



Gyrocopter Drop: Understanding Scientific Phenomena

Students will work with a partner to understand rotary motion and the scientific phenomena in this world by dropping paper loops and gyrocopters from varying heights.

LESSON PLAN

Learning Objectives:

The students will:

- Discern that science is a way of knowing
- Learn that the universe is a vast single system in which basic laws are consistent
- Learn that natural laws operate today as they did in the past and will in the future
- Identify science as both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge
- Build a paper loop and a gyrocopter
- Successfully fly the paper loop and gyrocopter

Purpose:

This class is designed to give students the opportunity to practice, observe, and analyze rotational motion with the use of gyrocopters and paper loops. Students will learn scientific phenomena and how science has natural laws that apply to everyday life. Lessons for understanding natural systems and processes will be taught to aid in the hopes of students expanding their knowledge of science. Students will understand that science is a way of knowing that is consistent throughout time and will always be with us in this world.

Introduction:

Students will use a self-made gyrocopter and paper loop and test different variables to obtain and analyze data. After the gyrocopter and paper loop is constructed, the student will drop it from a chair several times. Students will change the direction and weight of the blade to determine different variables. The gyrocopter and paper will then be dropped again several times. Without realizing that the students are using the scientific approach to experimentation, they will begin to understand that science is way of knowing through the use of continuous and defined processes. At the end of the experiment, the students will then be able to change other variables, such as the height of the gyrocopter and paper loop, to test other variables.

Grade Level: 1 – 2

[Ohio Learning Standards/Science \(2018\)](#)

Expectations for Learning

[Nature of Science:](#)

[Scientific Inquiry, Practice, and Applications](#)
[Science is a Way of Knowing](#)

Physical Science

[1.PS.2:](#) Objects can moved in a variety of ways

[2.PS.1:](#) Forces change the motion of an object

[Ohio Learning Standards/Mathematics \(2017\)](#)

Ohio Standards for Mathematical Practices

[MP.2:](#) Reason abstractly and quantitatively

[MP.3:](#) Construct arguments and critique

[MP.6:](#) Attend to precision

[MP.8:](#) Look for repeated reasoning

Operations and Algebraic Thinking

[1.OA.3:](#) Apply properties of operations

[1.OA.5:](#) Relate counting to addition & subtraction

Measurement & Data

[1.MD.4:](#) Organize, represent and interpret data

[2.MD.9:](#) Generate measurement data

[2.MD.10:](#) Organize, represent, and interpret data

Materials Required:

- Gyrocopter template (page 8)
- A piece of paper (1" x 8½") for each flying paper loop
- A piece of paper (1½" x 8½") for each gyrocopter
- Paper clips (for added weight)
- Pencil
- Paper
- Scissors

Procedure:

A. Warm-up

1. Give a short lesson on the four forces of flight and explain how airplanes and helicopters fly. (See page 7 for lesson facts)
2. Review the organization and recording of data.

B. Activity I

1. Construct the paper loop by using a strip of paper about 1 inch by 8.5 inches. On both ends of the paper (width side), mark about 1 inch down from the top.
2. With this mark, make two small cuts on diagonal ends of the paper. Do not cut all the way through. (Disclaimer: a small cut on one left side will be the same on the diagonal end of the paper)
3. Bend the paper (but do not crease it) so the two cuts fit into each other.
4. To fly the paper loop, hold it high above your head and drop it. As it falls it will start spinning and look like a blimp. Spinning makes it stable in the air.
5. Determine if the paper loop spins clockwise or counter-clockwise.
6. Write and record data and observations.

C. Activity II

1. Construct the paper gyrocopter using the gyrocopter template on page 8. Cut on the solid black lines. Fold on the dotted line at "A" so the fold does not cover the name. Fold on the dotted line at "B" so the fold does not cover the name. Fold on the dotted line at "C" so the fold does not cover the name. Now, fold on the dotted line at "D" so the fold does not cover the name and fold on the dotted line at "E" so the fold covers the name.
2. Bring the two "wings" up so they are perpendicular to the ABC section.
3. To fly the paper gyrocopter, hold it over your head and drop it. It will glide to the floor spinning.
4. Determine if the paper gyrocopter spins clockwise or counter-clockwise.
5. Now fold "D" so it covers the name and "E" so it does not cover the name.
6. Determine if it spins clockwise or counter-clockwise.
7. Add a paper clip near the fold at "C."
8. Write and record data and observations.

D. Wrap-up

1. You have just performed a simple experiment. The world around us is based on evidence from experimentation and observations.
2. You also made a prediction about the direction of the spin of the blades. Science and its components are said to be based on observable phenomena and empirical (factual) evidence.
3. This experiment was considered a fair test because all variables but one were kept constant. It is said that objects and events on this world occur in consistent patterns that are understandable through variable measurement and observation.
4. The experiment gave us reliable results because we tested our gyrocopters with repeated trials, but you should also carefully consider and evaluate all data including any outliers.
5. Next, experiment with gyrocopters of different mass, size, and material. This shows that our continual process and understanding of scientific knowledge is always growing over the years.
6. Answer the “Questions About Understanding Scientific Phenomena” on page 5.

Assessment/Evaluation:

Students will be evaluated on their observations and their responses to the questions about understanding scientific phenomena.

Resources:

Scientific Phenomenon:

<https://study.com/academy/lesson/scientific-phenomenon-definition-explanation-examples.html#:~:text=Explained%20Scientific%20Phenomena,-Contrary%20to%20popular&text=If%20something%20can%20be%20observed,it%20is%20a%20scientific%20phenomenon.>

Variables in Science:

<https://www.thoughtco.com/understanding-variables-in-science-609060>

Rotary Motion:

<https://www.sciencedirect.com/topics/engineering/rotary-motion>

Gyrocopters:

https://www.exploratorium.edu/science_explorer/roto-copter.html

Four Forces of Flight:

https://www.nasa.gov/audience/foreducators/k-4/features/F_Four_Forces_of_Flight.html#:~:text=The%20four%20forces%20are%20lift,made%20the%20Frisbee%20slow%20down.

How Airplanes Work:

[https://www.ct.gov/kids/cwp/view.asp?a=2731&q=330926#:~:text=Airplanes%20fly%20because%20they%20are,of%20the%20engine\(s\).](https://www.ct.gov/kids/cwp/view.asp?a=2731&q=330926#:~:text=Airplanes%20fly%20because%20they%20are,of%20the%20engine(s).)

How Helicopters work:

<https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-a-helicopter-58.html>

Name _____

QUESTIONS ABOUT UNDERSTANDING SCIENCE PHENOMENA (*Hint: Look at Lesson Plan*)

1. What two pieces of evidence is the world based around?

2. What two things are science and its components based on?

3. In what type of pattern do objects and events occur on this world?

4. True or False: After conducting an experiment, even with repeated trials, one should carefully consider and evaluate all data including any outliers.

True/False

5. True or False: Our understanding of scientific knowledge is done once we have completed all of our years in school.

True/False

6. True or False: The natural laws that operate and surround us in the world today will always be here, even in the future.

True/False



Name _____

QUESTIONS ABOUT UNDERSTANDING SCIENCE PHENOMENA (*Hint: Look at Lesson Plan*)

1. What two pieces of evidence is the world based around?

Experimentation and observations

2. What two things are science and its components based on?

Observable phenomena and empirical (factual) evidence

3. In what type of pattern do objects and events occur on this world?

Consistent

4. True or False: After conducting an experiment, even with repeated trials, one should carefully consider and evaluate all data including any outliers.

True/False (True)

5. True or False: Our understanding of scientific knowledge is done once we have completed all of our years in school.

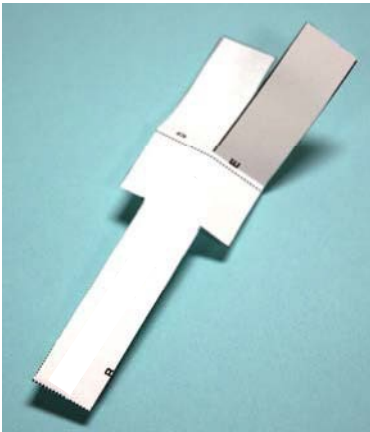
True/False (False)

6. True or False: The natural laws that operate and surround us in the world today will always be here, even in the future.

True/False (True)

Four Forces of Flight & More

1. The four forces of any flying object (ex: airplane) are lift, thrust, drag, and weight.
 - a. Lift is the force that holds an airplane in the air. The wings create most of the lift used by airplanes.
 - b. Thrust is a force that moves an aircraft in the direction of the motion. It is created with a propeller, jet engine, or rocket. Air is pulled in and then pushed out in an opposite direction. One example is a household fan.
 - c. Drag is the force that acts opposite to the direction of motion. It tends to slow an object. Drag is caused by friction and differences in air pressure. An example is putting your hand out of a moving car window and feeling it pull back.
 - d. Weight is the force caused by gravity.
2. The way the four forces act on an object makes the object do different things. Each force has an opposite force that works against it.
3. Helicopters are similar to airplanes, their rotor blades are wings and create lift. A helicopter moves air over its rotor by spinning its blades. This causes the helicopter to lift above the ground and move up or down.



1. Cut on the solid black lines. Fold on the dotted line at “A” so the fold does not cover the name. Fold on the dotted line at “B” so the fold does not cover the name. Fold on the dotted line at “C” so the fold does not cover the name. Now, fold on the dotted line at “D” so the fold does not cover the name and fold on the dotted line at “E” so the fold covers the name.
2. Bring the two “wings” up so they are perpendicular to the ABC section.
3. To fly the paper gyrocopter, hold it over your head and drop it. It will glide to the floor spinning.
4. Determine if the paper gyrocopter spins clockwise or counter-clockwise.
5. Now fold “D” so it covers the name and “E” so it does not cover the name.
6. Determine if it spins clockwise or counter-clockwise.



1. Cut on the solid black lines. Fold on the dotted line at “A” so the fold does not cover the name. Fold on the dotted line at “B” so the fold does not cover the name. Fold on the dotted line at “C” so the fold does not cover the name. Now, fold on the dotted line at “D” so the fold does not cover the name and fold on the dotted line at “E” so the fold covers the name.
2. Bring the two “wings” up so they are perpendicular to the ABC section.
3. To fly the paper gyrocopter, hold it over your head and drop it. It will glide to the floor spinning.
4. Determine if the paper gyrocopter spins clockwise or counter-clockwise.
5. Now fold “D” so it covers the name and “E” so it does not cover the name.
6. Determine if it spins clockwise or counter-clockwise.