

Lesson 3.2: Scientific Method 2

Weekly Focus: Scientific Method

Weekly Skill: Conducting an Experiment

Lesson Summary: This week students will conduct an experiment using the steps from the scientific method they studied last week. Please read the list of ingredients below to make sure they are available to conduct the experiment.

Materials Needed:

- [Unit 3.2 Handout 1](#) (4 pages total; adapted from Word Generation – Science Focus Unit 6.1)
- Enough paper bags for table groups with an item in it that students may not know – they will be using observation to make an inference as to what it is.
- [Unit 3.2 Handout 2](#) (5 pages total; adapted from Word Generation – Science Focus Unit 6.1)
- 12 petri dishes (or some sort of dishes to hold ingredients listed)
- 2 - 3 cups of baking soda
- 2 - 3 cups of cornstarch
- 2 - 3 cups of powdered sugar
- 2 - 3 cups of plaster of paris (purchase at craft store or make your own by mixing 3 cups flour with 2 cups of water and stir until no lumps of flour are present – you can substitute white glue for flour and reduce the amount of water)
- 1 - 2 cups vinegar
- 1 - 2 cups water
- iodine
- eye droppers (or pipettes or straws)
- toothpicks, tongue depressors, or something to stir the mixtures

Objectives: Students will be able to...

- Conduct and reflect upon a scientific experiment using the scientific method

College and Career Readiness Standards: RI, RST, WHST, SL

ACES Skills Addressed: N, EC, LS, ALS, CT, SM

Notes: This activity requires materials. Please make sure you have all materials before you begin the experiment. It may be a good idea to make sure students do not have any allergies to the materials used in the experiment (see above).

Assemble ingredients for experiment before class so they can be used with ease. (See Unit 3.2 Handout 1 page 1 for what is needed). Call upon students who arrive early to help set up the experiment. Ask for volunteers to assist with the clean-up, too. Remind students this is for GED 2014 science and so it should be taken seriously.

Lesson 3.2: Scientific Method 2

GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be a short answer portion (suggested 10 minutes) where students may have to summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.

Activities:

Warm-Up:	Time: 10 minutes
As students enter the class, write Step 1, Step 2, Step 3, Step 4, Step 5, Step 6 on the board. Ask students to write what each step is from last week's lesson on the scientific method. Challenge students to see if they can tell each other the order of the steps without referring to their notes. Can they remember the mnemonic device to help them from Andrew Guy's video in Unit 3.1?	

Activity 1: Introduction Experimentation Using the Scientific Method (Unit 3.2 Handout 1)	Time: 30 - 40minutes
<ol style="list-style-type: none"> 1) Explain to students that they will read more about using the scientific method in a real-life setting and then later conduct an experiment. 2) Hand out Unit 3.2 Handout 1 (page 1 – 4 printed back to back) to students. 3) Ask students to read the first page of dialogue between students in order to answer the questions on page 2. 4) Have students turn their papers over and discuss with their group what their section is about. Circulate to make sure students understand the objective and begin the discussion. 5) Before students begin with page 3, hand out the paper bags with item inside. Ask students to make scientific observations about the object in the space provided on page 3. They will have to make an inference based on their observations. When complete, ask for volunteer students to present their observations and inferences to the class. 	

Break: 10 minutes

Lesson 3.2: Scientific Method 2

Activity 2: Science Experiment (Unit 3.2 Handout 2)

Time: 50 minutes

- 1) Put students into groups of 2 – 4 per table and explain to students they have been reading a lot about the scientific method and now it's their turn to conduct an experiment.
- 2) Handout Unit 3.2 handout 2 (5 pages total) to students.
- 3) Explain to students they should read the steps of the experiment (Lab Task 2 on page 2 of 5) and work as a science team to conduct the experiment.
- 4) They can have one or two students mix the liquids with the dry powders while 1 – 2 students write the qualitative and quantitative observations in the appropriate spaces.
- 5) Point out that on page 3 of 5, there is a chart with what the observations will look like depending on the substance. This will help them make their inferences.
- 6) Students should each fill in their own charts on page 4 of 5.
- 7) If there is time, have students review the vocabulary used in scientific experiments and the scientific method on page 5 of 5.

Wrap-Up: Summarize

Time: 5 minutes

Have students turn to a partner (or write in their journals) about what they have learned today about conducting science experiments. They can summarize the steps used in today's experiments or discuss other wonderings they may have about the scientific method. Note: [Use Routine 4 Handout](#)

Extra Work/Homework:

Time: 30 minutes outside of class

Students can review the steps of conducting science experiments at:
<http://www.wikihow.com/Conduct-Scientific-Research>.

Or review material from other units:

Students can look read further about the Scientific Method (Unit 3.1 handout 3) or review previous handouts on this (Unit 1.5 Handout 3 - 6-way Paragraphs, Introductory Level, #74: The Scientific Method (pp. 144 – 145)).

Differentiated Instruction/ELL Accommodation Suggestions

If some student groups finish early, they can practice asking each other about the steps in the scientific method process.

Teachers should be aware that ELLs could have some difficult time with understanding some of the directions in the experiment. Make sure you can support their needs.

Activity

**Handout 1
Unit 3.2**

**Handout 1
Unit 3.2**

Lesson 3.2: Scientific Method 2

Online Resources: <http://www.wikihow.com/Conduct-Scientific-Research>

Suggested Teacher Readings:

- GED Testing Service – GED Science Item Sample (to get an idea of what the test may be like)

<http://www.gedtestingservice.com/itemsamplerscience/>

- Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:

<http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf>

- Minnesota is getting ready for the 2014 GED test! – website with updated information on the professional development in Minnesota regarding the 2014 GED.

http://abe.mpls.k12.mn.us/ged_2014_2

- **Word Generation (SERP)**

http://wg.serpmedia.org/download_files_misc/WG-Sci6.1_student%20copy.pdf

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 1 Page 1 of 4

SCIENCE CLASS SESSION 1

Focus Words:

compare | substance | inference | qualitative | contrast | quantitative

Cassie was sitting in the living room of her grandmother's apartment. Her grandmother had gone out and Cassie was waiting for her friends to come over. The doorbell rang and she jumped up to open the door for Tiana and Huang.

Cassie: Thanks for coming. I forgot my grandma's birthday is tomorrow. I want to bake her a cake as a surprise. She's out for a few hours so we have to work quickly.

Huang: Good thing you called us. I remember the last time you tried to bake a cake. It was awful. Please tell me you have a recipe this time.

Tiana: Give her a break. I'm sure she just needs a little help. Let's go to the kitchen. What's in the recipe?

Cassie: We need flour, sugar, and baking soda. Grandma keeps baking supplies on the third shelf. Huang, can you see the boxes and hand me the right ingredients?

Huang: There are just a bunch of plastic containers and the labels are definitely not in English!

Cassie: Grandma usually speaks Russian. That must be what's on the labels. We'll just have to figure out which box holds which ingredient.

Tiana: How do we do that? What if we mess up? Cassie, you can't even bake a cake when you know what's what!

Huang: Come on. Let's open all of them. I bet we can figure it out.

He took the containers off the shelf, put them on the counter and opened each one. Tiana took two containers and carefully compared them.

Tiana: This is not going to work. The boxes each have a white powder in them. Flour is white and so are baking soda and sugar. Now what?

Cassie: Well, sugar should feel different from flour. Let's see if we can at least figure out which is sugar.

Huang thought this would be a good qualitative observation. Cassie put her hand in the first box and the substance felt rough. In contrast, the powder in the second box felt smooth.

Cassie: I bet the first box is sugar.

Tiana: How can you know? You only tried two boxes. What about the others?

Reader's Theater

Huang agreed that Cassie shouldn't make an inference about the boxes until she had tried all of them. Cassie touched the powders in each box. Only one felt grainy.

Cassie: The first box is definitely sugar.

Tiana: Three boxes to go! What now?

Cassie: Grandma said we were running out of baking soda. Let's look at how much is in each box.

Tiana noticed that while two of the boxes were full, the third was filled only to the line marking one half on the box. Tiana decided the half empty box was baking soda.

Tiana: So which of the boxes left is flour?

Huang: What if we tasted them?

Cassie: NO! NO! NO! My grandma told me once that she sometimes keeps rat poison in the pantry. Don't taste anything!

Tiana: GROSS! I don't want to eat rat poison.

Huang: We've figured out two boxes. There must be other ways we can figure out the last two. Let me think for a few minutes.

Cassie: Think fast because Grandma will be home in two hours!

Being able to carefully make observations in science is very important. You might need to figure out what a mystery substance is or just tell your friend what the weather is like outside. You can make qualitative observations like color, shape and smell. To learn more, sometimes you might have to make quantitative observations like weight or temperature. By observing closely and then making inferences, you can find out all kinds of things about the world. That's what scientists do.

Lesson 3.2: Scientific Method 2

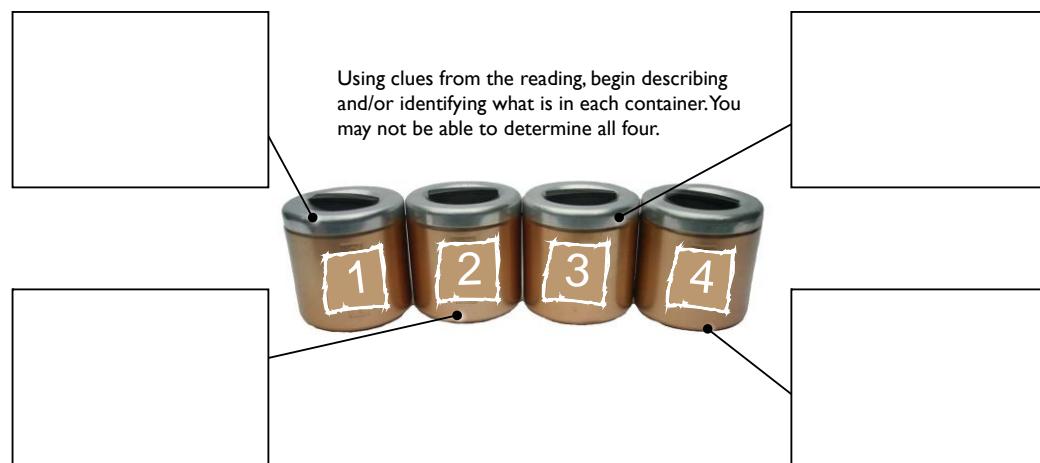
Unit 3.2 Handout 1 Page 2 of 4

Reader's Theater, cont.

Questions about the characters:

1. This person wanted to surprise her grandmother with a cake.
 Cassie
 Huang
 Tiana
2. This person noticed that the labels on the boxes were not written in English.
 Cassie
 Huang
 Tiana
3. This person thought that they could identify the powders by making observations.
 Cassie
 Huang
 Tiana
4. This person was doubtful that they could identify the powders by making observations.
 Cassie
 Huang
 Tiana
5. This person warned the others not to taste anything because of the danger that a powder could be rat poison.
 Cassie
 Huang
 Tiana
6. Which character is most like you?
 Cassie
 Huang
 Tiana

Why? _____



Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 1 Page 3 of 4

SCIENCE CLASS
SESSION 2

Speaking Scientifically

Observation and Inference

Cassie observed that the powder was white and grainy. She then **inferred** that the powder was sugar. But what does that actually mean?

Observation: Basic information you get by seeing, feeling, hearing, tasting, or smelling.

Inference: Something you think is true based on observations.

**Examples of
OBSERVATIONS**

**Examples of
INFERENCES**

The powder is white and grainy.

→ The powder is sugar.

Observations based on:

seeing **feeling** hearing - tasting - smelling

The animal has four legs and barks.

→ It's a dog.

Observations based on:

seeing **feeling** hearing - tasting - smelling

There is a smoky smell outside.

→ The neighbors are having a barbecue.

Observations based on:

seeing - feeling - hearing - tasting **smelling**

Erin is not in class today.

→ Erin has the flu.

Observation based on:

seeing **feeling** - hearing - tasting - smelling



Your teacher is going to present you with an object to practice making observations using your senses.

List the **observations** you make:

After you make several observations, discuss what you observed to see if you are prepared to make an inference.

If you have enough information to make an **inference**, write it here:

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 1 Page 4 of 4

Speaking Scientifically, cont.

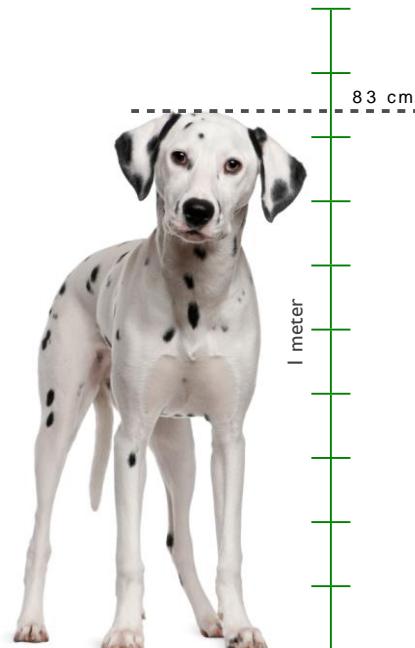
Two types of observations:



Qualitative observations are those that describe the situation using anything that does not use a number or measure. For example, the sun is bright today.



Quantitative observations are those that use a number in the description (weight, time, measurement, number of items, height, volume, etc.) For example, the temperature is 78 degrees Fahrenheit right now.



Practicing qualitative vs. quantitative

Examine the image of the dog above. Can you make some additional observations? If so, write them down and then classify them as qualitative or quantitative.



has four paws

fur is mostly white

Lesson 3.2: Scientific Method 2

Unit 3.2 Page 2 of 4 ANSWER KEY

1. Cassie
2. Huang
3. Huang (he wanted to compare them)
4. Tiana (they are all white powders)
5. Cassie
6. answer will vary – explain answers

Answers may vary: Possible Answers

Container / Box 1 Cassie said the substance felt rough & grainy (possibly sugar)

Container / Box 2 Cassie said the substance felt smooth (possibly flour)

Container / Box 3 Tiana noted it was only $\frac{1}{2}$ full (possibly baking soda)

Container / Box 4 ?? not enough information (possibly rat poison)

Unit 3.2 Page 3 of 4 ANSWER KEY

Answers will vary – depending on what teacher puts into paper bag students will have different observations and inferences.

Unit 3.2 Page 4 of 4 ANSWER KEY

Answers may vary – possible answers below

Qualitative	Quantitative
The dog looks young	Dog stands 83 cm tall
There are no spots on legs	The dog has two ears
The dog looks healthy	The dog has four legs
There are black spots	There are three spots on neck

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 2 Page 1 of 5

In the Lab, cont.

Combining powders with liquids...

Can this provide you more to observe?

LAB TASK #2

Materials:

- › 4 powders
- › 12 little dishes (or pieces of wax paper)
- › plastic spoons or scoops
- › water
- › vinegar
- › iodine
- › eye droppers or plastic pipettes (even straws will work)
- › toothpicks or popsicle sticks for mixing the powder and the liquid

Example of a possible qualitative observation:
- color changes to black.

Possible quantitative observations:
- fizzes for 12 seconds

Procedure:

1. Take a small amount of each one of the powders and place it in a small dish.
2. Add 3 drops of water to each powder.
3. Mix the liquid and the powder together and observe what happens.
4. Write your observations in your table.
5. Repeat steps 1-4 for vinegar and iodine.

POINTER:
→ LABEL EVERYTHING AS YOU GO!

	 Powder #1	 Powder #2	 Powder #3	 Powder #4
 water				
 vinegar				
 iodine				

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 2 Page 2 of 5

In the Lab, cont.

LAB TASK #3

Use the table below to help you determine the identity of each of your mystery powders.

Facts about powders and their reactions with liquids

	cornstarch	baking soda	powdered sugar	plaster of paris
 water		baking soda and water turns white and thick like glue	powdered sugar dissolves in water	plaster of paris and water turns sticky
 vinegar	cornstarch and vinegar turns hard - like a broken cookie	vinegar and baking soda together will bubble		
 iodine	starch turns black when iodine is added	iodine and baking soda turns orange/brown	iodine and powdered sugar turns very sticky	iodine and plaster of paris turns orange

Powder Based on our observation that _____,

#1 we infer that powder #1 is _____.

Powder Based on our observation that _____,

#2 we infer that powder #2 is _____.

Powder Based on our observation that _____,

#3 we infer that powder #3 is _____.

Powder Based on our observation that _____,

#4 we infer that powder #4 is _____.

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 2 Page 3 of 5

SCIENCE CLASS
SESSION 4



To prepare for the meeting:

List two examples of qualitative observations that you made.

List an example of a quantitative observation that you made.

What observation helped you figure out which powder was the baking soda?

Why did you have to do more than one kind of test to figure out which powder was which?

Share your ideas with someone next to you:

Compare your answers. What is the same?

Contrast your answers. What is different?

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 2 Page 4 of 5

SCIENCE CLASS
SESSION 5

Writing Prompt

Focus Words:

compare | substance | inference | qualitative | contrast | quantitative

→ **Several years ago, a member of Congress received a letter that contained a dangerous powder.**

After that, people thought it would be funny to play jokes and put powders in the hallways or bathrooms. Imagine your class is visiting your Congress member in Washington, DC when someone played one of these jokes. Your congressman is stuck in his or her office with your class until the mystery powder in the hallway is identified. He is supposed be in an important meeting and is wondering why it is taking so long to identify the mystery powder. What would you say to the congressman about what is involved in identifying a mystery powder?

In your response, be sure to include:

- The difference between observations and inferences
 - How to do careful observations and what kind of things to look for
 - What qualitative and quantitative observations can tell them
 - Why it is important to do several tests before making an inference
 - The focus words of the week
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 2 Page 5 of 5 - vocabulary review – use in pairs to review science vocabulary

FOCUS WORDS
UNIT 6.1 - SCIENCE FOCUS

Focus Word and definition	Example of use
<ul style="list-style-type: none"> ▶ compare <i>verb</i> – to examine two or more things to tell how they are the same and how they are different in Spanish: comparar 	<p>In English class, we compared the main characters by using a Venn diagram that showed how they were alike and how they were different.</p>
<ul style="list-style-type: none"> ▶ contrast <i>verb or noun</i> – to compare two or more things, focusing only on the differences (verb); the difference between two or more things (noun) in Spanish: contrastar or contraste 	<p>The essay question on the quiz asked us to contrast (verb) the two poems; one was a happy, upbeat poem and the other was a sad, somber poem. Miguel thought the quiz was really easy; in contrast (noun), Shayla thought the quiz was impossible!</p>
<ul style="list-style-type: none"> ▶ substance <i>noun</i> – a physical material that you can see and touch, like a powder or a gel; in Spanish: sustancia 	<p>One of the most common substances that detectives collect at crime scenes is blood because it contains a person's DNA.</p>
<ul style="list-style-type: none"> ▶ inference <i>noun</i> – when you draw a conclusion based on evidence in Spanish: inferencia 	<p>Sven made an inference that his friends were home because he could see lights on in their apartment window.</p>
<ul style="list-style-type: none"> ▶ qualitative <i>adjective</i> – describes observations that do not have numbers; for example: size, color, shape in Spanish: cualitativo 	<p>In science class, my partner Javon collected qualitative data by writing down the color and texture of the 3 different substances.</p>
<ul style="list-style-type: none"> ▶ quantitative <i>adjective</i> – describes observations that use numbers; for example in Spanish: cuantitativo 	<p>I collected quantitative data by measuring the volume and weight of the 3 different substances.</p>

Lesson 3.2: Scientific Method 2

Unit 3.2 Handout 3 (2 pages)

Name _____ Date _____

Scientific Definitions

The scientific method uses specific vocabulary related to each step in the process. Match each term in the word box to its definition.

hypothesis
experiment
data

control
procedure
conclusion

variable
theory

- 1 _____ This is the organized process used to test a hypothesis.
- 2 _____ This is an educated guess about the solution to a problem.
- 3 _____ This refers to the observations and measurements recorded during an experiment.
- 4 _____ This is a factor that changes in an experiment. Proper procedure calls for testing only one of these at a time.
- 5 _____ This is a set of statements or ideas that explain a group of facts or phenomena.
- 6 _____ This is the judgment based on the results of an experiment.
- 7 _____ This is a variable that is kept constant in an experiment.
- 8 _____ This refers to the series of steps taken in order to carry out an experiment.

Lesson 3.2: Scientific Method 2

Name _____ Date _____

The Scientific Method

Scientists study problems and conduct experiments in a variety of ways. However, all use the scientific method. The **scientific method** is an organized way to find answers to a problem. Match each phrase in the word box to an activity that describes it. Then number the descriptions to show the correct sequence for the scientific method.

interpret data
identify the problem

observe and record
arrive at a conclusion

make a hypothesis
test the hypothesis

A

A group of students discusses what they believe will be the outcome of an experiment they are about to conduct. Each student records a statement that will either be proven or disproven by the experiment.

B

Each member of the group carefully watches as the experiment proceeds. One group member writes down the comments of the group as they call out what they see.

C

After the experiment is complete, the group discusses their observations. They review their notes and create a graph that shows the results of the experiment. The group discusses what these findings might mean.

D

Now that the group has decided on a hypothesis, they are ready to proceed with the experiment. As they work, the group is cautious to test only one variable at a time and to follow all directions carefully.

E

The group reviews their notes and the data they have collected. After a short discussion, they decide whether or not the original hypothesis is correct.

F

A science group begins a discussion related to what they have been studying in class. They take turns posing questions they still have about the topic. Together, they decide on an experiment they would like to conduct. They hope the experiment will answer some of the questions they still have.

Unit 3.2 Handout 3

TEACHER ANSWER KEY**Page 1**

1. experiment
2. hypothesis
3. data
4. variable
5. theory
6. conclusion
7. control
8. procedure

Page 2

- A. make a hypothesis; 2
- B. observe and record; 4
- C. interpret data; 5
- D. test the hypothesis; 3
- E. arrive at a conclusion; 6
- F. identify the problem; 1