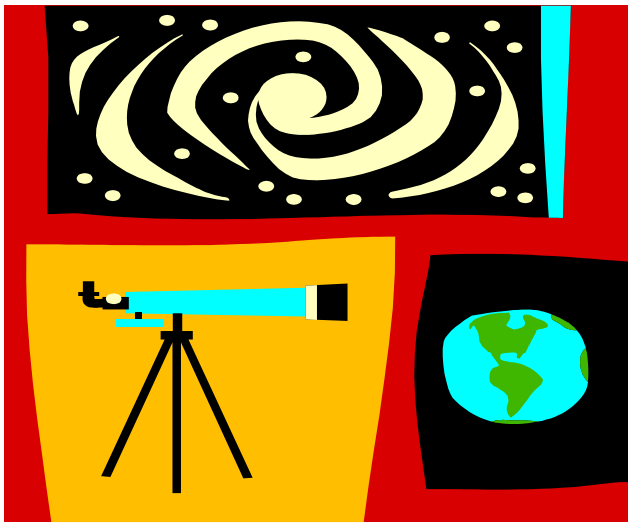
SCIENCE HANDBOOK 2003-2004

Helen Keller Middle School
Easton, CT



Name:

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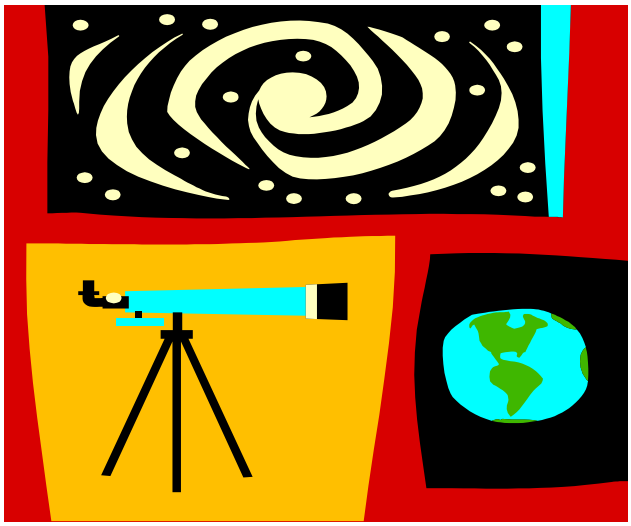
SCIENCE HANDBOOK 2003-2004

John Read Middle School
Redding, CT



Name:

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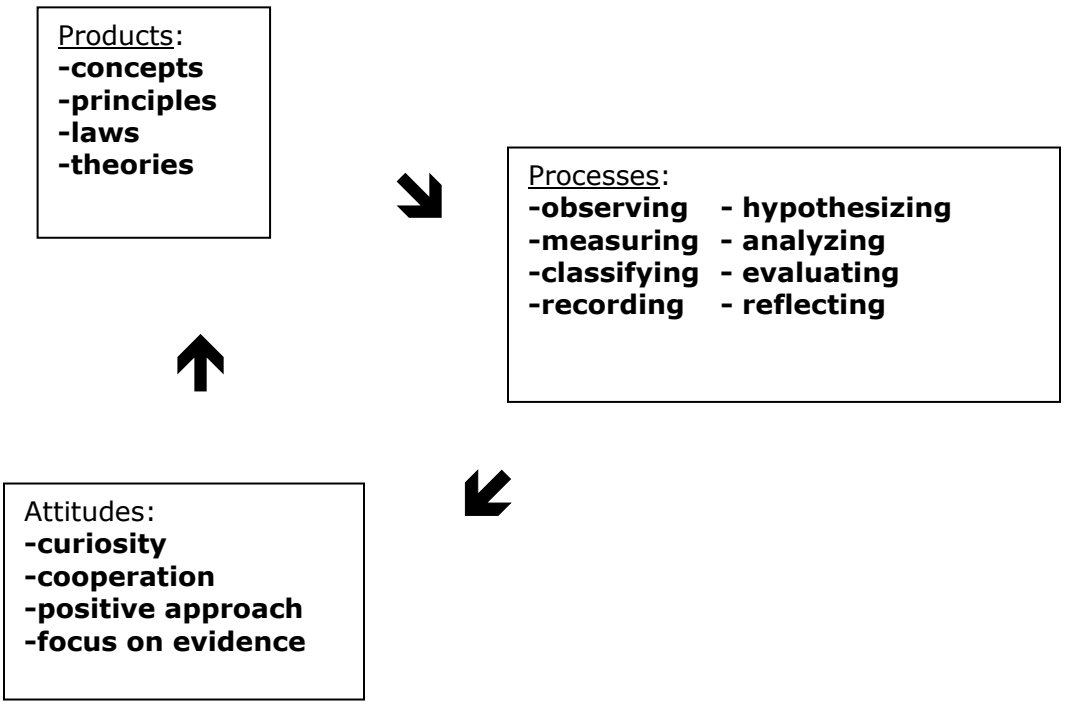


What is science?

Content: What science topics will you learn about?

5th Grade: General Science

- Nature and History of Science
- Landforms and Changes in the Earth's Surface
- Human Body
- Environment
- Nature of Matter

6th Grade: Earth Science

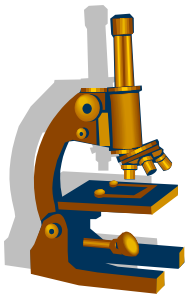
- Nature and History of Science
- Geology
- The Water Cycle
- Meteorology
- Astronomy

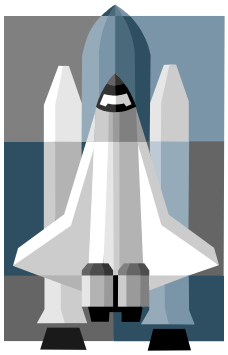
7th Grade: Life Science

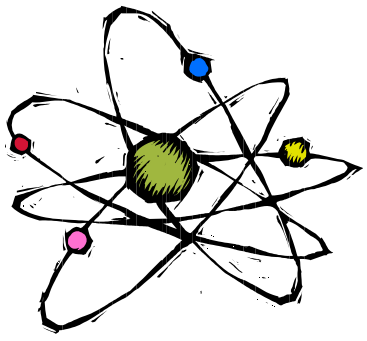
- Nature and History of Science
- Characteristics of Living Things
- The Cell and Cell Processes
- Classifying Life
- The Five Kingdoms

8th Grade: Physical Science

- Nature and History of Science
- Matter and Changes in Matter
- Elements, Mixtures and Compounds
- The Periodic Table and Atomic Structure
- Chemical Bonding and Reactions
- Motion and Forces
- Interaction of Matter and Energy







Experimentation: What is the scientific method ?

O-H-E-A-C-R

The scientific method is a logical process that helps us to solve problems in a scientific way. An easy way to remember the steps in the scientific method is:

O – H – E – A – C – R !!!

O – *Observe nature and identify a problem to figure out.*

H – *Make a hypothesis (an educated guess or prediction) about what you think will happen.*

E – *Design and conduct an experiment to test your hypothesis.*

A – *Analyze your data to make sense of it.*

C – *Make a conclusion about your study. What is the answer to your problem?*

R – *Think about your experiment and reflect on how you could do the experiment again to improve it or learn more.*

{insert scientific method cartoon}

Source: SCIENCE SCOPE. September, 1990.

Variables

A hypothesis is a special kind of prediction that forecasts how one variable will affect a second variable. These variables in an experiment are the <u>independent</u> (or manipulated) variable and the <u>dependent</u> (or responding) variable. An easy way to remember this is:

***M** anipulated*
***I** ndependent*
***X** axis (on a graph)*

***D** ependent*
***R** esponding*
***Y** axis (on a graph)*

- The independent/manipulated variable is the factor that is changed intentionally by the investigator. (This is the factor being tested in an experiment and is sometimes called "the cause".)

- The dependent/responding variable is the factor that might be affected as a result of the independent variable. (This variable is sometimes called "the effect".)

In addition, we also refer to "controlled variables". These are all the factors that we should keep the same in an experiment.

EXAMPLE: Identifying the three types of variables

A student wanted to test how the mass of a paper airplane affected the distance it would fly. Using the same paper airplane for each test, paper clips were added before each test flight to increase the mass of the plane. As each paper clip was added, the plane was tested to determine how far it would fly.

{insert graph}

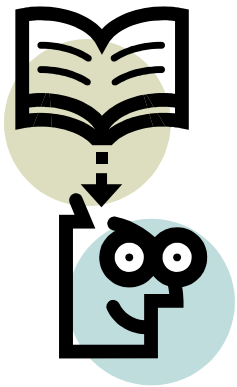
- Independent variable: mass of the airplane
- Dependent variable: the distance flown
- Controlled variables: same plane for each test
  same type of paper clips
  same wind conditions

✈ ✈ ✈

Communication: What is a lab report ?

A lab report is a form of communication among scientists – all of us who explore questions we have about the world around us. A lab report shows the results of your experiment. Writing a lab report is a process:

Identify the problem.	➔	Design and conduct the experiment.	➔	Write the rough draft.	➔	Refine the rough draft into a final draft.



What can help you to be successful in writing a lab report?

Guidelines: How do you write a lab report ?

On the next few pages, you will find information to help you write a good lab report:

- Guidelines and Format for Writing a Lab Report
- Draft Report Format
- Tables, Charts, and Graphs

GUIDELINES AND FORMAT FOR WRITING A LAB REPORT

Name: _____
Per: _____
Date: _____

Title: [Give the report a recognizable name. In a major lab report, this may be included on the cover page.]

Purpose: [State the goal of your experiment. What are your trying to find out? In the final report, re-phrase the research question as a goal statement.]

Hypothesis: [Your educated guess or prediction, based on previous knowledge, about what you think will happen or what you think the results of the experiment will be. Clearly state the independent and dependent variables.]

Materials: [List the equipment, chemicals, etc. that you need to do the experiment. Specify sizes and amounts of all equipment and materials.]

Procedures: [List and number the steps to conduct the experiment. Be specific. Someone else should be able to repeat the experiment from your directions.]

1. }
2. } Write the steps as <u>what to do</u>, not what you did.]
3. }
Etc. }

Observations: [Record your data, as appropriate, in the form of tables, graphs, descriptive information, etc. Make sure tables and graphs have a specific title that reflects the information provided. Label and mark the axes appropriately.]

Analysis: [Summarize and discuss your results (what you actually find out). Interpret and evaluate your data. Include, as appropriate, comparisons, rates of change, and explanation of "why" the results turned out the way they did.]

Conclusion: [Stay objective !! Your conclusion should answer the research question. It must be based on your observations and data (not on what you think should have happened or what happened at your neighbor's station), and must address whether your hypothesis was supported by the data or not.]

Reflection: [Your comments: What did you learn? What problems did you encounter? How would you design your experiment differently if you were to do the experiment again (e.g. change your materials? Change your procedures? Do you have any new testable questions as a result of doing the experiment?]

Draft Report Format [1]

Name _____ Date _____ Period _____ Lab group #: _____

Lab Partners _____ _____ _____

Title: [Write the name of your investigation; give it a recognizable title.]

_____

Problem/Research Question: [What are you trying to find out? In the final report, rephrase the problem as a purpose (goal) statement.]

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o Independent variable [identify the manipulated variable] **:**

_____

o Dependent variable **[**identify the responding variable] :

_____

Hypothesis: [Communicate your educated guess or prediction about what you think will happen. Specify how you think the manipulated variable will affect the responding variable.)

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[1] You can download copies of this report form (in template form) on the JRMS web site under Staff Pages.

Experimental Design/Procedure: [Describe the step-by-step process for completing the experiment.]

Materials: [List the equipment and materials that you need to do the experiment. Be specific!]

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Procedures: [List and number the steps to conduct the experiment. Be specific. Include a control set-up, if appropriate, specify time intervals, need for drawings, how you are going to record your observations, and clean up. The procedures should be detailed enough to be duplicated by another scientist.]

1._____

2._____

3._____

4._____

(etc.)_____

_____

_____

_____

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_____

Safety Concerns: [Identify any safety concerns applicable to this experiment.]

_____

_____

Factors to be controlled: [Identify and list all variables that must be controlled (kept the same), to limit sources of error.]

_____ _____

_____ _____

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Observations: [Record your data in the appropriate form(s) – tables, graphs, descriptive information, illustrations, etc. Make sure tables, graphs, and illustrations have specific titles that reflect the data . Data should be presented clearly, aligned, and with appropriate labels and units.}

[** **Insert all of your data tables, illustrations, and/or graphs here before the analysis !!**]

Analysis: [Summarize and discuss your results (what you find out). Interpret and evaluate the data. Use specific data to support your statements. Identify any significant sources of error that may have affected your results.]

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Conclusions: [After analyzing the data, state your findings. The conclusion should answer the research question and must be based on your data. It must also include discussion of the relationship between the independent and dependent variables and whether your hypothesis was supported by the data.]

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Reflection/Recommendations: [What did you learn? What problems did you encounter? How would you design your experiment differently if you were to do the experiment again (e.g., change your materials? procedures?). Do you have any new testable questions as a result of doing this experiment?]

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Tables, Charts, and Graphs[2]

[insert paste-up or scan in]

[2] Source: "Science World". Vol. 58; No. 2. September 17, 2001.

Rubrics: How will your lab report be graded?

Your lab reports will be graded according to a "rubric", a set of grading criteria that is appropriate for your grade level.

Analytic Rubric for Open Ended Lab Reports: Grades 5 and 6

Hypothesis Formation/Problem Definition: Statement that explains the relationship between variables being tested.
4. "If/then" statement clearly identifying variables
3. "If/then" statement but is missing supporting details relating to the problem
2. Stated but not using an "If/then" statement
1. Stated but is not related to the problem

Experimental Design: Procedures followed during experiment
4. Steps listed in logical order, are numbered, are specific and could be followed by another scientist
3. Steps listed in logical order, are numbered but could not be followed by another scientist. There are gaps and/or other missing information
2. Steps listed in logical order, but are not numbered, and another scientist could not follow them. There are gaps and/or missing information
1. Incomplete or non-sequential list of steps

Performance of Experiment (For in-class labs only)
4. Works independently, consistently and accurately
3. Works independently, consistently and with some accuracy
2. Works consistently but needs teacher assistance
1. Works carelessly or inconsistently, needs teacher re-direction.

Data: Notes, observations and measurements
4. Complete, organized and clearly presented
3. Essentially complete and organized; some lack of clarity
2. Somewhat incomplete and disorganized
1. Incomplete, presentation confusing

Analysis: Data review and explanation
4. Interpretations stated clearly and related to the problem; data clearly explained
3. Minor errors in interpretation, some inaccuracies, data explained
2. Major errors in interpretation; significant inaccuracies, poorly explained
1. Little interpretation of data

Conclusions: Statement explaining whether the hypothesis was supported or not supported
4. Hypothesis is evaluated accurately, relationship between problem and results shown with supporting details
3. Hypotheses is evaluated, relationship between problem and results are not clearly stated and/or do not have supporting details
2. Hypothesis is evaluated incorrectly and/or weak relationship between problem and result stated
1. Hypothesis is not evaluated, no relationship between problem and results described

Reflection: Overall review of the experiment
2. Reflection questions addressed
1. Reflection incomplete

Overall Rating:	**12 or below**	**Unsatisfactory**
	13 – 15	**Poor**
	16 – 18	**Fair**
	19 – 22	**Good**
	23 – 26	**Excellent**

Analytic Rubric for Open Ended Lab Reports (Grades 7 & 8)

Problem Definition/Hypothesis Formation	
Stated clearly as relates to independent and dependent variables	*Excellent*
Stated clearly; definition of variables not clear	*Good*
Stated vaguely; definition of variables incorrect	*Fair*
Stated vaguely; variables missing	*Poor*
Experimental Design	
Properly controlled experiment with procedures stated clearly	*Excellent*
Minor modifications to result in properly controlled experiment	*Good*
Major modifications to result in properly controlled experiment	*Fair*
No relationship between problem and planned action	*Poor*
Performance of Experiment	
Works independently, consistently and with precision	*Excellent*
Works independently, consistently and with some precision	*Good*
Works consistently, but needs substantial guidance	*Fair*
Works carelessly and/or inconsistently; needs teacher redirection	*Poor*
Data Presentation	
Complete, organized and presented clearly	*Excellent*
Essentially complete and organized; some lack of clarity	*Good*
Somewhat incomplete and/or disorganized	*Fair*
Incomplete, presentation confusing	*Poor*
Analysis	
Interpretations relate to problem, reflect data accurately and appropriately	*Excellent*
Minor errors in interpretation, some inaccuracies	*Good*
Major errors in interpretation; significant inaccuracies; inadequate detail	*Fair*
Little or no interpretation of data	*Poor*
Conclusions	
Hypothesis evaluated clearly, sources of error noted, relationship(s) between results and problem clearly stated	*Excellent*
Hypothesis evaluated, relationship between results and problem stated	*Good*
Weak relationship between results and problems	*Fair*
No relationship between results and problems	*Poor*
Reflection	
All reflection questions addressed	*Satisfactory*
Reflection incomplete	*Unsatisfactory*

Overall Rating: ***Excellent*** ***Good*** ***Fair*** ***Poor***

How can you be safe in the science classroom?

Safety Rules: What are some basic science safety rules?

Most of the basic safety rules in science are "common sense" :

1. Always read and follow instructions.
2. Always wait until you have permission to handle any materials for a science activity.
3. Never touch, taste, or smell materials (including chemicals), unless instructed to do so.
4. Always know where safety equipment is located and how to use it.
5. Always tell your teacher immediately about any accidents that happen.

Safety "Contract": Do you agree to be a responsible scientist?

You may be asked to sign a safety "contract" like the one below, that specifies additional safety concerns and rules that you should know about.

[insert paste-up or scan in]

How will you be assessed in science?

In addition to regular homework, classwork, labs, projects, quizzes, and test, you will be taking some special tests and completing some "performance assessments".

What are the statewide tests in science ?

Starting in 2007, students will take statewide tests in science in 5th and 8th grades. These tests will be similar to the CMT tests that you have taken before. In 10th grade, you will take a series of tests called the CAPT. The science part of the CAPT test includes an open-ended laboratory experiment, open-ended questions about the lab, open-ended questions about science laws, theories, and principles, and multiple choice questions on all branches of science.

What are performance assessments ?

The Easton and Redding school districts have chosen several performance assessments that are completed by students at each grade level. These include laboratory experiments and projects that show how you are able to apply your science skills and what you know about science facts.