Goals and Standards

As a result of participation in scientific investigation and the science fairs at all levels, students fulfill several national, state, and local goals and standards. The experiences of participation in authentic research inquiry and presentation at the CPS Regional Network and City Science Fairs aligns with the first dimension of the Next Generation Science Standards (NGSS), the College Readiness Standards (CRS), and the Common Core State *Literacy in Science and Technical Subjects and Writing*, and *Writing for Literacy in Science and Technical Subjects: Research to Build and Present Knowledge.*

Next Generation Science Standards As students progress through a research investigation they will engage in the first dimension of the NGSS, which involve the processes of science. This dimension relates to the behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems.
1. Asking Questions and Defining Problems
1a. Ask and evaluate questions that challenge the premise of an argument, the interpretation of a data set, or the suitability of a design.
2. Developing and Using Models
2a. Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
3. Planning and Carrying Out Investigations
3a. Design an investigation individually and collaboratively and test designs as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
3b. Design and conduct an investigation individually and collaboratively, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
3c. Design and conduct investigations and test design solutions in a safe and ethical manner including considerations of environmental, social, and personal impacts.
4. Analyzing and Interpreting Data
4a. Use tools, technologies, and/or models (e.g., computational, mathematical) to generate and analyze data in order to make valid and reliable scientific claims or determine an optimal design solution.
4b. Evaluate the impact of new data on a working explanation of a proposed process or system.
5. Using Mathematics and Computational Thinking
5a. Use mathematical representations of phenomena to describe explanations.
6. Constructing Explanations and Designing Solutions
6a. Make quantitative and qualitative claims regarding the relationship between dependent and independent variables.

6b. Apply scientific reasoning, theory, and models to link evidence to claims to assess the extent to which the reasoning and data support the explanation or conclusion.
7. Engaging in Argument from Evidence
7a. Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
7b. Evaluate the evidence behind currently accepted explanations to determine the merits of arguments.
8. Obtaining, Evaluating, and Communicating Information
8a. Produce scientific and/or technical writing and/or oral presentations that communicate scientific ideas and/or the process of development and the design and performance of a proposed process or system.

College Readiness Standards (CRS)

Engaging in authentic research investigations addresses the process standards of the College Readiness Standards (CRS), which align to the process of inquiry. The three CRS standards include:

1) Interpretation of data,

2) Scientific Investigation, and

3) Evaluation of Models, Inferences, and Experimental Results

	College Readiness Standards — Science		
	Interpretation of Data	**Scientific Investigation**	**Evaluation of Models, Inferences, and Experimental Results**
13–15	Select a single piece of data (numerical or nonnumerical) from a simple data presentation (e.g., a table or graph with two or three variables; a food web diagram) Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels)		
16–19	Select two or more pieces of data from a simple data presentation Understand basic scientific terminology Find basic information in a brief body of text Determine how the value of one variable changes as the value of another variable changes in a simple data presentation	Understand the methods and tools used in a simple experiment	
20–23	Select data from a complex data presentation (e.g., a table or graph with more than three variables; a phase diagram) Compare or combine data from a simple data presentation (e.g., order or sum data from a table) Translate information into a table, graph, or diagram	Understand the methods and tools used in a moderately complex experiment Understand a simple experimental design Identify a control in an experiment Identify similarities and differences between experiments	Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model Identify key issues or assumptions in a model
24–27	Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table) Compare or combine data from a complex data presentation Interpolate between data points in a table or graph Determine how the value of one variable changes as the value of another variable changes in a complex data presentation Identify and/or use a simple (e.g., linear) mathematical relationship between data Analyze given information when presented with new, simple information	Understand the methods and tools used in a complex experiment Understand a complex experimental design Predict the results of an additional trial or measurement in an experiment Determine the experimental conditions that would produce specified results	Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models Determine whether given information supports or contradicts a simple hypothesis or conclusion, and why Identify strengths and weaknesses in one or more models Identify similarities and differences between models Determine which model(s) is(are) supported or weakened by new information Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion
28–32*	Compare or combine data from a simple data presentation with data from a complex data presentation Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data Extrapolate from data points in a table or graph	Determine the hypothesis for an experiment Identify an alternate method for testing a hypothesis	Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model Determine whether new information supports or weakens a model, and why Use new information to make a prediction based on a model
33–36†	Compare or combine data from two or more complex data presentations Analyze given information when presented with new, complex information	Understand precision and accuracy issues Predict how modifying the design or methods of an experiment will affect results Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results	Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models Determine whether given information supports or contradicts a complex hypothesis or conclusion, and why

Common Core State Standards

Common Core Reading

Literacy in Science and Technical Subjects

Key Ideas and Details

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

RST. 11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST. 11-12.6 Analyze the author's purpose in providing an explanation, describing procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Common Core Writing

Writing for Literacy in Science and Technical Subjects: Research to Build and Present Knowledge

W.11-12.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

W.11-12.9. Draw evidence from informational texts to support analysis, reflection, and research.