Science Exit Project Task Descriptions

Students completing the Eighth Grade Science Exit Project requirement may choose one of the following types of projects:

- Controlled Experiment
- Fieldwork
- Secondary Research
- Design Project

Note: Not all research is going to fall so nicely into one of the four categories, therefore a single project may draw on more than one type of investigation.

Initial Development of the Project

Students must initially identify a problem that they are interested in investigating. This can develop from an exploration, various experiences, field trips, exposure to information through newspaper articles, TV, or other media, or just by "messing around". Opportunities must be provided for students to make original observations and to develop authentic questions that are of real value to them. Students need to tap into their prior knowledge regarding the problem they have chosen to investigate and to do background research to develop an informed hypothesis that can be tested. The background research should consist of an initial literature search and must make connections to the curriculum. This initial hypothesis must then be clearly stated and based on this prior knowledge and background research. The student must identify the variables to be examined and then decide on the type of project that best enables the student to address the hypothesis. The student must keep a scientific notebook that includes careful notes and records throughout the investigation and which will enable the student to write the final report of the investigation. The final report will reflect the scientific process the students used to solve the problem or find the answer to the proposed question.

After the student performs the background research, creates a researchable question and develops a testable hypothesis, the student should design strategies to test the hypothesis and determine what type of data needs to be collected to help answer the question. These decisions will then determine what type of investigation the student will engage in, as defined below. In all of the projects, the student must be working with data. This data can be generated by the students themselves (primary data), or could be obtained from other sources (secondary data). The data that students collect must be directly related to the researchable question and the hypothesis that is developed from the research question.

1. Controlled Experiment- students manipulate the environment being studied.

- Students will design the procedure, including identifying what factors are going to be varied and what is going to be controlled. Students should ensure that the precision of the tools they will be using are appropriate, and determine how, when, and where measurements will be taken. Sources of error must be addressed at every step of the project.
- The procedure should be implemented multiple times and data collected.

- Data must be analyzed and represented appropriately using charts and graphs. The data should be compared with existing data sets obtained through background research.
- The hypothesis must be evaluated in terms of the data.
- Conclusions should be drawn, asking new questions based on the results of the investigation.

Examples:

1. How does a substance, such as road salt or compost, affect the growth of a specific plant?
2. How do various coatings affect the corrosion of a metal?
3. How does the pH of water affect the growth of elodea?

2. Fieldwork- a study of a natural or man-made environment to gain practical experience and knowledge through firsthand observation. In this case the student is observing the environment and not manipulating it. The investigation must be able to be completed within the time constraints established by the teacher.

- Design a data collection procedure that includes a number of field observations, frequency of visits, and other appropriate information.
- Test the design for data collection.
- Revise the procedure after an initial trial. Revise hypothesis if necessary based on new observations. Carry out the procedure.
- Record and organize data using tables, graphs, or charts.
- Analyze the data looking for patterns.
- Develop a conclusion based on the available data.

Examples:

1. What is the date that "green down" occurs or budburst happens for different species of trees in the neighborhood or park?
2. What are the behaviors of the mountain gorillas that are most often observed in the Congo Gorilla Forest exhibit?
3. How does the salinity of the Hudson River change as we move south from 138th Street to Battery Park?
4. What is the correlation between day length and the direction of the sun's shadow?

3. Secondary Research- the researchable question must come from data sets (numerical data that has been generated by previous research) that is available to students on a variety of websites. An example of a researchable question is "How is X affecting Y over Z years?" The researchable question is then answered by using additional data sets that the student finds to support the hypothesis.

- Design a research plan that identifies the source of the data to be collected to answer the question/test the hypothesis that has been developed from the secondary data that has been analyzed.
- Obtain the needed data.
- Analyze the data identifying sources of error.

- Form a conclusion based on both the data collected and the background research.
- Identify further questions based on the work.

Examples:

1. How does the latitude or elevation of an area affect the day of the year buds of a particular species of tree open?
2. How does the incidence of asthma depend on the emissions of power plants or industry in different locations?
3. How has there been a change in hurricane frequency or intensity over the last 50 years?
4. How has the Clean Air Act had an effect on acid rain in New York State?

4. Design Project- students need to identify a need and develop a design that meets that need.

- Determine the criteria for success (Testing/ Optimization/Relevant parameters)
- Create a design that satisfies the criteria developed.
- Test design and gather data, or in the case of projects in which it is not possible to test the design due to time constraints, develop a plan on how the design is to be evaluated over time to see if it does meet the identified need.
- Analyze data, revisit the design and revise if necessary.
- Retest design as necessary until meets the established criteria.
- Generate conclusions and develop new questions to explore.

Examples:

1. Design and construct a hydroponic greenhouse for growing vegetable without soil. (Can vegetables be grown without soil?)
2. Design and construct a container that will prevent a frozen object from melting when shipped from one place to another. (Can frozen materials be shipped over long distances?)
3. Design and construct a solar powered racing car that can travel the greatest possible speed over a chosen distance. (How fast can a solar-powered car travel?)
4. Design a zoo exhibit that is both aesthetically pleasing and meets the needs of the animal exhibited. (How can you design a better exhibit for the mountain gorillas?)

For all of the projects, the conclusion should refer to the hypothesis, and there should be strong connections between the research question, the analysis of the data, and the conclusion. Does the data support the hypothesis? How does it do this? How are you sure of your results? The discussion should include error analysis and suggestions for further inquiry, as well as future improvements to the investigation procedure or design. If the students are not able to come up with a definitive conclusion, they should discuss why they were not able to do this.