

**Module: Science**

**Lesson Title: Scientific Inquiry: Which Falls Fastest?**

**Objectives and Standards**

Students will:

- Identify the steps of the scientific inquiry method
- Conduct a physics experiment
- Recognize and understand basic concepts of laws of motion

<b>Science Content</b> <b>2014 GED® Assessment Targets</b>	<b>Science Practices</b> <b>2014 GED® Assessment Targets</b>
<b>Physical Science</b> Recognize and understand the concepts of force, Newton’s Laws, gravity, acceleration due to gravity (e.g., freefall, law of gravitational attraction), mass, and weight.	Comprehending Scientific Presentations (SP.1)  Investigation Design (Experimental and Observational) (SP.2)  Reasoning from Data (SP.3)  Evaluating Conclusions with Evidence (SP.4)

**Materials**

- Calculators
- *Scientific Inquiry - Which Falls Fastest?* Activity Sheet
- Sheets of paper

**Instructional Plan**

*Overview*

In this lesson, students will become familiar with the scientific inquiry method by conducting a simple physics experiment. A step-by-step format is provided to ensure that students explore the process.

*Process*

Begin the lesson by asking students how science is important in their daily lives. Discuss that a major goal of science is to investigate and understand the natural world, to explain events in the natural world, and to use those explanations to make useful predictions. Share with students that they will be taking the role of scientists today as they observe a simple phenomenon of physics.

Review with students the basic terms of inquiry: quantitative data, qualitative data, observation, hypothesis, controlled experiment, controlled variables, and uncontrolled variables.

Divide the class into small groups of three to four students. Provide each group with the *Scientific Inquiry - Which Falls Fastest?* Activity Sheet. Review the expectations of the activity with the class. Share with students that they should follow each step carefully as they create their hypothesis and then test whether or not they were correct.

Debrief the activity by having students share their results with the class. As a class, identify whether other shapes were more aero dynamic and fell more quickly than those indicated on the sheet.

#### *Sample Debriefing Questions*

Have students answer the following questions regarding their experiment:

- Which paper shape fell fastest? Slowest? Why?
- What types of shapes did you also use to view similarities and differences in falling rate? Which were slower? Faster? Why?
- Would weight impact whether or not an item fell faster or slower? Example: What would happen if you dropped an orange and a grape from the same height at the same time? Why?
- What variables impact the speed of a falling object? Why?
- What law(s) of physics were you able to prove or disprove through your experiment?

#### **Assessments/Extensions**

Have students use the scientific inquiry method to prove or disprove hypothesis through creating different types of experiments. Make sure that students complete a science inquiry sheet as they observe, form a hypothesis, conduct an experiment, and then determine the accuracy of their prediction. A sample Science Inquiry Form is located at the end of this lesson.

Sample experiments and videos of experiments can be found via a search of the World Wide Web. Sites to start your exploration for experiments to use in the classroom are:

- **Newton's Apple.** NEWTON'S APPLE is a production of Twin Cities Public Television from a grant from the 3M Foundation. The site is filled with free videos for use in many different areas. <http://www.newtonsapple.tv/>
- **Steve Spangler.** This site has lots of free experiments and videos for use in the classroom. <http://www.stevespanglerscience.com/lab>
- **Edible/Inedible Experiments.** Lots of experiments which are easy to use in any type of classroom. <http://www.madsci.org/experiments/>
- **Home Experiments.** The name says it all as most products for these experiments are found in one's home. <http://scifun.chem.wisc.edu/HOMEEXPTS/HOMEEXPTS.HTML>
- **TryScience/New York Hall of Science.** Experiments online and with directions. Fun activities for all types of science. <http://www.tryscience.org/>

### Scientific Inquiry – Which Falls Fastest?

Which shape of paper falls fastest: An unfolded sheet of paper, a paper folded in fourths, or a sheet of crumpled paper? Or can you create a different shape with paper that falls even faster?

**Make Your Plan:**

What is your independent (manipulated variable)?	
What is your dependent (responding) variable	
What is your question?	
What is your hypothesis?	If, then . . .
What are the constants? (name at least 3)	

**Data:**

Identify your dependent and independent variables for each trial.

- Independent variables are the variables that are changed in a given model or equation. One can also think of them as the 'input' which is then modified by the model to change the 'output' or dependent variable.
- Dependent variables are considered to be functions of the independent variables, changing only as the independent variable changes.

Dependent Variables \_\_\_\_\_

Independent Variables \_\_\_\_\_

	Unfolded paper	Paper in Fourths	Crumpled Paper	Unique Shape
Trial 1				
Trial 2				
Trial 3				
Trial 4				
Average				

**Calculations: Show work below:**

Average for \_\_\_\_\_ paper:  
 \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_ ÷ 4 =

Average for \_\_\_\_\_ paper:  
 \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_ ÷ 4 =

Average for \_\_\_\_\_ paper:  
 \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_ ÷ 4 =

Average for \_\_\_\_\_ paper:  
 \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_ ÷ 4 =

Find your largest difference:

\_\_\_\_\_ paper fell in the slowest average time which was \_\_\_\_\_s.

\_\_\_\_\_ paper fell in the fastest average time which was \_\_\_\_\_s.

The difference between these two number (use subtraction) is = \_\_\_\_\_s

Is this Qualitative or Quantitative Data? Why?

**Conclusion:**

Based on the data from my experiment, I reject or accept the hypothesis that (Restate your hypothesis  
WORD FOR WORD) \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_.

The evidence to support this is that the average time for an unfolded piece of paper was \_\_\_\_\_ s, for a  
sheet folded in fourths was \_\_\_\_\_s, and a crumpled sheet of paper was \_\_\_\_\_s. The difference between  
the \_\_\_\_\_ piece of paper and \_\_\_\_\_ piece of paper was \_\_\_\_\_s. This difference  
does or does not seem significant to me. Therefore, I conclude that \_\_\_\_\_ paper  
\_\_\_\_\_.

### Inquiry Method Recording Sheet

Step 1 – Observations, Questions, and Hypotheses	
Observations	Questions
Hypothesis If . . .  Then . . .	
Step 2 – Scientific Testing	
Investigation & Data	
Step 3 – Analysis and Conclusion	
Discuss data & draw conclusion	
Step 4 - Communication	
We communicated our results by	