KIVALLIQ REGIONAL SCIENCE OLYMPICS

CORAL HARBOUR · REPULSE BAY · WHALE COVE · CHESTERFIELD INLET · ARVIAT · RANKIN INLET · BAKER LAKE

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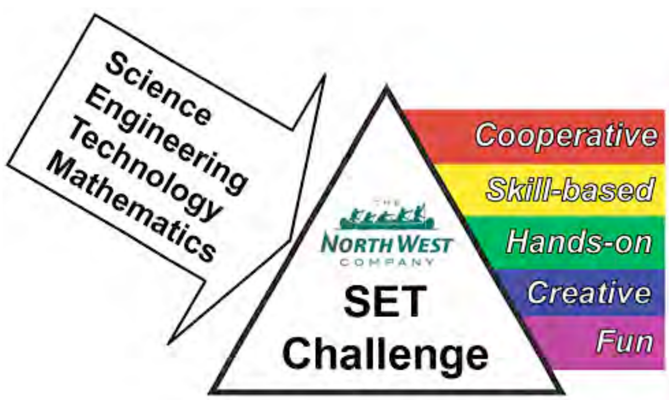
Silainnaq
Outer Space

Science • Engineering • Technology Challenge



A joint venture of the Kivalliq Regional Science Educators' Community and Kivalliq School Operations

Sponsored by

THE NORTH WEST COMPANY

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Ready, SET, Go!

The Kivalliq Science Educators' Community announces a new and exciting partnership with the North West Company. This year each school in the Kivalliq region will receive 75 t-shirts, several medals and a certificate template to distribute to participating and winning students.

School Medals

Each registered school will receive a set of student medals for their school to distribute for each of the 5 SET Challenge. Medals may be presented by the school to deserving students.

Event Certificates

Each registered school will receive event certificates to present to student participants.

Event T-Shirts

Each registered school will receive 75 event t-shirts. These shirts are for students and teachers to promote the event and be awarded as prizes.

Introduction

This package contains the SET Challenge 2013 activities for Kivalliq Schools. They may be used at any time throughout the year, **however to be eligible for certificates, schools must complete and register their students by Thursday, October 31, 2013.**

A SET Challenge is a problem-based activity that can promote the development of knowledge, skills and positive attitudes in the areas of science, engineering and technology. These activities foster the growth of problem solving skills, science process skills, communication skills, teamwork, and cooperation. SET Challenges also reinforce many of the Common Essential Learnings or Core Values of Inuit Qaujimajatuqangit (IQ). In particular, SET Challenges can reinforce:

- *Innuqatigiitsiarniq- the concept of respecting others, relationships and caring for people.* Group work and having fun together is part of every SET challenge.
- *Tunnganarniq- the concept of fostering good spirit by being open, welcoming and inclusive.* SET Challenge events are fun and create good will among the participants.
- *Piliriqatigiingniq- the concept of developing collaborative relationships and working together for a common purpose.* Each event has students working in pairs or teams collaboratively to construct a solution.
- *Avatimik kamattiarniq- the concept of environmental stewardship stresses the key relationship Inuit have with their environment and with the world in which they live.* Events often utilize recycled materials, such as cans and bottles and so in a small way SET challenges promote stewardship of the physical environment.
- *Pilimmaksarniq- the concept of skills and knowledge acquisition and capacity building is central to the success of Inuit in a challenging environment.* Learning by doing is a pedagogical technique that brings the traditional into the contemporary and is essential to the knowledge construction that occurs during a SET Challenge Event.
- *Qanuqtnurungnarniq- the concept of being resourceful to seek solutions by maximizing utilization of limited resources and improvising when and where necessary.* Resourcefulness is probably the strongest IQ value embedded in the SET Challenge. Participants must be resourceful to create a solution because they are given limited time and materials to do so.
- *Aajiqatigiingniq- the concept of consensus decision-making relies on strong communication skills and a strong belief in shared goals.* Each SET Challenge Event has a specific goal; successful completion of the task requires many decisions that all members of the team must support.
- *Pijitsirarniq- the concept of serving and community as opposed to pure self-interest.* Working in pairs or in teams helps participants see beyond themselves. SET Challenges always utilise this teamwork approach.

The SET Challenge is about process and creating within a context of a scientific concept such as aerodynamics, buoyancy or structural design. **This year's theme is Silainnaq (Outer Space) and students co-operate within teams to design and construct solutions to problems all involving rockets.** These activities encourage students to use their imagination and physically construct their solutions. Most of all, SET Challenges are fun and appeal to students of all ages and academic abilities. This year there are five different challenges for different grade levels in the school.

Silainnaq

Each Set Challenge has a Teacher's Guide which helps to further explain the challenge and highlights some possible concepts, skills and attitudes that may be developed before, during, or after the event. The teacher's guide also offers suggestions for setting up the event as well as curricular connections for the science classroom.

A promotion and awards package, funded by the North West Company, will be provided to schools by KSEC to help support the SET Challenge in the school. These prizes may be distributed at the discretion of the school.

Participation and Evaluation Forms are also included and are important aspects of the SET Challenge. These forms are necessary for both KSEC and the North West Company to gauge the participation of the events and make improvements for future SET Challenges. Digital photographs of each school's event activities are now required to be included with the participation data. Please ensure that your school completes these necessary forms.

Create a School Event

Turn **Silainnaq** into a School-wide event by judging the events in the gym and inviting the parents to watch or event participate as an adult entry. This event has great potential to develop positive buzz in your community. Check out the event guide and reach for the stars!

In summary, the theme of the 2013 Set Challenge is **Silainnaq** (Outer Space) and contained in this package are the following:

- ✓ SET Challenge 2013 activities for K-12 Students
- ✓ Teachers' Guide with curricular connections
- ✓ Registration Forms
- ✓ SET Challenge Evaluation Form

Silainnaq 2013
Registration Form

This form allows your students to be eligible for regional certificates.

Please fill in your schools' results and fax this form, along with the event evaluation form, to Maani Ulujuk Ilinniarvik via email keoconne@hotmail.com by Thursday, October 31, 2013

School:______________________________ Contact Person:________________________________

Balloon Blasters (K-Gr. 2)

1st Place Distance ________ Team Members: ____________________________________

____

____

Squash Rockets (Gr. 3-5)

1st Place Distance ________ Team Members: ____________________________________

____

____

Fizz Rockets (Gr.6-7)

1st Place Distance ________ Team Members: ____________________________________

____

____

Rubberband Rockets(Gr.8-9)

1st Place Distance ________ Team Members: ____________________________________

____

____

Water Rockets (Gr.10-12)

1st Place Distance ________ Team Members: ____________________________________

____

____

Please email 5 digital photos of the SET Challenge at your school to Katharine O'Connell at the email listed above.

SET Challenge 2013 Evaluation Form

<u>Part one of this form provides data to help secure funding for this event;</u> Part two is used to improve the activities.

School Name:___________________________ **Contact Person:**_____________________________

School/Community Participation Data

1. Estimate how many students participated in each activity in your school.
    _______ Balloon Blasters (K-Gr. 2)
    _______ Squash Rockets (Gr. 3-5)
    _______ Fizz Rockets (Gr. 6-7)
    _______ Rubberband Rockets (Gr. 8-9)
    _______ Water Rockets (Gr. 10-12)

2. How many teachers utilised these activities in your school? _______

3. How many parents helped with these activities in your school? ______

4. Were any of the activities open to public spectators? __________
    If yes, estimate the number of spectators. ____________

5. **<u>Email 4-6 digital pictures of this event to Katharine O'Connell at Maani Ulujuk Ilinniarvik</u>**

SET Challenge 2013 Event Evaluation

Contact teachers should fill out one evaluation sheet for their school.
1. Evaluate the event.
(1=Absolutely Yes, 2=Probably Yes, 3=Not Sure, 4=Probably Not, 5=Definitely Not.)

1 2 3 4 5	Did students enjoy the activities?
1 2 3 4 5	Did the activity help foster positive attitudes towards science?
1 2 3 4 5	Did the activity help develop teamwork skills?
1 2 3 4 5	Did the activity help develop science process skills?
1 2 3 4 5	Was the Teachers' Guide useful?
1 2 3 4 5	Would you participate in a similar type of activity next year?

2. General Comments and Suggestions:

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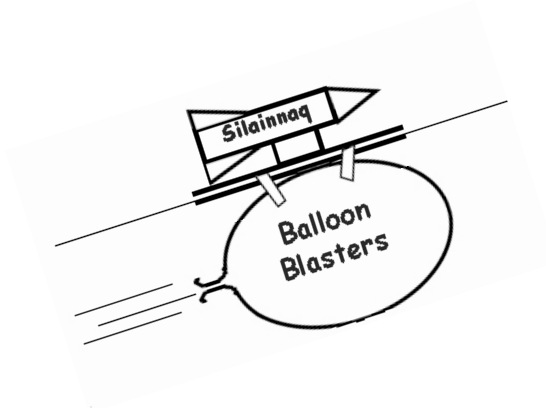


GRADES K-2

Silainnaq I BALLOON BLASTERS

DEADLINE: October 31, 2013

OBJECTIVE
To construct a balloon-powered rocket that will “fly” the furthest distance along a fishing line.

PARTICIPANTS
Groups of 3 students in grades K-2

MATERIALS
Each group should receive the following:
• 1 rocket template (see Flights of Fancy Teacher's guide) or sheet of construction paper
• 1 drinking straw • 1 round balloon • 50 cm of masking tape

TIME
Students have 20-30 minutes to make and decorate their rockets. **Additional time will be needed for the competition in the gymnasium.**

RULES AND JUDGING
Students may use the rocket template provided or draw their own rocket on a piece of construction paper. Rockets should be at least 15 cm long. A balloon must propel the rocket along the fishing line track. The inflated circumference of each team’s balloon may not exceed 1 metre (use a piece of string to check questionable entries). The rocket that travels the greatest distance along the fishing line is the winner. Instructions for registering your class and/or school team winners are included with this package. **Be sure to send your results to Katharine O’Connell by Thursday, October 31, 2013**

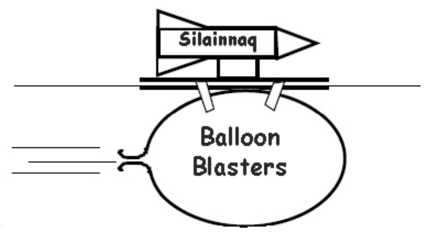
SUGGESTIONS
String may be substituted if fishing line is not available. If more than one line is available, multiple teams can test their rockets at the same time. Extend the fishing line out 20-30 metres for each track. Since only 1 balloon is available, have each team choose one member to blow up the balloon. If one or more rockets make it all the way to the end of the track, extend the track and let them go again. The construction phase of this activity is well suited to a classroom, but the Balloon Blasters should be tested in the gym or a long long hallway. If the activity is to be used as part of a school open house or as public entertainment, then a gym is most suitable. Refer to the Teachers’ Guide for general instructions and teaching suggestions.

BALLOON BLASTERS

A Note To Teachers: These instructions are only suggestions and are not intended to be prescriptive. Kindergarten and Grade 1 students may need help and so a template is provided; Grade 2 students may design their own rockets if they are capable.

Making the Balloon Blaster

1. Colour and cut out the rocket template. Fold in half around a drinking straw and glue rocket halves.
2. Tape rocket and straw to inflated balloon and get ready for launch.



Launching the Balloon Blasters

Although the Balloon Blasters are easy to make, they can be time consuming to launch as you must thread the launch line (fishing line) through each Balloon Blaster. Here are two suggestions aimed at speeding up the launch.

a) Attach a bamboo skewer or plastic "Pick-up Stick" to one end of the launch line. This will speed up the threading process.

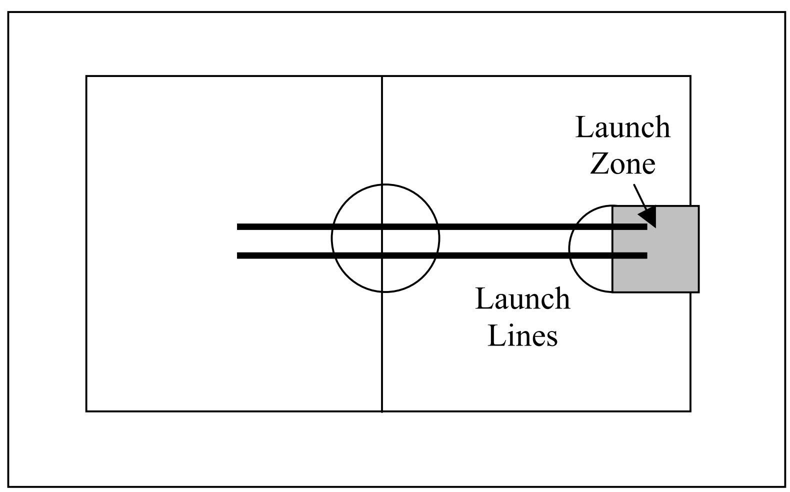
b). You can eliminate most of the threading by not giving the students a straw as part of their materials. Have students tape their rockets directly to their inflated balloon. During the launch, students may tape their balloons to a straw already threaded.

When fishing line is taut, rockets may be released individually or in groups, depending on the number of fishing lines available.

1. Stand in the launch zone facing the target end of the launch line.
2. Hold the Balloon Blaster by the pinched balloon opening.
3. When you are ready, release the Balloon Blaster and watch it fly down the launch line.

JUDGING

1. Launch lines should run from one end of the gym to the other.
2. Allow team members to attach their Balloon Blasters to the launch line. Note: each end of the launch line should be held taut by team members.
3. Count down and release the Balloon Blasters.
4. The Balloon Blaster that travels the furthest distance along the launch line is the winner.

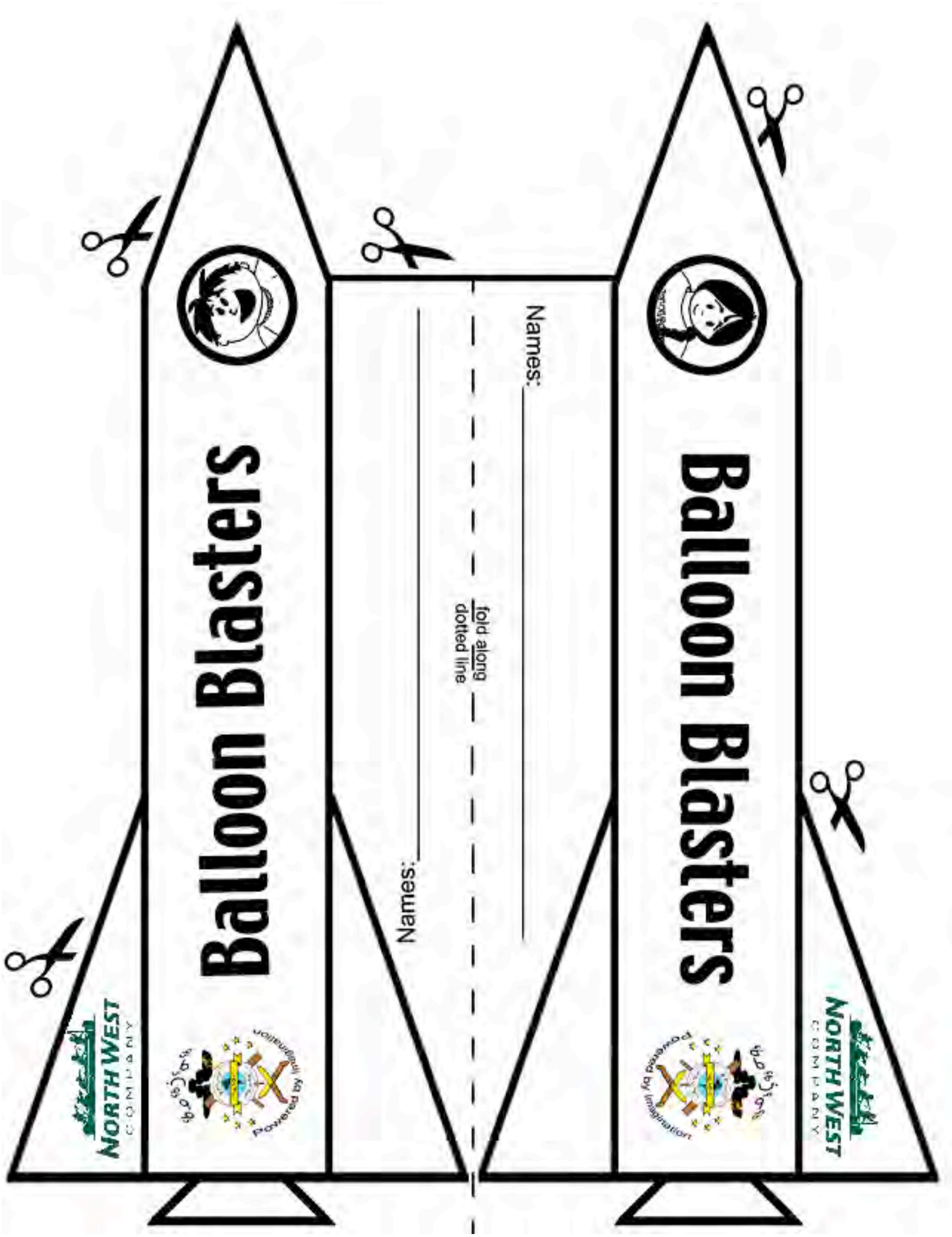


SAFTEY

This is a fun activity that can be safely managed if teachers take the necessary steps.

1. If bamboo skewers are used as part of the launch line, teachers should assist with threading the Balloon Blasters.
2. Ensure that there is a clear and wide path in front and along the sides of the launch line.

Balloon Blaster Template



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GRADES		DEADLINE:
3-5	**Silainnaq II** **SQUASH ROCKETS**	October 31, 2013

OBJECTIVE
To design and construct an air-powered rocket that will “fly” the furthest distance from the launch site.

PARTICIPANTS
Groups of 2 or 3 students in grades 4-6

MATERIALS
Each group should receive the following:
- empty plastic bottle (pop, ketchup etc.)
- 1 regular drinking straw (thin)
- 1 milkshake drinking straw (fat)
- 20 cm-30cm of rubber or plastic tubing
- cube of plasticine
- glue or tape • paper

TIME
Teacher may decide how much time is appropriate for their students to design and build their rockets. (1 hour is suggested).

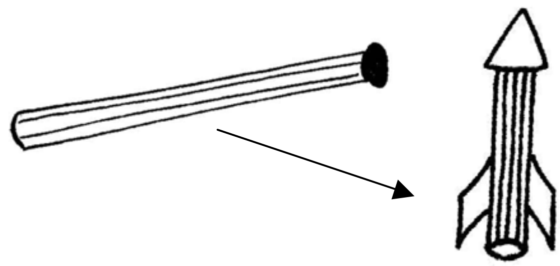
RULES AND JUDGING
Student groups will have two attempts to launch their rockets. The team whose rocket lands the greatest distance from the launcher is the winner. The distance is measured from the launch site to where the rocket first touches the ground. **Record the winning distance along with the names of the winning team members on the event summary sheet and fax it to Katharine O’Connell at Maani Ulujuk Ilinniarvik by Thursday, October 31, 2013**

GENERAL INSTRUCTIONS FOR SQUASH ROCKETS

A Note To Teachers: These instructions are only a suggestion and are not intended to be prescriptive. Teachers may choose not to provide this level of support to their students.

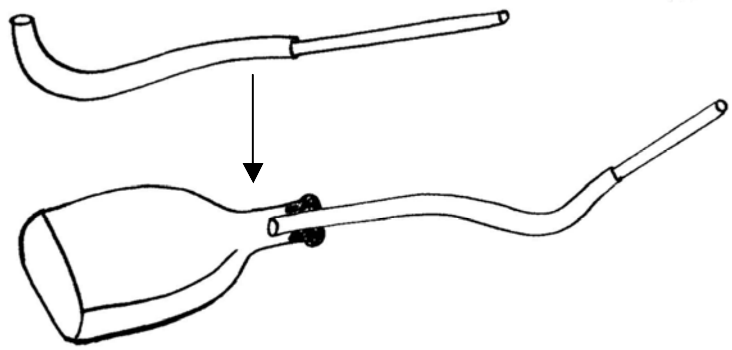
The Rocket

1. Plug one end of a milk shake staw with a small amount of plasticine.
2. Fashion stabilizer fins and a nose cone out of paper or cardboard and glue to milk shake straw.



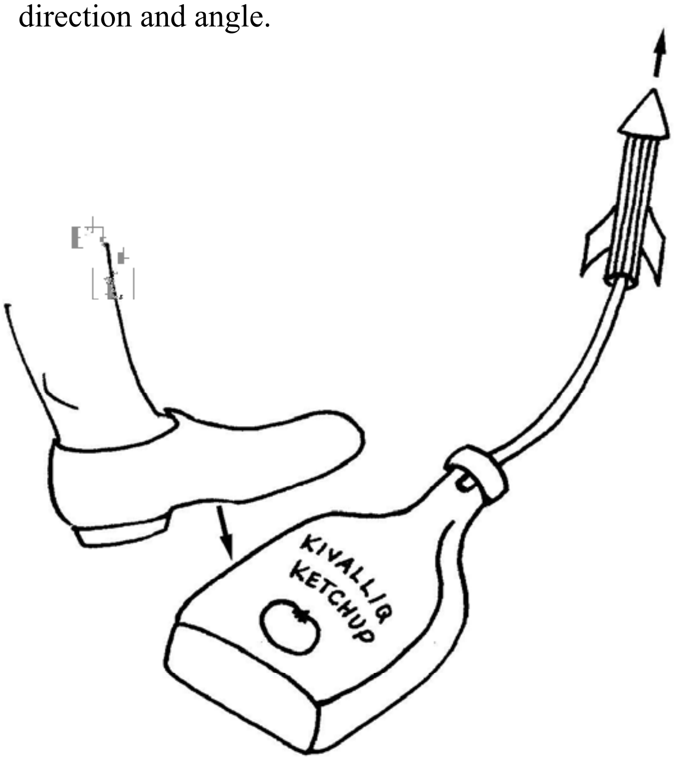
The Launcher

1. Attach one end of the rubber tubing to an end of the regular drinking straw
2. Insert the other end of the rubber tubing into the plastic bottle and pack the bottle opening with plasticine.



Launching The Rocket

1. Place the rocket (milk shake straw) over top of the launch straw and point rocket in a desired direction and angle.



2. Signal a member of your group to stomp on the launch bottle and send your rocket into flight.

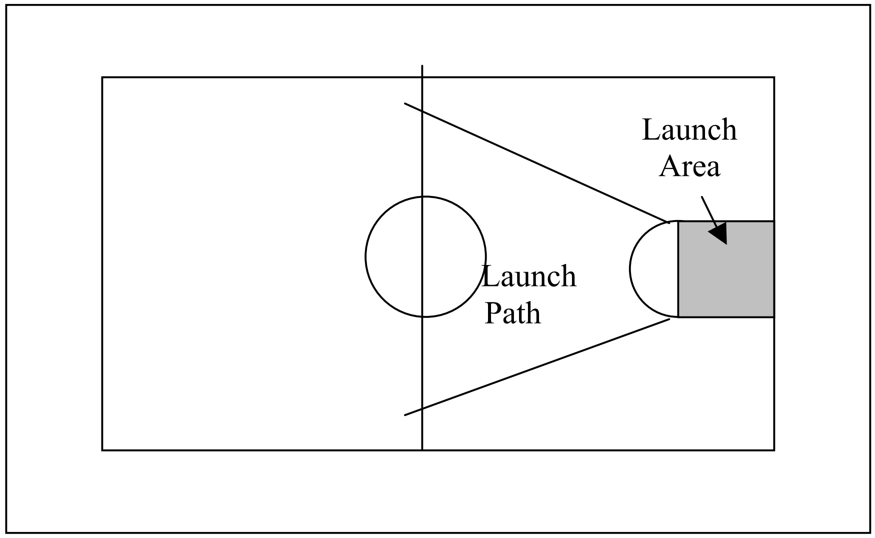
Safety

This is a fun activity that can be safely managed if teachers take the necessary steps.

1. Students must be cautioned on the safe use of their rockets and not be permitted to aim or launch rockets when people are in the flight path. Uncooperative students should be removed from the activity.
2. Ensure that there is a clear and wide path in front of the launch zone.
3. Safety glasses should be worn by students when launching rockets.
4. Teachers should practice launching rockets before demonstrating for students.

Judging (Safety goggles should be worn in the launch zone)

1. Student teams must launch their rockets from within the basketball key and aim toward the mid-court area.
2. Each team may launch their rockets twice.
3. The team whose rocket travels the farthest distance in the air will be declared the winner.



Judging this activity can be time consuming. To speed things up and reduce the down time, try the following ideas:

- Assign each team a number and line them up in order, ready to launch.
- Use a small piece of masking tape with Team # to mark the landing spot of each rocket.
- Allow each team to launch one rocket, then line up again and repeat activity. (This allows time for teams to repair launcher, without slowing down the activity.)
- When all rockets have been fired, measure the top three distances and record these results.

Suggestions

Students should be encouraged to consider what type and size of plastic bottle to use and then locate and bring one for the activity. Ask questions like "What purpose does the bottle serve in launching the rocket?" This may help students choose a suitable plastic bottle. Constructing the rocket is simple, but important. Ask students why the nose of the rocket should be plugged and weighted. Also ask them to consider the purpose of the fins. Finally, the launch angle is an important consideration for student team. Be sure that students understand that the rocket which touches down the furthest distance from the launch pad is the winner of this event. Have them consider what is the best launch angle.

The construction phase of this activity is well suited to a classroom, but the Squash Rockets should be tested in an area of ample space, like a gymnasium. The judging of this activity is an excellent spectators event and makes an great addition to an assembly or open house.

Discussion Questions

1. Why do we plug the end of the rocket with plasticine?
2. What is the purpose of the fins on the rocket?
3. Where does the air come from that pushes the rocket?

<u>Ideas for tying this activity into your science curriculum may be found on the following page.</u>

Science Curriculum Connection for Squash Rockets" (Grades 3-5)

The more classroom practice your students receive with their slings, the better they will become at launching their rocket and the more they will come to understand the forces acting on them. Make safety a priority.

Outlined below are references to the Nunavut Science curricula that apply to this activity.

Science Concepts (Check out the Department of Education's CD ROM or Kivalliq Curricula folder inside the Teachers Conference on the FirstClass server for PDF versions of the approved Nunavut Curricula)

Grade Three (**Refer to *Elementary Science Primary Program Guide*, p. 103)**

3.2 Energy, Heat and Temperature
Work is done when a force acts to move an object. In this case, the student's foot applies a force to the bottle, squashing it and pushing the air out through the tubing. This escaping air pushes the straw rocket off the launcher and propels it through the air.

Grade Four (**Refer to *Elementary Science Intermediate Program Guide*, pp. 106-108)**

4.4 Structures and Forces
The design, size and materials of a object is related to the function of the object/machine.

1. The external structure of an object is frequently related to its function.
6. The materials/designs of objects determine their ability to withstand/overcome forces.

Grade Five (**Refer to *Elementary Science Intermediate Program Guide*, pp. 118-121)**

5.3 Forces and Motion

1. Forces are pushes or pulls and exist in pairs.
2. Forces can put an object in motion and change the motion of the object.
3. The force that causes an object to change its motion is called an unbalanced force.
9. The force that an object can exert or withstand is dependent on the object's strength.
10. When an object exerts a force on another object and the latter objects exerts an equal but opposite force on the former, the system is at rest.
11. Force, time and mass can affect the change in an object's motion.

Process Skills and Attitudes

This activity encourages students to naturally go through many of the steps of the scientific method. By having them construct their rockets and launchers in groups helps them to learn cooperation. The class activity may be used as an opportunity to practice measurement skills. Launching the rockets allows students to try out different theories about the path of the path of the rocket and where to aim. Finally, when the event is over and winners have been declared, a discussion may be used to summarise what worked well and what didn't. Besides encouraging the process skills outlined above, this activity may also be used to encourage desirable attitudes and behaviours. Curiosity, openness, risk-taking, objectivity, precision, confidence, perseverance, satisfaction, respect for theoretical structures, responsibility, consensus and collaboration are all attitudes that can be strengthened by this activity. See pages 69-79 (Elementary Science Intermediate Program Guide) for more details on process skills and attitudes. This problem solving approach can also reinforce the IQ principles of Qanuqtuurniq (innovation), Aajiiqatigiinniq (consensus), Piliriqatigiinniq (collaboration), and Pilimmaksarniq (experiential learning).

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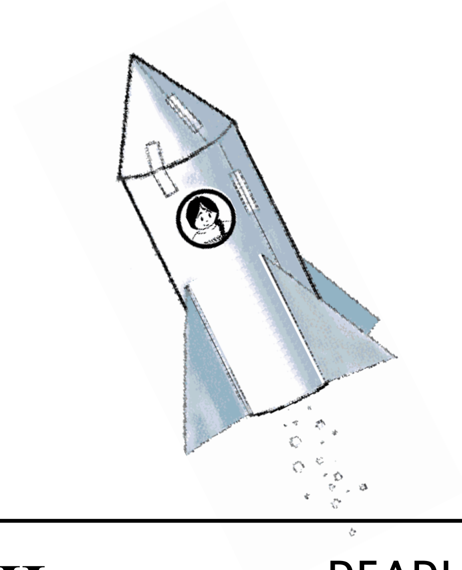


GRADES 6-7

Silainnaq III
FIZZ ROCKETS

DEADLINE:
October 31, 2013

OBJECTIVE
To design and construct a fizz rocket that will fly to the greatest height.

PARTICIPANTS
Groups of 3 or 4 students in grades 6-7

MATERIALS
Each group should receive the following:

Construction
- **Paper Fizz Rocket template**
- **Scotch tape**
- **Plastic 35-mm film canister**
- **Scissors**

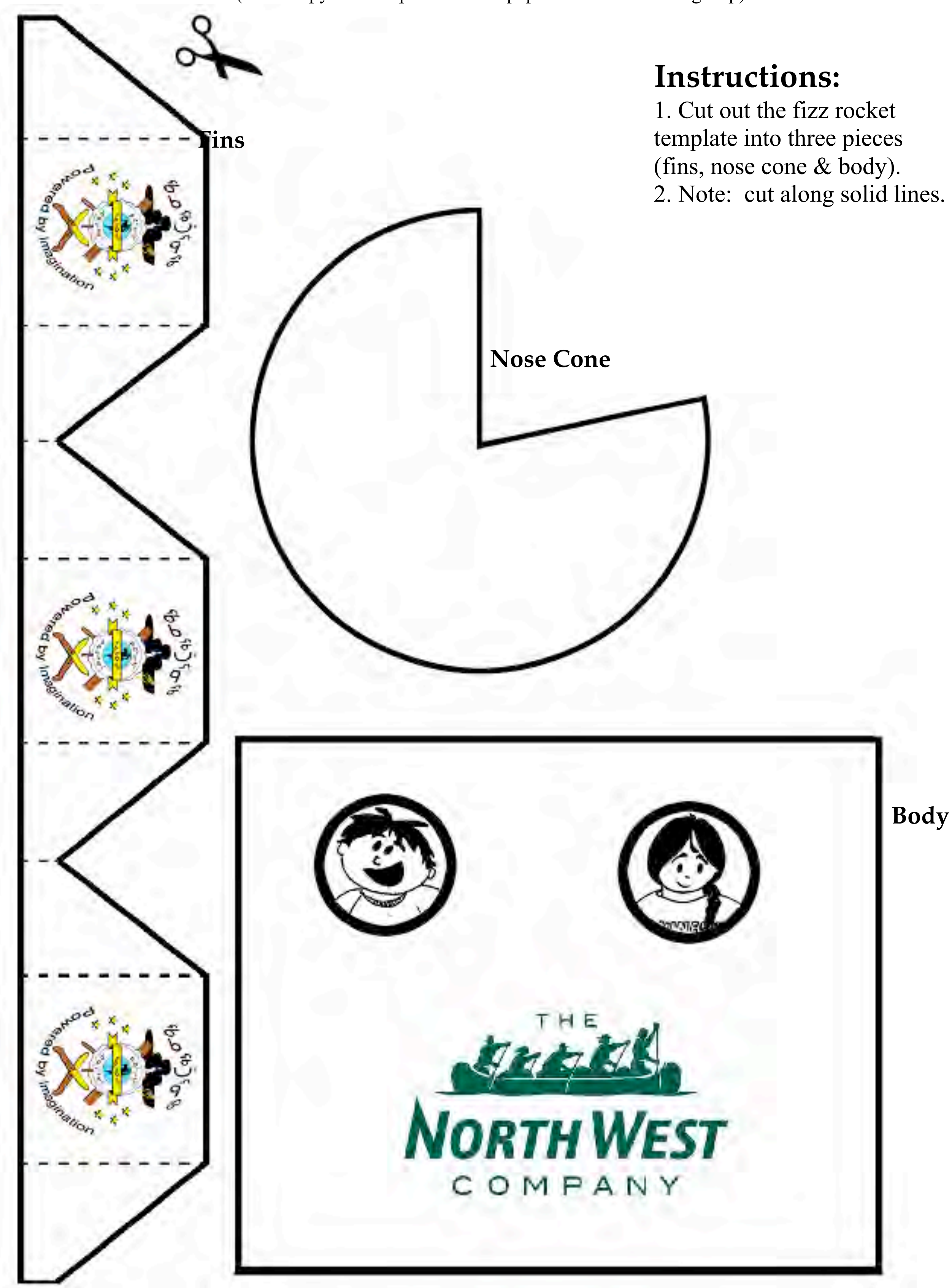
Launch
- **Alkaseltzer tablet**
- **Paper towels**
- **Water**
- **Safety glasses**

TIME
Students have up to 1 hour to construct and tweak their fizz rocket systems.

RULES AND JUDGING
Students must use only the materials listed above to construct their fizz rockets. The challenge is launch a rocket that will fly to the greatest height. Tools, such as scissors, may be used to construct the system, but may not become part of the system. After construction, teams will get two launch attempts and their greatest height will be counted. The team whose fizz rocket flies to the greatest height is the winner. Note: the height is measured from the floor to the top of the rockets path. Judges will need a stepladder and a “height gauge” to estimate each rocket’s height. (See Judging Suggestions) **When all teams in the 6-7 division have completed this event, record the heights of the top rocket and the names of the students who constructed them on the event summary sheet and send it to Katharine O’Connell at Maani Ulujuk Ilinniarvik by Thursday, October 31, 2013.**

Fizz Rocket Template

(Photocopy one template on stiff paper for each student group)

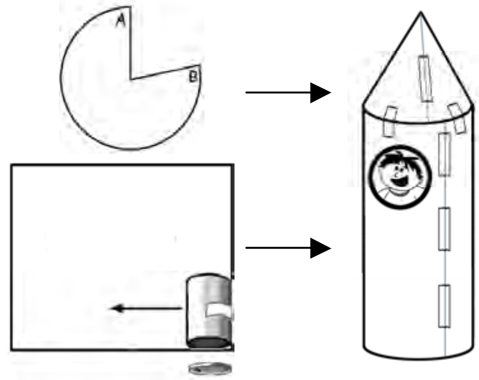


Instructions:

1. Cut out the fizz rocket template into three pieces (fins, nose cone & body).
2. Note: cut along solid lines.

Instructions for Building and Launching a Fizz Rocket

Building your Rocket



1. Decorate your team's fizz rocket template and cut out. Make sure you write your names neatly on the template.
2. Wrap and tape the paper body template around the film canister as shown in the diagram. (Make sure that the lid side is down).
3. Slide Part B under Part A and rotate until cone is correct size to fit on rocket body. Secure with tape.
4. Cut out rocket fins and fold along dotted lines.

5. Wrap fins around rocket base and staple together so that three fins result. Also secure fins with tape. Your rocket is now ready for fuel and launch.

Creating a Fuel Mixture

Your fizz rocket is powered by carbon dioxide gas that is released when alkaseltzer is mixed with water. Alkaseltzer is a product used to settle an upset stomach. It is a dry mixture of sodium bicarbonate (baking soda) and citric acid (the acid found in lemons and other citrus fruits). Alkaseltzer does not really react with water. Water dissolves the baking soda and citric acid in the alkaseltzer and they react with each other to produce carbon dioxide gas (the same gas we exhale!).

As the carbon dioxide gas is produced it builds up pressure until it can no longer be contained in the film canister and blows off the lid. As the rocket pushes out the gas and liquid, the gas and liquid push back on the rocket and propel it into flight. This is an example of Newton's third law of Motion (for every action there is an equal reaction in the opposite direction).

Your challenge is to decide how much water and alkaseltzer to use in your rocket. You want to maximize the pressure created by the gas so that when it blows off the cap, the rocket flies high into the air.

Launching your Rocket (with Teacher supervision)

1. Put on your eye protection.
2. Turn the rocket upside down and remove the canister's lid.
3. Add water to the canister. You decide how much to add, one-quarter to one-half full.
4. Decide how much alkaseltzer to use (one-quarter to one-half of a tablet).
5. Drop alkaseltzer into canister and quickly snap the lid on tight.
6. Quickly stand your rocket up in the launch basin and stand back.
7. 5—4—3—2—1--Blast Off!

For more information check out this cool NASA web site: http://spaceplace.nasa.gov/en/kids/rocket.shtml

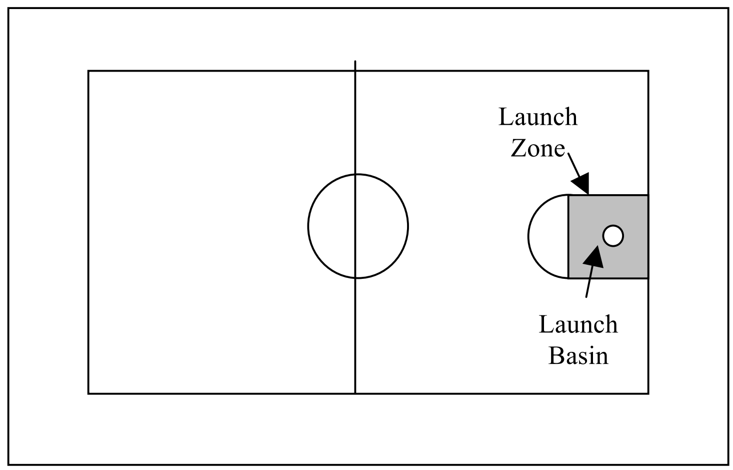
Safety

This is a fun activity that can be safely managed if teachers take the necessary steps.

1. Students must be cautioned on the safe use of their rockets and not be permitted to aim or launch rockets without supervision Teachers should not pass out water or alkaseltzer until team is in the launch zone. Uncooperative students should be removed from the activity.
2. Only one team is allowed in the launch zone at a time.
3. Safety glasses should be worn by students when launching rockets.
4. Launch rockets from inside a plastic wash basin to contain liquid exhaust and minimize mess. Have a mop available to keep launch zone dry.
5. <u>Teachers should practice launching rockets before demonstrating for students.</u>

Judging (Safety goggles should be worn in the launch zone)

1. Student teams must launch their rockets from within the launch zone (basketball key) and aim rockets straight up.
2. Each team may launch their rockets twice.
3. The team whose rocket reaches the greatest height will be declared the winner.
4. Secure a tape measure to the wall behind the launch basin. Judges should be located facing the launch basin and wall. When rocket launches judges estimate height on launch height guide.
5. If necessary, one judge may stand on a stepladder to increase accuracy of estimates.



Suggestions

Students should be encouraged to consider how much water and alkaseltzer to use. Too much or too little will not produce good results.

The construction phase of this activity is well suited to a classroom, but the Fizz Rockets should be tested in an area of ample space, like a gymnasium. The judging of this activity is an excellent spectators' event and makes a great addition to an assembly or open house.

Discussion Questions

1. What is fizz?
2. Why does the lid pop off the rocket?
3. Why could it be dangerous to shake a can of pop?

<u>Ideas for tying this activity into your science curriculum may be found on the following page.</u>

Teacher's Guide for Fizz Rockets (Grades 6-7)

This activity introduces students to many concepts such as energy conversion, forces, Newton's Laws of Motion (inertia, acceleration and unbalanced forces and action/reaction), useful and destructive energy as well as many others. Students are challenged to build a fizz rocket that will blast off and reach the greatest height. Each design must strive to maximize the force of propulsion created by the carbon dioxide gas that is produced from the reaction of alka seltzer tablets and water. Outlined below are references to the Nunavut Science curricula that apply to this activity.

Science Concepts

Grade Six (Refer to *Elementary Science Intermediate Program Guide*, p. 146-157)

6.3 Forces and Machines

1. Forces act on all things at all times. Forces may change the direction of an object in several ways. Objects being acted upon by forces may be stationary or mobile.
2. Several or many forces may be added up to make one large force.
3. Machines are designed to produce changes in a force's strength.

Grade Seven (Refer to *Junior High Science: Curriculum document, 1991*)

Strand: Matter and Energy (pp. 27-30)

Rationale: Principles of science and technology permeate the students' daily lives. Students need to know about science concepts that affect them and influence the way they live.

Central Questions:

2. How can we apply science and technology to our daily lives?

Major Concepts and Understandings:

- physical properties which apply to the function/design of everyday machines
- forces in our lives: mechanical
- how energy can be converted from one form to another
- different forms of energy in our lives
- heat and the conservation of energy
- work, motion and energy in terms of simple machines
- applications of science and technology to solve real problems

Skills: observation, inferring, predicting, controlling variable, construction of models, applying learning to new situations, gathering and collecting data, measuring, formulating hypotheses, experimenting, researching, technological problem solving, decision making, critical thinking, creative thinking/design, and communicating results.

Attitudes and Behaviours:

- awareness that technology can be understood from the perspective of a small number of physical concepts and properties
- appreciation of the value of traditional and scientific knowledge to the community
- confidence in the ability to design and conduct experiments
- confidence in the ability to solve problems

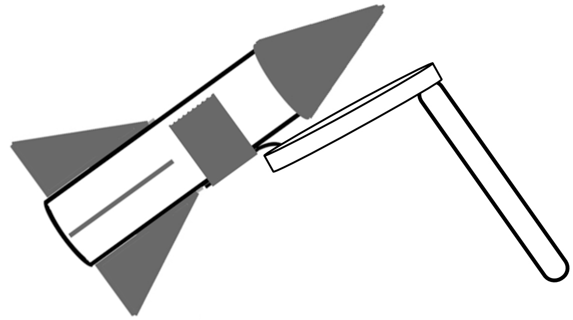
Common Learning Experience/Activities

- use and design models to illustrate concepts
- utilise local resource people
- demonstrate conversion of energy from one form to another
- illustrate and demonstrate the differences between the various kinds of forces

This use of technology to solve a practical problem stresses the connection between Science, Technology, Society and Culture as the IQ principles of Qanuqtuurniq (innovation), Aajiiqatigiinniq (consensus), Piliriqatigiinniq (collaboration), and Pilimmaksarniq (experiential learning) are valued and strengthened by this activity.

KIVALLIQ REGIONAL SCIENCE OLYMPICS

CORAL HARBOUR · BAKER LAKE · REPULSE BAY · RANKIN INLET · WHALE COVE · ARVIAT · CHESTERFIELD INLET



GRADES 8-9

Silainnaq IV
RUBBERBAND ROCKETS

DEADLINE: October 31, 2013

OBJECTIVE
To design and construct a rubber band powered rocket that will fly the furthest distance.

PARTICIPANTS
Groups of 3 or 4 students in grades 8-9

MATERIALS
Each group should receive the following:

- **1 paper towel or toilet paper tube**
- **3 rubber bands (thick ones work best)**
- **small cube of plasticine**
- **some bristol board or thin cardboard**
- **20 cm duct tape**
- **2 popsicle sticks or pencils**

TIME
Students have 45 minutes to construct their Rubber Band Rockets.

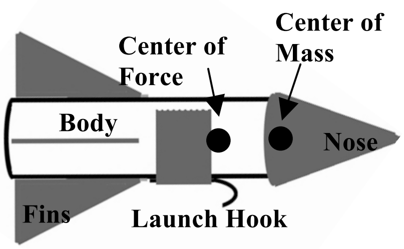
RULES AND JUDGING
Students must use only the materials listed above to construct their rockets and launchers. Tools such as scissors may be used but they may not become part of the launcher or rocket. Teams will be allowed to launch one calibration round and two competition rounds of ammunition. The challenge is to propel your rocket the greatest distance possible. The team whose rocket lands the greatest distance from the launch zone will be declared the winner. Keep all students away from the line of fire. **When all teams in the 8-9 division have completed this event, record the names and point totals of the top teams on the event summary sheet and send it Katharine O'Connell at Maani Ulujuk Ilinniarvik**

Other contests may be judged as well, such as: most artistic rocket, most colourful rocket, most co-operative team, etc.

General Instructions for Rubber Band Rockets

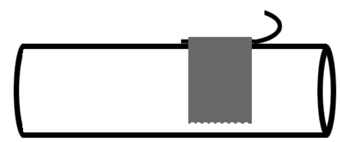
A Note To Teachers: These instructions are only a suggestion and are not intended to be prescriptive.

The Rocket



The success of your rockets design will depend on your attention to the following principles of flight: center of mass, center of force, thrust, drag, gravity, and lift. The center of mass (also called the center of gravity) is the point where the rocket will balance. That is, the mass is equal on all sides of this point. The center of force is the point on your rocket where the rubber band attaches and pulls the rocket forward. The center of force should be in the front $^{1}/_{3}$ to ¼ of the rocket. The most stable rockets have the center of mass in front (on top of) the center of force so a small mass should be added to the nose cone to help stablize your rocket. Thrust is the force that propels the rocket forward. In your rocket, thrust is provided by a stretched rubber band. Drag is the force of friction caused by air moving over the rocket's surface. Your rocket should be designed to minimize drag. Gravity is the force that pulls your rocket down after blast off. The greater your rocket's mass, the greater the force of gravity acting on it. Finally, lift is a force that opposes gravity. It is created by air flowing quickly over surfaces like wings. Designing glide wings may increase your rocket's flight distance.

Body



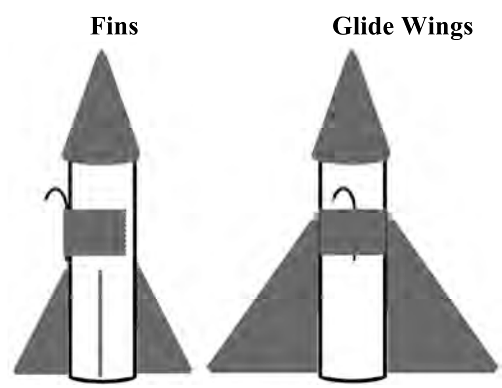
1. Reinforce a paper towel tube or toilet paper tube with duct tape.
2. Bend a paper clip to make a small hook and tape it to the body near the top, about the top $^{1}/_{3}$ to ¼ of the rocket.

Nose

1. Fashion a nose cone out of bristol board or thin cardboard provided. The nose cone should make your rocket more aerodynamic.
2. Affix a small mass to the inside of your nose cone and attach your nose cone to your rocket's body. This mass will move your rocket's center of mass towards the front of the rocket and make it more stable during flight. Note: too much mass will make your rocket heavy and decrease flight distance; not enough mass will make your rocket wobbly and decrease flight distance.

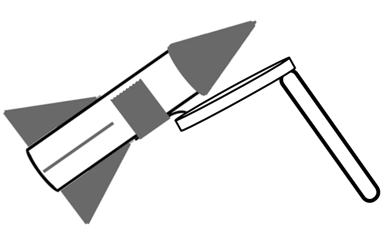
Stabilizers

1. Using materials provided, make a stablization system for your rocket. Two possible options include: stabilization fins or glide wings. The stabilization system will help keep your rocket on a straight flight path.



Two possible stabilizer designs

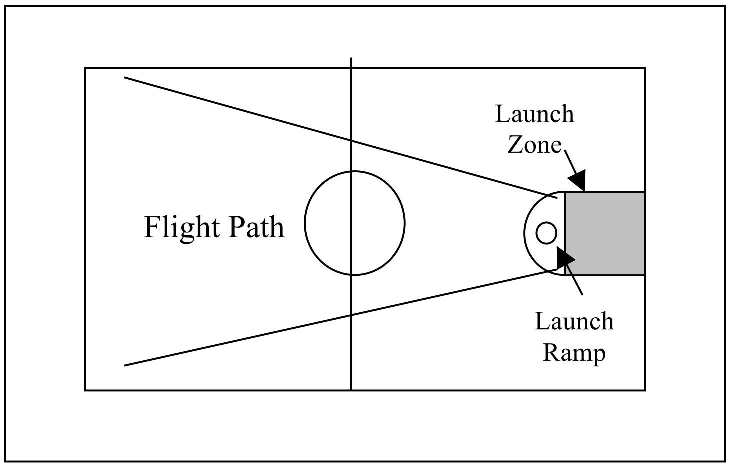
Launch Stick



1. Your rocket is now ready to launch. Attach a rubber band to the end of a pop sickle stick or pencil. Holding on to the stick, loop the rubber band around the hook on your rocket and pull the rocket back. Aim the rocket towards the launch zone and release.

Judging

Students must launch their rockets from within the basketball key and aim toward the mid court. Measure flight distance from where the rocket first touchdown and not where it stops sliding.



Launching

This is a fun activity that can be safely managed if teachers take the necessary steps.

1. Students must be cautioned on the safe use of their rockets and uncooperative students should be removed from the activity.
2. Ensure that there is a clear and wide path in front and behind the team launching their rubber band rockets.
3. Students should not stretch their rubber bands too far or they risk breakage and injuring a team member or spectator.
4. Rockets may only be launched from inside the launch zone. Only team members are allowed in the launch zone.
5. Safety goggles must be worn by all members of a launch team during the launch.

Teacher's Guide for Rubber Band Rockets (Grades 8-9)

This activity introduces students to many concepts such as energy conversion, forces, Newton's Laws of Motion (inertia, acceleration and unbalanced forces and action/reaction), useful energy and efficiency as well as many others. Students are challenged to design a rubber band rocket system that will project their rocket the furthest distance in the air. Each design must strive to be both aerodynamic and durable. The potential energy of the stretched rubber band is converted to kinetic energy when the rocket is released. The path of the projectile is determined by the elastic force (thrust), air resistance (drag), lift provided by the wings and and gravity.

Science Concepts (Check out the Department of Education's CD ROM or Kivalliq Curricula folder inside the Teachers Conference on the FirstClass server for PDF versions of the approved Nunavut Curricula)

Grade Eight and Nine (Refer to *Junior High Science: Curriculum document, 1991*)

Strand: Matter and Energy (pp. 27-30)

Rationale: Principles of science and technology permeate the students' daily lives. Students need to know about science concepts that affect them and influence the way they live.

Central Questions:

1. What is the physical and chemical nature of our world?
2. How can we apply science and technology to our daily lives?

Major Concepts and Understandings:

- physical properties which apply to the function/design of everyday machines
- forces in our lives: mechanical
- how energy can be converted from one form to another
- different forms of energy in our lives
- heat and the conservation of energy
- work, motion and energy in terms of simple machines
- applications of science and technology to solve real problems

Skills: observation, inferring, predicting, controlling variables, construction of models, applying learning to new situations, gathering and collecting data, measuring, formulating hypotheses, experimenting, researching, technological problem solving, decision making, critical thinking, creative thinking/design, and communicating results.

Attitudes and Behaviours:

- awareness that technology can be understood from the perspective of a small number of physical concepts and properties
- appreciation of the value of traditional and scientific knowledge to the community
- confidence in the ability to design and conduct experiments
- confidence in the ability to solve problems

Common Learning Experience/Activities

- use and design models to illustrate concepts
- design and illustrate simple machines
- utilise local resource people
- demonstrate conversion of energy from one form to another
- illustrate and demonstrate the differences between the various kinds of forces

This use of technology to solve a practical problem stresses the connection between Science, Technology, Society and Culture as the IQ principles of Qanuqtuurniq (innovation), Aajiiqatigiinniq (consensus), Piliriqatigiinniq (collaboration), and Pilimmaksarniq (experiential learning) are valued and strengthened.

KIVALLIQ REGIONAL SCIENCE OLYMPICS

CORAL HARBOUR
REPULSE BAY
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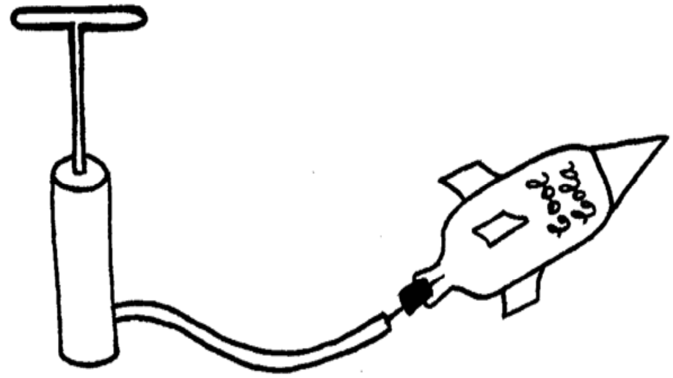


GRADES 10-12

Silainnaq V
WATER ROCKETS

DEADLINE
October 31, 2013

OBJECTIVE
To design and construct a water rocket that will “fly” the furthest distance from the launch site.

PARTICIPANTS
Groups of 2 or 3 students in grades 10-12

MATERIALS
Each group should receive the following:

- 2 empty plastic pop bottles (in good condition)
- duct tape
- 1 rubber stopper or cork to fit bottle
- scrap cardboard or plastic for stabilizer fins and cone
- glue or glue gun

TIME
Students have one hour to construct and tweak their water rockets.

RULES AND JUDGING
Student groups should get three attempts to launch their rockets. The team whose rocket lands the greatest distance from the launcher is the winner. The distance is measured from the launch site to where the rocket first touches the ground. **When all teams in the 10-12 division have completed this event, record the distance of the best launch and the names of the students who constructed the system on the event summary sheet and send it to Katharine O’Connell at Maani Ulujuk Ilinniarvik by October 31, 2013.**

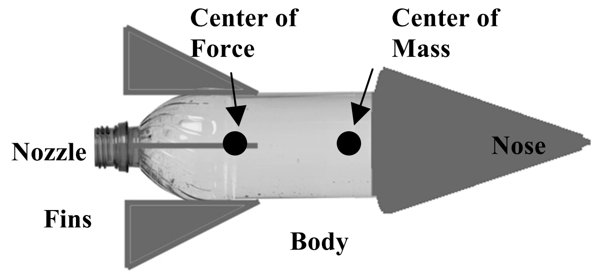
SUGGESTIONS
Students should be encouraged to consider what size of plastic pop bottle to use and then locate and bring one for the activity. The construction phase of this activity is well suited to a classroom, but the Pump Projectiles should be tested in an area of ample space, like a gym or sports field. If the activity is to be used as part of a school open house or as public entertainment, then a gym or auditorium is most suitable.

efer to the General Instructions for more details, safety directions and teaching suggestions

General Instructions for Water Rockets

A Note To Teachers: These instructions are only a suggestion and are not intended to be prescriptive.

The Rocket



The success of your rocket's design will depend on your attention to the following principles of flight: center of mass, center of force, thrust, drag, gravity, and lift. The center of mass (also called the center of gravity) is the point where the rocket will balance. That is, the mass is equal on all sides of this point. The center of force is the middle of the surface that air/water pushes against as it rushes out the rocket nozzle. The center of force will be approximately where the fins are located. The most stable rockets have the center of mass in front (on top of) the center of force. Thrust is the force that propels the rocket forward. In your rocket, thrust is provided by a pressurized mixture of air and water. Drag is the force of friction caused by air moving over the rocket's surface. Your rocket should be designed to minimize drag. Gravity is the force that pulls your rocket down after blast off. The greater your rocket's mass, the greater the force of gravity acting on it. Finally, lift is a force that opposes gravity. It is created by air flowly quickly over surfaces like wings.

Body

1. Wrap a plastic pop bottle with duct tape. Make sure that the bottle has no cracks or stress points.

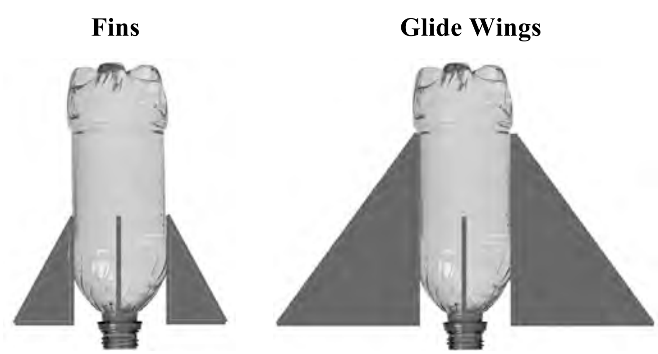
Two possible nose designs

Nose

2. Affix a small mass to the nose of your rocket. This will move your rocket's center of mass towards the front of the rocket and make it more stable during flight. Note: too much mass will make your rocket heavy and decrease flight distance; not enough mass will make your rocket wobbly and decrease flight distance.
Fashion a nose cone out of paper, cardboard, or plastic provided. The nose cone should cover up the nose mass and make your rocket more aerodynamic.

Stabilizers

3. Using materials provided, make a stablization system for your rocket. Two possible options include: stabilization fins or glide wings. The stabilization system will help keep your rocket on a straight flight path.



Two possible stabilizer designs

Fuel Mixture

Your water rocket is powered by a pressurized mixture of air and water. You must decide what proportions to use. Too much or too little water will not produce enough thrust during launch. Your challenge is to determine the best ratio of water to air. Since you have three attempts to launch your rocket, try some different possibilities and take note of their results. (Hint: begin with ¼ to 1½ cups.)

Teachers' Launch Instructions

This activity takes some preparation, but the results are well worth it. Most students' efforts result in sustained flight.

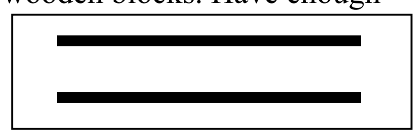
The Launch System

Pressure System

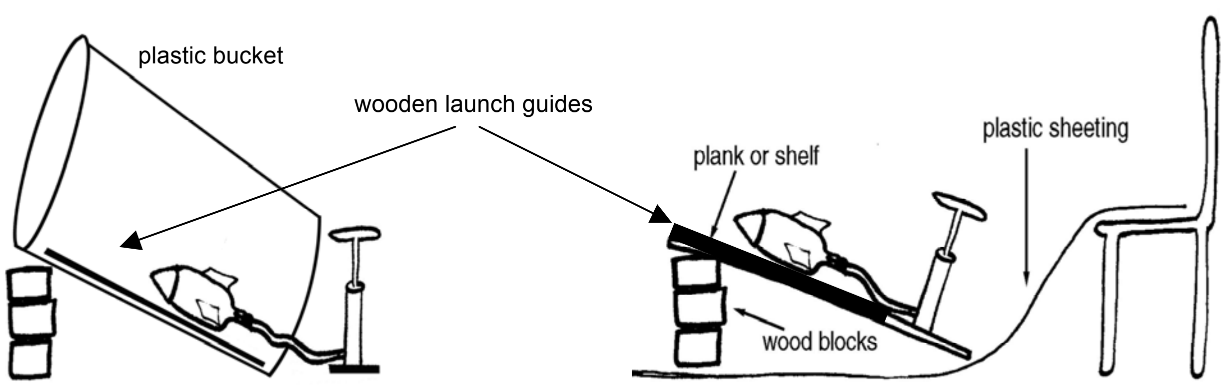
1. Insert "ball inflation pin" (ask your Phys.Ed. teacher for one) into cork or rubber stopper as shown in diagram. A pick may be necessary to make a pilot hole for the pin to go in. The pin must fit snugly or air will escape. Attach threaded end of inflation pin to a manual tire pump or electric ball pump.

The Launch Pad

1. Line floor of launch zone with plastic sheeting and have a mop and bucket ready for clean-up. (Each rocket launched expels about ½-1 cup of water.)
2. Create a launch ramp from a wooden plank or shelf and stack of wooden blocks. Have enough wooden blocks available to allow teams to vary the launch angle.
3. Attach two 2x2 pieces of wood to the launch ramp so that they provide a launch guide for the rockets.
4. For increased safety and reduced mess use a large plastic pail or bucket for your launch ramp. Affix the wooden launch guide inside the bucket and cut a hole in the bottom for the pump hose to pass through.). Place the launch bucket on the wooden blocks and adjust to proper angle.



Launch ramp with wooden launch guides



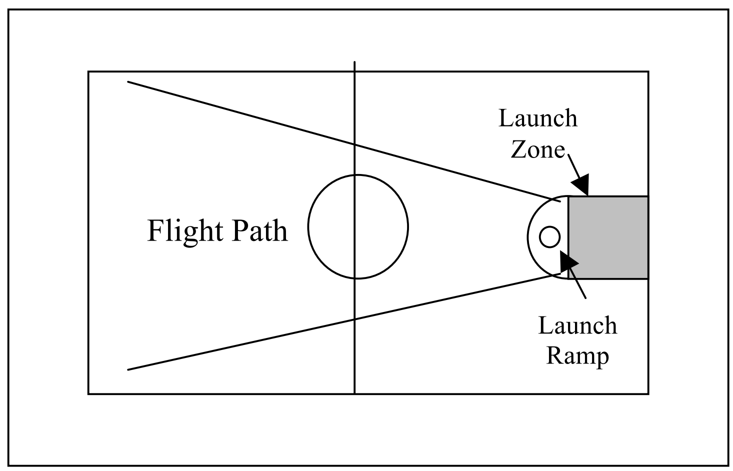
Two possible launch systems. The one with the bucket is safer and creates less mess.

Launching the Rockets

1. Set up launch pad in the basketball key area facing the center of the gym. Keep all spectators away from the flight path and allow only one team in the launch zone at a time.

2. Once team is in the zone allow them to adjust the launch ramp to desired angle and add the desired amount of water to their rocket. Rocket may now be stoppered and attached to pump.

3. Teams must align their rocket in wooden launch guides and retreat behind the rocket to begin pumping. Once pumping has begun, no one is permitted directly beside or in front of the rocket being launched. Well built and fueled rockets can launch with great force and fly the entire length of the gymnasium. Stand off to the side when pumping to avoid the direct spray of the rocket exhaust. Mop up water after each launch.



Caution: Do not launch or point rockets when people are in the flight path. Students should wear safety goggles when launching rockets. Clean up water after each launch.

For more information on water rockets check out the following web sites:

bee-eee.com/page/rocket_principles

Teacher's Guide for Water Rockets (Grades 10-12)

Pumping air into the bottle increases the number of air particles (molecules and atoms) bouncing around and exerting pressure on the sides of the bottle. The air particles are forced to move closer together and become compressed. Eventually the pressure builds up to the point that it is strong enough to blow the cork off the end of the bottle.

Once the cork blows off, the compressed air escapes, pushing the water out with it. This exhaust of air and water is what propels the rocket forward. Newton's 3rd Law of Motion states that for every action there is an equal and opposite reaction. In this case, the action is the air and water rushing out the back of the rocket, while the reaction is the rocket moving forward. Water does not compress very easily and therefore does not increase the pressure that builds up in the rocket however, water does add considerably to the rocket's power. According to Newton's 2nd law of motion, force is a product of mass and acceleration. The water adds mass to the exhaust, which accelerates out the back of the rocket. This added mass increases the force pushing out of the rocket and the force propelling the rocket forward. Repeating the demonstration without water will produce a less powerful rocket.
The rocket's motion from a state of rest was created by an unbalanced force supplied by pressurized air added to the rocket. The path of the rocket is determined by the initial horizontal and vertical velocity delivered by the propulsion force and by gravity's downward pull and the drag created by air.
Outlined below are references to the Nunavut Science curricula that apply to this activity.

Science Concepts (Check out the Department of Education's CD ROM or Kivalliq Curricula folder inside the Teachers Conference on the FirstClass server for PDF versions of the approved Nunavut Curricula)

Science 10 (Refer to *Science 10 Course of Studies*)

Unit 4: Change and Energy (pp. 41-51)

- energy is always associated with change (energy can be changed from one form to another)
- energy cannot be created or destroyed, only converted from one form to another
- useful energy diminishes during any energy transformation

Science 15 (*Refer to NWT Science 15-25 (New) Curriculum Document)*

Unit 3: Understanding Energy Transfer Technologies (pp. 26-33)

- forces that cause objects to move are another way of transferring energy

Science 25 (*Refer to NWT Science 15-25 (New) Curriculum Document)*

Unit 3: Understanding Common Energy Conversion Systems (pp. 58-67)

- machines are useful because they transfer energy more quickly than the human body, at the cost of high input energy

Unit 4: Energy, Change and Transportation Safety

- the change in position and speed of objects can be described mathematically/graphically
- all moving objects possess kinetic energy and if they collide, energy is transformed
- all moving objects posses momentum and if they collide, momentum is conserved
- **See Science 20/Physics 20 for an explanation of these concepts.**

Science 20/Physics 20 (Refer to *Science 20-30 Program of Studies*)

Unit 4: Changes in Motion (pp. 43-51)

- motion of objects is described in terms of displacement, time, velocity and acceleration
- Newton's laws of motion relate force to the motion of objects

- momentum is conserved in physical interactions

Processes Skills and Attitudes

This activity encourages students to naturally go through many of the steps of the scientific method. This activity encourages students to make many hypotheses. For example, where to put the launch arm, how long to make the launch arm, and how to make the ammunition. Each time they test their designs, they carry out an experiment. Their final rocket is, in effect, the conclusion to their experiments. The class activity may be used as an opportunity to practice measuring, collecting, recording and analysing data . This use of technology to solve a practical problem stresses the connection between Science, Technology, Society and Culture as the IQ principles of Qanuqtuurniq (innovation), Aajiiqatigiinniq (consensus), Piliriqatigiinniq (collaboration), and Pilimmaksarniq (experiential learning) are valued and strengthened

KSEC 2013