

2011-12 Official Scientific Inquiry/Engineering Design Scoring Guides Grades 6, 7 and 8

	<p style="text-align: center;">SI- Forming a Question or Hypothesis <i>Based on observations and scientific principles, propose questions or hypotheses that can be examined through scientific investigation.</i></p>	<p style="text-align: center;">ED- Identifying and Defining a Problem to be Solved <i>Based on observations and scientific principles, formulate the statement of a practical problem that can be addressed through the process of engineering design.</i></p>	
5/6**	<ul style="list-style-type: none"> • Proposes a question or hypothesis that can be scientifically investigated and demonstrates understanding of scientific relationships. • Provides background, observations and science principles to establish a detailed context for this investigation. • The question or hypothesis clearly guides the design of an effective and/or innovative investigation. 	<ul style="list-style-type: none"> • Describes in detail a problem to be solved through the process of engineering design. The solution addresses a specific need identified through research. • Uses and applies relevant background information and science principles to identify potentially viable solutions to the problem. • Explains criteria and constraints or limits to be applied to a solution based on science principles, with supporting rationale. 	5/6**
4	<ul style="list-style-type: none"> • Proposes a question or hypothesis that can be scientifically investigated. • Provides background, observations and scientific principles related to the question or hypothesis. • The question or hypothesis is specific enough to guide the design of an effective investigation. 	<ul style="list-style-type: none"> • Describes a problem to be solved through the process of engineering design. • Describes relevant background information and science principles that relate to the problem. • Identifies criteria and constraints to be applied to the solution. 	4
3	<ul style="list-style-type: none"> • Proposes a question or hypothesis that is incomplete but could be scientifically investigated. • Provides background, observations and/or scientific principles that partially relate to the question or hypothesis. • The question or hypothesis lacks the clarity necessary to guide the design of an effective investigation. 	<ul style="list-style-type: none"> • Partially describes a problem to be solved through the process of engineering design. • Describes background information and/or science principles that partially relate to the problem. • Identifies given criteria and constraints to be applied to a solution in an overly general way. 	3
1/2*	<ul style="list-style-type: none"> • Proposes a question or hypothesis that cannot be scientifically investigated. • Provides background, observations and/or scientific principles that are not relevant to the question or hypothesis. • The question or hypothesis cannot guide the design of an effective investigation. 	<ul style="list-style-type: none"> • Describes a problem that is unable to be solved through the process of engineering design. • Describes background information or science principles that do not relate to the problem. • Identifies unrelated criteria and constraints to be applied to a solution. 	1/2*

**5 for preponderance (most) completed, 6 for all completed.

*2 for preponderance (most) completed, 1 for less completed or missing.

A hypothesis may be stated as a claim. An engineering design problem addresses a need with a solution that uses relevant science principles.

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	<p style="text-align: center;">SI- Designing an Investigation</p> <p style="text-align: center;"><i>Design a safe and ethical scientific investigation to gather data to respond to a question or hypothesis.</i></p>	<p style="text-align: center;">ED- Generating Possible Solutions</p> <p style="text-align: center;"><i>Evaluate and select an engineering solution from a range of possible options, and defend that solution for testing using trade-offs, criteria, and constraints.</i></p>	
5/6**	<ul style="list-style-type: none"> • Proposes scientifically logical, safe, and ethical procedures in a precise and efficient design that maximizes resources which contribute to the outcome. • Thoroughly identifies relevant variables (including controls) and defines a systematic investigative process that is clearly defined and adaptable if necessary. • Presents a design that will provide data of exceptional quality and quantity to address the question or hypothesis and to investigate possible relationships. 	<ul style="list-style-type: none"> • Describes a variety of possible engineering solutions that are distinctly different. • Uses the concept of trade-offs to compare and evaluate possible solutions in terms of criteria, constraints and priorities. • Selects and defends a solution for testing based on a comprehensive review of the design and performance criteria and constraints. 	5/6**
4	<ul style="list-style-type: none"> • Proposes a scientifically logical, safe, and ethical procedure that can be easily and accurately followed. • Identifies the variables and controls relevant to the procedure. • Designs a scientific investigation that uses appropriate resources/materials and techniques to collect data relevant to the question or hypothesis. 	<ul style="list-style-type: none"> • Describes possible engineering solutions to the problem identified. • Evaluates the proposed solutions in terms of design and performance criteria, constraints, priorities, and trade-offs. • Selects and explains why a proposed solution was selected for testing based on criteria and constraints. 	4
3	<ul style="list-style-type: none"> • Proposes a partially scientifically logical, safe, and ethical procedure that includes some or minor scientific errors. • Partially identifies the variables and controls relevant to the procedure. • Designs a scientific investigation with insufficient resources/materials and techniques to collect data relevant to the question or hypothesis. 	<ul style="list-style-type: none"> • Describes only one possible engineering solution. • Makes limited use of design and performance criteria, constraints, priorities, and trade-offs to evaluate the solution. • Presents a solution for testing that partially relates to criteria and constraints. 	3
1/2*	<ul style="list-style-type: none"> • Proposes a procedure that is illogical and difficult to follow and/or includes significant scientific errors. • Variables and controls relevant to the procedure may be present, but are not identified. • Designs a scientific investigation lacking the necessary resources/materials and techniques to collect data relevant to the question or hypothesis. 	<ul style="list-style-type: none"> • Gives an incomplete description of an engineering solution. • Incorrectly uses of the concept of trade-offs to evaluate possible solutions in terms of criteria and constraints. • Presents solution for testing with unrelated criteria. 	1/2*

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	SI- Collecting and Presenting Data <i>Collect, organize, and display sufficient data to support analysis.</i>	ED – Testing Solution(s) and Collecting Data <i>Test solution(s) by collecting, organizing, and displaying data to facilitate the analysis and interpretation of test results.</i>	
5/6**	<ul style="list-style-type: none"> Collects detailed data that are consistent with the planned investigation design. Carefully records detailed, relevant and annotated data in a consistent and organized manner with the appropriate level of precision. Displays data in a manner that highlights information and patterns and supports interpretation of relationships. 	<ul style="list-style-type: none"> Constructs a solution that thoroughly addresses the criteria and constraints and is appropriate for testing. Design may incorporate modifications made during construction. Collects accurate, detailed and complete data relevant to the criteria and constraints using effective and/or advanced techniques to test or analyze a solution. Displays data that is complete and facilitates a thorough evaluation of the solution. 	5/6**
4	<ul style="list-style-type: none"> Collects data that are consistent with the planned investigation design. Records relevant and accurate data in a consistent and organized manner. Displays data in a manner that supports analysis and interpretation. 	<ul style="list-style-type: none"> Constructs a solution that adequately addresses the criteria and constraints and is appropriate for testing. Collects accurate data relevant to the criteria and constraints using appropriate techniques to test or analyze a solution. Displays data that is complete and facilitates evaluation of the solution. 	4
3	<ul style="list-style-type: none"> Collects data that are partially consistent with the planned investigation design. Records relevant data in an inconsistent or disorganized manner. Displays data in a manner that is incomplete or disorganized. 	<ul style="list-style-type: none"> Constructs a solution that does not adequately address the criteria and constraints and/or can only be partially tested. Collects data partially relevant to the criteria and constraints and/or used partially appropriate techniques to test or analyze a solution. Displays data that is incomplete or does not facilitate evaluation of the solution. 	3
1/2*	<ul style="list-style-type: none"> Collects data that are inconsistent with the planned investigation. Records irrelevant or inaccurate data. Displays incomplete and disorganized data. 	<ul style="list-style-type: none"> Constructs a solution that does not address the criteria and constraints and cannot be tested. Collects data that is not relevant to the criteria and constraints and does not use appropriate techniques to test or analyze a solution. Displays data that is incorrect and does not facilitate evaluation of the solution. 	1/2*

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Data means evidence or record which may or may not require transformation to communicate results.

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	SI- Analyzing and Interpreting Results <i>Summarize and analyze data including possible sources of error. Explain results and offer reasonable and accurate interpretations and implications.</i>	ED- Analyzing and Interpreting Results <i>Summarize and analyze data, evaluate the proposed solution in terms of design criteria and constraints and trade-offs and suggest design improvements.</i>	
5/6**	<ul style="list-style-type: none"> Analyzes relevant data and forms a comprehensive explanation (including patterns and trends) and relates the results of the investigation to other scientific information. Clearly communicates the conclusions including sources, magnitude, and significant sources of error and possible affect on results. Relates detailed results to question or hypothesis. Suggests and outlines further investigations based on analysis of results with justification. 	<ul style="list-style-type: none"> Thoroughly evaluates the tested solution and testing process referencing design and performance criteria, constraints, priorities, and trade-offs. Thoroughly explains to what extent the solution addressed the criteria and constraints. Identifies and explains in detail possible design improvements using scientific and engineering principles and trends in the data collected. 	5/6**
4	<ul style="list-style-type: none"> Analyzes relevant data and constructs an evidence-based explanation of the results of the investigation. Clearly communicates the conclusions including possible sources of error and how these might affect the results. Relates results to question or hypothesis. Suggests relevant revisions or further investigations based on analysis of results with justification. 	<ul style="list-style-type: none"> Evaluates the tested solution in terms of design and performance criteria, constraints, and identifies priorities and trade-offs. Describes to what extent the solution addressed the criteria and constraints. Identifies and explains possible design improvements. 	4
3	<ul style="list-style-type: none"> Partially analyzes the data. Constructs an overly general explanation of the results of the investigation. Communicates conclusions in a general manner; stated sources of error are irrelevant or overly formulaic. Partially relates results to question or hypothesis. Suggests relevant revisions to the investigation, but without justification. 	<ul style="list-style-type: none"> Partially evaluates the tested solution in terms of design and performance criteria, constraints, and identifies some priorities and trade-offs. Incompletely describes to what extent the solution addressed the criteria and constraints. Identifies simplistic design improvements. 	3
1/2*	<ul style="list-style-type: none"> Inaccurately analyzes the data. Constructs a simplistic explanation of the results of the investigation. Incompletely communicates conclusions; stated sources of error are missing or irrelevant. Does not relate results to question or hypothesis. Suggested revisions are irrelevant to the investigation. 	<ul style="list-style-type: none"> Inaccurately or incompletely evaluates the tested solution in limited terms of design and performance criteria, constraints, priorities, and/or trade-offs. Little evidence provided regarding how the solution addressed the criteria and constraints. Identifies irrelevant design improvements. 	1/2*

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