

# ISEF Science Inquiry

1) Be curious, choose a limited subject, ask a question; identify or originate/define a problem. It is important that this question be a 'testable' question – one in which data is taken and used to find the answer. A testable question can further be identified as one in which one or more variables can be identified and tested to see the impact of that variable on the original set of conditions. The question should not merely be an 'information' question where the answer is obtainable through literature research--*it should be able to stand up to the "SO WHAT test"*

2) Review published materials related to your problem or question. This review should also include reviewing the International Rules and Guidelines ([www.societyforscience.org/isef/rulesandguidelines](http://www.societyforscience.org/isef/rulesandguidelines)). This is called background research--*create a bibliography or works cited page.*

3) Evaluate possible solutions and guess why you think it will happen (hypothesis)--*Use the template from science inquiry form.*

4) Experimental design (procedure). In designing the experiment, it is critical that only one variable – a condition that may affect the results of the experiment – is changed at a time. This makes the experiment a 'controlled' experiment--*identify the variables that you will be testing and determine how you will ensure you will be testing only one variable at a time.*

5) Challenge and test your hypothesis through your procedure of experimentation (data collection) and analysis of your data. Use graphs to help see patterns in the data--*all data must be presented in data table form that needs to be transformed into the best graph to illuminate the trends and patterns in the data.*

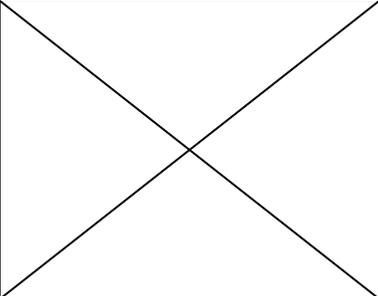
6) Draw conclusions based on empirical evidence from the experiment--*what did you discover? Use your data to draw conclusions and use the Lab Report Format Analysis to help you round out your analysis.*

7) Prepare your report and exhibit--*see student handbook for completing research report and exhibit.*

## ISEF--RESEARCH PLAN

	<b>Score 1 Beginning Proficient</b>	<b>Score 2 Developing Proficient</b>	<b>Score 3 Proficient</b>	<b>Score 4 Highly Proficient</b>
Scientific Question	Question being asked is not scientifically relevant--or it can easily be answered through research.	Question being asked is legitimate--but is not scientifically thoughtful--does not address the "SO What" Factor	Question being asked is scientifically thoughtful and the "SO What" Factor is partially addressed.	Question being asked is scientifically thoughtful and answers the "SO What" Factor
Goals/Expected Outcome (Hypothesis)	Some or all of the required components are missing or do not meet the minimum proficiency expectations.	All three required components are present, description of a goal, background information is present--although it could be improved upon and it has a correctly formatted hypothesis statement.	All three required components are present--a description of a goal--explain in good detail, good background information prepared in paragraph form and a correctly formatted hypothesis statement.	All three required components are present--well articulated goal, thorough and scientifically valid background information prepared in multiple paragraphs and a correctly formatted hypothesis statement.
Detailed Procedures and Materials	Procedures and/or list of materials are incomplete or lack a clear focus or organization. Cannot be used to repeat the experiment.	Procedures are in a list or bulleted format, they need improvements in two of the follow: clarity, concise, thorough, easy to follow. Materials are listed but they need to be more detailed in type and quantity.	Procedures are in a list or bulleted format, they need improvements in one of the follow: clarity, concise, thorough, easy to follow. Materials are listed but they need to be a little more detailed in type and quantity.	Procedures are in list or bulleted format, they are clear, concise, thorough and easy to follow. Materials listed are thorough, detailed in type and quantity.
Method of Data Analysis	Data tables for qualitative and quantitative data are incomplete, variables that are being controlled for are not fully being addressed and there is no mention of graphs.	Identify which variables will be tested and controlled for. Addresses both quantitative data and qualitative data--but the emphasis is on quantitative data. Graphs are mentioned but not explored in depth.	Addressed how variables will be reduced or eliminated. Addresses the collection of both qualitative and quantitative data and eludes to different ways the data may be graphed.	Clear description of how variables will be reduced or eliminated. Clearly addresses how both qualitative and quantitative data will be collected and then graphed.
Bibliography (5 Major References)	Less than 5 reputable sources.	Presence of 5 Sources--majority of informal--yet reputable sources and minority of academic sources.	Presence of 5 Sources--majority of academic sources minority of informal--yet reputable sources.	Presence of 5 Academic Sources

## ISEF PROJECT DATA BOOK

	<b>Score 1 Beginning Proficient</b>	<b>Score 2 Developing Proficient</b>	<b>Score 3 Proficient</b>	<b>Score 4 Highly Proficient</b>
Research and Bibliography	Incomplete Bibliography--major formatting issues, not in APA or MLA format. No copies of heavily used or cited research sources.	Completed Bibliography--some formatting issues but complete and accurate according to an APA or MLA format. A few copies of the heavily used or cited research sources.	Completed Bibliography in MLA or APA format. Printed copies of most heavily used or cited research sources.	Participation in ISEF Fair
Research Plan	See Research Plan Rubric			
Data Collection and Graphs	Incomplete data tables and/or graphs or serious errors in units, scale, labels or titles.	Qualitative and Quantitative Data Tables and Graphs are well formatted with correct units, scale, labels and titles with minor errors. The choice of graphs transform the data--however it is not the best graph for analysis.	All Qualitative and Quantitative Data Tables and Graphs are High Quality--correct units, scale, labels and titles. The choice of graphs best illustrate the transformation of data.	
Research Paper	See Research Paper Rubric			
ISEF Forms	Missing forms or crucial information or signatures.		Correct Forms Approval Form IB Risk Assessment Form Human Participants Form Human Consent Form Vertebrate/Invertebrate Form Potentially Hazardous Form + Appropriate Signatures and Information	

## ISEF--RESEARCH PAPER

	<b>Score 1 Beginning Proficient</b>	<b>Score 2 Developing Proficient</b>	<b>Score 3 Proficient</b>	<b>Score 4 Highly Proficient</b>
Title Page and Table of Contents	Missing required components, lack of formatting is evident--major revisions needed.	All of the required components are present however they are not organized well and the presentation is not sufficient.	Title Page contains student name(s), date, title of project, scientific question, date, and school. Table of Contents are complete. Presentation is sufficient.	Title Page contains student name(s), date, title of project, scientific question, date, and school. Table of Contents are clear and straightforward. Presentation is of the highest quality.
Introduction	The introduction is incomplete and/or is not written coherently.	The introduction includes the purpose, hypothesis, and an explanation of what prompted your research, and what you hoped to achieve. The narrative does not completely tie all the elements together it is brief but succinct.	The introduction includes the purpose, hypothesis, and an explanation of what prompted your research, and what you hoped to achieve. The narrative is complete and ties all of the elements together.	The introduction includes the purpose, hypothesis, and an explanation of what prompted your research, and what you hoped to achieve. The narrative is complete and it thoroughly ties all of the elements together.
Materials and Methods	The methods are incomplete are hard to follow, there are no drawings or photographs.	The methods you used to collect data, make observations are described. Writing is clear but not detailed enough to be repeated exactly--photo's or drawings are included.	The methods you used to collect data, make observations are described in detail. Writing is detailed enough that it can be repeated including photographs and/or drawings of experiment.	The methods you used to collect data, make observations are described in detail. Writing is so detailed that it can be repeatable including photographs and drawings of experiment.
Results	The data and analysis is incomplete and/or not well presented.	The data and analysis--all statistics, graphs and pages of raw data are present with minor errors and they are not well conceived or presented.	The results include the data and analysis--all statistics, graphs and pages of raw data with no errors. It only has some minor formatting issues.	The results include the data and analysis--all statistics, graphs and pages of raw data. It is organized and well conceived and presented.

<p><b>Discussion</b></p>	<p>Discussion is incomplete--need more reflection and revision to be considered a complete body of work.</p>	<p>Results are compared to expected results and a limited discussion on possible errors is included. Discussion also includes limitations and what you should have done differently next time. Writing needs some revision and further reflection.</p>	<p>Results are compared to expected results including a discussion of possible errors. Discussion includes events out of your control (limitations) and what you would do differently if you repeated the experiment. Quality of writing is good and show moments of deep reflection.</p>	<p>Results are compared to theoretical values, published data, and/or expected results, including discussion of possible errors. Discussion includes events out of your control (limitations) and what you would do differently if you repeated this experiment. Quality of writing is high and reflective.</p>
<p><b>Conclusions</b></p>	<p>Incomplete conclusion lacking data, a sufficient summary, addressing the variables in the experiment and a firm conclusion if the hypothesis has been supported or not.</p>	<p>Conclusion includes a brief summary of your results (addresses hypothesis but superficially or incorrectly)--including the relationship of the changed and unchanged variable--use of data is used to back up conclusion, however the data chosen may not make the best correlation.</p>	<p>Conclusion includes a brief summary of your results (was the hypothesis supported?)--including the relationship of the changed and unchanged variable--use of data is used to back up conclusion and practical applications are mentioned.</p>	<p>Conclusion includes a summary of your results (was the hypothesis supported?)--including the relationship of the changed and unchanged variable--use of multiple sets of data are used to back up conclusion and practical applications are mentioned.</p>
<p><b>References/Bibliography</b></p>	<p>Less than five highly reputable sources, improperly formatted.</p>	<p>Bibliography should be complete, properly formatted in MLA or APA style and be at least 5 sources with a majority of reputable sources and minority of academic sources.</p>	<p>Bibliography should be complete, properly formatted in MLA or APA style and be at least 5 sources--a mixture of academic and reputable sources.</p>	<p>Bibliography should be complete, properly formatted in MLA or APA style and exceed 5 sources,</p>

## ISEF--VISUAL DISPLAY and ABSTRACT

<http://www.societyforscience.org/document.doc?id=329>

	<b>Score 1 Beginning Proficient</b>	<b>Score 2 Developing Proficient</b>	<b>Score 3 Proficient</b>	<b>Score 4 Highly Proficient</b>
Display Board	Project board is incomplete--does not incorporate all of the required elements from the <i>Creating a Project Board</i> link.	Incorporates all of the required but none of the recommended elements from the <i>Creating a Project Board</i> link.	Incorporates all of the required and some of the recommended elements from the <i>Creating a Project Board</i> link.	Incorporates all required and recommended elements from the <i>Creating a Project Board</i> link.
Abstract	Abstract is over 250 words and it does not include the purpose, procedures, data and/or conclusions. Revisions are needed.	Abstract is less than 250 words and it includes the purpose, procedures, data and conclusions. However the writing makes it hard to connect each of the elements and is missing crucial information.	Abstract is less than 250 words and it includes the purpose, procedures, data and conclusions. The structure of the abstract gives the reader a clear understanding of the project from beginning to end.	Abstract is less than 250 words and it includes the purpose, procedures, data and conclusions. The abstract is well written, succinct and give a clear picture of the experiment from conception to final product.