Science Notebook Expectations Grades K-12

Purpose of Science Notebook

A scientist's notebook is a detailed record of their engagement with scientific phenomena. It is a personal representation of experiences, observations, and thinking; it is an integral part of the process of actively doing scientific work. A scientist's notebook is a continuously updated history of the development of scientific knowledge, reasoning and conceptual knowledge. The notebook allows students to formulate and record their questions, make predictions, record data, procedures, and results, compose reflections, and communicate findings. Most importantly, notebooks provide a place for students to record new concepts they have learned ***and allow teachers to complete regular, structured formative assessments.***

For Students, engaging in active science involves experiences and making sense of respective phenomena. Science notebooks help students with the "sense-making" part. They assist with documentation and information organization as students create simple tables, graphs, charts, drawings, and labeled illustrations as standard means for representing and displaying data. Science notebooks also assist students with cognitive engagement. As data is recorded and organized in an efficient manner, students use it to draw conclusions about phenomena. Their data, based on their experiences and observations, are the raw materials that students use to forge conceptual knowledge and relationships. ***The major goal for using science notebooks for Grades K-12 is to establish practices and routines that will enable students to collect data, make sense of it and ultimately relate these to Cross-Cutting Concepts (CCC), Science and Engineering Practices (SEP) and Disciplinary Core Ideas (DCI) as outlined in the Next Generation Science Standards (NGSS).***

For Teachers, notebooks are tools for gaining insight into students' thinking through ongoing formative assessment. Notebooks inform and refine instructional practice as they work to elicit students' understanding. They can be used to assess student's science practice skills as well as measure the quality and quantity of student's learning. It's an excellent medium for providing feedback to individual students regarding their work. Notebooks can act as a focal point for discussion about students' learning at several levels and provide insight on refining teaching practices to improve instruction.

Science Notebook Formats

Teachers work with students to generate their respective student notebooks. Teachers should insert district-approved duplications into them using the duplication masters provided in the Teacher Resources binder of the FOSS Teacher Toolkit. Duplication masters can be bound into consumable notebooks for students to use. This type of notebook is most optimal and will require modeling by the teacher to provide enough structure to make the notebook useful.

Science Notebook Organization

Organizational Elements are used to streamline access to the contents of student's notebook over time to support their learning. Student notebooks include the following components:

Cover Page

The cover page should include the student's name, school, teacher's name and class room number. Recording this information enhances student understanding of common text features that support the development of literacy skills.

First Page

Students should generate a "Science Is… page' that expresses their thoughts or feeling towards Science. Examples of for this page would be; student interpretation/drawing of a scientists, picture and or poems about science, etc.

Science Notebook Expectations Grades K-12

Table of Contents
The first pages of the notebook should be reserved for the table of contents. Students may need to be reminded to add to it systematically as you proceed through the module. The table of contents can be based on the names of the investigations in the module, the specific activities undertaken, the concepts learned, or some other schema that makes sense to everyone. As a modification when needed, teachers may provide students with a template or preprinted table of contents without page numbers. As students work through each investigation, they record the relevant page numbers in their table of contents. Common elements of a table of contents may include:

- Date
- Title of activity
- Page number
- Initials (Both Student and Teacher each day)

Page Numbering and Documentation
Each page should be pre-numbered front and back. These can be referenced in the table of contents as the notebook progresses.

Documentation Date and Time
As entries are made, each page should include the date and time of the entry.

Index or Glossary
Vocabulary acquired while students are engaged in hands-on investigations, contribute to the development of scientific literacy. To support to students in building understanding of scientific terminology it is important that students maintain in index in their science notebooks. The index should be located at the back of the notebook and have a block of letters assigned to several index pages (A–F, G-L, etc.). Students write the new vocabulary word or phrase in the appropriate square and tag it with the number of the page on which the word is defined in the notebook.

Four mandatory organizational components of the notebook that must be planned from the outset are: table of contents, page numbering, documentation, and an index.

Notebook Components

As students engage in scientific exploration and learning, they will make entries in their notebooks. Students should be encouraged and instructed to use many means of recording and communicating besides writing, including charts, graphs, drawings, color codes, numbers, and images attached to the notebook pages.

Organization of Entries
These features allow students to organize their work and more efficiently access learning from prior activities or lessons. These features also assist the teachers in assessing student understanding. Common organizational features include:

- Page numbers
- Date
- Headings (e.g. focus question, vocabulary, prediction, data, results, claims and evidence, etc)
- Documentation of authentic student work
- Time (e.g. time observations made, elapsed time for activity)

Science Notebook Expectations Grades K-12

General Components are necessary to the conceptual shape and direction of scientific notebooks. Investigations generally start with a question, challenge or phenomena, and then proceed with an activity, data collection, examples of working conceptual understanding, next steps and questions for further investigation. The science notebook should be used each day. ***The expected format for the science notebook starting Grade 6 is below:***

Science Notebook Expectations Grades K-12

Science Notebook Entry Types

Entry Type	Definition and Purpose
Investigation	Scientific investigation is the way in which scientists and researchers use a systematic approach to answer questions about the world and phenomena around us. They generally follow this process: **Focus Questions/Phenomena:** The focus question/phenomena establish the direction and conceptual challenge for the activity. **Plan and Procedures:** The planning of investigation may be detailed or informal, depending on the requirement of the investigation. They take time to develop and document. **Predictions:** Students may be able to make a prediction as they attempt to relate prior experiences to the question posed. **Data:** Data are the pieces of information (both quantitative and qualitative observations) from which scientists construct ideas about the phenomena of the world around them. Data records should be accurate and precise, clearly related to the focus question; and organized for efficient referencing. Students should pay attention to both independent and dependent variables, titles, units and legends from Grade K up. **Analyzing Data:** Students must establish the practice of making sense of the data collected and using it as evidence to explain their thinking. **Conclusions:** At the end of an investigation (major conceptual sequence), students should work to generate a summative narrative to communicate what they have learned in a detailed fashion. **Next Steps/ Questions for Further Investigation:** The outcome of science investigation should stimulate students to think of new or extended questions that they would like to investigate. Students should be encouraged to record these questions framing them as investigable questions.
Scientific Drawings	Student generated drawings of materials, scientific investigation set-up, observations, or concepts. Three common types of drawings used in science notebooks include: **Sketches:** Informal pictures of objects or concepts created with little detail. **Scientific Illustrations:** Detailed, accurate, labeled drawings of observations or concepts. **Technical Drawings:** A record of a product in such detail that someone could create the product from the drawings.
	Purpose Students use drawings to make their thinking and observations of concrete or abstract ideas visible. Drawings access diverse learning styles, allow entry to the writing process for special needs students and emergent writers, and assist in vocabulary development (e.g. oral explanations, group discussions, labels). ***Drawings should work to address formatively assess students working conceptual knowledge.***

Science Notebook Expectations Grades K-12

Tables, Charts, and Graphs	Formats for recording and organizing data, results, and observations.
	Purpose Students use tables and charts to organize information in a form that is easily read and understood. Recording data in these forms facilitates record keeping. Students use graphs to compare and analyze data, display patterns and trends, and synthesize information to communicate results. ***Students should pay attention to both independent and dependent variables, titles, units and legends from Grade K up.***

Science Notebook Expectations Grades K-12

Graphic Organizers	Tools that illustrate connections among and between ideas, objects, and information. Examples include, but are not limited to, Venn diagrams and concept maps.
	Purpose Graphic organizers help students organize ideas to recognize and to communicate connections and relationships. ***Graphic organizers should work to connect each lesson to each other and the major topic for the unit.***
Notes and Practice Problems	A record of ideas, observations, or descriptions of information from multiple sources, including but not limited to direct instruction, hands-on experiences, videos, readings, research, demonstrations, solving equations, responding to guiding questions, or developing vocabulary.
	Purpose Students use notes and practice problems to construct meaning and practice skills for current use and future reference. Practice problems should focus on assessing students working conceptual knowledge and not solely rote knowledge.
Reflective and Analytical Entries	A record of a student's own thoughts and ideas, including, but not limited to initial ideas, self-generated questions, reflections, data analysis, reactions, application of knowledge to new situations, and conclusions.
	Purpose Students use reflective and analytical entries to think about scientific content from their own perspective, make sense of data, ask questions about their ideas and learning processes, and clarify and revise their thinking. ***Emphasis should also focus on identifying Cross Cutting Concepts, Science and Engineering Practices and Disciplinary Core Ideas as outlined by the NGSS.***
Inserts	Inserts are artifacts placed within a notebook, including FOSS duplication materials, pictures and the like.
	Purpose Students use inserts to document and to enrich their learning. Inserts can also help students with note-taking that may need more structure to it.

Science Notebook Expectations Grades K-12

Supporting Students

Students need to have successful, ongoing experiences with notebooks. Different supportive structures can help transform a science notebook into a valuable reference tool. These supports and scaffolds can be used with the whole class, a small group, or an individual and should be adjusted to meet students' needs.

A Class Notebook can be created using chart paper tablets, paper notebook displays under document camera or smart-boards displays etc, to introduce strategies, write a summary statement and document investigations as a way to model the various notebook components. The class notebook should be accessible at all times for students to reference.

Scaffolds can be used to provide structure to a notebook entry. They should only be made available for students when the student needs them. They will vary from student to student and from investigation to investigation. Scaffolds include:

Sentence Starters or drawing starters provide a beginning point for a notebook entry.
Example: What really surprised me was…

Sentence Frames are used to focus and organize and prompt student's thinking. They help students become more proficient in scientific writing and less reliant upon the prompts.
Example: I claim that a _____ helps _____ because _____.

Duplication Masters can guide students thinking and help them collect data with a table, graph, or list of questions.

Think-Aloud Sessions can help students verbalize their thoughts and explain their decision-making process for particular notebook entries.

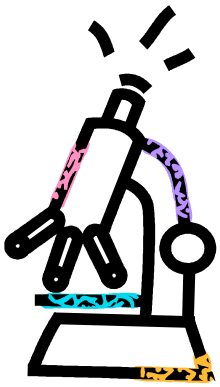
Providing Students with Time and Prompting them to record observations and notes within active engagement can help student fully document their discoveries.

Teacher Feedback

Students' writing often exposes areas for growth in students' conceptual understanding. ***It is important to use the notebook to provide regular, specific and timely feedback that guides students to think about the content of their work.*** Give suggestions for how to improve, ask for clarification or additional information; ***the notebook is a formative assessment tool with which students will be tracked and graded (using a rubric) throughout the year.*** Attach a self-stick note, which can be removed after the student has taken appropriate action. When students return to their notebooks and respond to the feedback, additional information will be exposed that will help in discriminating between knowledge and communication difficulties.

Notebook writing is viewed as a critical aspect of science teaching and learning. ***All students must maintain an organized science notebook making routine scientific entries throughout the entire school year.*** Science notebooks must contain authentic student work detailing students' scientific educational experiences. Students must formulate and record their questions, make predictions, record data, procedures, and results, compose reflections, communicate findings, record new concepts and ***relate to Cross Cutting Concepts, Science and Engineering Practices and Disciplinary Core Ideas as outlined in the NGSS.***

Science Notebook Expectations Grades K-12



Science Notebook Format at A Glance

Focus Question: Students need to identify, write and analyze questions that can be answered by conducting scientific experiments. **These should be phenomena based.**

Writing Scaffold: How does…? How can…?

Example: How can a lever be used to make work easier?

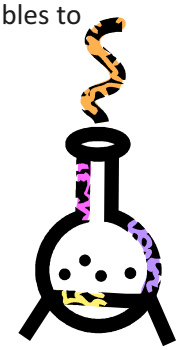
New Vocabulary: New vocabulary needed to better understand scientific concepts. New vocabulary should be listed and used in student explanation and writing.

Previous Knowledge: Reflection of what students already know or have observed. Reflecting on previous knowledge is foundation scientists build from.

Writing Scaffold: I remember when _____

Example: I remember a time when my dad tried to lift a large rock in the yard. He couldn't pick it up, so he used a shovel to roll it in to place.

Prediction: A statement that defines what you think the outcome of your investigation/experiment will be, backed by reasoning. A prediction is like a hypothesis, and should be testable, relating independent variables to dependent variables.



Framing Scaffold: I predict that _____ because_____.

If _____ then_____ because _____.

Example: I predict that a lever can be used to decrease the force needed to do work by/because…

Plan and Procedures: Students plan their investigation. The planning may be detailed or informal, depending on the requirement of the investigation. A brief class discussion of the procedure may lead to a sentence or two recorded in the class notebook.

Data/Accurate Records: Collect and record and analyze evidence from your investigation.

Examples: Tables, labeled drawings, graphs, written observations, etc.

Claims and Evidence: Students use evidence to analyze descriptions, explanations, predictions, and models so that they can communicate scientific procedures and explanations.

Framing Scaffold: I claim that _____. I claim this because _____

Conclusion: How were your predictions supported by the evidence or how would you revise/change your thinking based upon the evidence? What did you learn from this investigation.

Writing Scaffold: The evidence supported /did not support my prediction because _____

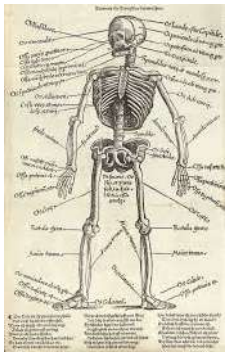
Reflection: What students think about after the investigation:

Writing Scaffold: Questions that I still have are _____

What really surprised me was _____

I want to learn more about _____

I would like to try a new experiment that after what we learned because _____



Science Notebook Expectations Grades K-12

*"**Think** as a Scientist, **Record** as a Scientist, **Reflect** as a Scientist"*

Scientist Notebook Organization Rubric

4 = Excellent 3 = Good 2 = Fair 1 = Needs Work

	Evidence **Please refer to the "Science Entries" Section Above for More Details**	**Student Score**	**Teacher Score**
Table of Contents	• All entries include topics covered • All dates and page numbers written		
General Organization	• Appropriate titles/headings throughout investigation/notebook • Dates and page numbers included • Notebook is legible and organized appropriately		
Written Entries and Reflections			
Focus Question	• Relates to phenomena/focus question • Can be investigated, needing evidence to support it		
Prediction	• Addresses the phenomena/Focus Question • Uses "because" (or other derivative) and supports their opinion		
Data	• Labeled scientific drawings • Data tables throughout investigation are comprehensive		
Claims and Evidence	• Claims and evidence statements are related to question/phenomena • Shows conceptual understanding of the material • Includes main ideas supported by observations/etc.		
Conclusions	• Prediction revisited and affirmed/revised with explanation • "Today I learned" statement • Reflects on CCC, SEP, DCI		
Reflection:	• Responds to: • "What really surprised me about… was..." • "A new question that I have about… is..." • "I wonder if ..." • "I would like to try another experiment because…"		
Total	Biggest Area for Growth:		

Comments using Rubric (in addition to notes in Student's Notebook):

Next Steps for Student/How to Improve:

Science Notebook Expectations Grades K-12

Sample Table of Content Template

Date	Focus Question/Investigation/Phenomena	Page #	Student Initial	Teacher Initial

Sample Index Template

Index A-F

Index G-L