Flights of Fantasy Grade 6

Newton's Laws, Flight, Flying Animals

CLASSROOM BEGINNINGS LEARNING PACKAGE

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Flights of Fantasy Grade 6

Newton's Laws, Flight, and Flying Animals

Introduction

How is natural flight possible? Birds, insects, and some mammals fly, but how? During the *Flights of Fantasy Curricula Experience,* students will explore Newton's 3 Laws of Motion and apply their understanding in the context of natural flight. Students will have the opportunity to experiment, to perform, to collaborate, to inquire and to play with aspects of Newton's Laws as they relate to birds, bees, and flying squirrels. Furthermore, this inter-curricular hands-on series of lessons will have students as architects of flight, designing airplanes and ornithopters.

How to Use this Resource

The Flights of Fantasy Curriculum Package has 3 Components:

Part 1. Classroom Beginnings: Recommended for use in the classroom prior to the Flights of Fantasy Field Experience.
Part 2. The Flights of Fantasy Field Experience Curriculum: A facilitated curricular experience.
Part 3. Classroom Culminations: Recommended for use in the classroom following the Field Experience.

Flights of Fantasy Grade 6: Content & Curricular Competencies

Science	Newton's 3 Laws of Motion Effects of balanced and unbalanced forces in daily activities Force of Gravity	Demonstrate a sustained curiosity about a scientific topic or problem of personal interest Make observations in familiar or unfamiliar contexts Identify questions to answer or problems to solve through scientific inquiry Make predictions about the findings of their inquiry Contribute to care for self, others, and community through personal or collaborative approaches Co-operatively design projects Transfer and apply learning to new situations
Applied Design, Skills, and Technology	Techniques for using images, sounds, and text to communicate information, settings, ideas, and story structure	Identify and use appropriate tools, technologies, and materials for production Select, and as needed learn about, appropriate tools and technologies to extend their capability to complete a task
Physical Education	Participate in different types of physical activities, including individual and dual activities, rhythmic activities, and games	Develop and apply a variety of movement concepts and strategies in different physical activities Develop and demonstrate safety, fair play, and leadership in physical activities

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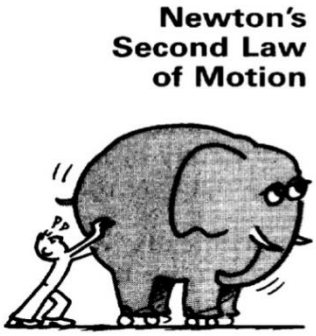
About the Flights of Fantasy Classroom Beginnings

This series of lessons will introduce students to Sir Isaac Newton and his Laws of Motion through project-based learning and hands-on science. Lessons include an engaging experiment to accompany each of Newton's Laws as well as a unit review in the form of Jeopardy. This introduction to Newton's 3 Laws of Motion will support students as they relate the Laws of Motion to natural flight during their Field Experience.

Lessons in this Resource

The Flights of Fantasy Classroom Beginnings Learning Package has 5 lessons:

Important Vocabulary
Lesson 1: Who is Sir Isaac Newton?
Lesson 2: Ball Drop and the Law of Inertia
Lesson 3: Craters
Lesson 4: Balloon Rockets
Lesson 5: Review: Jeopardy and Newton's 3 Laws



Important Vocabulary

force: A push or a pull action on an object.

inertia: The tendency for objects in motion to stay in motion, and objects at rest to stay at rest, unless acted upon by an outside force.

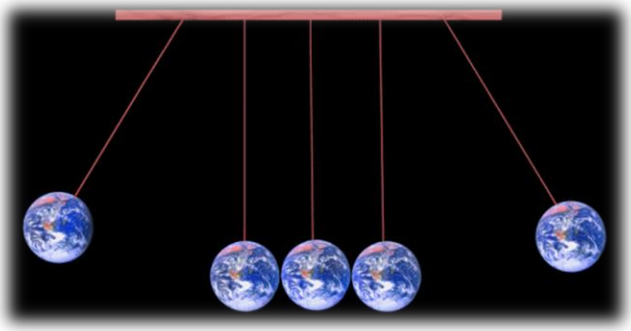
friction: The resistance an object meets when moving over a surface or through a gas or liquid; it is the force that resists the motion of two surfaces that are touching each other.

mass: The amount of matter in an object, which is measured in grams (g) or kilograms (kg).

acceleration: A change in an object's velocity (speed) over time (from not moving to moving, or from moving quickly to moving slowly or stopping).

velocity: How far an object travels in a certain direction over a period of time.

gravity: The force of attraction which the earth exerts on objects on or near its surface, pulling them downwards. It is also the force of attraction between any two objects.



Newton's Laws, Flight, and Flying Animals

Lesson 1: Who is Sir Isaac Newton?

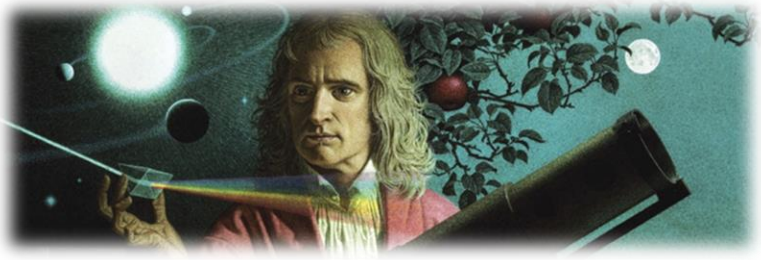
Background
During this lesson, students have the opportunity to explore the life of Isaac Newton. Students use reference books and the Internet to investigate Newton's life. Following group discussion and individual research, students create a slide of an aspect of Isaac Newton's life. The class will create a slideshow presentation and students will deliver it to another class or parents.

Objective
Students will use reference books and the Internet to research contributions to science made by Isaac Newton. Students will develop key words to use for Internet searches. Students will edit work to refine grammar and spelling. Students will create a slide that will be incorporated into a presentation for the class. Students will practice and present a slideshow.

Time: 120 Minutes

Materials: Reference books and other print materials on Sir Isaac Newton.

Technological Materials: Computers, Internet, and Powerpoint



Procedure

1. Introduce the lesson and create interest by asking what students know about Isaac Newton. Most often they will say he discovered gravity by having an apple fall on his head. Some know he was "Sir" and that he was smart. Write all answers on the board, overhead, or chart paper.

2. Ask students where they might go to find information on Isaac Newton. The most common answer is the Internet, so ask where else. Have reference books hidden from view. When someone mentions books, reveal related reference books and hand them out (ideally having 1 for each student).

3. Check for understanding of using reference books by asking how information is found in books. For example, words are arranged in alphabetical order in the dictionary. Another response might be that the index would have topics listed alphabetically.
   Ask what they might look up to find Isaac Newton (i.e., which topic he is associated with, which volume in the encyclopedia or what keyword to use on the Internet). When students have suggested several good ways, have students open their books and find information on Isaac Newton.

4. When all students have some information on Newton, have them share an item they learned with the class. Write all answers on the board including key words used. This gives more ideas on places to find information and key words to use.

5. Divide the class into groups of 3 or 4. Hand out copies of the "Isaac Newton Facts Sheets" (see Appendix 1). This sheet will be used to guide each group in their research about Newton. Each group is assigned one topic to research about Newton's life. Give each group 1 topic and have them be responsible for that same section of the slideshow the class will assemble. Show the class the teacher-prepared slide show (see attached). This slideshow demonstrates what is expected of each group.

6. Explain the rubric which will be used to evaluate their work. Students will need to do more research on their topic to make their slides complete. Provide a copy of rubric to all (see Appendix 2).

Lesson 1: Who is Sir Isaac Newton? (continued)

Procedure (continued)

7. After students have used the reference books, allow them to visit the following sites to gather more information on Isaac Newton.

(Sir Isaac Newton) *This site provides details about Newton's life.*
https://www.ducksters.com/biography/scientists/isaac_newton.php
(Newton's Laws of Motion) *This site informs students about Newton's 3 Laws of Motions.*
http://www.physics4kids.com/files/motion_laws.html

8. Once all research is complete, have students complete their slides. When slides are complete, combine into one slideshow by copying and pasting. Have each group help assemble and add the appropriate hyperlinks and animation so the show will flow smoothly.

9. Discuss Newton's life. Ask what they have learned about him they did not know before. After hearing answers from all students, ask what they noticed about Newton's discoveries (it does not take them long to notice that Newton built on other's ideas and gave more accurate explanations).

10. Have students practice presenting the completed slideshow. Make appointments and have students present the show to either parents or other classes.

Assessment
Using the accompanying rubric (see Appendix 2), have students self-assess their contribution to the presentation. If time, meet with each student to discuss any discrepancies you may have between their self-assessment and your own.

Alternative Introductory Lesson Plan on Isaac Newton
If time does not allow, the following video clip summarizes Newton's life and his contribution to science and mathematics, in a playful and engaging fashion: https://www.youtube.com/watch?v=1vTbtna25j8

Newton's Laws, Flight, and Flying Animals

Lesson 2: Ball Drop & The Law of Inertia

Introduction

Students will learn about Newton's Laws of Motion by pushing, pulling, rolling, dropping, and bouncing two balls.

Objective

To begin to understand Newton's Laws of Motion.
To compare balls of different masses to determine the difference in accelerative force.

Time 10-15 Minutes

Materials

- 2 balls of different masses (e.g. tennis, soccer, basket, volley, rubber, or whiffle!)

Procedure

1. Begin by asking students questions such as:

   - What starts or stops the movement of a ball?
   - What is a force?
   - What kind of force is being applied to you all the time?
   - What is friction? Rub your hands together — what happens?
   - What kind of energy is produced when two objects rub against each other?

2. Demonstrate, or get kids to demonstrate the following with the balls, and compare and contrast the effects of your actions on the two different masses.
   - Push or pull the balls to make them roll to the right or left.
   - Push the balls with a little or a lot of force.
   - Drop the balls from the same height.
   - Drop the balls from different heights.
   - Roll the balls down a ramp, or send them up a ramp.
   - Cover the ramp with a cloth and see how that affects the movement of the balls.

3. Ask questions to start a discussion on forces and Laws of Motion. Encourage students to ask questions, make predictions, and discover the conclusions themselves.
   - When comparing two balls, how much force do you need to apply to each ball to get it rolling? Which one is easier to stop?
   - What do you learn by trying to get both balls moving at the same speed? How much force do you apply to each? What does that tell us about the effect of more or less force on the movement of the balls?
   - Which ball do you think will hit the ground first when you drop them from the same height?

4. Explain to students that this activity demonstrates Newton's 1st Law of Motion:

The 1st Law of Motion: The Law of Inertia
Unless an external force (i.e. a push or a pull) is applied,
an object in motion, stays in motion
and an object at rest, stays at rest.

Lesson 3: Craters & The 2nd Law of Motion

Background
Because gravity's acceleration is constant, all objects fall at the same rate regardless of their mass.

Objectives

Materials

- A rock
- Wadded up Piece of Paper
- 2 Bowls
- Powdered Sugar or Flour

Procedure

1. Collect a rock and a wadded up piece of paper. Test gravity's constancy by dropping both items simultaneously and watching them fall at the same speed.

2. Now place a bowl filled with powdered sugar or flour underneath the rock.

3. Drop the rock from a fixed height into the powder. Set the bowl to the side, being careful not to disturb the powder in it.

4. Drop the ball of paper from the same height into a bowl with the same amount of the same powder.

5. Compare the craters in the powder created by each impact.

6. Because acceleration was constant, the difference in size between the crater made by the rock and the one made by the paper illustrates that an increase in mass directly increases the force of the impact into the flour.

7. Explain to students that this activity demonstrates Newton's 2nd Law of Motion:

The force exerted by a moving object is equal to its mass times its acceleration in the direction from which it is pushed, stated as F=ma.

Lesson 4: Balloon Rockets & the 3rd Law of Motion

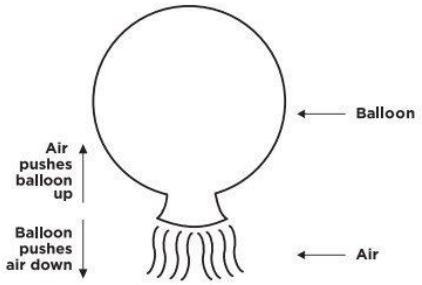
Introduction
Students learn about Newton's Third Law by making balloon rockets.

Background
Using a balloon, we can create a good demonstration for the type of propulsion that moves a rocket. When we inflate a balloon, we fill it with a pressurized gas (air). When we let go of the end, the air rushes out and pushes against the air around the balloon to move it in the opposite direction.

Newton describes this effect in his third law of motion: for every action, there is always an equal and opposite reaction. The gas rushing out of the rocket or balloon is the action and the movement of the object in the opposite direction is the reaction.

Because balloon openings are wobbly, the flight path of a balloon is wobbly, too. The air escaping the balloon (the action) pushes out in every which way and the reaction of the balloon is to move in every which way, too.

One way to stabilize the direction of the balloon is to attach it to a simple track made of string. Once attached to a straight path, it's easier to see the direct relationship between the size of the action (the amount of air escaping the balloon at once) and the resulting size of the reaction (the distance the balloon travels).



Objectives

- Explore and demonstrate the effects of action and reaction forces.
- Apply their understanding of forces and their effect on objects to manipulate the flight of toy rockets.

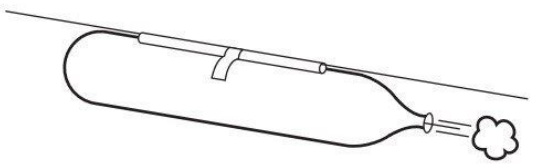
Materials

Per pair or group of students:

- a balloon
- 3 m length of string (thin enough to thread through a straw - fishing line works well)
- one straw
- some tape

Procedure

1. Put students in pairs or small groups and have them try the following:
2. Tie or tape one end of the string to a desk, a post, or the wall.
3. Thread the straw onto the string. One person holds up the free end of the string so that it runs parallel to the ground. They should hold the string taut.
4. Blow up a balloon and pinch the end shut to stop the air from escaping. Don't tie it off!
5. Without letting any air out, tape the blown-up balloon to the straw with the mouth end facing you (and the person holding the string).
6. Release the balloon, and see how far it goes!



Teacher Tip: If you're working with a younger groups, set up the strings with the straws before the start of the activity.

Lesson 4: Balloon Rockets (continued)

Procedure (continued)

7. Discuss observations using the following questions:

- What is the force causing the balloon to go forward? In what direction is that force?
- Can you suggest any ways that we can make the balloon travel further along the string? Try a few out!
- What do you predict would happen if you change the size or shape of the balloon?
- What makes the balloon stop?

8. Explain to students that this activity demonstrates Newton's 3rd Law of Motion:

For every action there is always an equal and opposite reaction.

9. Share with students that Newton's 3rd Law of Motion also helps birds to fly. Ask students what they think is the relationship between Newton's 3rd Law and birds flying. (Answer: The wings exert a downward force on the air. The air also exerts an equal and opposite force which pushes the bird upwards. This action reaction combination helps birds to fly in the air).

Lesson 5: Newton's Laws of Motion Jeopardy Review

Background

This is a fun way to review Newton's 3 Laws of Motion and the associated vocabulary.

Procedure

1. Divide the class into 2 teams.
2. Using the following link, have a team begin by picking a category and a point value. https://jeopardylabs.com/play/newtons-laws-of-motion-review3
3. Click on the chosen box for the question.
4. Students must give the answer in the form of a question. The teacher may want to set a time limit for answering the question.
5. To see if a group is correct, click the spacebar for the answer.
6. If the student or team is correct, they are awarded the point value of the question. (Click the "+ or -" button associated with that team.
7. Click the "ESC" button on the slide to return to the main board.
8. The dollar values disappear after each question.
9. Continue until all questions have been answered. The team with the most points wins

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Video Resources:

Newton's 1st Law of Motion: https://www.youtube.com/watch?v=LEHR8YQNm_Q
Newton's 2nd Law of Motion: https://www.youtube.com/watch?v=ZvPrn3aBQG8
Newton's 3rd Law of Motion: https://www.youtube.com/watch?v=EgqcGrB3re8

Appendix 1

Isaac Newton Facts Sheet

Directions: Using reference books and the internet, find the following information about Sir Isaac Newton. Write your answers in point form.

Names of Group Members:

Group A. His Life

1. Birth
    a. Date
    b. Place
2. Family
    a. Father
    b. Stepfather
    c. Mother
    d. Who raised Newton?
3. Education
    a. Elementary School
        i. What event in school made him a good student?

    b. High School

    c. University
        i. Name
        ii. Date
        iii. What happened to shorten his stay at school?

        iv. What subject was he hired to teach at Cambridge?
4. Farm
    a. Interesting information

    b. Special skills and interests
5. Love
    a. Sweetheart's name
    b. What happened?

Newton's Laws, Flight, and Flying Animals

Isaac Newton Facts Sheet

Directions: Using reference books and the internet, find the following information about Sir Isaac Newton. Write your answers in point form.

Names of Group Members:

Group B. Scientific "Discoveries"

1. Color
    a. Equipment used to bend light by Newton
        i. Explain how it works

        ii. What did Newton expect to happen when he passed sunlight through the window shade and the prism?

        iii. What did he actually see?

    b. Colors identified in Newton's spectrum

    c. Draw Newton's color wheel

2. Telescope
    a. What other "discovery" led Newton to revise his ideas on the telescope?

    b. What group asked him to join them after seeing his telescope?

    c. What was the name of the president of this group who disagreed with Newton's explanation of light?

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Isaac Newton Facts Sheet

Directions: Using reference books and the internet, find the following information about Sir Isaac Newton. Write your answers in point form.

Names of Group Members:

Group C. Scientific "Discoveries" 2

1. Telescope
    a. What other "discovery" led Newton to revise his ideas on the telescope?

    b. What group asked him to join them after seeing his telescope?

    c. What was the name of the president of this group who disagreed with Newton's explanation of light?

2. Gravity
    a. What event started Newton thinking about gravity?

    b. What is the name of the German scientist whose work on explaining planetary motion Newton built upon?

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ISAAC NEWTON FACTS SHEET

DIRECTIONS: USING REFERENCE BOOKS AND THE INTERNET, FIND THE FOLLOWING INFORMATION ABOUT SIR ISAAC NEWTON. WRITE YOUR ANSWERS IN POINT FORM.

NAMES OF GROUP MEMBERS:

Group D. Scientific "Discoveries" 3

1. Laws of Motion
    a. What is the name of the book he wrote with Laws in it?

    b. State 1st law of motion

        i. Scientist Newton credits this law with…

        ii. What is the other name of this law?

    c. State 2nd law of motion

        i. Scientist Newton credits this law with…

        ii. What is the mathlike equation of this law?

    d. State 3rd law of motion

        i. Scientists Newton credits this law with…

        ii. What is the natural phenomena explained by his laws?

ISAAC NEWTON FACTS SHEET

DIRECTIONS: USING REFERENCE BOOKS AND THE INTERNET, FIND THE FOLLOWING INFORMATION ABOUT SIR ISAAC NEWTON. WRITE YOUR ANSWERS IN POINT FORM.

NAMES OF GROUP MEMBERS:

Group E. Mathematical Discoveries

1. Calculus
    a. Definition
    b. What is calculus used for?
    c. What was the name of the German scientist who also explained things with calculus
2. General Conclusions about Newton

Newton's Laws, Flight, and Flying Animals

Appendix 2: Multimedia Project : Isaac Newton

Group Members: _____ _____

Student Name: _____

CATEGORY	4	3	2	1
Oral Presentation	Interesting, well-rehearsed with smooth delivery that holds audience attention.	Relatively interesting, rehearsed with a fairly smooth delivery that usually holds audience attention.	Delivery not smooth, but able to hold audience attention most of the time.	Delivery not smooth and audience attention lost.
Attractiveness	Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation.	Makes good use of font, color, graphics, effects, etc. to enhance to presentation.	Makes use of font, color, graphics, effects, etc. but occasionally these detract from the presentation content.	Use of font, color, graphics, effects etc. but these often distract from the presentation content.
Organization	Content is well organized using headings or bulleted lists to group related material.	Uses headings or bulleted lists to organize, but the overall organization of topics appears flawed.	Content is logically organized for the most part.	There was no clear or logical organizational structure, just lots of facts.
Content	Covers topic in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are 1-2 factual errors.	Content is minimal OR there are several factual errors.
Mechanics	No misspellings or grammatical errors.	Three or fewer misspellings and/or mechanical errors.	Four misspellings and/or grammatical errors.	More than 4 errors in spelling or grammar.
Requirements	All requirements are met and exceeded.	All requirements are met.	One requirement was not completely met.	More than one requirement was not completely met.

Sources

Alabama Learning Exchange: https://alex.state.al.us/lesson_view.php?id=7242

BC's New Curriculum, Ministry of Education: https://curriculum.gov.bc.ca/curriculum/science/6

Newton's Laws Jeopardy: https://jeopardylabs.com/play/newtons-laws-of-motion-review3

Science World: https://www.scienceworld.ca/resources/units/forces