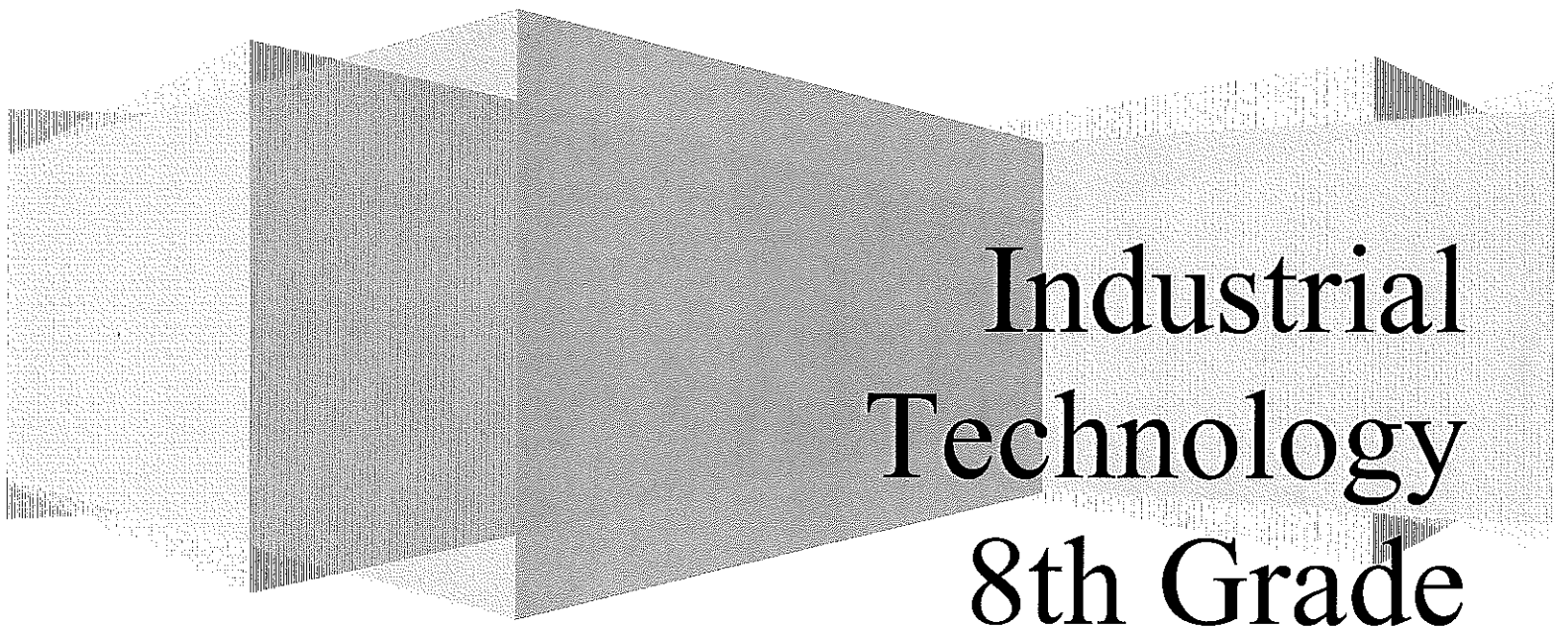


Solon Board of Education

Aerospace

Newton's Laws through Rocketry

By: Mrs. Aughinbaugh



**Industrial
Technology
8th Grade**

Aerospace

Module summary and overview

Objective

Understand Newton's laws and how they apply to space flight

Construct a model rocket that successfully flies.

Description

Many factors and scientific principles come together to make a rocket fly. Thrust, produced by the rocket's engine, allows it to fly. Other forces, such as drag - the friction of air, and gravity - the force that tries to keep the rocket on Earth, try to keep it from flying. Understanding these forces gives a better insight into the miracle of space flight.

Continuation

Personalize the model rocket with two coats of paint, stickers, or decals.

Create a technical drawing of the structure.

Day one: History

Day 1

Today's target goals:

- Gain an understanding of the history and development of rockets and space travel.
- Discover the basic principles of model rocketry.
- To learn what Newton's First Law is and to complete experiments to understand this law

Rocket History

Read from the booklet "Ignite the Imagination"

Located at the back of the binder

Read the first 5 pages in the reading section
(Excluding activities/extension sections on each page)

Newton's First Law: Objects at rest stay at rest, or objects in motion will stay in motion unless acted upon by an unbalanced force.

Before you begin the experiments in the back of the book ask yourself: What are the names we give to the forces that are becoming unbalanced?

Experiment #1 - testing gravity - directions on page 6 of packet

Materials - Popcorn

Read and Complete experiment entitled "testing gravity" from packet.

Answer the following questions on the answer sheet provided.

Questions for experiment One "Testing Gravity" Day 1

1. What force returned the popcorn again to a state of rest?
2. Describe how the motionless popcorn was like a rocket on the launch pad?
3. What force keeps a rocket motionless on launch pad?
4. Could you repeat the experiment exactly in the weightlessness of space? Why?
5. What would you do differently in the weightless situation?

Experiment #2 - "Let's get lifting" - directions on page 6

Materials:

- 16 oz. empty water bottle
(Fill with water for part 2 of experiment)
- String
- Rubber band
- Water
- Ruler/Meter stick

Chart the band stretch on the answer sheet

Observe when the bottle achieves lift

Answer questions on answer sheet under experiment title.

1. Would the experiment work the same in the weightlessness of space?
2. On earth, would the same amount and type of force be needed to pull the bottle across a desk?

Define: Mass

Clean up and record the day's events on log sheet

Day 2

Today's learning target:

- To learn what Newton's Second Law is and to complete experiments to understand this law

Newton's Second Law: The acceleration of an object is directly related to the force exerted on that object and oppositely related to the mass of that object

Experiment #3 - Getting a jump on gravity - page 7

Material: a single partner

- By yourself**, arms at side, jump into air
 1. What forces became unbalanced to cause you to move skyward?
 2. What forces caused you to return to earth?
- Re-read Newton's Second Law

Note: To increase acceleration you have to either decrease mass or increase thrust.

Jump with a partner

3. If you **jump with a partner** back-to-back will this then increase acceleration? Write down answer then test with a partner
4. What was the result of the jump? Why?

As a team increase thrust without increasing mass by having one person jump and partners on either side lift at the same time.

5. How did it feel to be lifted skyward by several people?

6. Would the job be easier to lift with more people helping?
7. Are there challenges when designing larger rocket engines to produce greater thrust?

Experiment #4 - Bouncing Things

(Page 8 of packet for directions)

This experiment should help you see what Inertia is all about

Materials: Tennis ball and Basketball

Tech term: Inertia

Clean up and record the day's events on log sheet

Did you meet your target Goal?

Day 3

Today's target goal:

- To learn what Newton's third Law is and to complete experiments to understand this law

Newton's Third Law: For every action there is an equal and opposite reaction.

Experiment #5 - Coming and going

Page 10 from packet for directions

Materials: found in Tupperware container

Nylon String

Drinking Straw

2 Chairs

Tape

Long Balloon (do not tie the balloon)

Observe what the balloon does. On answer sheet respond to:

1. What is happening to the balloon? (What do you see)
2. Why does this happen to the balloon? (think it is not just deflating apply answer to science and what you just learned in previous experiments)
3. Would adding weight affect the performance of the balloon?

FINS ON A ROCKET

Read page 15 of reading packet to determine if you need fins on a rocket and explain your answer on answer sheet based on the reading. Your answer should include the following considerations

- What if your rocket did not have fins?
(Imagine a balloon you blow up and let go.)
- How does it move through the room?
(The fins on a rocket provide stability.)

Do not forget BALANCE of a rocket

Read page 17

- Determine why you need balance in a rocket
- What is the relationship between balance and the center of pressure?
- Explain on answer sheet in paragraph form

Clean up and record the day's events on log sheet

Day 4 through 8

Today's target goal

Put Newton's law to the test while learning how to follow technical building directions.

Locate and watch the video entitled

Aerospace Technology: Model Rocketry

This is a 15 minute video that will help you build your rocket.

Building the rocket

- Now that you have a little history and information on rockets it is time to build one.
- Read the steps below and then see the instructor for a kit and directions.
- The instructor will ask you a question about these notes so make sure you read them.

Building the Rocket

Read below before you get a Rocket from your instructor
Procedures

- Begin working on your model rocket by reading and completing the following sections in the instructions pamphlet.
- As you build your rocket, *mark all lines on the body tube fro fins and launch lug and then progress through the steps in order.*
- Pay special attention to the drawings included with the instructions.
- As you complete each step, place a checkmark or X next to that step to help you keep up with the assembly during each class period.

- Do not use too much glue - less is more in this case.
- Pay close attention to the instructions as you glue the fins to the body tube.
- If the fins are improperly installed, the rocket may not fly properly.
- Be sure to cut the shock cord mount and fin pattern from your paper instructions when instructed.
- Use the extra-fine sandpaper to lightly sand the nose, body, and fins on your rocket to make it smoother.
- Read and complete the steps in the rocket kit instructions pamphlet to put the parts together.

*Clean up every day
and record the day's events on log sheet*

Day 9

Today's learning target

Comparing completed rocket to the Rubric

Finishing your rocket with style.

- Locate the rocket rubric (Performance will not be scored at this time)
- Go over the rubric to assess your work - score yourself first.
- Adjust your rocket as necessary and show to instructor for a grade.
- If all parts are done and the instructor has given you the go ahead you may paint the fuselage or paste stickers to personalize your rocket.
- If you are not done continue working. *You must have instructor's permission before painting.*

Clean up

and record the day's events on log sheet

Day 10

Today's learning target:

Create a technical drawing of the structure.

Collecting all materials for an organized turn in

- Finish all questions from beginning of module.
- Make sure your rocket is painted and dry.

Project completion and turn in

Turn in the following:

1. rocket (40 pts available)
2. Aerospace answer sheet (25 pts)
3. daily log (10 pts)
4. KWL (5 pts)
5. Explain what the pre flight prep will be. Day 10 of answer sheet (10 pts)
6. Bonus 5 pts Drawing to Scale of Rocket

Bonus Directions.

- Using a T-square and drafting board create a 1"=1" scale drawing of your rocket.
- You will need to measure the rocket to ensure exact dimensions.
- You may add colors if done.

Clean up
and record the day's events on log sheet

Answer sheet

Day 1

Experiment #1 - testing gravity

1. _____
2. _____
3. _____
4. _____
5. _____

Experiment #2 - Let's get lifting

No water

- Lift #1 - _____
Lift #2 - _____
Lift # 3 - _____
Average of 3 lifts - _____

With water

- Lift #1 - _____
Lift #2 - _____
Lift # 3 - _____
Average of 3 lifts - _____

1. _____
2. _____

Mass defined is: _____

Day 2

Experiment #3 - Getting a jump on gravity

1. _____
2. _____
3. _____
4. _____
- _____
- _____
5. _____
- _____
- _____
6. _____
7. _____
- _____

Experiment #4 - Bouncing Things

Define Inertia -

Day 3

Experiment #5 - Coming and going

1. _____

2. _____

3. _____

Explain in paragraph form: Do you need fins on a rocket?

Why do you need balance in a rocket?

DAY 10

What is the Pre - Flight set up?

How do you know a flight is successful?

How do you determine Altitude of the rockets flight?
