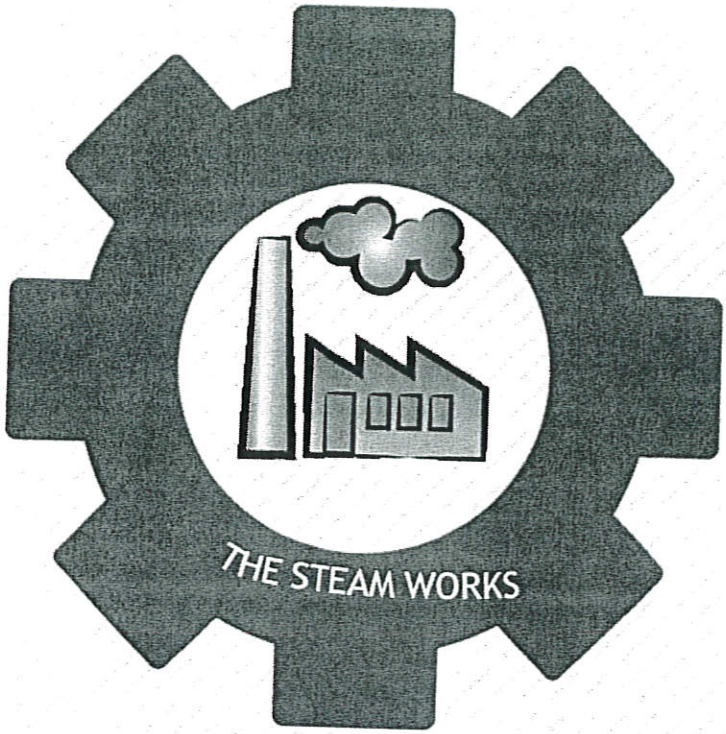
Little Goat Design Company



Science
Technology
Engineering
Arts
Math

Mrs. Kozlek's

8th Grade

STEM CLASS

You are Hired to work for the Little Goat Design Company. Every few weeks you will complete various challenges with your team. You will be researching, designing, and creating.

Use this workbook to help complete all your challenges.

Student Name:_____

Student Info Sheet

What is **one goal** you have for this school year?

What is something you would like to **improve** this school year?

Draw a Picture of a Scientist

Inventory of Experiences:

1. What sports do you like to play?
2. What team sports do you participate in? *(in or out of school)*
3. Do you belong to any outside clubs or groups such as scouts or 4-H?
4. Do you have any pets? If yes, then what kinds?
5. What are your favorite TV shows to watch?
6. What are your favorite movies?
7. If you have a day off what do you like to do for fun?
8. What places (cities/states/countries) have you traveled to? List as many as you can…

9. Tell me one thing that really makes you happy...

10. Tell me one thing you worry about...

11. Tell me one thing you really don't like...

12. What do you think you want to be someday when you grow up? Any ideas??

13. Tell me what you think of technology...

14. Tell me what you think of writing...

15. Tell me something about yourself that you find unique (*different*)...

16. Favorites...

Favorite food_____ Favorite Musical Group _____

Favorite TV Show _____ Favorite Book _____

Favorite Friends _____

Favorite Holiday to celebrate _____

Favorite place to visit _____

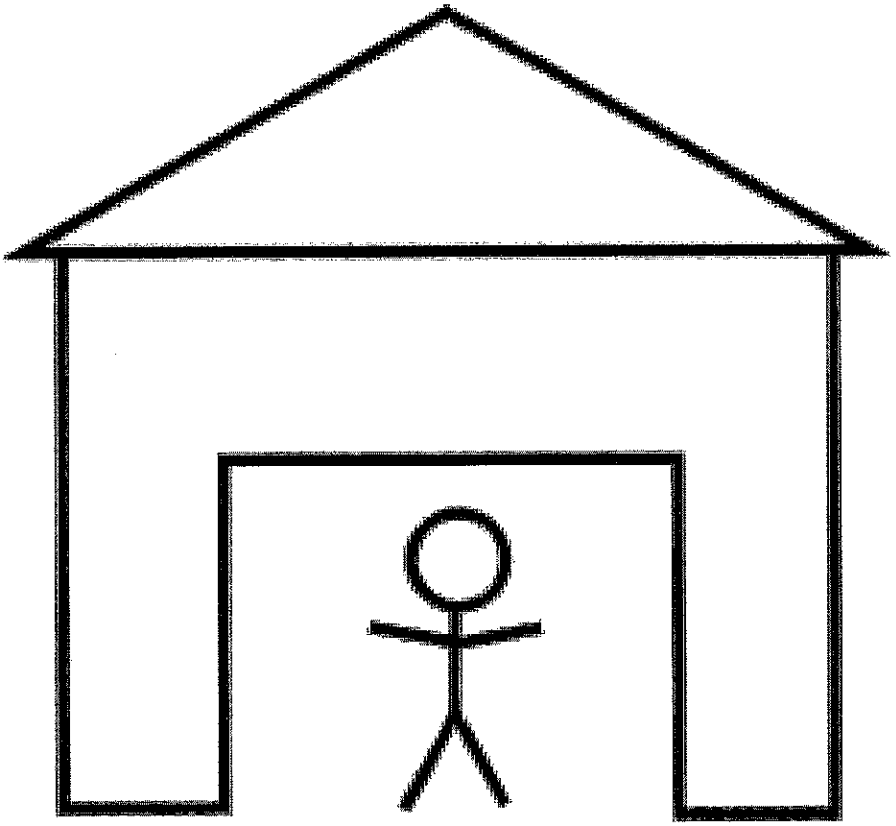
Favorite color _____ Favorite place to shop _____

Favorite website _____ Favorite season of the year _____

Shoes

Design Box: Design a Pair of shoes for your favorite sport

Can you copy the image below without ever lifting your pen from the paper?
(it *is* possible!)



Team Name:

Team Members:

Area of Study: *Engineering, Art, Marketing, Design principals,*

This Week's Challenge: Just Do it! Shoe Design

Design | Comfort | Fashion Appeal | Durability | Price

This week the ***Little GOAT Design Company*** will be working with Nike. Nike is an American company that is engaged in the design, development, manufacturing, and worldwide marketing and sales of footwear, apparel, equipment, accessories, and services . We will start with examining Nike's success as a company, their add campaigns, and slogan. Our company will be pitching 3 products/ideas to the company. As a interns, your team will complete the three challenges. Remember to work together, take pride in your work, and respect the company's equipment.

Project 1

Design a Sneaker Challenge

Your team will need to pitch a new sneaker design to Nike. When your sketch is approved you will receive a piece of card stock to draw your finished product.

Shoe Name:_____

Materials Used:_____

Cost of Shoe:_____

Draft Sketch

Project 2

Shelving Unit Challenge (Structure challenge)

How much does your shelving unit cost (If each plank is $10):_____

How many boxes of shoes does your unit hold:_____

Design Proposal: Why should Nike pick your team's structure for the store?

_____

_____

_____

_

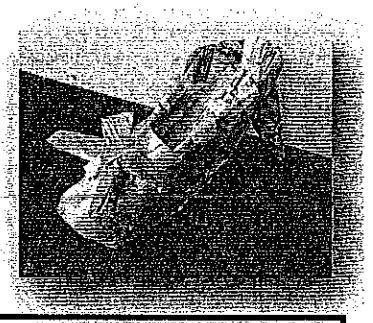
_____

_____

Project 3

Newspaper Shoe Challenge

Using just newspaper and tape, create a wearable newspaper shoe for one of your team members to display at the end of the week.



Shoe Name:_____

What makes your shoe stand out from the rest of the class:

_____

_____

_____

_____

_____

_____

_____

_____

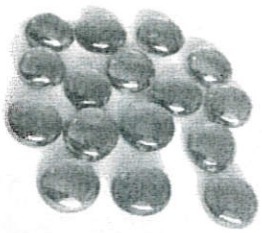
_____

_____

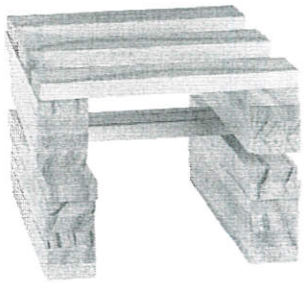
Sketch your newspaper shoe design in the box:

Shoe Shelving Challenge

A new Footlocker is opening up in our area. Nike is providing $1000 to the store to build a new shelving unit. Nike wants the unit to display all of their new line. Retail space in a stores is limited. So make the best use of your resources to be able to display the most product.



Your challenge is to design a shelving unit in the space provided that can hold the most merchandise. The display should be visually appealing. Figure out how much your structure costs and how much product you can display. Each plank costs us $10 to use. Each stone represents one box of shoes.



SPACE PROVIDED FOR SHELVING UNIT

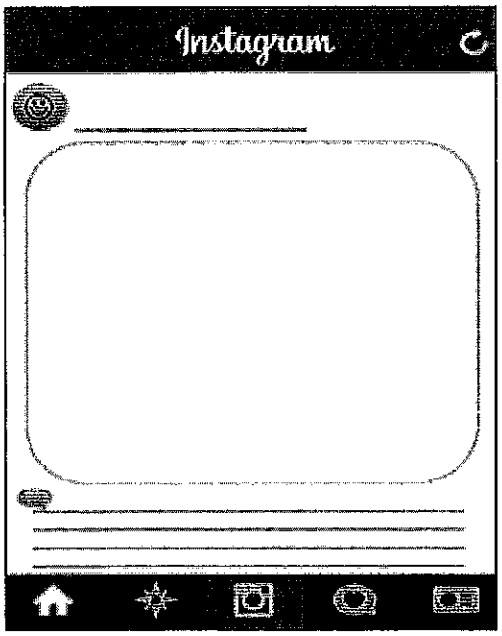
Name:

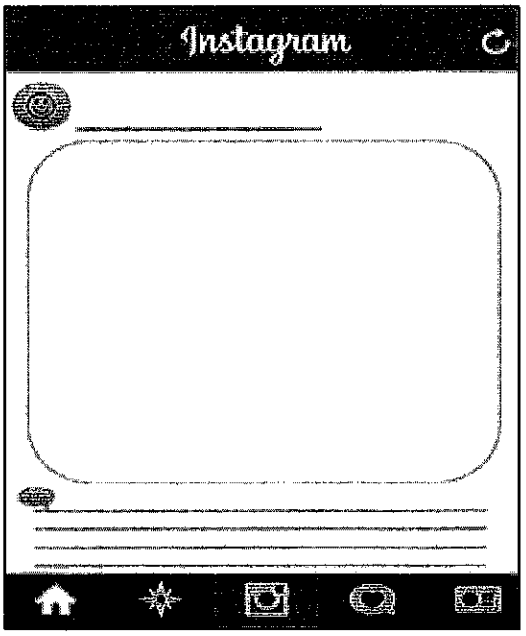
Time to Tweet

Twitter is often referred to as a micro blogging site. Posts on Twitter are limited to 140 characters per post and are called tweets. Tweets are written as though you are having a conversation with a friend. Every Tweet should have a purpose, be genuine and should showcase your wit or sense of humor. Practice writing Tweets below using the following ideas in 140 characters or less (approximately 36 words):

1 Tweet about your newspaper shoe design: _____

2 Tweet about your favorite shoes: _____





Come up with an Instagram campaign for your shoes!

Space Unit

Design Box: Design a Bedroom on a Space Station

BRAIN TEASERS

1. Emily loves cats and she keeps some as pets. All but two of them are completely black. All but two of them are completely white. All but two of them are completely ginger.

How many cats does she have in total ?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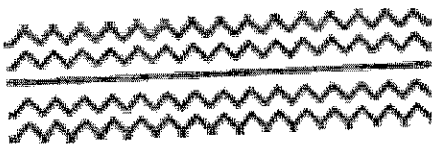
2. A family of five people drove in a car for 300 miles at an average speed of 50 miles per hour. For the whole journey nobody noticed that the car had a flat tyre.

How came nobody noticed?



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3. Try to re-arrange the letters of **NEW DOOR** to make one word.

---

4. A school orchestra with six musicians can play the first section of Beethoven's 5th symphony in 7 minutes and 23 seconds.

How long would it take to play if they doubled the number of musicians?

---

5. Tom owns an antique grandfather clock made in the year 1877.

How long is it designed to go without winding?

---

6. Emma was running in a 5 mile marathon. With the end in sight she sprinted past Chloe who was in second place and triumphantly crossed the finish line.

Why didn't Emma win the marathon?

Moon Landing

You are a member of a space crew scheduled to rendezvous with a mother ship on the lighted surface of the moon. However, due to mechanical difficulties, your own ship was forced to land at a spot 200 miles from the rendezvous point.

During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile trip.

15 items are listed as being intact and undamaged after landing. Your task is to rank them in terms of their importance for your crew, to allow them to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through to number 15 for the least important.

Instructions

1. Provide a 'moon landing ranking chart' for every member of your group.

2. Ask each young person to take 10 minutes to decide their own rankings, and record the choices in the left-hand column (my ranking).

3. Invite everyone to get into groups of 3-4. Discuss their individual choices and refine their rankings based on the collective thoughts of the team. Record the group rankings in the second column (team rankings).

4. The correct answers were compiled by a team of scientists and engineers at NASA. Display the NASA 'expert' rankings on a PowerPoint presentation, whiteboard or photocopy. Compare your individual and group answers with the correct answers and determine a score.

5. For each item, mark the number of points that your score differs from the NASA ranking and then add up all the points. Disregard plus or minus differences. The lower the total, the better your score.

6. As the young people work together in a team, sharing thoughts and ideas, this should produce an improved score over the individual results. But will this be enough to survive?

Moon Landing Ranking Chart

My ranking	Salvaged items	Team ranking
	Box of matches	
	Food concentrate	
	50 feet of nylon rope	
	Parachute silk	
	Two .45 caliber pistols	
	One case of dehydrated milk	
	Two 100-pound tanks of oxygen	
	Stellar map	
	Self-inflating life raft	
	Magnetic compass	
	Five gallons of water	
	Signal flares	
	First aid kit containing injection needles	
	Solar powered FM receiver	
	Portable heating unit	
Score		Score

TRAILBLAZERS IN AMERICAN SPACE HISTORY

West Area Computers

From the 1940s until the 1980s, many African American women worked as "computers" at NASA (National Aeronautics and Space Administration).

"Math Whizzes in Skirts"

When we think of computers, we often think of blinking lights and whirring fans. But before electronic computers, the term "computer" referred to people, usually women, who performed complex mathematical calculations.

Computers have a long history dating back to the 18th century when computers would assist with astronomical and military calculations. In the 20th century, the role of computers became a gendered role as women processed large-scale data that would undergird the work of male engineers and scientists.

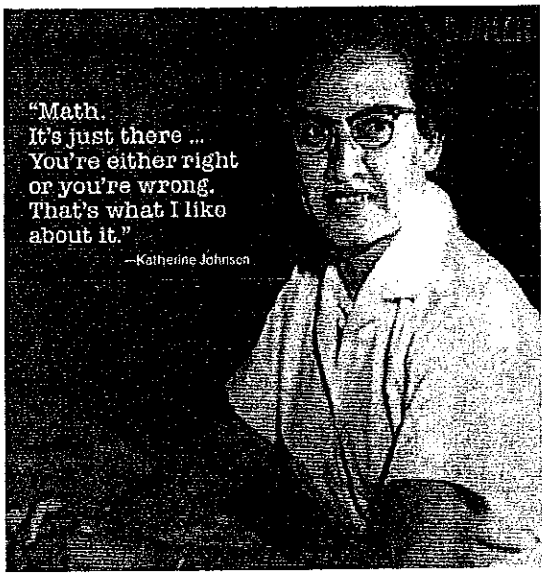
The Langley Research Center of NASA began hiring women computers starting in the 1930s and especially during World War II. With many men being drafted or volunteering for war, industries which had previously been closed to women and people of color were opened temporarily. African American women with degrees in mathematics began to be hired for these positions. Many of them came from nearby HBCUs such as Hampton University and Virginia State University.

African American computers worked, ate, and even used the restroom in segregated facilities in the West Area at Langley, producing the name "West Area Computers." Facilities were so thoroughly segregated that white computers often were not even aware of the presence of the West Area Computers. Computers were regularly "loaned" to different branches of NASA, which is how many African American women first entered these areas.

Melba Roy Mouton was a Howard University alum who became Assistant Chief of Research Programs at NASA's Trajectory and Geodynamics Division in the 1960s. She headed a group of NASA mathematicians called "computers". Image courtesy Wikimedia Commons.

AIP Center for History of Physics

The American Institute of Physics' Center for History of Physics works to preserve and make known the historical record of modern physics and allied sciences. Through documentation, archival collections and educational initiatives, the Center ensures that the heritage of modern physics is safeguarded and its story is accurately told. The "Teachers Guide to the History of African Americans in the Physical Sciences" is part of an initiative to increase knowledge on the history of women and minorities in the physical sciences. More information at http://www.aip.org/history-programs.



Katherine Johnson calculated trajectories and orbits for historic missions including the first flight to put a man on the moon. She also helped develop space navigation systems to guide the astronauts. Image courtesy of MAKERS

Katherine G. Johnson

Physicist and mathematician Katherine G. Jackson made a significant mark in history at NASA, becoming one of the first women to work closely with the space program. A native of West Virginia, Johnson graduated from West Virginia High School at 14 and from West Virginia State University at 18. A math prodigy, she would go to work, literally as a "computer" for Langley Research Center, a part of NACA—the National Advisory Committee for Aeronautics, which was later changed to NASA.

Johnson and the many other women at Langley Air Force Center were described as a "math whizzes in skirts." Her all-female team would perform mathematical calculations and read the data from the black boxes of planes. It was only on a day where she was asked to fill in on the all-male flight research team that Johnson made her way up the aeronautics ladder.

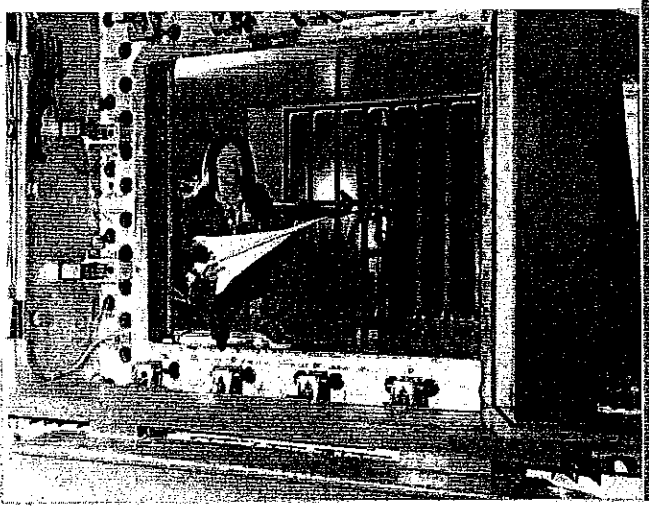
Johnson then moved from the all-male Flight Mechanics Branch to the Spacecraft Controls Branch. There, she would also calculate the trajectory that put Alan Shepard (the first American) in space and for the historic Apollo 11 flight to the moon in 1969. Now 95, Johnson is retired and resides in Hampton, VA.

Christine Mann Darden

Mechanical engineer Christine Darden was hired as a computer at NASA Langley Research Center in 1967. Born in Monroe, North Carolina, Darden's interest in mathematics started when she was a young girl. She and her father used to explore the mechanics of bicycles and cars. She entered Hampton Institute when she was only 15 and majored in education because of the lack of prospects of finding a job in mathematics for an African American woman. Later, she would take study physics and mathematics at Virginia State College, and earn an M.S. In mathematics in 1967, the same year she accepted a position at the NASA Langley Research Center in Hampton, Virginia.

Darden started at Langley as a computer. In the 1970s, electronic computers were being introduced on a wider scale. Darden was one of the first people that worked on developing computer programs. She also asserted herself and entered the engineering world, researching sonic boom minimization. In 1983, she received her Ph.D. in engineering. Her career demonstrates the immense contributions that African American women have made to the history of NASA.

Christine Darden started as a computer at NASA in 1967 but rose to the position of engineer. She worked for 25 years on sonic boom minimization. Image courtesy of the National Air and Space Museum, Smithsonian Institution.



NASA OPPORTUNITIES

One Stop Shopping Initiative (OSSI) is a great resource for students as young as sophomores in high school to learn about internships, summer camps, scholarships and more.

Students have the ability to search and apply for all types of NASA internships, fellowships, scholarship opportunities in one system. A single internship or fellowship application places students in the applicant pool for consideration by mentors for all NASA internships or fellowships. NASA programs include design competition challenges and volunteer outreach opportunities.

Apply today!
https://intern.nasa.gov/ossi

RESOURCES

ScienceMakers Digital Archive
www.sciencemakers.com

For more resources by AIP on African Americans in Physics, Astronomy, and Related Disciplines

When Computers Wore Skirts

Project 1: Read Article and Research online to answer the following questions about Katherine Johnson and Christine Darden.

Discussion Questions (Answer on notebook paper and turn in)

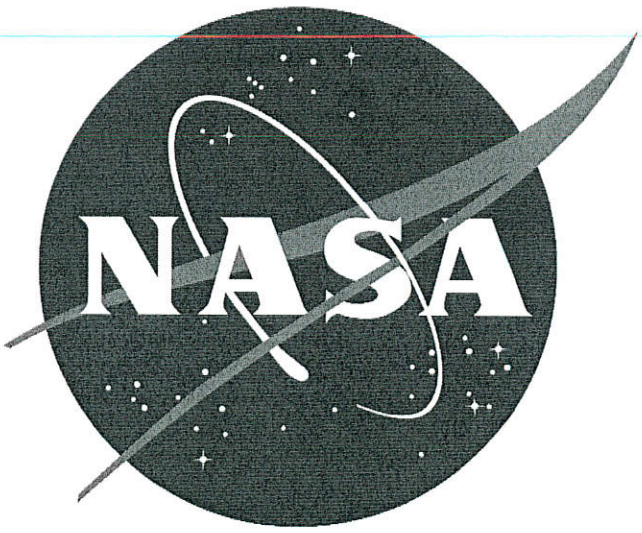
1. Compare Katherine Johnson's and Christine Darden's life and experience at NASA. How were their experiences similar? How were they different?
2. When did electronic computers start being introduced into NASA? What were they like (appearance, size, etc.) and how did people use them?
3. How were Katherine Johnson and Christine Darden recruited to work at NASA? How did they end up leaving the "computer pool"?
4. How was the computer pool organized? How did the computers receive assignments? How did this change over time?
5. What major historical events led to the first African American women being able to work at NASA?
6. What are some of the larger changes that were happening in African American history between when Katherine Johnson started as a computer at NASA in the 1940s and when Christine Darden started in the late-1960s? How would these changes have affected their experiences at NASA?
7. What do you think it would have been like for Johnson and Darden as African American women to work in a predominantly white and male environment as engineers?

Project 2: Create a 5 slide PowerPoint on the life of either Katherine Johnson or Christine Darden to share with the class.

Slide One: Title Slide
Slide Two: Early Life History
Slide Three: Education
Slide Four: Employment/Career
Slide Five: Fun/Interesting Facts

Include pictures on all your slides.

When Done
Visit Website:
http://www.capecosmos.org/
https://nclab.com/when-computers-wore-skirts/



What does Zero Margin of Error Mean?

NASA Mars mission

The Curiosity rover is designed to travel Mars studying climate and geology. The rover is looking for signs of carbon, the building blocks of life. Some of the rover's features:

Robotic arm
Used to examine and manipulate soil and rocks; it also has two scientific instruments, one uses X-rays to determine materials' composition and the other is a magnifying camera

Laser
Burns small holes in rocks and soil up to 23 feet away and identifies chemical elements

Color cameras
Stereo mastcams on either side of the rover's mast take color pictures and movies in 3-D

UHF antenna
Primary transmission antenna

Plutonium power source
A nuclear battery that converts heat into electricity

Neutron detector
Detects water in rocks and soil

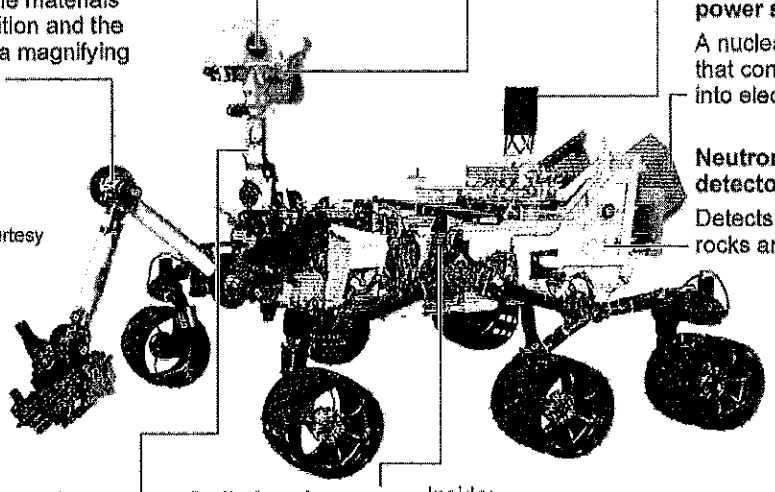


Photo courtesy of NASA

Weather station
Records wind speed/ direction, air pressure, humidity, temperature and UV radiation

Radiation detector
Measures radiation from the sun, supernovae and other sources

Inside:

Chemistry lab
Analyzes rock and soil samples for organics

Mineral detector
Shines an X-ray beam at a rock or soil sample to identify types of minerals

SOURCE: NASA

AP

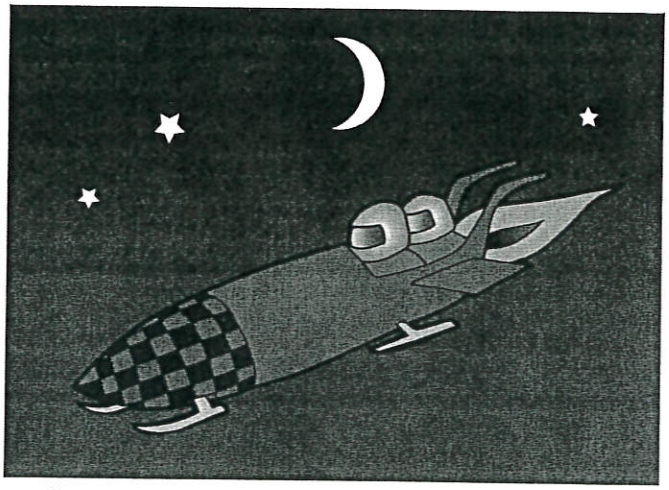
Hovering on a Cushion of Air

Pre-game Talk Show

If you have mixed feelings about friction, it's easy to understand. Friction is the force that resists motion when two objects are in contact with each other. It's both good and bad. Take cars, for example. Forget to check the oil and friction can ruin a car engine. However, without friction a car couldn't move. Tires are made from rubber, which produces friction with the road surface. When the wheels turn, friction enables the wheels to exert a force on the road to propel the car.

Reducing friction is important in many sports. Ice hockey depends upon the puck being able to slide across ice. Curling, a sport similar to shuffleboard but with heavy stones instead of pucks, also needs ice to slide across. Team members actually sweep the ice in front of moving stones to help reduce friction and guide the stones to the target. Bobsleds and luge sleds run down ice-covered chutes to achieve breakneck speeds. The chutes twist

Colorado Avalanche player Ryan O'Reilly applies Newton's Laws of Motion with his stick to smack (action) the puck across the rink (reaction).



and turn. Runner blades on the sleds reduce downhill friction to attain high speeds while increasing sideways friction to help steer the turns.

Reducing friction makes it easier to start objects moving. Isaac Newton's First Law of Motion explains why. The law states that objects remain still unless acted upon by unbalanced forces. In other words, if forces on an object are unbalanced, the object moves. What then is an unbalanced force?

To understand unbalanced forces, imagine what would happen if you and a friend were to push on each other with equal force. Neither of you would move because the forces are balanced. However, if one of you pushes harder than the other, movement takes place because now the forces are unbalanced. An ice hockey puck, for example, is resting on the ice. The ice surface is very slick but it still has a small amount of friction. When a player smacks the puck, the puck shoots across the rink. The force exerted on the puck by the stick is far greater than the force of friction trying to hold the puck where it is. Consequently, the forces are unbalanced, and the puck shoots away.

Newton's First Law of Motion also explains that an object in motion will travel in a straight line at a constant speed unless an opposing unbalanced force slows or stops it. In ice hockey, the goalie will try to exert

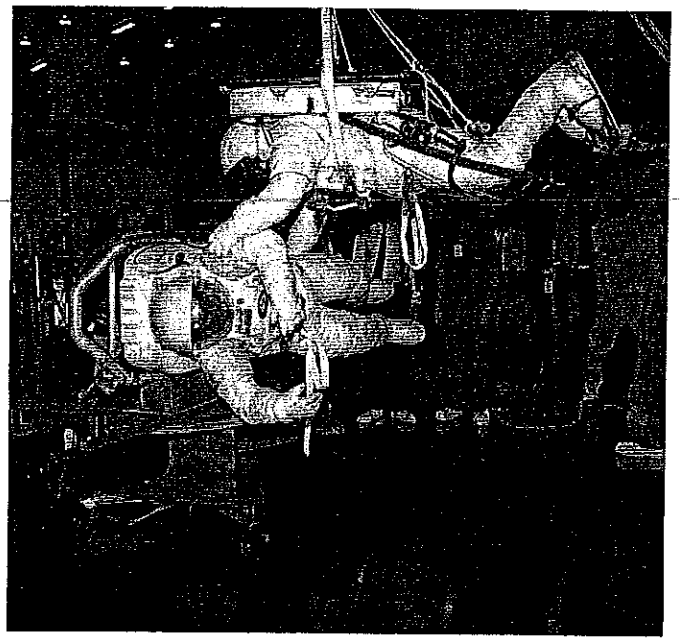
an unbalanced force by blocking the puck. If the goalie misses, the goal net will exert the unbalanced force and stop the puck - score 1!

Understanding Newton's First Law of Motion is important for astronauts training for future space missions on the International Space Station (ISS). When in space, they will have to move objects and themselves from place to place. To do that, they need to exert unbalanced forces. But being in space is something like being on an ice rink on Earth. Try taking a quick step on an ice rink without wearing ice skates. With little friction, you are likely to end up on your backside!

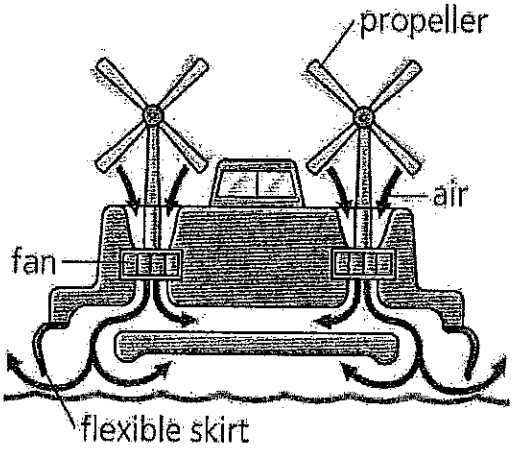
In space, friction is greatly reduced because of the microgravity environment. It feels like gravity has gone away. Of course, gravity is still there because gravity holds the ISS in orbit. But orbiting Earth is like a continuous fall where the spacecraft and everything inside falls together. The type of friction caused by objects resting on each other is gone. To move, astronauts have to push (exert an unbalanced force) on something, and to stop themselves, they have to push on something else.

How can astronauts practice for the microgravity environment on the ISS? NASA uses many different simulators to train astronauts. One simulator is something like a large air hockey table. It is called the Precision Air Bearing Platform (PABP) and is located at NASA Johnson Space Center in Houston, Texas.

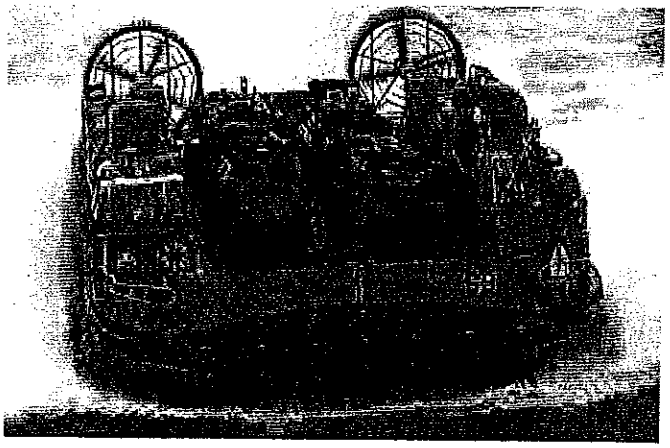
The PABP uses moving air to produce a powerful lifting force very much the way hovercraft work. High-pressure air rushes out of three small pad-like bearings and lifts the pads, and a platform mounted above them, a fraction of a centimeter from the floor. No longer resting directly on the floor, the device, with the



Two astronauts practice space rescue over the Precision Air Bearing Platform (PABP) at the NASA Johnson Space Center. One astronaut is suspended from a crane but the other is riding on cushions of air. Beneath the small platform, the sideways astronaut is riding on three small pads that lift the platform with high pressure air shooting out from them. This nearly eliminates friction with the smooth floor and simulates microgravity.



What's a Hovercraft?
Hovercraft are vehicles used for carrying people and heavy objects over water and rough surfaces. Powerful fans, like airplane propellers, blow air downward. The air blast is caught by a skirt that lifts the craft above the surface before the air escapes to the sides under the lower edges of the skirt. This reduces friction with whatever surface over which the craft is hovering and enables it to be easily propelled by action/reaction with other fans mounted horizontaly.



astronaut on top, is virtually frictionless.

There is one more important feature of the PABP. In order to move across the floor, the astronaut has to push on something. Additional air is fed to small nozzles around the astronaut. The astronaut uses a hand control to release the jets of air in different directions to create a push. How much of a push the astronaut gets determines how fast he or she slides across the PABP floor. This is explained by Newton's Second Law of Motion. The force of the air jets is equal to how much air shoots from the jets times how fast the air accelerates. Newton's Second Law of Motion is really an equation.

force = mass times acceleration (F=m x a)

With the control jet, the more air shot from the jet and the faster it shoots out, the greater the force produced and the more the astronaut moves.

There is one more law of motion. This is Newton's Third Law of Motion. It is also called the action/reaction law. When a force is exerted (action), an opposite and equal force (reaction) is created. You can see this with rockets. Burning rocket propellants produce gas that shoots out of the engine. The rocket moves in the opposite direction. If you happen to be riding a PABP like the one at the NASA Johnson Space Center, you get to experience action/reaction first hand. The PABP greatly reduces friction and an air jet (action) propels you across the platform (reaction). Unless you exert a new action force in the opposite direction, you will smack into the wall surrounding the PABP.

Analyze any sport or the movements of astronauts in microgravity, and you will see all three of Isaac Newton's Laws of Motion at work.

Hovercraft Challenge

Name: _____

Create an Olympic sport for your

Challenge others to compete for the Interplanetary cup.

Describe your sport:

What is its objective?
What happens when you play your sport?
What does your playing field look like?
How many teams compete?

What are the rules:

How is the game scored:

How do Isaac Newton's Laws of Motion apply to your sport?
Could your sport be played on the International Space Station? On the moon? On Mars?

Use the other side of this page for your answers.

Team Name:

Team Members:

Area of Study: *Engineering, Science, Marketing, Physics*

This Week's Challenge: The Final Frontier

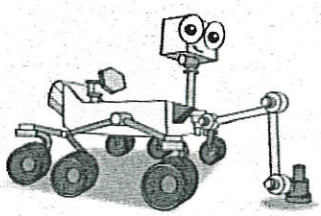
This week the ***Little GOAT Design Company*** will be working with NASA. The National Aeronautics and Space Administration (NASA) is an independent agency of the United States federal government responsible for the civilian space program, as well as aeronautics and aerospace research. They reached out to our engineering department to help develop and test three new Science toys for their the National Air and Space Museum's gift shop.

Project 1

Design a Rover Challenge

Your team will develop model rovers using Legos, wheels, axels and tires. Your Rover must be able to travel down rough terrain. Measure the distance your successfully roles in the rest model area. At the end of class dissemble your creation for the next class.

Field Notes



Distance Rover Traveled:_____

What challenges did your team encounter with your rover with the design:

_____

_____

How does size of your wheels effect your rover's ability to complete the challenge?

_____

_____

_____

Did you make any modifications to your rover to get it to go farther?

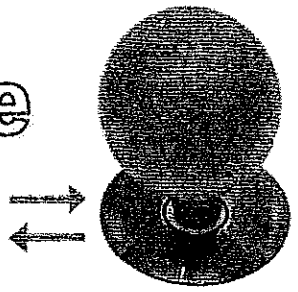
_____

_____

_____

Project 2

Hover Craft Challenge



Rug Vs Table Top: How does the surface of the floor effect the hoover craft?):

_____

_____

_____

How does the size of a balloon affect the CDs ability to hover?:_____

_____

What game did your team come up with for kids to play with the craft?

_____

_____

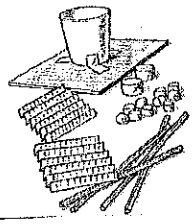
_____

_____

_____

Project 3

Lunar Lander Challenge



Design and build a shock absorbing lander to protect two aliens during impact on earth. Only using the supplies available on the alien spacecraft can be used. The aliens are represented by two mini marshmallows who will be traveling in an upright plastic cup. The aliens require the cup to be unobstructed. All building must take place below the landing platform. Your goal is to slow down the lander as it hits earth so that the aliens remain inside the cup.

Highest drop point (That aliens stayed in cup):_____

Test		Spacecraft Landing?	Modifications
1 Foot Drop Test	Test 1	Yes/No	
	Test 2	Yes/No	
	Test 3	Yes/No	
2 Foot Drop Test	Test 1	Yes/No	
	Test 2	Yes/No	
	Test 3	Yes/No	

Design Sketch (Remember you can only build below your landing platform)

Flight

Design Box: Design a Hot Air Balloon Style Flying Device

Ditloid Puzzles

Try to crack all of the Ditloid puzzles below.
They're all connected with the passing of time.
The first one has been done as an example:

24 H i a D = 24 Hours in a Day

12 M i a Y = ...

31 D i D = ...

1000 Y i a M = ...

1 L Y e F Y = ...

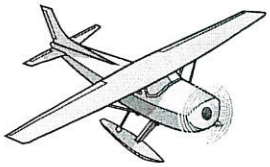
4 S (S S A W) = ...

12 D o C = ...

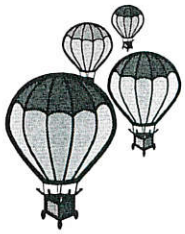
60 S i a M = ...

10 Y i a D = ...

366 D i a L Y = ...



Flight Worksheet



Please answer questions on a separate sheet of paper.

History of Flight

1. Who were Wilbur and Orville Wright?
2. What happened on December 17, 1903?
3. How long was the first flight?
4. What did John Alcock and Arthur Whitten do in 1919?
5. List three reasons why Amelia Earhart important to flight?

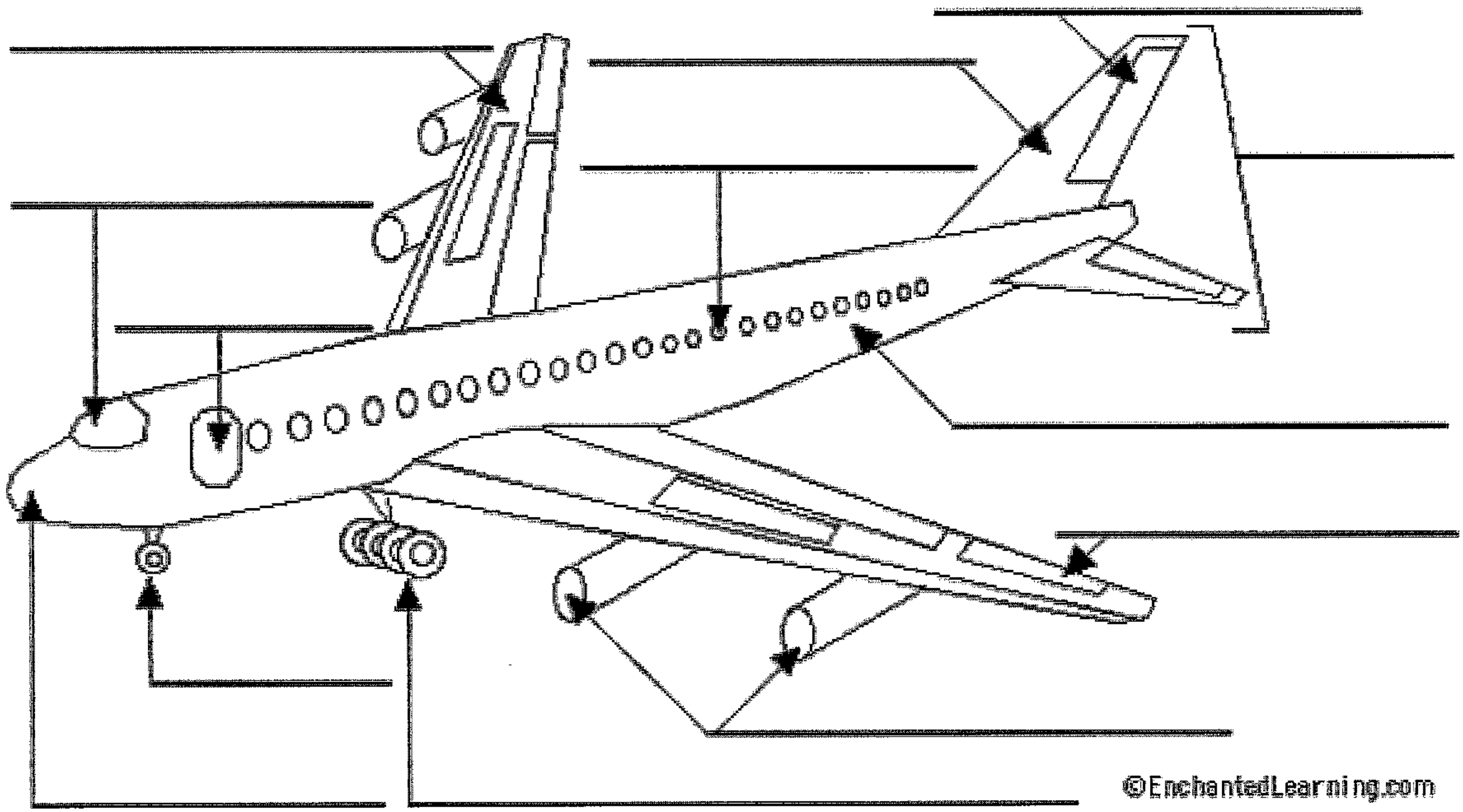
Forces of Flight

1. Name the four forces of flight and tell what effect they have on a plane.
2. What is Aerodynamics?
3. What is Propulsion?
4. How does the Bernoulli principle relate to flight?

Parts of a Plane

1. Name the six main parts of a plane and tell what they do.
2. Why is the shape of an airplane's wing important to flight?

28



Label Parts of the Plane

Team Name:

Team Members:

Area of Study: Engineering, Science, Marketing, Physics

This Week's Challenge: Flight

This week the ***Little GOAT Design Company*** will be working with Boeing. We will be testing out and developing objects that Fly.

Project 1

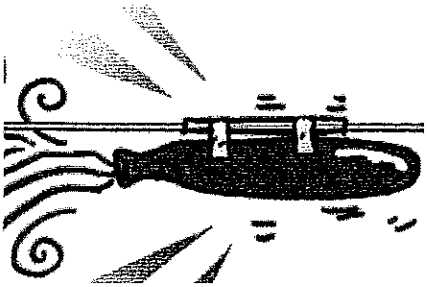
Helicopter Challenge

Using the template and paperclips create paper helicopter and experiment. Then as a team build a paper helicopter that will take 2 minutes to fall from the ground from a height of at least 3 meters. (The group that create the helicopter that spins the slowest will win the challenge)

What could you change to make the helicopter spin faster?

What could you change to make the helicopter spin slower?

Did you make any modifications to your helicopter to meet the challenge?



Balloon Rocket Challenge

Project 2

Your team will develop a balloon rocket that will travel the fastest and farthest across the classroom in the end of our week challenge.

Does the shape of the balloon affect how far (or fast) the rocket travels?

Does the length of the straw affect how far (or fast) the rocket travels?

Does the angle of the string affect how far (or fast) the rocket travels?

Project 3

Paper Airplane Challenge

Your team will create four paper airplanes following directions from funpaperairplanes.com. Your team will test each of the four planes for distance and speed. Test each plane three times and mark down the best time. Keep one plane, or design your own for Friday's competition.

Type of Plane	Furthest Distance Flown	Speed of plane to reach mark	Rank Plane Choice 1-4
Arrow			
Delta			
Condor			
Bullet			

1. Which airplanes flew the farthest distance and why?

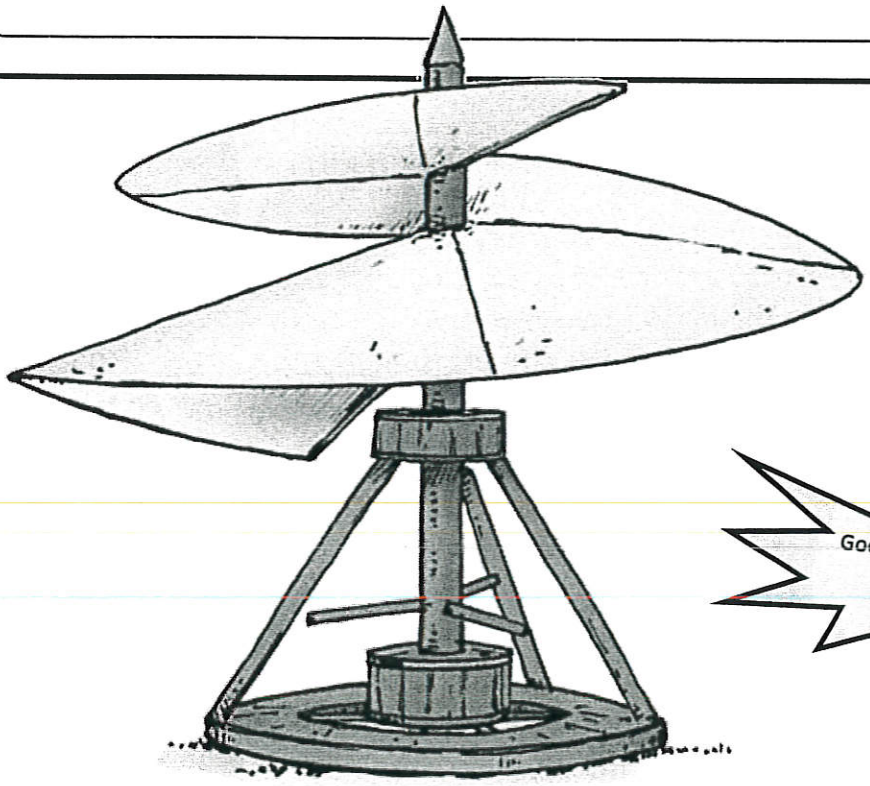
2. Which airplanes flew the fastest and why?

Did you know?

What is this? _____

Who invented it:_____

How Does it Work: _____



Google DaVinci's Flying Machines

Leonardo DaVinci's Helical Screw Helicopter (1480) could, until recent times, lay claim to being the first design of that type. However, it has now been established that the first recorded toy of this type dates all the way back to about year 1320 and had a rotor more like windmill sails. Though the first actual helicopter wasn't built until the 1940s, it is believed that Leonardo da Vinci's sketches from the late fifteenth century were the predecessor to the modern day flying machine. Leonardo DaVinci's Helical Screw Helicopter (1480) could, until recent times, lay claim to being the first design of that type. However, it has now been established that the first recorded toy of this type dates all the way back to about year 1320 and had a rotor more like windmill sails. Though the first actual helicopter wasn't built until the 1940s, it is believed that Leonardo da Vinci's sketches from the late fifteenth century were the predecessor to the modern day flying machine.

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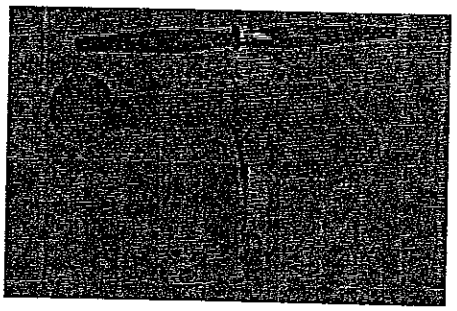
Director of The STEMAZing Project

Rubber Band Helicopters

Adapted slightly from: http://www.instructables.com/id/Rubberband-Helicopters-step-by-step/
A project from The Workshop for Young Engineers (http://thewye.com)



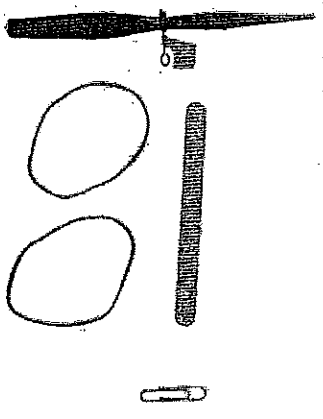
The rubber band-powered helicopter is easy to construct, and with a little practice it can be flown 20+ feet into the air!

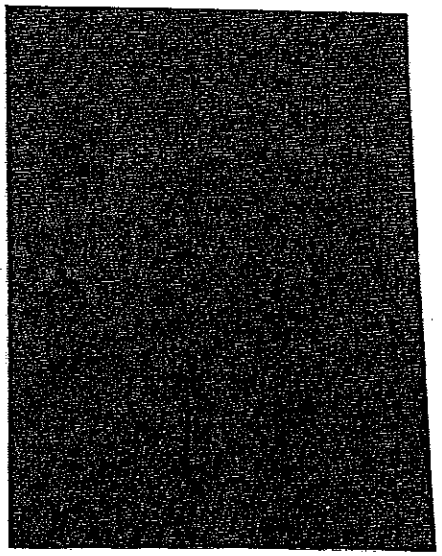
How It Works:

1. Elastic potential energy is stored in the rubber band by winding the propeller.
2. When flown, the rubber band rapidly transforms its potential energy into kinetic energy for the propeller by unwinding, which turns both the propeller blade and the paper cutout.
3. The paper cutout pushes against the surrounding air, which creates horizontal air resistance, or drag. This makes it harder for the cutout to spin. Because the cutout does not spin as easily, more energy from the rubber band is released into the propeller, which is much easier to turn. In this way, the paper acts like the rear rotor of a real helicopter
4. As the propeller spins rapidly, it begins to create lift by pushing air downward. With enough energy, the helicopter will fly in whatever direction it is pointing.

Step 1: Materials

6" hook nose propellers
Craft sticks
Paperclips
Rubber bands
4x6 Index Cards
Masking tape
Scissors





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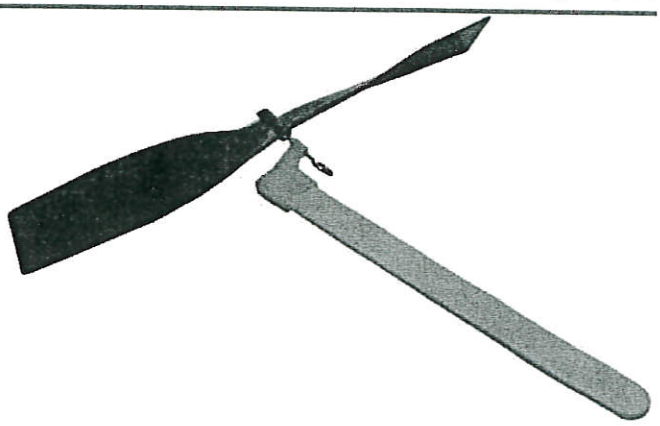
Director of The STEMAZing Project

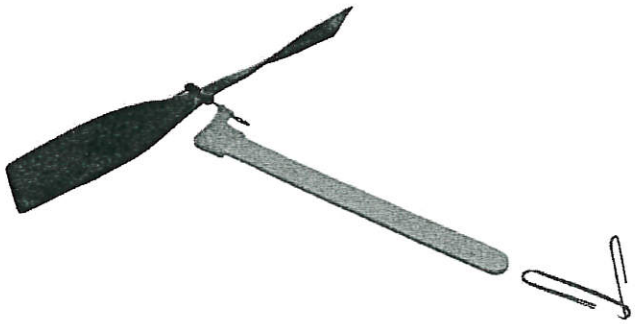
Step 2: Propeller



Put a craft stick into the hook propeller.

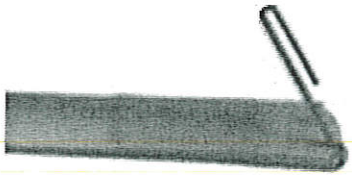
(These propellers can be found at www.kelvin.com.)

Step 3: Paperclip

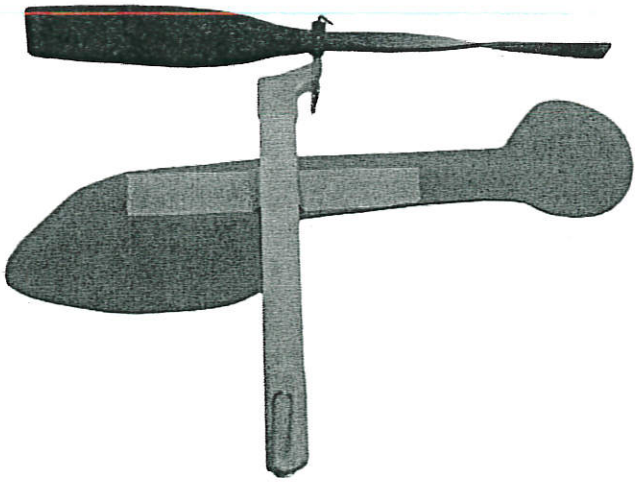


Bend a paperclip open, as shown to the right. Then, put one side below the end of the craft stick (notice the hook on the propeller is up).

Tightly wrap a piece of masking tape around the paper clip to secure it to craft stick.



Step 4: Paper cutout



Cut out one of the helicopter templates and tape it to the craft stick on the opposite side of the hook, as shown to the right.

The paper cutout is crucial; it's what make the copter work. If it's too small, then it won't create enough lateral drag, and too much of the energy in the rubber band will be diverted to the craft stick. If the cutout is huge, it'll simply be too heavy.

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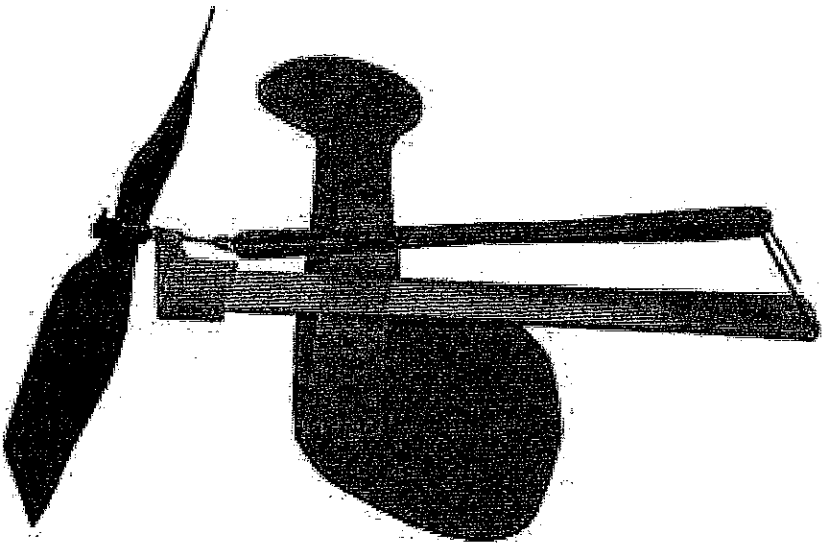
Director of The STEMAZing Project



Step 5: Attach rubber bands

A rubber band should easily slip into the propeller hook and paper clip, as shown to the right. You can use more than one rubber band.

Step 6: How to fly

The helicopter must be wound up. To do this, students must spin the propeller to twist the rubber band. The number of turns depends on the rubber band you use.

Once the rubber band has be wound, hold the top of the propeller and the bottom of the craft stick near the paper clip. For a stable and high-reaching flight, you must let go of the top first and then the bottom within half of a second of each other. This can be difficult for young students to coordinate, so tell them to verbally say "tick tock." As they say "tick" they should let go of the top and "tock" let go of the bottom of the helicopter.

You can also fly the helicopter sideways following the same procedure.

King Arthur Society

Design Box: Draw a castle

Animal Connections

Try to move from the start to the end by following the chain of animals. The last letter of each animal's name is the first letter of the next animal's name. We've joined up the first three for you ..... (The last one is a bit of a trick!)

START

Y	D	T	Y	Q	E	R	A	B	B	I	L	J	O	I	P	S	V	K
Z	O	B	T	I	G	F	C	V	P	T	O	R	T	S	D	P	H	A
L	G	O	A	H	S	R	U	T	C	P	Z	X	C	E	L	E	V	N
U	B	Z	X	C	V	K	H	W	E	N	O	I	L	S	V	N	M	T
K	F	J	K	L	D	E	V	D	C	X	Z	C	E	E	L	T	R	U
A	G	N	A	K	A	Y	Q	W	E	R	T	P	N	G	U	P	X	T
R	D	N	Q	W	P	R	W	P	B	C	W	K	L	R	A	T	R	E
O	Y	R	I	C	H	Y	E	N	A	L	L	T	B	O	K	P	Q	E
O	S	T	Z	X	C	V	B	C	B	Q	I	G	A	T	H	J	Q	F
K	F	B	F	D	W	Q	X	T	P	R	P	H	J	K	O	G	O	R
Q	W	T	Y	X	O	L	L	I	D	A	M	G	R	Z	R	D	L	K
C	V	B	G	M	C	M	N	Q	Z	C	R	A	L	L	I	P	H	J
Q	W	R	P	O	T	P	Q	D	S	T	N	Q	B	N	G	T	Y	U
E	R	W	U	R	G	B	O	A	L	A	N	J	K	L	Z	P	Q	W
T	Y	L	S	K	U	N	K	P	Y	J	T	E	A	T	E	R	X	Z

END

King Arthur Questions

1. Who was King Arthur and when/where did he live? Is there historical evidence of his existence?

2. Who was King Arthur killed by?

3. Who was Merlin and what is his significance to King Arthur?

4. Where was Camelot?

Catapult Questions

1. What were the uses of catapults in the middle Ages?

2. What is a Ballista, and what is a trebuchet?

3. What were the first catapults made of?

4. How far can a catapult shoot?

Castle Questions

1. What is a motte and bailey castle?

2. Why do castles have spiral staircases? Do they always go the same way?

3. Why are the windows of a castle often narrow or shaped liked crosses?

4. What were Medieval times' dungeon used for?

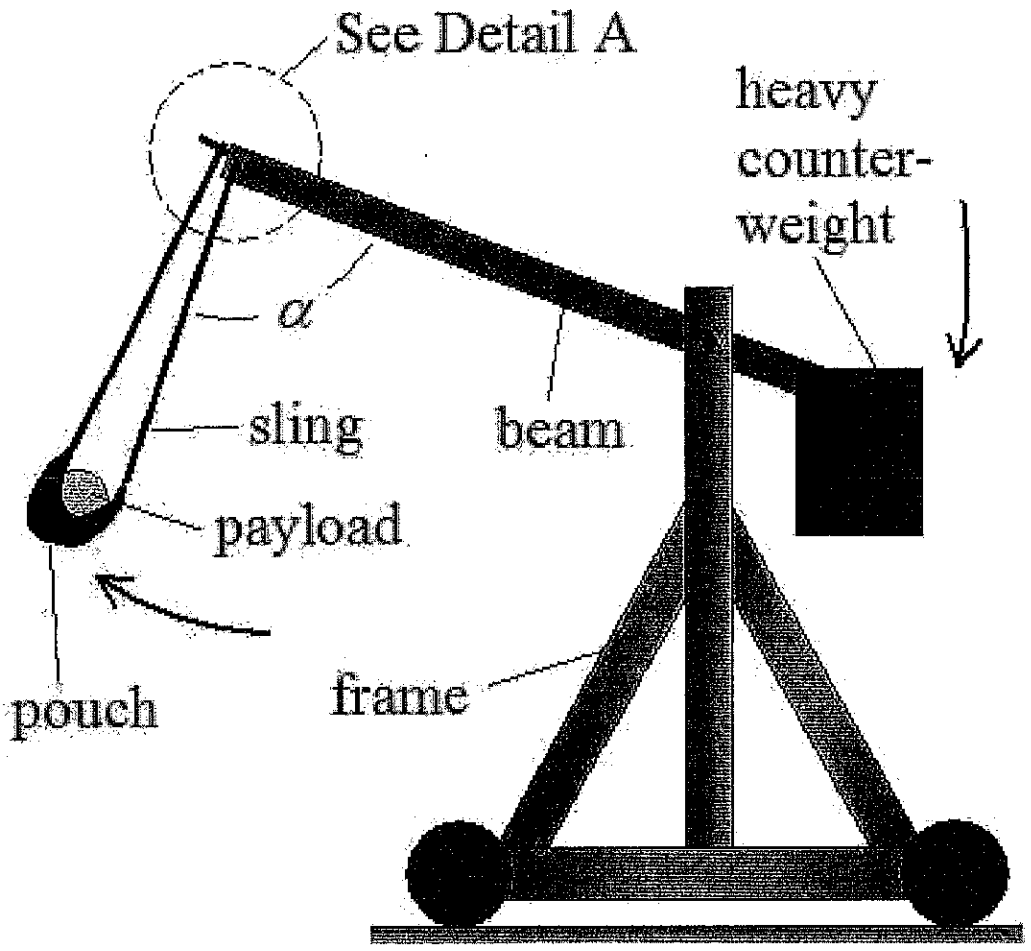
Stained glass Window Questions

1. Who was the Coeur de lion?

2. What did unicorn represent in medieval times?

3. When were stained glass windows invented?

4. Why did they use Stained Glass in Medieval times?



Design your catapult

Team Name:

Team Members:

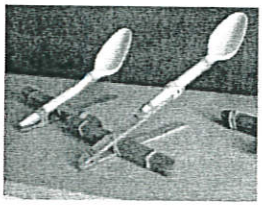
Area of Study: *Engineering, Science, ART, Physics*

This Week's Challenge: King Arthur Society

This week the ***Little GOAT Design Company*** will be working with the King Arthur Society. This group works on mixing fact with fiction. We will step back in time as we design working catapults, castles, and design stain glass windows.

Project 1

Catapult Project



Using rubber bands, popsicle sticks, and a plastic spoon.. You will design a workable catapult. You will need to knock down a stack of cups and catapult a mini marshmallow a far distance. Are you ready for the challenge?

What kind of simple machines are used in a catapult?

_____

_____

_____

What are the physics of a catapult?

_____

_____

_____

How far can you shoot a marshmallow from your catapult?_____

How many cups could your catapult know down (out of 8)? _____

How would you redesign your catapult to knock down more cups?

_____

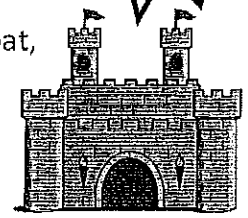
_____

_____

_____

Castle Challenge

Project 2



Using either the structure planks or Lego pieces you will develop a castle structure with the following: tower, moat, draw bridge

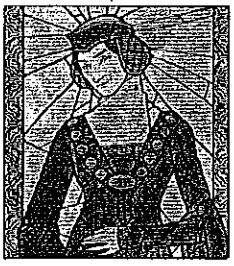
Which is better square or round towers?

Draw a sketch of your team's castle (Don't forget to get a picture)

What protection does your castle have from outside attacks?

Project 3

Stained Glass Windows



http://www.bbc.com/culture/story/20140630-the-10-best-stained-glass-windows

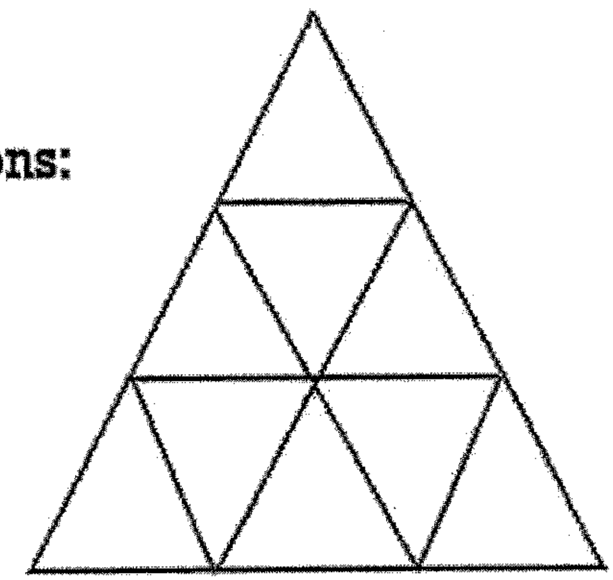
You will be using Microsoft Paint to create a stained glass picture of a lion, unicorn, or castle. You will use one clipart photo and draw the rest using the line tool. Use your paint bucket tool to fill in colors. Draw samples of the two best from your group in the boxes below.

Robotics

Design Box: Design a Robot for your House

How many Triangles are there??

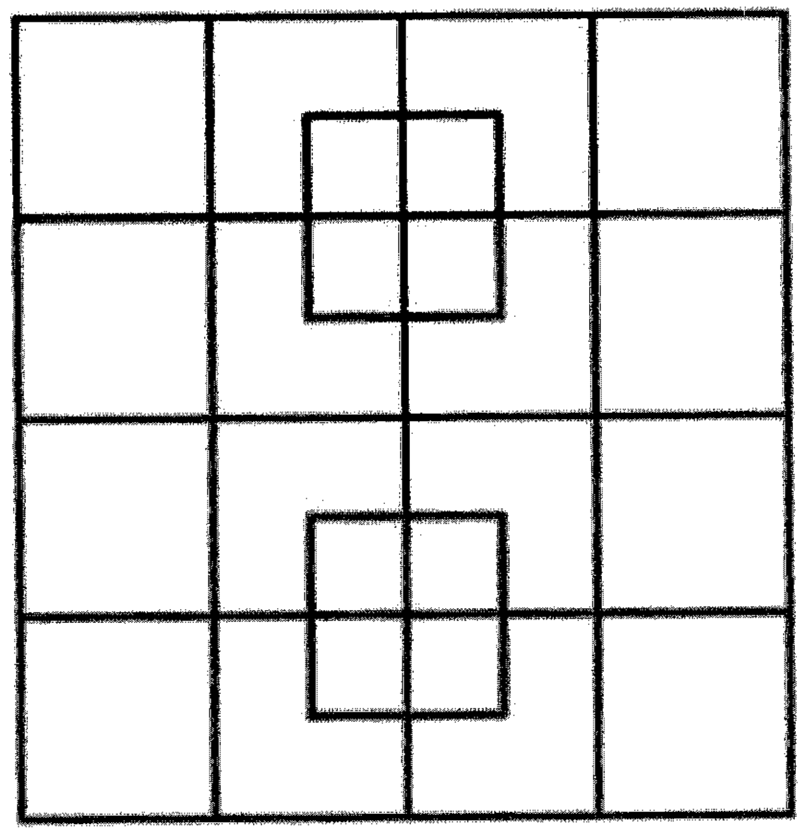
Lets see how smart are you?



Options:

1) 9
2) 12
3) 10
4) 11
5) 13

How Many Squares Are There?



Team Name:

Area of Study: *Engineering, Science, ART, Physics*

Team Members:

This Week's Challenge: ROBOTICS

This week the ***Little GOAT Design Company*** will be working with First Lego League. FIRST LEGO League introduces a scientific and real-world challenge for teams to focus and research on. The robotics part of the competition involves designing and programming LEGO Mindstorms robots to complete tasks. The students work out solutions to the various problems they are given and then meet for regional tournaments to share their knowledge, compare ideas, and display their robots.

http://carolynparkmiddle.stpsb.org/documents/20152016/FLL_2016_17_Robot_Game_Rules_Setup_Missions.pdf

Project 1

Robotic Challenge

Using the Lego mind storm robot. Program the robot to do program atl east 2 different mission. Program your robot to travel the board. (Shark Tank, Pig, Feed Animals?)

Draw your programming blocks for the pig mission:

Draw your programming blocks for mission of your choice:

How many rotations did you use to get your robot to travel until the end of the board?

_____

How many motors are on the robot: _____

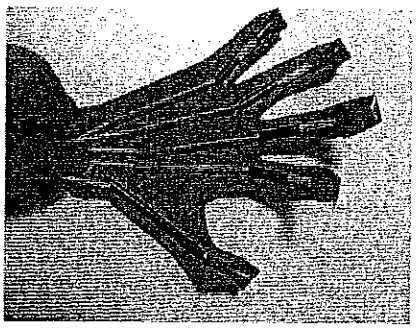
How would you redesign the robot to accomplish more missions: _____

_____

_____

Robotic Hand Challenge

Project 2

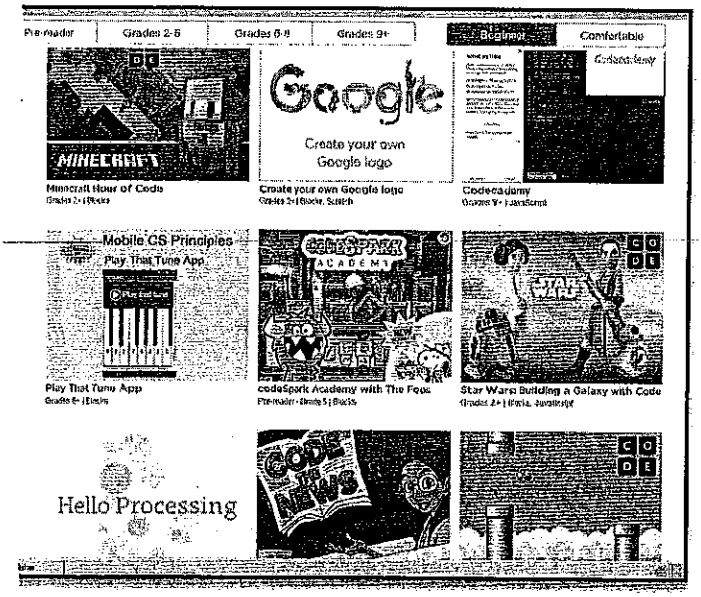


Following the direction sheet, you and your team will develop a robotic hand. Try to pick up

How do you think robotic hands will be useful in the future?

Project 3

Programming Challenge



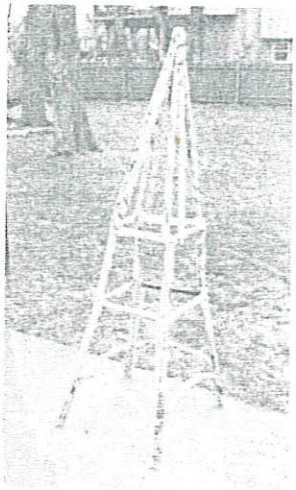
Using **https://hourofcode.com/us/learn** pick three different models and complete all puzzles to earn a certificate for your team. Hour of code uses block coding principals similar to Lego mind storms.

What is hour of code?

Name of Model Completed	
Name of Model Completed	
Name of Model Completed	

The Stem Olympics

Task One: NEWSPAPER CHALLENGE



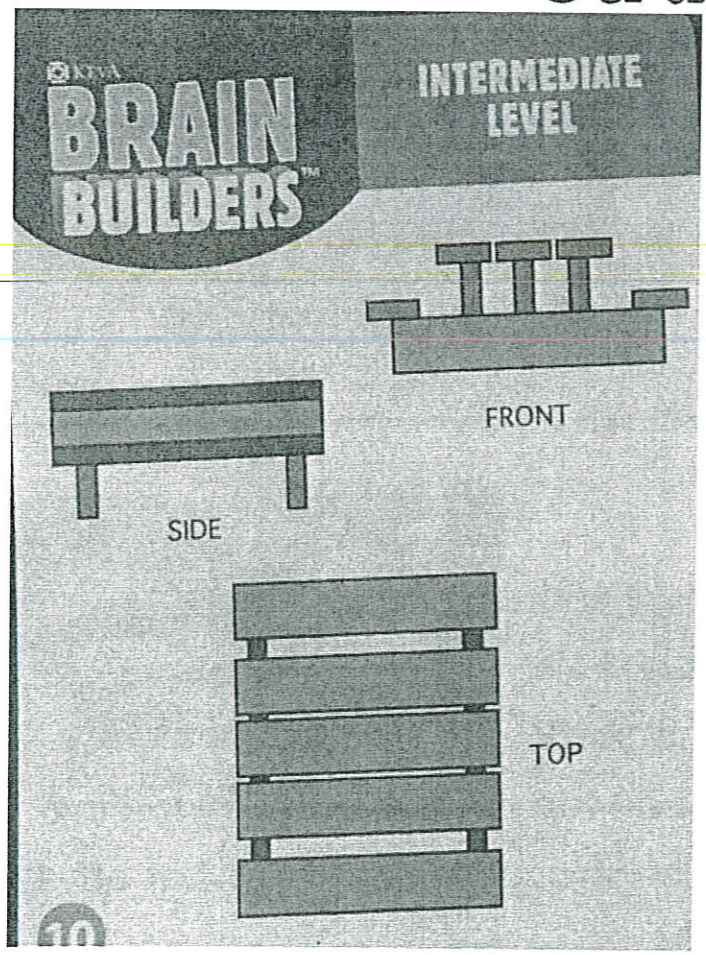
Supplies: 12 inches (30 cm) Tape, 3 full Sheets of Newspaper

Objective: You must build the tallest newspaper tower that does not topple over when wind is blown on it.

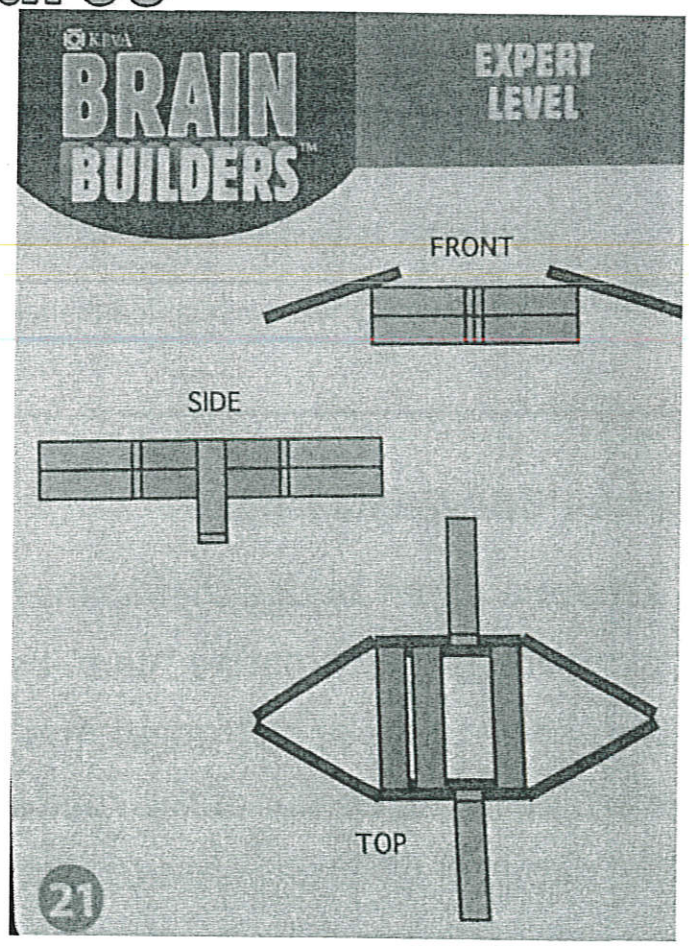
Today, your engineering design challenge is to design and construct a model tower using only newspaper and tape and scissors. Your team will be given limited supplies and a time limit. The tower must be as tall as you can make it, but also stable enough to stand up to a wind load since it will be built in a hurricane-prone region.

Your task mirrors the challenges that engineers are given in the real world—with objectives, requirements and constraints such as budgets, material limitations and deadlines. An engineering team that can design a structure to meet the objectives with the fewest materials (hence, less cost), is favored over other companies that cannot utilize the given materials as effec-

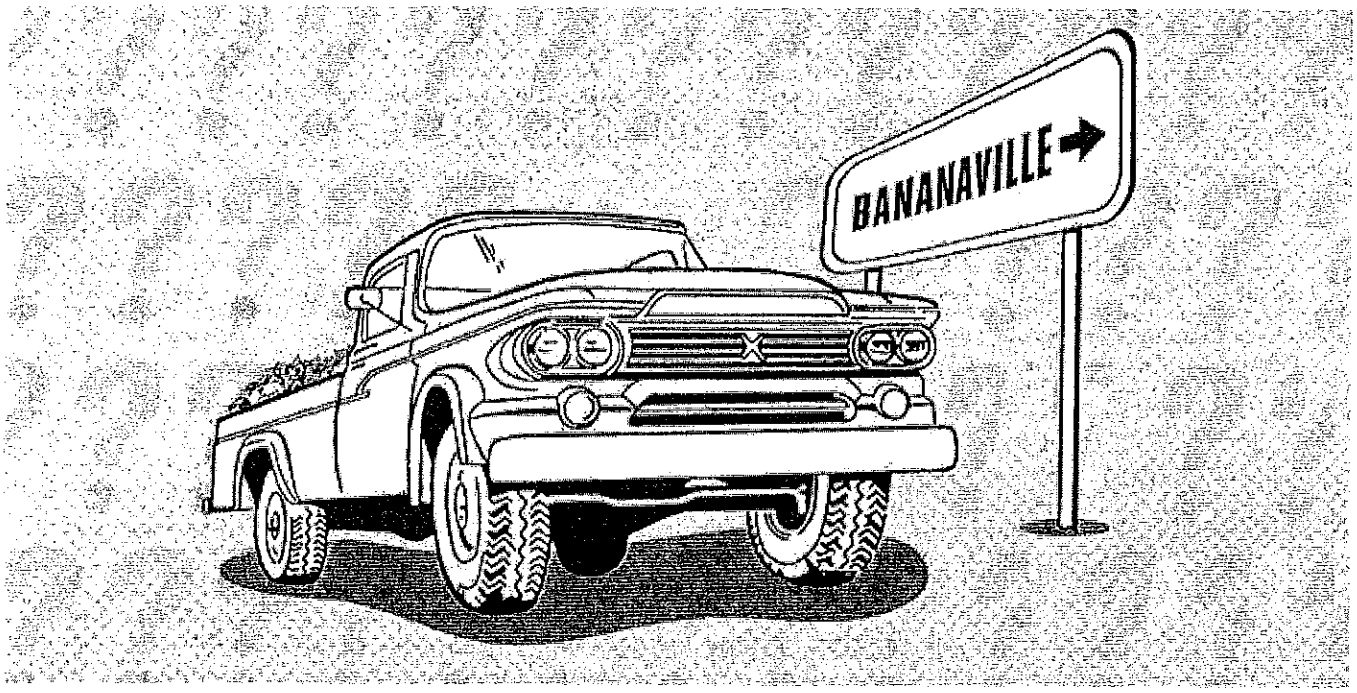
Structures



What Shape is it?



What Shape is it?



Brain Teaser Challenge

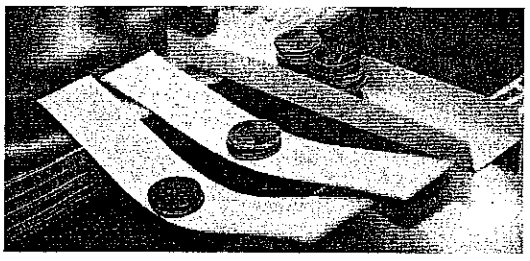
Welcome back. This week we try to help the fictional town of Bananaville, which, despite its predilection for the yellow fruit, is eagerly awaiting a shipment of delicious apples.

Problem
You are tasked with transporting 3,000 apples from Appleland to Bananaville, a distance of 1,000 miles. You have a truck that holds 1,000 apples. However, there is an apple toll on the road to Bananaville, and you must pay 1 apple per mile you drive. There is no toll when you are headed in the opposite direction, toward Appleland.

What is the largest number of apples you can transport to Bananaville?

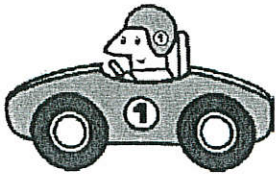
Hint: You may leave apples on the side of the road and return to pick them up later.

Paper Bridge Challenge



Create a paper bridge that spans the blocks and supports as many marble "cars" as possible. Fold the paper to make it stronger. You can only stack marbles in the center of the roadway, not on top of the blocks. Try folding the paper in different ways to construct the strongest roadway. What other household items will your roadway hold?

Rubber Band Racers



Student Resource:
Automobiles and Automotive Engineering

◆ Automotive Engineering

Automotive engineers design the vehicles that we use for life, work, and play. They are involved in aspects of engineering design ranging from the initial design concept all the way to production. They design, test and refine vehicles for safety, style, comfort, handling, practicality, and customer needs. The work of automotive engineers falls into three basic categories: design, development and production. The work of some engineers involves designing the basic part or systems of an automobile, such as brakes or engines. Research and development engineers devise solutions to various engineering challenges. Production engineers design the processes that will be used to manufacture the automobile.

Here are a few science concepts that will be helpful to keep in mind when designing and testing your rubber band car.

◆ Energy

Energy is the ability to do work. All forms of energy fall into two basic categories: potential energy and kinetic energy. Potential energy is mechanical energy which is due to a body's position. It is also known as stored energy. A car at rest has potential energy. Kinetic energy is mechanical energy that is due to a body's motion. For a car to move, potential energy must be transformed into kinetic energy.

◆ Newton's Laws of Motion

Sir Isaac Newton (1642 – 1727) was a brilliant mathematician, astronomer and physicist who is considered to be one of the most influential figures in human history. Newton studied a wide variety of phenomena during his lifetime, one of which included the motion of objects and systems. Based on his observations he formulated Three Laws of Motion which were presented in his masterwork Philosophiæ Naturalis Principia Mathematica in 1686.

Newton's First Law – An object at rest will remain at rest and an object in motion will remain in motion at a constant speed unless acted on by an unbalanced force (such as friction or gravity). This is also known as the law of inertia.

Newton's Second Law – An object's acceleration is directly proportional to the net force acting on it and inversely proportional to its mass. The direction of the acceleration is in the direction of the applied net force. Newton's Second Law can be expressed as: $F = ma$

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

Rubber Band Racers

Student Worksheet:
Design a Rubber Band Racer

You are a team of engineers who have been given the challenge to design your own rubber band car out of everyday items. The rubber band car needs to be able to travel a distance of at least 3 meters within a 1 meter wide track. The car that can travel the farthest distance within the track is the winner.

◆ Planning Stage
Meet as a team and discuss the problem you need to solve. Then develop and agree on a design for your rubber band car. You'll need to determine what materials you want to use.

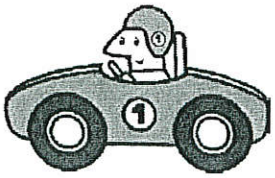
Draw your design in the box below, and be sure to indicate the description and number of parts you plan to use. Present your design to the class.

You may choose to revise your teams' plan after you receive feedback from class.

Design:

Materials Needed:

Rubber Band Racers



Student Worksheet (continued):

◆ Construction Phase
Build your rubber band car. During construction you may decide you need additional materials or that your design needs to change. This is ok – just make a new sketch and revise your materials list.

◆ Testing Phase
Each team will test their rubber band car. Your rubber band car must travel 3 meters within a 1 meter wide track. Calculate your car's speed (distance traveled per unit of time; S = d/t). Be sure to watch the tests of the other teams and observe how their different designs worked.

Rubber Band Car Data			
	Distance Traveled within Track (m)	Time Traveled within Track (s)	Speed (m/s)
Test 1			
Test 2			
Test 3			
Average			

◆ Evaluation Phase
Evaluate your teams' results, complete the evaluation worksheet, and present your findings to the class.

Use this worksheet to evaluate your team's results in the Rubber Band Racer Lesson:

1. Did you succeed in creating a rubber band car that traveled 3 meters within the track? If so, how far did it travel? If not, why did it fail?

Rubber Band Racers

Student Worksheet (continued):

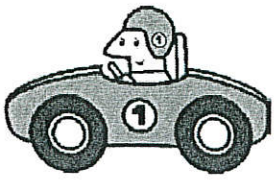
2. Did you negotiate any material trades with other teams? How did that process work for you?

3. What is the average speed your car achieved?

4. Did you decide to revise your original design or request additional materials while in the construction phase? Why?

5. If you could have had access to materials that were different than those provided, what would your team have requested? Why?

6. Do you think that engineers have to adapt their original plans during the construction of systems or products? Why might they?



Student Worksheet (continued):

7. If you had to do it all over again, how would your planned design change? Why?

8. What designs or methods did you see other teams try that you thought worked well?

9. Do you think you would have been able to complete this project easier if you were working alone? Explain...

PI DAY SCAVENGER HUNT

Below is a list of items you are to research (using the Internet) having to do with the first 14-digits of Pi. All entries must be school-appropriate. Have fun with this and GOOD LUCK!! A great Search engine that will help is: www.google.com

Find the Following:

1. U.S. state which tried to legislate a value for pi (name the state and the year in which the action was taken)

2. Mathematical formulas which include π (give the formulas in symbols and tell what each formula is used to find.

3. Labels or advertisements for products which use circles in their name or logo (Insert images from the internet.)

4. U.S. cities with names that have references to something circular - cities should not both be in the same state (name each city and state)

5. U.S. state flags which include circles in their design (turn in pictures of the flags)

6. Sports or games which use a circle or a sphere in their play (turn in pictures of the circles or spheres from the games, labeled with the names of the games)

7. Famous people with birthdays on March 14 (give name and year of birth)

8. Movie titles with references to something circular (list the movie titles)

9. Kinds of candy that come in circular pieces (turn in pictures of candy from the Internet)

10. Song titles with references to something circular (list the song titles)

11. Recipes for different kinds of pie (turn in complete recipes)