Department of Education

Dennis M. Walcott, Chancellor

TEACHER HANDBOOK

Facilitating Successful Science Fair Projects for Grades 4 and 5

Office of School Programs and Partnerships

Spring 2013

Table of Contents **Page**

Introduction

You have invited your students to do a science fair project. Great! A science fair project gives your students hands-on experience and knowledge while engaging in an independent study involving science. Your students will learn how to:

- investigate
- conduct interviews
- follow rules and guidelines
- use science tools and equipment
- analyze data
- write a report
- prepare a display
- and speak in public!

A science project studies a scientific problem to be able to answer a proposed question or develop a better technique or final project. The basic procedure involved in a science project is modeled on a process called scientific methodology. **Scientific methodologies** consist of the following elements: problem/purpose, hypothesis, research/procedure, experiment, and analysis of results or conclusion.

With your assistance and your students' work and dedication, this experience will help your students prepare for middle school and beyond. This guide will help you help your students produce a successful science fair project.

The Scientific Methodology

What are scientific methodologies?

Problem/Purpose: The problem or question students are testing or seeking to solve.

Hypothesis: An educated guess about the solution to the problem and the results expected to be achieved from the experiment.

Research/Procedure: The process by which information is gathered. This may include consulting reference materials, the Internet, mentors or professionals in the science field, or organizations such as museums or zoos that will help students better understand their topic and help formulate how to test their hypothesis through an experiment.

At this stage students should carefully plan how the experiment will be carried out through project scheduling, variables, and controls, and how the results will be observed and measured.

Experiment: The process by which the procedure is carried out outlined during the research/procedure stage to test the hypothesis.

Analysis and Conclusions: The solution to the proposed question and proof the hypothesis was correct or incorrect.

Steps for Facilitating a Science Fair Project

Step 1: Students set up a bound notebook for maintaining their research. Remind them to number the pages.

Step 2: Students select a topic.

Step 3: Help students refine and narrow their topics to a specific problem. Students should state the topic as a research question with a single variable.

Step 4: Guide students in conducting research about the topic and recording notes in their notebook.

Step 5: Next, students should form a hypothesis or state the purpose of the research.

Step 6: Work with your students to develop a research plan/experimental design.

Step 7: Create a system where students can apply for approval in order to proceed.

Step 8: Students then write the research report.

Step 9: Students collect materials and equipment.

Step 10: Students conduct the experiment and record the data.

Step 11: Help the students analyze the data from their experiments.

Step 12: Encourage your students to repeat their experiments, as necessary, to thoroughly explore the problem.

Step 13: Students form a conclusion.

Step 14: Students create the visual display.

Step 15: Students review and polish presentation and display for the science fair.

KEEP A SCIENCE NOTEBOOK

Students should start their project by using a science fair notebook to record all of the information about their projects. Students will use the information in their notebook to put together a project board. Encourage students to document everything they do including the data they collect and the day-to-day activities and observations of their experiment. Students will probably want to have tabs that say: Introduction, Experimental Procedure, Data, Results, Conclusions, Experimental Notes, Research Notes, and References/Acknowledgments.

What should my students write in their Notebook?

- Scientific observations
- Thoughts/reflections about observations
- Questions
- Exploration of ideas, questions, and thoughts
- Data collected in experiments
- Connections between observations and science concepts learned
- Notes on experiments
- Labeled graphs, data charts, drawings, images, photographs and/or diagrams with comments
- Sketches on observations from a field trip or lab set up
- Pressed samples or rubbings of a gathered objects
- Reflections and reflections

Accurate notes are very important when creating a science fair project. Students can use a variety of different sources. Here are some tips that will help students take notes:

- Never write in complete sentences.
- List information that is important. Remember to look and listen for key words or phrases.
- Write details that support the key ideas or phrases.
- Try to find the main idea of the text that you are reading and then write it in your own words.
- Always write the source, (book, article, website) where you obtained your information next to the notes that apply to it, so as not to confuse which source applied to which note.

Types of Note-taking
There are several ways to take notes. Here are some suggestions for your students:

Paraphrase**:** is when you rewrite or rephrase the words of an author.

Summarize**:** is when you use the main idea of one or several authors and write it into your own words.

Quote**:** is when you copy the exact words of an author and indicate that you are doing so by using quotation marks.

Reflective Note-taking*:* If you take notes carefully and react to them with your own thoughts and ideas, you will find that you can make sense of what you are reading. The reactions will prepare you for drawing conclusions and creating your final product without copying someone else's ideas. Use the following tips for reflective note-taking:

NOTES	REACTIONS
Learning logs can be used any time you are responsible for writing down information (from library sources, interviews, lecture notes). Write notes in your own words in the left column and react to those notes in the right column. The purpose of a learning log is to help you learn to interact mentally and emotionally with your notes while taking them. Not only do you learn more while you are taking notes, but you also can identify areas where you need additional information or different perspectives.	Reactions can include: • Personal comments or feelings about the information (*I think companies that dump toxic waste should be heavily fined.*) • Questions (*What are the laws on toxic-waste dumping? What source will give me another perspective on this issue?*) • Notes about organization (*Use this information in my introduction.*) • Connections to previous knowledge (*Toxic-waste dumping is worse than oil spills because it's intentional. I think this information is true because it agrees with 2 other sources.*)

Project-Based Learning: Inspiring Middle School Students to Engage in Deep and Active Learning, p. 39
New York City Department of Education

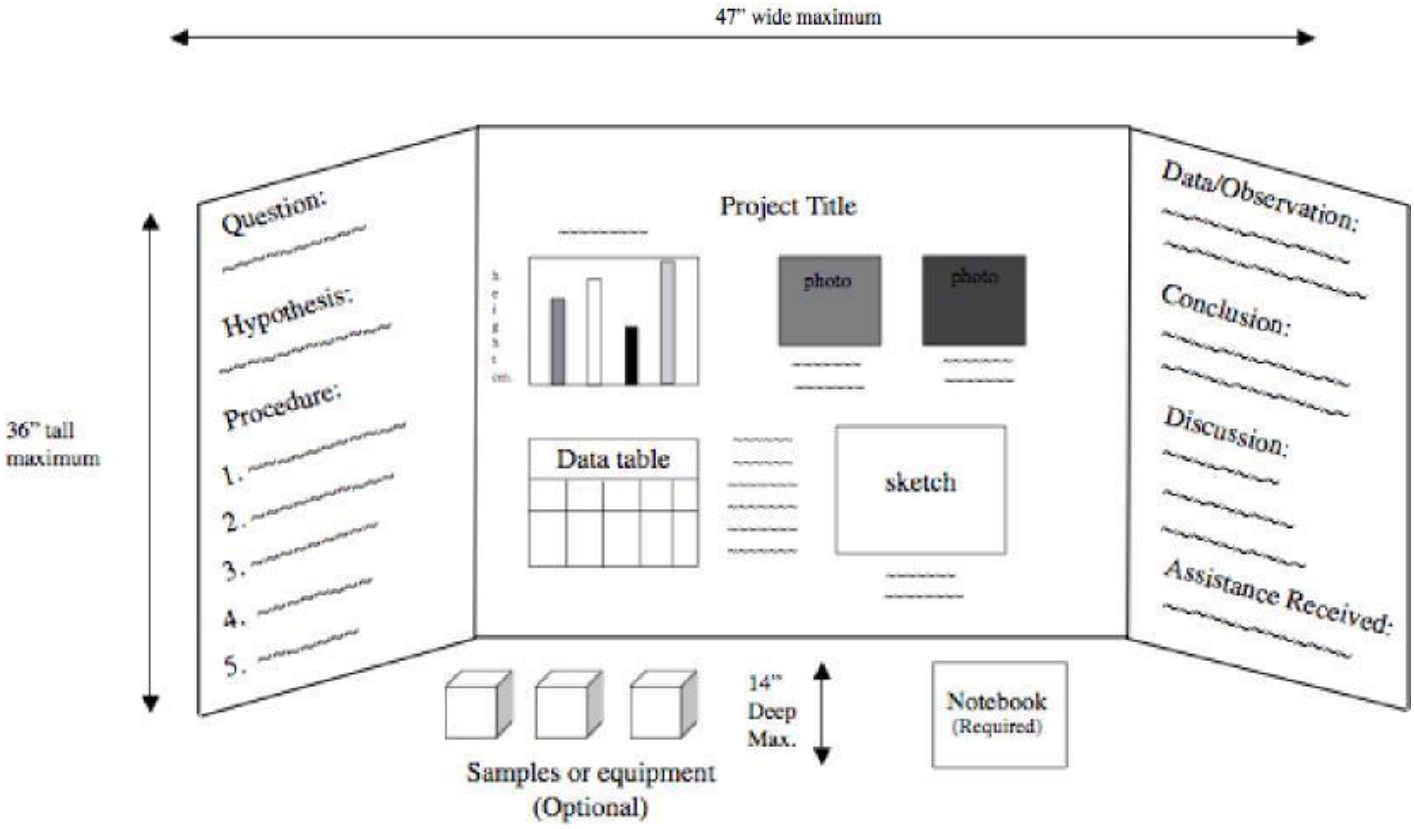
SCHEDULING THE PROJECT

It is important to help your students plan out the amount of time it will take to complete a science fair project. Students should plan on finishing their project two weeks before the science fair so that they may practice their presentation several times. Begin by having students make a list of the things that must be done. Students should plan the date by which you have assigned them to have each item completed.

Completed-by Date	**Task**	**Date Due**
At least 10 weeks before	Choose a topic. Research the topic. State the hypothesis. Plan the Procedure. Gather materials.	
At least 8 weeks before	Begin the first experiment. Complete the first experiment. Repeat the experiment.	
At least 4 weeks before	Begin the written report. Complete the research. Graph the data on a computer or paper.	
At least 3 weeks before	Complete the written report. Complete the notebook or journal Locate a display board. Proofread your work. Begin creating the display. Finish all sections of display board.	
At least 2 weeks before	Select items from experiment to display. Practice presentation in front of a mirror. Practice presentation with parents. Practice presentation with friends.	
During the week it's due	Turn in your project.	
Day of your presentation	Present your project.	

THE DISPLAY BOARD

Note: The diagram below is an example of what a display might look like.
The display should include a notebook for grades 3-6.



What are the parts of a science fair project board?

Title
The title should attract attention to their project. It should be thought provoking and creative. The title must appear on project board and on the cover of the science notebook.

Statement of the Problem (Purpose)
The statement of the problem is a brief description of the problem to be solved or the study being researched. What question(s) is your student trying to answer in this experiment?

Hypothesis

The hypothesis tell the audience what your student thinks will happen. A hypothesis should be in the following form: "If [the independent variable]..., then [the dependent variable].

Materials

The materials section should list everything used in the experiment. Remember to include the amounts (how much) of materials used. Please use metric units!

Procedure

The procedure will detail step-by-step instructions stating how the project was done. The procedure should be written clearly enough that anyone could repeat it. This component explains how the experiment was done. It must include three trials. If you are in grades 3-6, variables must be identified in this section.

Just a reminder:

Independent Variable: the variable that is manipulated or changed
Dependent Variable: the variable that changes as a result
Controlled Variable: things that need to be kept constant (cannot change) during the experiment

Data/Results/Observations

What did your student find out? Remind your students to record all of their measurements (in metric units) as well as any observations and descriptions they notice when they perform their experiment. Measurements should be presented in a data table. Whenever possible, a graph, chart, or both should be displayed to make the data easier to understand.

Conclusion

Based on your data, what was discovered? What did the experiment show? Does the data show the hypothesis was correct? Or does the data indicate the hypothesis was wrong? What is the answer to the question/problem?

CREATING A BIBLIOGRAPHY

When doing research and writing a report, it is always necessary to name the source(s) of the researched information. Sources used in a project should be compiled into a Bibliography or Works Cited. Sources in a bibliography should be listed alphabetically by last name of the author, or if no author, the first word of the citation. (Exclude "a", "an", and "the" when alphabetizing.)

Sample Bibliography Entries

A. FOR A BOOK:
Author's last name, first name. *Title of Book.* Place of publication: Publisher, copyright year.

Example: Fogle, Bruce. *Training Your Dog.* New York: DK Publishing, 2001.

If you only used part of a book:
Fogle, Bruce. *Training Your Dog*. New York: DK Publishing, 2001, pp. 50-55.

B. FOR A MAGAZINE OR NEWSPAPER ARTICLE:
Article author's last name, first name. "Title or Headline of Article." Name of magazine or newspaper. Date of magazine or newspaper, page(s).

Example: McGill, Kristy. "A Baltic Scramble." Faces. May, 2003, p. 27.

C. FOR AN INTERNET ADDRESS:
Author's last name, first name. "Title of item." [Online] Available
http://address/filename, date of document or download.

Example: DiStefano, Vince. "Guidelines for Better Writing." [Online] Available
http://www.usa.net/~vinced/home/better-writing.html, October 5, 2002.

D. FOR AUDIOVISUAL MATERIALS:
Title of material. Type of material. Place of publication: Publisher, copyright date.

Example: Bizet's Dream. Videotape. New York: Sony Wonder, 1998.

E. FOR AN INTERVIEW:
Name of person interviewed (last name first). Kind of interview. Date.

Example:Watson, Cosmo. Personal interview. July 29, 2003.

SAFETY GUIDELINES

Performing science work can be exciting and wonderful work. However, it can also be very dangerous without proper safety precautions. You must remember to follow all safety rules set by your teacher, your school and the New York City Department of Education. Please speak with your teacher if you have any questions or concerns about safety and your science project. Please see the **Student Safety and Student Laboratory Safety** documents and contract below.

The following items are not permitted:

- No organisms: living, dead or preserved (plants or animals)
- No fungi or bacteria
- No projects which involve the injury or death of vertebrate animals will be accepted
- No fresh or preserved human or vertebrate animal tissue may be displayed

STUDENT SAFETY

(NOTE: Review the following rules with students, then distribute copies of their rules and contracts that they and their parents must sign and return to class.)

1. Students may not work in the laboratory or participate in performing demonstrations unless they are under direct supervision of a licensed teacher/laboratory specialist and have been given specific instructions.

2. Students must wear clothing that will not interfere with science apparatus or chemicals. Their hair must be tied back so it does not come into contact with flames or chemicals.

3. Students must wear goggles and other protective equipment when appropriate. Contacts may be worn in the laboratory in conjunction with non-vented safety goggles.

4. EYE PROTECTION
   All persons must wear eye protection whenever chemicals are handled, glassware is used, flames are involved, or when there is a danger of splattering of liquids, or chipping of ores, minerals, and rock samples. This includes students and faculty who are not actively engaged in the experiment or demonstration.

   Ordinary eyeglasses do not provide adequate protection for use in the science laboratory or classroom. Contact lenses afford no protection and may be harmful to the eyes because chemicals can be trapped beneath them. Only safety goggles marked with the code "Z87" provide the necessary protection. Safety goggles are either *Type G* which has no ventilation or *Type H* which is indirectly ventilated. Both types are equipped with flexible edging so they fit firmly against the skin of the face, protecting against splashes as well as flying fragments of glass or rock. Students who must wear contacts should inform the teacher and be required to wear non-vented goggles.

   "Safety glasses" are unacceptable. These are similar in appearance to ordinary eyeglasses and have side shields which are not as effective against large chemical splashes.

   Protective eyewear used by one class should be properly sterilized by an approved Board of Health method before being distributed to the next class. Ideally, a goggle sanitizer should be present in every laboratory room.

5. Students may not test any chemicals or substances nor drink out of laboratory glassware or vessels. Students may smell substances only when given specific instructions by the teacher. The teacher will demonstrate the appropriate method of wafting chemicals.

6. Students are to report immediately anything in the laboratory that seems unusual or improper, such as broken, cracked, or jagged apparatus, and reactions that appear to be proceeding in a peculiar or unexpected manner.

7. Students should behave properly and not try any procedures that have not been approved by the teacher. They should report to the teacher any behavior on the part of other students that is disruptive or dangerous.

8. Students should not grasp any apparatus that has been heated unless they have allowed ample time for cooling.

9. Students are to report immediately to the teacher any personal injury (burn, scratch, cut, or corrosive liquid on the skin or clothing) no matter how trivial it may appear.

10. Students should know the location of fire extinguishers, fire blankets, eye wash stations, safety showers, and first aid kits.

11. Students are never to pour reagents back into bottles or to exchange stoppers of bottles, or to place stoppers on the table. Stoppers should be replaced immediately after using reagents.

12. Students should be cautioned about the possible dangers from work done at home in connection with projects and science fairs. Use of dangerous substances, such as carcinogens, explosives, hormones, and radioactive substances should be avoided.

13. Students should transport materials through the halls only when classes are not passing. However, students may not transport dangerous chemicals, such as concentrated acids and bases.

14. Demonstrate how students are to pour liquids properly from a bottle, without spilling.

15. Students should do only the experiments assigned or approved by teachers.

16. Instruct students never to handle apparatus or chemicals in the laboratory unless they have had specific instructions. Before working with sharp tools, students must demonstrate to the teacher that they are competent to use them.

17. Students may not dilute any concentrated acid or base.

18. Advise students that glass wool and steel wool should be handled carefully to avoid getting fragments into the skin. Where appropriate, use a grasping tool, such as tongs, or wear gloves.

19. Caution students to make certain that the delivery tubes are not clogged when a gas is being collected by water displacement and a thistle tube is employed to add acid. Otherwise, explosive pressure may develop, or acid may be spattered.

20. Caution students that, in or out of school, certain activities involving chemicals are hazardous, e.g., setting fire to gasoline cans, breaking open fluorescent light tubes, and throwing aerosol cans into a fire.

21. Advise students against experimenting with rocket fuels. FORBID their use in school. Many rocket fuels are dangerous explosives that may not be used legally within city limits.

22. Students should not use direct sunlight as a source of light for the microscope. Students should not observe a solar eclipse directly through a telescope or binoculars. The image should be projected on a screen instead.

STUDENTS LABORATORY SAFETY CONTRACT

(NOTE: These two pages should be duplicated and distributed to each student.)

Your health and safety are most important! In the science laboratory, you will be carrying out a number of laboratory activities that could be hazardous to your health and well being UNLESS they are done by following your teacher s instructions both oral and written. The rules listed below will help ensure your safety. They must be followed at all times. The bottom portion requires your signature and that of your parent or guardian. After both of you have signed the tear-off sheet, it must be returned to your teacher so that you can participate in laboratory activities. Failure to carry out laboratory experiments will result in a lowered class grade and might result in a failing grade m the course. The upper portion of this contract is to be pasted or taped in your science notebook and should be reread prior to starting each new laboratory activity.

GENERAL RULES

1. Follow all instructions carefully. If you don't understand what you are expected to do, ask your teacher before proceeding.
2. Conduct yourself in a responsible manner whenever you are in the science laboratory. Horse play and pranks are dangerous and have no place in the science laboratory. When you enter the laboratory, do not touch any equipment or chemicals until you are instructed to do so.
3. Eating and drinking is not permitted in the laboratory. Do not use any glassware in the laboratory as a container for food or drinks. Keep your work area neat and clean. If available, wear a lab apron or coat.
4. Know where the safety equipment including the eyewash station, safety shower, fire extinguisher and fire blanket is located. Notify your instructor immediately of any unsafe condition.
5. Use the fume hood when working with gaseous substances. Never put your head inside the fume hood.
6. If a fire drill occurs during a laboratory period, be sure to close all chemical containers, gas and electricity.
7. Keep your hands away from your eyes, mouth and face when using chemicals or handling preserved specimens. Wash your hands with soap and water before leaving the laboratory.
8. Clean and return all equipment when instructed to do so by your teacher.
9. When handling sharp instruments such as scissors and dissecting instruments, always carry them with the tips and points in a downward position. Always cut away from your body. Hold the instruments by their handles. If a sharp instrument falls off the table, don't try to catch it!
10. Wear goggles when instructed by your teacher. There are no exceptions to this rule. If you wear contact lenses, ask your instructor for non-vented safety goggles. If a chemical should splash into your eye or get on your skin, immediately flush the eye or skin with running water from the safety shower or eyewash station for at least fifteen minutes. Notify your instructor at once. Report any accident including a chemical spill or breaking of equipment to your teacher at once. Notify your teacher of any injury no matter how slight. This includes cuts and burns and chemical splashes on any part of the body.

11. Long hair, hanging jewelry, and loose or baggy clothing are hazardous in the laboratory. Long hair must be tied back. Hanging jewelry and loose clothing must be secured. Sandals are not permitted in the science laboratory. Shoes or sneakers must be worn.
12 Follow instructions for handling chemicals. Do not taste, touch, or smell any chemicals unless told to do so. Don't return unused chemicals to their stock containers. Dispose of all chemicals by following your teacher's instructions. Don't use the sink drains for mixing chemicals.
13. Follow instructions for the handing and dilution of acids and bases.
14. Follow directions for inserting and removing glass tubing from rubber stoppers. Never handle broken glass with your bare hands. Use a dustpan and a brush or broom for cleaning up broken glass.
15. Do not use glassware that is chipped or cracked.
16. Make sure your hands are dry before removing an electric plug from a socket. Report any damaged electrical equipment, including, frayed wires and loose connections.
17. Be very careful when using a gas burner. Keep hair, clothing, and your hands safely away from an open flame. Never point the open end of a test tube that is being heated at yourself or anyone else. Hot glass and hot metal stay hot for a long time. Set them aside to cool on an insulated pad. Remember, hot glass and cold glass look exactly alike.

AGREEMENT

I _____ of Class _____ have read and agree to follow all of the safety rules in this contract. I will follow my teacher's directions. I am aware that failure to follow these rules is dangerous and may result in my being barred from the laboratory, and that this may result in a failing grade.

_____

Student Signature Date

Dear Parent or Guardian:

Your signature indicates that you have read these safety rules and have instructed your child to follow these rules and procedures in the science laboratory.

_____

Parent/Guardian Signature Date

ONLINE RESOURCES

Data & Statistics

Using Data and Statistics
http://www.mathleague.com/help/data/data.htm

Display & Presentation

Discovery Education: Science Fair Central, Science Fair Presentations
http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Presentations.html
The Science Fair Judging Sheet
http://sciencefairproject.virtualave.net/judging_sheet.htm

Scifair.org: Display Boards
http://scifair.org/tips/how-to-create-a-winning-display.html

Graphs & Charts

Interactive: Pie Chart
http://www.shodor.org/interactivate/activities/PieChart/

Create a Graph
http://nces.ed.gov/nceskids/createagraph/default.aspx

Science Fair Project Ideas

All Science Fair Projects
http://www.all-science-fair-projects.com
Science Fair Idea Exchange
http://scienceclub.org/proj/kidproja.html
Science Fair Project Ideas
http://www.sciencebuddies.org/science-fair-projects/project_ideas.shtml
PBSKIDS.ORG: Dragonfly TV
http://pbskids.org/dragonflytv/scifair/index.html
Pie Network
http://pienetwork.org/
Pie Network: Getting Ideas
http://pienetwork.org/a2z/g/getting_ideas/
Education.com: Science Fair Project Ideas
http://www.education.com/science-fair/help-child-with-science-fair-projects/

Science Fair Helpful Hints and Guides

Discovery: Science Fair Central
http://school.discoveryeducation.com/sciencefaircentral/

7 Steps To A Successful Project -- Science Fair Projects -- Conservation International
http://www.conservation.org/resources/education/science_fair/Pages/projects.aspx

The Ultimate Science Fair Resource
http://www.scifair.org/

Internet Public Library: Science Fair Project Guide
http://www.ipl.org/div/projectguide/

Make It Solar
http://www.makeitsolar.com/science-fair-information/01-the-scientific-method.htm

Science Websites

The Yuckiest Site in the Internet
http://yucky.kids.discovery.com/

Try Science
http://tryscience.com

Search Engines

Google: http://www.google.com

Ask Kids: http://askkids.com

Dogpile: http://www.dogpile.com

KidsClick: http://www.kidsclick.org/

Lycos: http://lycos.com

Metacrawler: http://www.metacrawler.com

Scrub the Web: http://scrubtheweb.com

Yahoo Kids: http://kids.yahoo.com

Before You Start: A Checklist for Student Project Success

This document has been provided in the student handbook.

Projects offer you the chance to learn on your own and become an expert in a subject that interests you. Projects also require careful organization and steady work in order to complete them successfully, without last-minute scrambling. Consider the tips below to help you stay on track and produce high-quality products, presentations, and performances.

Directions: When you complete one of the tasks listed, place a **check mark** next to it, but only if you feel you've completed that task to the best of your ability.

ORGANIZATION AND STUDY SKILLS

Do you understand the project and what you have to do to be successful?

- Make sure you understand the assignment and all the pieces that are due as a part of the assignment.

Have you completed a long-term plan for completion of all the parts to your assignment?

- If you have a long-term assignment, make a plan for completing each part. Ask your teacher to help you think of all the parts to complete. For example,
    - Complete the research by _____ date.
    - Take notes by _____ date.
    - Write your first draft by _____ date, etc.
    - Keep track of the parts you complete to track your progress. Plan to complete the entire assignment early.

Do you have a clear picture of your due dates?

- Write down due dates for all short-term or long-term assignments. Review these dates often to make sure you stay on track.

Does your plan include work every night?

- Work a little bit on your project every single night; if you skip a night it will just mean more for next time.

Do you have partners or friends to help you stay on track throughout the project?

- Choose your study buddies and partners for projects carefully – remember the goal is to be responsible for your learning and to succeed.

Have you gathered the supplies that you need?

- Make sure you have the materials you need for any projects that are due (special papers, presentation boards, covers, etc.).

<u>INVESTIGATION SKILLS</u>

Have you found a topic that you really want to learn about?

- Find a topic or research question that interests you. Look for the connections to your own life.

Do you know the steps to follow to investigate your topic?

- Follow a research process and complete each step carefully before moving on to the next step (for example, be sure you have a good topic or research question before you spend a lot of time looking for information).

Do you have an organized way to keep track of your work as you complete each part of the investigation?

- Carefully document your work throughout the process so that you don't waste time trying to find or remember what you already did. For example, write down as you go along:
  - Your topic and questions
  - The key words and search strategy that seem to be the most successful
  - Full bibliographic information on every source you use
  - Notes organized by source or by question/subtopic
  - Outline or graphic organizer of the way you plan to present your information
  - Rough draft
  - Revised final draft.

Do you know what a good final product / presentation / performance looks like? Have you looked at the rubric?

- Take care with the presentation of your final work. Even the best information and thinking are less successful if they are presented in a sloppy or disorganized manner.

Have you given yourself time to practice your final presentation or performance?

- If you are making an oral presentation of your project, practice out loud several times before you have to present. Write reminders of your main points on index cards so that you can easily refer to them during your presentation. Relax – remember, you're the expert on this project.

Preparing To Write Your Science Fair Project: Steps to Follow

This document has been provided in the student handbook.

Use this worksheet as a guide in writing up your project. Directions and suggestions are given in each section. Fill in the blanks in all the sections.

A. Title – Choose a brief title for your project. Titles are often "catchy", but do not have to be. (You may want to wait until you have completed your experiment before giving it a title.)

The title of my project is _____.

B. Question – What question are you trying to answer by doing your project? A statement and not just a "yes" or a "no" should answer your question. Your question should be fairly specific. A good way to form a question is: "How will changing _____ affect _____?"

Examples:
- How will changing *the color of light plants receive* affect *plant growth*?
- How will changing *the amount of baking soda in cupcakes* affect *cupcake height*?

Remember, you must have at least one variable (something that changes), and a control (something that stays the same).

My Question is_____.

C. Introduction – This section talks about why you chose this experiment, who helped you, and what special research did you do to learn more about this experiment. This section should be 3 or more sentences.

I chose this experiment because_____

I got help from_____

I learned more about_____

D. Hypothesis – This is a guess of **what** you think will happen and **why** it will happen based on your research on your variable. A good way to write a hypothesis is:

"I think that _____ because _____.

Examples:
- I think that *plants that receive white light will grow taller and fuller than plants that just get red or blue light* because *I read that plants need lots of sunlight for growth*.
- I think that *putting more baking soda in cupcakes will make cupcakes taller* because *baking soda produces gas that makes the cupcakes rise*.

My Hypothesis: I think that _____

because_____

_____

E. Materials – List all the materials you will use to perform the experiment. This is similar to the ingredient list of a recipe. More detail is better! Another person should be able to do your experiment based on your list of materials.

These are the items I need to perform my experiment are:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

F. Procedure – Write a step-by-step guide for doing the experiment. This is similar to the instructions part of a recipe. The more detail the better. Another person should be able to do your experiment based on the instructions in your procedure. You should repeat your experiment 2 or more times to see if you get the same results.

The steps to doing my experiment are:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

Feel free to add more steps if you need to. You may include photographs or drawings of the items in your experiment on your display board.

G. Results – Record the results of your experiment. Make a chart or a graph to make it easier for a person to see what you observed during your experiment. Write a paragraph that talks about the results in your charts and/or graphs. Remember to do your experiment more than once. On your display board, you may include photographs or drawings of the results of your experiment. It may be helpful to show "before" and "after" pictures in some cases.

Chart of Results from Trial 1

Chart of Results from Trial 2

Chart of Results from Trial 3

Feel free to do more trials and chart the results.

Are your results consistent? If yes, what is the trend?

Example:

• *When the plants with under the white light grew taller than the plants under the red or blue light*

• *The more baking soda I used, the taller the cupcake.*

If there is no trend, say that your results do not show any trend.

Example:

• *My results were inconclusive because two of the three plants with the white light grew taller than the plants with the red and blue light. But one of the plants with the red light was taller than all the plants with the white light. Also, a couple of the plants with the blue light were taller than the red light plants, but shorter than the white light plants.*

• *The heights of the cupcakes did not vary consistently with the amount of the baking soda used.*

My results show

_____

_____

_____

_____

_____

_____

H. Conclusion – What did you learn from the experiment? Tell whether your results show that your hypothesis was right or wrong. How do your results show that your hypothesis was right or wrong? If your hypothesis was wrong, why do you think you guessed wrong? Did anything go wrong when you did your experiment? What do you think you can change to make the experiment better? Who might benefit from what you have learned in your experiment?

My results show that my hypothesis was

_____

because_____

_____

_____

_____

_____

To make this experiment better, I can

_____

_____

_____

The people who may benefit from what I have learned in this experiment are

_____

because_____

_____

Staying on Track: A Self-Assessment Checklist

This document has been provided in the student handbook.

Your Name _____ Class_____

Directions: When you complete one of the tasks listed, place a **check mark** next to it, but only if you feel you've completed that task to the best of your ability.

SECTION 1 - Science Understanding

- I used topics and ideas that we discussed in class or on field trips to come up with a question that I could investigate.
- I explained my observations and my results by using science concepts, terms and ideas.
- I used more than one way of explaining my ideas – like words, pictures, diagrams, charts or graphs.
- I was able to make connections between what I learned from the project and other areas of science.

SECTION 2 - Scientific Process

- I identified a problem and asked a question that I could investigate. (It was not a "yes or no" question.)
- I made a hypothesis that I could test. I did not already know for sure what the answer to my hypothesis would be. I also know that my hypothesis does not have to be supported by the data, because in science we can learn both when we get results we expect or when we get results we do not expect.
- I designed a plan and method to collect data to test my hypothesis.
- I conducted my research carefully and with scientific accuracy.
- I collected, recorded and organized data from my work.
- I made graphs, charts, tables or artwork that represent my data
- I made a conclusion that says whether my hypothesis was supported or not supported (either one is proper) based upon my data, that explains my observations and why things came out the way they did.

- I explained what I would do differently next time and I discussed any possible sources of error in my project.

    - I looked back at my work and explained what I might have changed to make the project even better.

    - *"If I were to do the project all over again, here is what I'd do differently this time....."*

SECTION 3 - The Written Report

- I used at least 3 different sources to collect my background research information, which I have written down in my bibliography.

- The report is written in a manner that makes sense. I made sure my report has:
    - an abstract
    - an introduction which includes the purpose and the reason why I chose this topic
    - an hypothesis
    - a materials and methods section
    - my actual data and an analysis/explanation of the data
    - a conclusion that refers back to my hypothesis with a discussion of my results
    - a reflection on the quality of my entire project
    - a glossary of terms
    - a bibliography
    - any attachments (Appendices/Addenda)

- I compared concepts and showed the reader that I understood MORE THAN just what I researched about. I compared it to other things not in my research (...*"**this**" is similar to the idea of* "that").

- I supported my ideas with examples, definitions and references back to other sources of information.

- I gave credit for anything that I did not learn by myself. If I didn't learn it from actually doing this project, then I showed where I got the information.

- I used graphics, charts or artwork to enhance my report.

- I have checked for grammar, spelling, punctuation and sentence structure. I have not included any street talk, slang, or text message abbreviations in my report.

SECTION 4 - The Oral Presentation

- I organized my presentation in a way that people can understand. I know that not everyone listening to the presentation is as much an expert on my topic as I have become.

- I used notes, index cards, or computer slideshows to make sure I followed my presentation in the correct manner and that I am giving accurate data. I did ***NOT*** read directly from my report, and I made eye contact with the audience.

- I gave examples, definitions and direct references and quotes to support my ideas.

- I was able to answer questions about my topic: ***I am the expert!***

- My audience was able to understand my concept.

- I used proper grammar and sentence structure. I did not use any "street talk" or "slang". I spoke slowly, loudly and clearly, so that I could be understood.

- I used some visual display such as: slideshows, tri-fold board, movie or other multimedia to make my presentation more interesting.

APPENDIX 1: Sample Rubric for the Written Component

4 Exceeds Standard	3 Meets Standard	2 Approaches Standard	1 Below Standard
Follows assigned format.	Follows most of assigned format.	Has some components of assigned format.	Does not follow assigned format.
Carefully organized.	Good overall structure.	Satisfactorily organized.	Poorly organized.
Clearly displays student's personal understanding of historical impact. Supports opinions.	Shows some personal understanding of historical impact. Partially supports opinions.	Shows little understanding of historical impact. Supports few opinions.	Shows no understanding of historical impact. No evidence of support for opinions.
Demonstrates an excellent understanding of written English: grammar, spelling, punctuation and sentence structure.	Good understanding of written English, some grammatical errors.	Many grammatical errors.	Grammatical errors make it impossible to understand.
Uses multiple sources of information in developing an accurate written project. Annotated bibliography explains how sources were used.	Uses several sources of information in developing an accurate written project. Contains bibliography.	Uses few sources of information, ineffective use of research materials. No evidence of using sources listed.	Shows evidence of little or no research. No bibliography.
Displays evidence of mastering major issues.	Displays evidence of understanding major issues.	Displays little evidence of understanding major issues.	Displays no evidence of understanding major issues.

APPENDIX 2: Sample Rubric for the Oral Component

4 Exceeds Standard	3 Meets Standard	2 Approaches Standard	1 Below Standard
Follows assigned format.	Follows most of assigned format.	Has some components of assigned format.	Does not follow assigned format.
Effective use of graphic component.	Uses graphic component.	Has graphic, but makes little or no reference to it.	No graphic.
Displays mastery of English language (or native language) through clear communication of ideas. Very few grammatical errors.	Good understanding of English language (or native language) demonstrated through clear communication of ideas, some grammatical errors.	Ideas somewhat unclear, many grammatical errors.	Ideas are vague and unclear, impossible to comprehend because of poor grammar and communication.
Presentation logically developed, with definitions and examples, accurate details.	Good presentation connecting ideas, several examples used, some inaccuracies.	Some ideas not well connected or developed, many inaccuracies.	Most ideas not connected or developed, details and facts completely inaccurate.
Fully engages the audience, excellent eye contact, explains presentation, does not read to audience.	Engages the audience most of the time, generally maintains eye contact, mostly explains.	Does not engage the audience most of the time, has poor eye contact, reads presentation.	Does not engage the audience at all, makes no eye contact with audience, reads presentation or fails to complete presentation.
Fully addresses major issues.	Somewhat addresses major issues.	Does not address some major issues.	Fails to address any major issues.
Well developed sense of closure.	Develops sense of closure.	Little sense of closure.	No sense of closure.

APPENDIX 3: Sample Rubric for the Graphic/Visual Component

4 Exceeds Standard	3 Meets Standard	2 Approaches Standard	1 Below Standard
Follows assigned format.	Follows most of assigned format.	Has some components of assigned format.	Does not follow assigned format.
Graphic representations are included that strongly support ideas/ opinions.	Graphic representations are included that generally support ideas/ opinions.	Some inaccuracies and irrelevant graphics used.	Extraneous and inaccurate graphics with little relevance; no graphics.
Shows much evidence of research and conclusions drawn.	Shows evidence of research and conclusions drawn.	Shows little or some evidence of research.	Shows little or no evidence of research.
Reflects s deep understanding of the topic; questions/ ideas are clearly addressed.	Reflects an understanding of the topic; questions/ ideas are slightly vague.	Reflects a beginning understanding of the topic; questions are unclear.	Shows no understanding of the topic; no attempt to answer questions.
Graphics are organized and shown in a logical, sequential manner.	Display is mostly organized in a logical way.	Display is somewhat organized.	Graphics poorly organized and difficult to understand.
Graphics are effectively used in oral presentation.	Graphics are used in the oral presentation.	Little use of graphics in oral presentation.	Graphics are not used in oral presentation.

APPENDIX 4: Sample Science Project Rubric

Dimensions Categories	The Project	Conceptual Understanding of Science	Scientific Process	Written Work	Oral Presentation
Components In Scoring	Collects data to assist in completing a project. Uses appropriate techniques to collect data (e.g., surveys). Evaluates information for completeness and relevance. Shows evidence of research. Uses word processing, graphics, database, and spreadsheet programs to produce project and related material.	Utilizes key concepts in life, earth and/or physical science. Uses scientific concepts accurately to explain observations and/or make predictions. Represents the concept in multiple ways (ex. words, charts, diagrams, graphs or artwork).	States identified problem. States an hypothesis. Explains procedures and observations accurately. Records and organizes data clearly in ways which can be verified by others. Includes clear and accurate graphic representations of collected data (numbers, tables, graphs, artwork, diagrams etc.) States a conclusion that explains observations and inferences. Reflects and defends conclusions and recommendations.	Uses several sources of information in addition to an encyclopedia in developing a research report that may include a brochure, narrative procedure or guide as part of the project. Overall structure has a clear introduction, development and conclusion. Connects, compares and contrasts concepts. Supports concepts with examples, definitions and references to texts. Cites all sources in footnotes. Uses graphics/art to enhance work. Demonstrates an understanding of the English language in written form: grammar, spelling, punctuation and sentence structure.	Organizes presentation in a logical way. Uses notes or other visual aids to structure presentation of project findings. Presents examples, definitions and direct references to text to support concepts. Responds appropriately to questions. Shapes content and information to achieve a specific purpose. Demonstrates an understanding of the rules of the English language in oral presentation (grammar, paragraph and sentence structure, usage). Speaks clearly for more than one minute but not more than two minutes

APPENDIX 4: Sample Science Project Rubric Cont'd

Dimensions Categories	The Project	Conceptual Understanding of Science	Scientific Process	Written Work	Oral Presentation
4 Exceeds Standard	Excellent project. All components included and the work goes beyond what is expected	Excellent use of scientific concepts to accurately explain observations/ predictions. An array of words, charts, graphs, diagrams or artwork used. All components included, going beyond what is expected.	Excellent presentation. The work includes all steps in the scientific process clearly and accurately using an array of graphic representations. Work goes beyond what is expected.	Excellent overall structure carefully organized from beginning to end. The work connects an array of concepts and supports findings. All components included and work goes beyond what is expected.	Excellent presentation. An array of visual aids used to support ideas. The presentation includes all the components and goes beyond what is expected.
3 Meets Standard	Good project. All components included and meet set expectations.	Good conceptual understanding of key scientific concept shown in multiple ways. All components included and meet set expectations.	Good evidence of the scientific process. All steps follow accurately using multiple representations All components included and meet set expectations.	Good overall structure. Clearly organized work connects multiple concepts. All components are included and meet all set expectations.	Good presentation. Several examples and visual aids used to support ideas. The work includes all of the components and meets all set expectations.
2 Approaching Standard	The project includes many components which meet set expectations.	An understanding of key scientific concept shown in at least one way. Many components included but may not meet set expectations.	Some evidence of the scientific process shown. Many steps included using more than one graphic representation. Many components included that meet set expectations.	Overall structure organized but with some lapses in order. Only one core concept addressed. Most components included and meet set expectations.	Presentation approaching standard. Some examples and visual aids used to support ideas. The work includes most components which meet set expectations.
1 Significantly Below Standard	Project needs overall improvement. Work includes few components that meet set expectations.	Poor understanding of science concepts. Work is unclear or inaccurate. No graphics used to support ideas.	Evidence of the scientific process is missing major components. Components included are inaccurate or unclear.	Poor overall structure and difficult to follow. Few components are included which meet expectations.	Presentation needs improvement. Few examples and visual aids used to support ideas. Some components included. Work meets some expectations.
				Total Score:	

APPENDIX 5: Science Project Journal Rubric

	4 Exceeds Standard	3 Meets Standard	2 Approaches Standard	1 Below Standard	Score
Table of Contents	All pages and descriptions correct	Mostly correct	Many errors	Missing	
Observations	Observations are clearly written, sketches and diagrams are included	Observations are clearly written, but sketches and diagrams are not included	Some clarity with observations, but sketches and diagrams not included	Lacks observations or not written clearly, lacking sketches and diagrams	
Daily Entries During Investigation	Well detailed daily entries with data	All daily entries included but not well detailed	Missing daily entries, lacking in some of the details	Missing daily entries, little or no details	
Data Analysis, Conclusion, Results	Clearly written with all information included	Clearly written with most information included	Some clarity with most information included	Not clearly written with little or no information included	
Exit Project Reflection	Clearly written with all topics addressed	Clearly written with most topics addressed	Some clarity with most topics addressed	Not clearly written with most topics not addressed	
				Total Score:	