7TH GRADE LIFE SCIENCE
EXPERIMENTATION PROJECT

- ☐ The following pages will explain how the project should be completed. *Students should not complete parts without getting prior teacher approval.* This may result in a lot of extra work. The final copy of the report should be word processed. Neatness counts! Students should check for errors and fix them before they hand in the report.

- ☐ Lost work and broken printers are not acceptable excuses for late work. Please plan ahead. There are computers in each of the science classes that students can use before or after school. Assignments can also be emailed to students' school accounts and then printed BEFORE school.

- ☐ Late work will lose 50% except for the final project that will lose 10% a day. Please plan ahead and be prepared.

- ☐ The sequence of activities and the sequence of parts to put the project together at the end are different – see below.

SEQUENCE OF ACTIVITES	SEQUENCE FOR PUTTING THE WORD PROCESSED PROJECT TOGETHER AT THE END:
☐ Know the organization format, presentation and convention expectations for the write up of the experimentation project. ☐ Write the OPERATIONAL/INVESTIGATIVE QUESTION. Complete the parent signature form. ☐ Write up the RESEARCH QUESTIONS in double column notes. Then, research the answers and take notes to answer the questions. Students keep and write up a RESOURCE LIST as they go. ☐ Determine if the MV is continuous or discrete. ☐ Write the HYPOTHESIS/prediction with a justification ☐ Plan the experiment in an EXPERIMENTAL DESIGN DIAGRAM or EDD. ☐ Write the MATERIALS LIST ☐ Draw a PROCEDURAL DIAGRAM with a title, labels, and a caption ☐ Write a PROCEDURE ☐ Make a BLANK DATA TABLE in EXCEL for writing down the data ☐ Collect the materials/build any necessary apparatus ☐ Conduct the experiment and collect the data (measurements in the table and observations in written list format) ☐ Display the data in the appropriate EXCEL GRAPHS ☐ Write the 6 paragraph CONCLUSION (Purpose statement; conclusion paragraph with supporting results; hypothesis or research supported or not supported; scientific explanation; three problems that affected accuracy and improvements or solutions; further investigations) ☐ MAKE THE TITLE PAGE ☐ Write a SPECIAL THANKS to those who helped/offered support. ☐ Write the TABLE OF CONTENTS ☐ PUT THE PARTS TOGETHER IN THE CORRECT ORDER. (See column on the right) ☐ Construct a DISPLAY BOARD.	1. Title page 2. Special Thanks 3. Table of Contents 4. Introduction 5. Experimental Design Diagram 6. Materials List 7. Procedure (with diagram) 8. Results Table(s) 9. Graphs 10. Conclusion 11. Resource List

PARENT/GUARDIAN SUPPORT

There are 240 students doing this project so parent/guardian support is much appreciated. Please guide your students with encouragement, but do not do the project for them. For example, when writing/word processing their written work, or making their data tables and graphs in Excel, the student should always be in the seat at the keyboard. Students should make their own best attempt to edit their work before the parent or guardian checks the editing.

ORGANIZATION / PRESENTATION / CONVENTIONS

- ☐ All parts are present in the write up.
- ☐ Parts are in the correct order.
- ☐ It is word processed.
- ☐ Neatness counts.
- ☐ Main titles are centered.
- ☐ Subheadings are left aligned.
- ☐ Font type is appropriate (New Times Roman, Ariel, Comic Sans… something professional, not cutesy)
- ☐ Double spaced (except the main heading)
- ☐ The titles are larger font size than the text (12 for text, 14 or 16 for main heading and subheadings)
- ☐ Proficient spelling/capitalization/punctuation.
- ☐ Good word choice. Use scientific vocabulary.
- ☐ Voice - use 3rd person formal.

INTRODUCTION (SUMMARY OF THE BACKGROUND RESEARCH)

Background Research – Students were instructed to take notes (pre-write form) in the **double column notes format** on all the questions on their introduction question list (handout given in class). Students then **word process** the final in the following format. Write down each question in **bold.** Answer in full sentences (1-5) in regular text

Introduction

"Operational Question"

Question

Answer in 1-5 sentences minimum.

Question

Answer in 1-5 sentences minimum.

Question

Answer in 1-5 sentences minimum.

Etc

This is where students summarize what they have learned about their topic BEFORE starting the experiment. The background research will describe what other people already know about the topic, previous studies that are similar to theirs and detailed information about what living conditions the living organism requires. This is a very important part of the project. If the student plans to study the development of a certain type of butterfly and find out that it is only available to order in October, the student needs to find that out before a lot of time is invested in the project. (HINT: Students can also start collecting graphics in a WORD document that may be useful on their display board for the presentation at the end of the project).

RESOURCE LIST - students were instructed to keep a resource list

Students were given a handout on how to write the resource list, and some direct instructions and help from our school librarian on during the week of Feb. 23. Students should word process this on a separate sheet of paper from the research as it goes at the very end of the report, in a different place from the research.

Minimum:

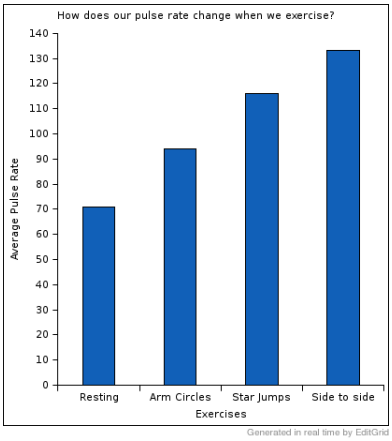
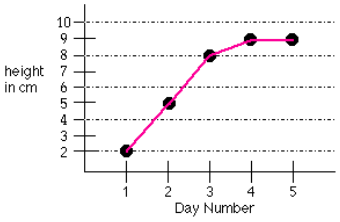
1 book

1 interview

1 previous science experiment

1 Internet article

DETERMINE IF THE MV IS CONTINUOUS OR DISCRETE (see below for help).

Word or Phrase.	Definition Breakdown and extra notes The first item is the category.	Example and illustration
Discrete Variable	• Type of variable • Has no in-between values • It is divided into types like kind of car, or type of pet. • Or it is counted as whole numbers, like counting the number of people. (Because there cannot be half a person). • To display a discrete variable on a graph use a column or bar graph.	• Type of antiseptic • Type of bread • Number of people • Type of surface 
Continuous Variable	• Type of variable • On a continuum - a scale • Has in-between values • Measured on a scaled instrument • With a ruler –for length, triple beam balance – for mass, spring scale – for weight, thermometer – for temperature, clock – for time. • To display a continuous variable on a graph use a scatter or line graph.	• Length • Time • Mass • Amount of water • Amount of fertilizer 

EXPERIMENT DESIGN DIAGRAM

- This is a planning tool that includes the vital parts of the experiment. Students have completed many of these this year and should be familiar with them.
- The first EDD below has instructional notes, and the second one is a blank table students can copy and paste into their own word document and fill out.

OPERATIONAL QUESTION

OPERATIONAL QUESTION

- Operational questions help set up an experiment that tests a hypothesis about the affect of one variable on another.
- For example, does caffeine really make students more disruptive in class? The scientist would set up an operational question that includes a manipulated variable (MV) and a responding variable (RV).
- *The **manipulated variable** (MV) is the variable that is **changed or manipulated by the scientist.*** If a scientist is studying the effect of caffeine on student behavior, the amount of caffeine would be the MV. The scientist would directly control how much caffeine the subject will get.
- *The **responding variable** (RV) is the variable that is **measured**.* In this example the student behavior is the RV and needs to be measured. The RV needs to be measured objectively with numerical data. In the case of behavior, a rubric scale of 1-10 would be written in a series of increasingly disruptive observable behaviors.

Operational questions usually take the form of:

How does (describe the change) the MV affect the RV? Or What is the effect of the MV on the RV?

Examples:

How does increasing the amount of fertilizer affect grass growth?

How does the type of activity affect the person's heart rate?

HYPOTHESIS:

This is a prediction - what the student thinks the outcome of the experiment will be with a justification using science facts.

Format: If the MV is ….then the RV will …., because……

First decide if the MV is discrete or continuous. (See above for help)

If it is continuous use the format:

If (the MV) is (describe the change) then (the RV) will (the prediction), because (the scientific reason/justification for the prediction).

Example: If amount of light is increased then the height of the plant will increase because light is needed for photosynthesis which is the process used by plants to make their own food from carbon dioxide and water and if a plant has more food it will be able to grow taller.

If it is discreet use a statement for both the **highest and lowest** result.

Use the format:

If (the MV) is (the type) then (the RV) will (the prediction), because (the scientific reason/justification for the prediction). If (the MV) is (the type) then (the RV) will (the prediction), because (the scientific reason/justification for the prediction).

Example: If the type of soil is potting soil, then the radish plants will grow taller because this soil provides the extra nutrients for growth and holds water needed for photosynthesis. If the soil is mostly sand, then the radish plant will grow less because the sandy soil provides less nutrient material for growth and will not hold much water that is needed for photosynthesis.

For the justification (because….) **use the research** of scientific facts and concepts learned from doing the background research for the introduction and finding the definitions of the key terms.

ONE MANIPULATED VARIABLE (MV)

The variable changed by the experimentor. Include the **unit** of measurement.

Levels - Write in the different levels of the MV – the values that the scientist decides to use.
Trials – Choose and write in a number of trials that will be done. There needs to be at least 3. The number of trials is **the same for each level** of MV.

Levels of MV						
Number of Trials						

ONE RESPONDING VARIABLE (RV)

The variable measured. Include the unit of measurement.

CONTROLLED VARIABLES - These are the variables that must keep constant or the same /they must not change.

1.
2.
3.
4.
5.

EXPERIMENT DESIGN DIAGRAM

Operational Question:						
Hypothesis (with justification):						
Manipulated Variable (MV) and units:						
Levels of MV						
Number of Trials						
Responding Variable (RV) and units:						
Controlled Variables: 1. 2. 3. 4. 5.						

WRITE THE MATERIALS LIST

How to Write an Excellent Materials List

- ☐ Materials list - subheading – left aligned – 14 font size.
- ☐ BULLET the list - do not number the list.
- ☐ Keep the same easy to read, standard font style – 12 font size for the text.
- ☐ Double space.
- ☐ List ONE ITEM PER LINE.
- ☐ List DOWN THE PAGE not across.
- ☐ Do not forget the MEASURING TOOL(S).
- ☐ Include everything that will be used to do the experiment *except basic office supplies*. Include ***everything used while doing*** the experiment or investigation. Do not include things used to write up the experiment, like pencils and data tables.
- ☐ Be specific about AMOUNTS and SIZES. Examples:
  - 50 peanuts
  - 1 - 2.5N Spring Scale
  - 1 - 10 cm piece of string
- ☐ GROUP SIMILAR ITEMS together.
- ☐ Try to write items down in the order used them unless it separates items that should be in a group.

PROCEDURE

DRAW THE PROCEDURAL DIAGRAM

- ☐ Subheading – "Procedural Diagram," - left aligned – 14 font size
- ☐ The labeled scientific diagram needs to help someone understand the procedure.
- ☐ It is included after the materials list and before the written procedure.
- ☐ Use half a page
- ☐ Leave a blank one inch margin all around.
- ☐ Draw a clear diagram of the material set-up to conduct the experiment.
- ☐ Choose the hardest step in the project to explain. Ask for help if you do not know what this means.
- ☐ Label all the materials neatly. Read the notes about scientific diagrams in your Experimentation Binder to review labeling expectations.
- ☐ Use carefully drawn (use a ruler) horizontal lines to connect all the materials to their labels, which should be written on the left and right sides of the diagram.
- ☐ Write a descriptive caption (3-4 sentences) in complete sentences underneath the drawing. It should explain what the picture is trying to show/explain about the procedure step. Describe the diagram and how it relates to the experiment.

  HINT: In addition you can also take a photograph of your set-up for later use on your display board.

WRITE THE PROCEDURE

Procedure Criteria

- Procedures are one of the most difficult sections to write. The biggest problem is that students write procedures that lack enough detail.
- The procedure should be good enough that someone else can use it and do the exact same experiment without asking you any questions.
- The following is the SCORING CRITERIA FOR PROCEDURES.

□ Follows the writing process (Do a pre-write, rough draft and final copy).

□ Word process

□ Subheading- Procedure – left align - headings should be one size larger (14). They can be bold and/or underlined.

□ Double spaced

□ Correct font (easy to read standard) and font size (12).

□ It should be numbered and the steps go under each other, not side to side.

□ Write with the correct sentence structure:

a. Each sentence is an imperative sentence **(**each sentence starts with a verb).

b. Write in the present tense.

□ Write in the third person (that means you cannot use I, we, us, you, me, my, your, you're, our…)

□ Add enough detail for someone else to do <u>every step</u> of the experiment without having to ask any questions.

□ Include/identify the manipulated variable, all the MV levels, and the number of trials for each level.

□ Explain the responding variable with units used.

□ Include/identify all the controlled variables

□ Include all the necessary safety precautions (may not apply to all experiments)

□ Everything on the materials list should be mentioned in the procedure.

□ Edit for conventions (punctuation, spelling, grammar) as always.

MAKE A BLANK DATA TABLE

- ☐ Open an Excel document
- ☐ Make a data table - This is to record the NUMERICAL DATA.
- ☐ All numerical data should be measured using metric units.
- ☐ The data table will vary depending on the experiment, but it should be similar to the general format below:

Results Table

	RV with units			
MV (units if needed)	Trial 1	Trial 2	Trial 3	Average
Level of MV				
Level of MV				
Level of MV				

- ☐ If the RV is measuring something over time (anything that is growing) the data table will need to include dates on the left hand side. See example below:

Results Table

	RV with units															
MV	**level of mv**				**level of mv**				**level of mv**				**level of mv**			
Day	t1	t2	t3	Average	t1	t2	t3	Average	t1	t2	t3	Average	t1	t2	t3	Average

- ☐ NOTE: also collect / record OBSERVATIONS using:
  - scientific drawings,
  - photographs
  - videos
  - written notes

COLLECT THE MATERIALS.

BUILD ANY NECESSARY APPARATUS.

CONDUCT THE EXPERIMENT AND COLLECT THE DATA (MEASUREMENTS IN THE TABLE AND OBSERVATIONS IN WRITTEN LIST FORMAT). (EXPERIMENTS WILL RUN FROM APRIL 9 TO MAY 1) DON'T START BEFORE WITHOUT SPECIAL TEACHER PERMISSION!!

HINT: Remember to take photographs along the way for the display board.

GRAPHS

To see the TRENDS better the numerical data is displayed in a graph. All students are required to do two graphs. Students can ask for help if they do not understand which two graphs they should do.

(i) The first will be a graph over time, or a graph that shows all of the trials.

(ii) The second one will be the final averages of the responding variable.

CHOOSE THE CORRECT TYPE OF GRAPH: To choose which kind of graph will be best determine if your MV is discrete or continuous.

(i) Remember that DISCRETE VARIABLES are "types" or "counts". There are no in-between values. Examples include types of dogs and makes of cars. Counts of things like people that cannot be divided (cannot have half a person) are also discrete. Discrete variables are best represented by BAR GRAPHS.

(ii) CONTINUOUS VARIABLES have values between the ones used in the experiment procedure. Examples include temperature, length, and time. Continuous variables are best represented by LINE GRAPHS or SCATTER GRAPHS

PUT THE DATA IN EXCEL AND USE EXCEL TO CREATE THE GRAPHS. Students will be given "how to" instructions in a handout to help with this. The following criteria are important, and are used when grading/scoring a graph

- ☐ Subheading - Graphs – left align - headings should be one size larger (14).
- ☐ The correct type of graph (line or bar) was chosen.
- ☐ The x and y axes were correctly assigned.
- ☐ Each graph has an appropriate central title (the operational question) that includes both variables. The first letter of every word is capitalized.
- ☐ Appropriate label for the vertical axis with units. The first letter of every word is capitalized.
- ☐ Appropriate label for the horizontal axis with units. The first letter of every word is capitalized.
- ☐ Consistent AND appropriate scale (even interval on the x-axis & y-axis).
- ☐ The graph has a key when appropriate.
- ☐ For a line graph - the points are correctly marked on the graph and a line connects them.
- ☐ For a bar graph the bar heights are accurate and the bars are spaced evenly and correctly labeled for good presentation.
- ☐ The graph is neat and the graph is as large as possible and takes up most of the page.
- ☐ an additional table will be needed for just the averages in order to have Excel make the graphs.

MV (units if needed)	Average RV with units
Level of MV	
Level of MV	
Level of MV	

WRITE THE CONCLUSION – 6 paragraphs

The conclusion is where students interpret the results. Students will write a good conclusion by answering 6 questions in detail (in 6 paragraphs). Some of these answers repeat other parts of the experiment. This will enable someone to understand the experiment just by reading the conclusion.

1. What was the purpose of the experiment? A purpose is written in the format: The purpose of this experiment was to determine how …. (increasing/decreasing) ……the MV……affects……the RV. Restate the hypothesis in the format: The hypothesis was… Also VERY BRIEFLY summarize the procedure in the past tense, just to be able to know what was changed (levels of MV) and what was measured(RV). (3-4 sentences)

2. What was the overall conclusion with all the supporting evidence/results? This is the most important paragraph in the conclusion. See the next page for help with this paragraph. Students have written these many times. (4 sentences)

3. Did the results support or refute the previous project or hypothesis. Explain.

4. What is a possible explanation for the results? Use strong scientific facts. The explanation must make sense and must match the results. This paragraph may be the most difficult for the students to write. They are asked to make their best effort. (Minimum 3 sentences)

5. Discuss 3 specific problems in the experiment procedure and a fix for each. (Like not being able to completely control all the controlled variables). How could these affect the results? Describe how to make improvements to the experimental design and procedure to fix the three specific problems mentioned. (minimum eight sentences)

6. What other related experiments could be done to find out more about the topic? i.e. Give other possible further operational questions that could be investigated. These questions should relate to the explanation of the results in this experiment. (3-4 sentences)

OVERALL CONCLUSION WITH SUPPORTING EVIDENCE/RESULTS

2nd paragraph in the conclusion

Students choose the levels that gave them the highest and lowest results. If students have a graph that shows a minimum or maximum value they need to choose three points on the graph to demonstrate the minimum/maximum. Students can ask for help.

Four sentences **Instruction** Example

Conclusive Statement

Correctly answer the operational or investigative question

In conclusion, when the batteries were charged for a longer time, the flashlight stayed on for a longer time.

Supportive Data for the LOWEST condition

Use the lowest measured value from the data table (use the average)

For example, when the batteries were charged for 30 seconds, the flashlight stayed on for an average of _____ seconds.

Supportive Data for the HIGHEST condition

Use the highest measured value from the data table (use the average)

When the battery was charged for 240 seconds, the flashlight stayed on for an average of _____ seconds.

Explanatory language

Connect or compare the supporting data – use comparative language like, "longer, less than, same as".

Since _____ seconds was longer than _____ seconds, the data showed that the longer the battery was charged, the longer the flashlight stayed lit.

FINAL PARAGRAPH WHEN ALL PUT TOGETHER

In conclusion, when the batteries were charged for a longer time, the flashlight stayed on for a longer time. For example, when the batteries were charged for 30 seconds, the flashlight stayed on for an average of _____ seconds. When the battery was charged for 240 seconds, the flashlight stayed on for an average of _____ seconds. Since _____ seconds was longer than _____ seconds, the data showed that the longer the battery was charged, the longer the flashlight stayed lit.

MAKE THE TITLE PAGE

The title page needs to include:

- A complete name heading. Include the names of both partners if students did not work by themselves.
- The title – the operational question – with proper capitals.
- A colored picture or drawing that relates to the experiment.

WRITE THE SPECIAL THANKS

This is a few short sentences to thank the people who helped with the project. Be as specific as possible.

WRITE THE TABLE OF CONTENTS

This is a list of the parts of the report and their page numbers (see below for the list of the parts that come after the title page and this table of contents). The table of contents should be neat and all of the numbers should line up on the left side of the page. Students will not be sure of the exact page numbers until they have written the entire report. That is why this part is done at the very end.

Table of Contents

Page number (the ones here are for example)

STAPLE THE PAGES OF THE REPORT TOGETHER IN THE TOP LEFT HAND CORNER. LOOK AT PAGE ONE OF THIS PACKET TO SEE WHAT ORDER THE PAGES GO IN. WELL DONE! – YOU ARE FINISHED.