Steps to Creating a Science Research Project

Lesson 1 of 3
**Can be used in conjunction with the following lesson plans:*
Lesson 2 of 3: Scientific Method – How Do Scientists Solve Problems?
Lesson 3 of 3: What is the Effect of Light on Ice?

TOPIC 1 – What are the steps necessary to conduct a science research project?

Georgia Performance Standard:
Characteristics of Science:
SCSh3 a.-f
SCSh4a-b
SCSh6a, c, d
SCSh9b, c

OBJECTIVES
At the end of this lesson, students will be able to:

1. Work in groups
2. Make observations and collect data
3. Graph data
4. Draw a conclusion
5. Present results to class

MOTIVATION – Place two 150 ml beakers on hot plates and using thermometer, measure boiling points of 100 ml of tap water and tap water with table salt.

MATERIALS

Two 150ml beakers	2 (tablespoons) of table salt	
1-2 hot plates	Tap water	Chronometers
2 thermometers	Metric rulers	Calculators

PRESENTATION OF CONTENT

INSTRUCTIONAL STRATEGIES	**TEACHER'S NOTES**	**10 MINUTES**
Motivation – Inquiry question	Conduct motivation procedure. Ask and solicit answers from students: ***Which beaker will reach boiling first: Beaker #1- plain tap water, Beaker #2- tap water with salt?*** -tally responses on a chart. Students follow and answer inquiry activity #1 -have 2 volunteers observe boiling points and state the boiling points of each beaker. ***-Based on your observation of this demonstration, what is the effect of salt on boiling water?***	

	-solicit answers and write on board. Acceptable answers include: NaCl is an ionic compound; ionic bonds require more heat to break. So, it takes more heat to break the bonds. -***What would be the steps involved in designing an experiment?*** 1. Raise a testable question based on prior knowledge. (Write on board) (A testable question is one that can be measured) 2. Draw a hypothesis (A hypothesis is an educated answer that would help explain your choice of response). 3. Gather information about the subject through readings 4. Design an experiment including materials and methods 5. Perform experiment 6. Collect data 7. Analyze data 8. Draw a conclusion based on your observation 9. Document the experiment so others may find out about your results and to repeat the experiment if they wanted to.
	10 MINUTES
Inquiry Activity- Team work, making observations, raising questions	Students break up into groups and conduct inquiry activity #2 Circulate classroom, aid students and answer questions Gather students as a class and discuss student's questions. Emphasis will be placed on questions that can be tested within the boundaries set by the classroom teacher.
	40 MINUTES
Inquiry Activity- Team work, designing experiment, conducting experiment, gathering data, graphing data, drawing a conclusion	Students work in groups and conduct inquiry activity #3 Circulate classroom, aid students and answer questions Gather students as a class and discuss students' observations, experiments and conclusions. Each Group of students communicates their experiences to the class for about 2 minutes. Each group should: 1. State their testable question 2. Explain how they designed their experiment and why they felt that was the appropriate method 3. Present the averaged results 4. Present their conclusion

	5-7 MINUTES
SUMMARY	When conducting science experiments, the scientist has to pay close attention to all factors surrounding the experiment. ***-In our boiling water experiments, several factors could have affected the results. Name some of these factors.*** - Answers should include: - Calibration of thermometers and hot plates - Type of salt used - Air humidity, air pressure, Experiments also raise further questions that are necessary in the scientific world. When an experiment raises other questions, it opens other doors for other researchers to experiment, adding to the body of science. ***What were some other questions raised by the boiling experiment?*** -Answers should include: -When is a liquid considered boiling? -What would happen if a different brand of salt were used? -What would happen if we conduct the same experiment at high altitudes? -Which ions present in tap water may change its boiling point? - Does adding salt to water change the freezing point of water?
	15 MINUTES
	Discussion on science project expectations (read and discuss handout)
	10 MINUTES
Assignment	Assignment – To be handed out to students

HOMEWORK ASSIGNMENT **1**

NAME_____ DATE_____

1. Decide on a chemistry question that you would like to study further. Consider questions that may lead to further studies. Write this question down.
2. Write out a strategy that may test this question. You may include a control, a variable and all materials needed to conduct this experiment.
3. You may include any support material from literature or web sites. Remember, write down the title of the book, author, and year the book was published for printed sources and web site address including the date that you used it.

(A lesson on literature referencing will follow so you can learn how to classify and document them properly)

STUDENT HANDOUT 1

Name _____ Date_____

<u>TOPIC:</u> What are the steps necessary to conduct a science research project?

Activity 1

Two beakers containing tap water and tap water and table salt are placed on hot plates to determine which one will boil faster. Based on prior knowledge, which beaker will boil first?

Your answer:_____

Explain your answer (This is your hypothesis)._____

Actual Results_____

Explanation (actual explanation)_____

NOTES

1. **A science research project is one that _____**

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2. **Steps to a science research project include:**

   a. Raising a testable question based on prior knowledge.
   (A hypothesis may or may not be included)

   b. Gathering information about the subject through readings

   c. Designing an experiment including materials and methods

   d. Performing the experiment

   e. Collecting data

f. Analyzing data

g. Drawing a conclusion based on your observation

h. Documenting the experiment so others may find out about your results and to repeat the experiment if they wanted to.

Refer to these steps when necessary

Activity 2

1. Break up into groups
2. Observe your surroundings. Look for patterns, look for things that make movements, focus on the immediate world around you.
3. Discuss and agree with your group what would be a testable question based on your surroundings. For example, how often does my classmate blink?
4. As a group, decide and write down at least **5** testable questions to share with the class.

Based on our class discussion, what is a testable question?_____

Activity 3

1. Break up into groups
2. As a group, decide on one of the questions you would like to test.
3. Draw a hypothesis
4. Design an experiment that would test your question
5. List all materials and methods necessary to test the question.
6. One of the students should be the recorder of all information
7. Conduct experiment and collect data
8. Create a table or graph that would present your data in an organized way
9. Draw a conclusion based on your observations
10. Present to class (Be prepared to include in your presentation anything that could have affected your results)

STUDENT HANDOUT 2 SCIENCE PROJECT GUIDELINES

Name_____ **DATE_____**

In order to maximize your science experience in this class, a science research project has been assigned as part of your grade. Participation in this activity is quite unique. It gives you the opportunity to conduct research on observations that you may not have answers for. In addition, science projects teach you many useful skills necessary in your academic career.

There are many steps involved in a scientific project. Our aim is to help you succeed in this enormous yet rewarding task. It is important that you follow the recommendations listed and discussed in class in order for you and us to work efficiently.

You may work in groups of two; however, **each** student is responsible for a 5 – 7 page typed scientific paper. No two papers are alike.

I- A scientific paper consists of a well researched topic, a hypothesis, an experimentation process and a conclusion based on your experimentation process.

1. To begin with your research topic, a testable question is raised and literature is read for background information. A visit to the library will give you the opportunity to gather information to support your hypothesis.
2. A minimum of **3 science references** will be required to support your study. References must include at least 2 printed sources.
3. All science projects must follow all steps of the scientific process (unless otherwise instructed).
4. A **reference section** will be included at the end of your paper.

II- Deadlines

The following work is due on these specific dates.

_____ - Assignment #1 is due.
_____ - List of 3 references for topic must be handed in.
_____ - First draft of Introduction and revised List of References is due
_____ - Second draft of introduction is due
_____ - Experimentation strategy is due
_____ - Results are due (tables, graphs and charts)
_____ - Conclusion is due
_____ - First draft of completed project is due
_____ - Second draft of completed project is due

III – Grading System

Your completed project is worth _____ of your grade.
Your project will be graded on the rubric below.

Points / Concept	3	2	1	0
Presentation	•Well-organized •Shows continuity •Double-spaced •12 point font	•Single-spaced •Font too small or too large •Some spelling errors	• Single-spaced •Font too small or too large •Frequent spelling errors	•Cut & Paste •Poor writing •Did not proof-read
Research	•3 or more sources used •Proper referencing (quoting, paraphrasing)	•2 sources used •Source material is irrelevant to topic •Improper referencing	•1 source used •Web sources only •Source material is irrelevant to topic • Improper referencing	•No sources used • Improper referencing
Content	•Well-organized •Answers 3 or more questions	•Centers around 2 or less facts •Not fully thought out	•Facts presented haphazardly •Facts not clearly stated	•Presents no central idea
Analysis	•Comprehensive •Well-structured	•Not fully coherent •Lacking key information	•Topic not clearly explained •Frequent incorrect statements	•No coherence •No original ideas •Ideas taken entirely from sources
Bibliography	•3 or more sources cited •Proper format	•2 sources cited •Incorrect format	•1 source cited •Incorrect format	•No sources cited

To succeed in this project, there are several rules you must follow:

Presentation must be neat, comprehensible and grammatically correct. Paper should be doubled spaced, 12 point size and Roman Times Font.