up to 33 pages only if an endorsement is included). The page total includes *Abstract, Safety Sheet*, endorsement (if required), and the Research Summary (title page, table of contents, body of paper, reference list of literature cited, and appendixes of data, graphs, photos, and other items). *The page limit and other criteria will be strictly enforced.* Papers submitted with excess pages will have the excess pages removed and returned to the author. **The student’s last name and research title are in the upper right-hand corner of all pages after the Table of Contents.** All of the following sections should be included and in the order listed below.

#### a. Abstract

The *Abstract* is a concise, one-page abbreviation of the *Research Summary*. It should contain only information or statements that are an inherent part of the *Research Summary*. This paper must use the exact form presented on page 59 and must be typed. The *Abstract* consists of three paragraphs (purpose, procedure, and conclusions) having a total of 250 words or fewer. *The Abstract is required for all projects.* Words and phrases should be carefully chosen so that the full impact of the research is conveyed in the minimum number of words. *The limit of three paragraphs consisting of 250 words or fewer will be strictly enforced.* The *Abstract* must be displayed on the front of the exhibitor’s display board.

#### b. Safety Sheet

The purpose of the *Safety Sheet* is to keep students aware of all actual and potential safety hazards. Describing hazards involved with the project on the *Safety Sheet* does not mean the project will be disqualified. The important issue is how the potential hazards were handled.

A statement of the hazards encountered and precautions taken in the project is to be prepared by the student and signed by both the student and the sponsoring teacher. The *Safety Sheet* is found on page 61 of this handbook. High school students who want to be considered for the ISEF will need to download the proper forms. The *Safety Sheet* is required for all projects and must be displayed on the front of the exhibitor’s display board.



### c. Endorsement

Projects using humans, vertebrates, firearms or potentially hazardous biological agents often pose risks to the student researcher or the test subjects. For this reason, the plans for such projects must be reviewed by a team of qualified scientists and science teachers before experimentation begins. When permission is granted, the student is provided with a document called an endorsement. Endorsements are required for research on vertebrate animals (including humans), human or vertebrate tissue, recombinant DNA, for some projects involving microorganisms, and for use of firearms. (See pages 10 -22 of this handbook to determine whether a project requires an endorsement.) A copy of the endorsement(s) must be displayed on the front of the exhibitor's display board.

### d. Research Summary

The *Research Summary* is a condensation of the *Research Document*. It should be an accurate summary of the research done by the student and should reveal the experimentation and/or observations which have been made. Specific criteria have been established for the preparation of this report. Details for writing this paper follow.

The components of the format of the *Research Summary* are as follows:

- i. Title Page:** See page 56 for correct format.
- ii. Table of Contents:** The list of topics or matter contained in the paper, including page numbers.
- iii. Acknowledgments:** A listing of persons or agencies that gave the student guidance and helped with this research. It may include a single individual, an organization, a hospital, or some other agency.
- iv. Purpose and Hypothesis:** An explanation of what is to be accomplished by doing this research. A description of the expected outcome should be included.
- v. Background Research:** A discussion of the background information that helps establish the hypothesis and explains procedures adapted for the experiment where necessary. Also any similar research that helps establish the hypothesis or procedure. Other background information about the topic that may help the reader understand the project should also be included. Paraphrased information should be cited as such. No references to the literature are to be placed in footnotes. Citation to particular pages in the text should be in the form (Smith, 2010, p. 10); for a general citation in the text (Smith, 2002). This citation should be placed at the end of the sentence to which it refers. The style for citations is based on the *Publication Manual of the American Psychological Association*, 6th ed., (APA style) which is the official style manual for the Illinois Junior Academy of Science. Materials with a copyright date within the last seven years should be used whenever possible.
- vi. Materials and Methods of Procedure:** A listing of the materials used in the research. How the materials in the research problem were used should be included. The method used in research should be described in sufficient detail so that others may duplicate this work. Drawings and/or photographs are appropriate if they enhance or clarify the explanation.
- vii. Results:** A clear, concise presentation of all the data accumulated as a result of the procedure, including data inconsistent with the hypothesis. All data is valuable. Drawings, charts, graphs, and other items pertinent to the project are important in conveying results and should be included. Caption all photographs. Label all drawings, charts, graphs. Include units of measurement. Always label axes of the graphs.
- viii. Conclusions:** A concise evaluation and interpretation of the data and results. Opinions of the results may be expressed in this section. The conclusions should be limited to results of the investigation and should refer to the stated purpose and hypothesis. The effects of experimental error should be estimated and considered while drawing conclusions.
- ix. Reference List:** A list of at least 12 published articles, books, and other communications, including works either quoted or paraphrased that are actually cited in the Review of Literature. Use the format described in the *Publication Manual of the American Psychological Association*, 6th ed. (APA style). The reference list should be presented alphabetically by author's last name and should be placed at the end of the paper. (The correct style for listing references can be found on pages 30–33 of this Handbook.