APPENDIX A

How to Get Started Developing Your NASA Explorer School's
Goals for Family Involvement

- Identify four goals for your school improvement plan that will be the focus of the school's family and community involvement program.

Goal 1:

_____
_____
_____

Goal 2:

_____
_____
_____

Goal 3:

_____
_____
_____

Goal 4:

_____
_____
_____

- With a partner, select one of the goals above and write it in the "Goal" box. Together, brainstorm family and community involvement activities that your school presently implements to reach the selected goal.
- Brainstorm new family and community involvement activities that your school could implement this year to help reach the selected goal.

Goal:

Current family and community involvement activities that help reach this goal:	New family and community involvement activities that may help reach this goal:
1.	1.
2.	2.
3.	3.
4.	4.

APPENDIX B

Research Documenting the Impact of Family Involvement on Student Achievement

Introduction

Research and experience has consistently shown that family involvement has a positive effect on a child's success in school (Henderson and Berla, 1995; McNeal, 1999; National PTA, 1998). It is imperative that schools encourage and offer opportunities for family involvement. The NASA Explorer Schools provide a wonderful environment for promoting family involvement as the school is providing science and math academic opportunities due to NASA's involvement. By including the parents, research has proven that student achievement will soar!

Picture a wonderful structure that only master carpenters were allowed to build. Its roof soars into the sky with evenly pitched eaves; every corner is finely notched, the beams are seamless with the joists, and all the wood shines from careful finishing. It seems as perfect as any construction could be. Yet, where the wood meets the ground, there is no foundation. Nothing shields the building from shifting earth or water seeping underneath. Although only the finest materials and experts helped build it, the frame soon will sag, the boards will separate, and it eventually will collapse (Lewis and Henderson, 1997, p.1).

A district can have the most wonderful school in the universe, but without the solid foundation built by an informed and active school community, it may not be entirely effective. Schools must find ways of integrating home and school environments, so that the children know that everyone has a goal for her/him (Gonzalez-Pienda, Nunez, Gonzalez-Pumariega, Alvarez, Roces, Garcia, 2002). It is imperative that deep, continuous conversations among educators, parents, and students about all aspects of the school environment be encouraged, because a quality education requires the collaborative efforts of all in order to ensure common, high-quality goals.

Family supports the student

Families are extremely important in the lives of all students. As James Comer, 1994, states

> **A child develops a strong emotional bond to competent caretakers—usually parents—that enables them to help that child develop. . . in social, psychological, emotional, moral, linguistic and cognitive area [that] are critical for future academic learning. The attitudes, values, and behaviors of the family and its social network strongly effect such development . . . in addition, the meshing of home and school fosters development (p. 2).**

To the importance of familial support, discussion in other research and literature, on the educational success of students, concludes that higher achieving students appear to receive more social support from their parents, teachers, and friends leading to a strong social, linguistic and cognitive development (Benard, 1991; Bogenschneider, 1996; Fan, 2001). A study by S. Alva (1991) specifically deals with the academic vulnerability

among Mexican-American students and the importance of support resources. Feeling socially supported by a family at home seems to encompass a large part of building academic adaptability and to encourage positive educational outcomes. The child is introduced to learning within the first few minutes of being born into a family and continues. As Eugene Garcia (1999) states

> **Moreover, "successful" families support and nurture an appreciation of education for all family members. A micro learning community flourishes in the home, with parents teaching children, children sometimes teaching parents, and siblings and extended family members teaching one another. There is an overarching respect for each person's potential and actual contribution to the family (p. 135).**

Schools have the opportunity to become a part of this micro learning community and by working together expand the vision of the student and family. Academic success for students is documented by increasing the family involvement in the schools. The National PTA in 1998 reviewed literature and research on the effectiveness of family involvement in education with the following conclusions noted:

- When parents are involved, students achieve more regardless of socioeconomic status, ethnic/racial background, or the parents' education level (Lopez, Scribner, and Mahitivanichcha, 2001).
- The more extensive the parent involvement, the higher the student achievement.
- When parents are involved in their students' education, those students have higher grades and test scores, better attendance, and complete homework more consistently.
- When parents are involved, students exhibit more positive attitudes and behavior.
- Students whose parents are involved in their lives have higher graduation rates and greater enrollment rates in post-secondary education.
- Different types of parent/family involvement produce different gains. To have long-lasting gains for students, parent involvement activities must be well planned, inclusive, and comprehensive.
- Educators hold higher expectations of students whose parents collaborate with the teacher.
- In programs that are designed to involve parents in full partnerships, student achievement for disadvantaged children not only improves, it can reach levels that are standard for middle-class children. In addition, the children who are farthest behind, make the greatest gains.
- Children from diverse cultural backgrounds tend to do better when parents and professionals collaborate to bridge the gap between the culture at home and the learning institution.
- Student behaviors such as alcohol use, violence, and antisocial behavior decrease as parent involvement increases.
- The benefits of involving parents are not confined to the early years; there are significant gains at all ages and grade levels. Junior/middle and senior high school students whose parents remain involved make better transitions, maintain the quality of their work, and develop realistic plans for their future.
- Students whose parents are not involved, on the other hand, are more likely to drop out of school.
- The most accurate predictor of a student's achievement in school is not income or social status, but the extent to which that student's family is able to (1) create

a home environment that encourages learning; (2) communicate high, yet reasonable, expectations for their children's achievement and future careers; (3) become involved in their children's education at school and in the community (Scharge and Smink, 2001, pp. 52–54).

- High achievers, across grade levels and social groups, were identified with the following home characteristics: daily routines for study, sleep, household chores, and limited TV watching; parent expression of high, but realistic, expectations for achievement, encouragement, and reinforcement of school progress, reading, writing, and discussions among family members, and the use of community resources such as libraries (de Carvalho, 2001, p. 14).
- Increased family involvement is associated with higher math and reading scores, decreased likelihood of suspension or expulsion and greater student participation in extracurricular school activities (de Carvalho, p. 110).

School supports parental involvement

> . . . Parent involvement contributed most to a school when it reflected consensus between parents and staff over the school's mission. If there was general agreement about the school's mission, then parent involvement provided important help and reinforced collective responsibility for student success. Such consensus affirmed respect for the professionalism of the staff and promoted a strong effort on behalf of student learning (Newmann and Wehlage, 1995, p. 17).

Historically, parental involvement would mean bake sales and open houses, but activities such as these do not have much impact on student achievement (Jones, 2001). Schools need to move beyond this point. The Education Commission for the States found that two of every three urban teachers rated parent involvement at their schools either poor or fair. Eighty percent of parents participating in a Maryland study stated they would be considerably more involved if teachers invited them (Lam, 2004). Studies have shown that when teachers make an effort to reach out to parents, everyone in the school benefits (Lam, 2004). Therefore, it is imperative that the NASA Explorer Schools provide opportunities for the families to be an integral part of the school.

How a school supports parental involvement can vary, but there a few suggestions to begin a strong program that successful schools have used. The list includes

- Welcoming and inviting all families by providing professional development in order for teachers to be able to communicate with the diverse population that they serve. All parents want their children to do well in school, but many times they simply do not know how to be involved. Parents from different cultures are expected to conform to the expectations of the school even though the parents may not understand. Teachers want to communicate with the parents but are viewing the parents through their own cultural lenses (Colombo, 2004).
- Respecting the educational backgrounds of family members.
- Encouraging active participation with extended hours such as in the evenings or on Saturdays.
- Visiting the families in their homes.

- Increasing and broadening communication through the use of technology or family centers.
- Providing the team approach that consists of teachers, administrators, and parents in the planning and development of school policies.
- By developing a strong home-school-community connection by using learning service projects or by simply starting with newsletters (Schargel and Smink 2001).
- Opening the lines of communication between the school and home. The families must be aware of what is happening in the schools and feel that they have a place as a member of the educational team for their children. "The frequency and content of school-to-home communications are important. When these communications contain information that influence parents' perceptions of their child as a learner, when they give parents a sense of efficacy and when they make the parent feel comfortable with the school, they enhance parent involvement" (Dodd and Konzal, 2002, p. 7).

Conclusion

Family involvement requires a partnership. Together the teachers, students, administration, and families view student achievement as a shared responsibility and everyone works together to support the children's learning. Schools must bear the responsibility of reaching out to the families and provide avenues to work together. Traditionally, families from the diverse populations have simply left the education of their children to the schools and have not felt welcome. With more than 85 research studies and the National PTA's many years of experience to support the data of the power of family involvement that results in an increase in student achievement and success (National PTA, 2000), schools cannot afford to ignore the family involvement component.

The NASA Explorer Schools are in a unique position to strengthen the academic curriculum in science and math while incorporating techniques to involve the families; both will result in providing a successful learning environment for the students in those schools. In this handbook, there are suggestions and ideas that will make it easier for the NASA Explorer Schools to successfully begin and implement a family involvement program.

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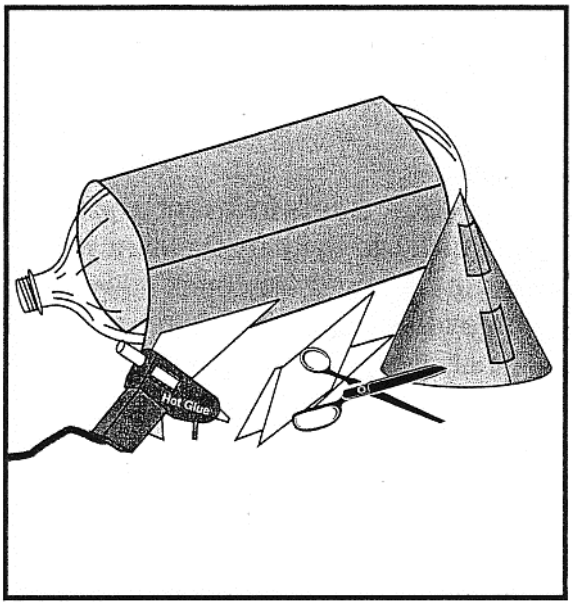
APPENDIX C



Educator Information

Bottle Rocket

Objective:
To construct and launch a simple bottle rocket.

Description:
Working in teams, learners will construct a simple bottle rocket from 2-liter soft drink bottles and other materials.

Science Standards:
Physical Sciences—Position and motion of objects
Science and Technology—Abilities of technological design

Science Process Skills:
Measuring
Making Models

Mathematics Standards:
Mathematical Connections
Measurement
Geometry and Spatial Sense

Materials and Tools:

- 2-liter plastic soft drink bottles
- Low-temperature glue guns
- Poster board
- Tape
- Modeling clay
- Scissors
- Safety glasses
- Decals and stickers
- Markers
- Launch pad from the Bottle Rocket Launcher

Management:
This activity can stand alone or be incorporated in the activity “Project X–35” that follows. Having the learners work in teams will reduce the amount of materials required. Begin saving 2-liter bottles several weeks in advance to have a sufficient supply for your class. You will need to have at least one bottle rocket launcher. Construct the launcher described in the previous activity or obtain one from a science or technology education supply catalog.

The simplest way to construct the rockets is to use low-temperature electric glue guns that are available from craft stores. High-temperature glue guns will melt the plastic bottles. Provide glue guns for each table or set up a glue stations in various parts of the room.

Collect a variety of decorative materials before beginning this activity so students can customize their rockets. When the rockets are complete, test fly them. Refer to the “Altitude Tracker” activity starting on page 79 for information on determining how high the rockets fly. While one group of students launches their rocket, have another group track the rocket and determine its altitude.

When launching rockets, it is important for the other students to stand back.

Countdowns help everybody to know when the rocket will lift off. In group discussion, have your students create launch safety rules that everybody must follow. Include how far back observers should stand, how many people should prepare the rocket for launch, who should retrieve the rocket, etc.

Background Information:
Bottle rockets are excellent devices for investigating Newton's Three Laws of Motion. The rocket will remain on the launch pad until an unbalanced force is exerted propelling the rocket upward (First Law). The amount of force depends upon how much air you pumped inside the rocket (Second Law). You can increase the force further by adding a small amount of water to the rocket. This increases the mass the rocket expels by the air (and water) as it rushes out the nozzle creates an equal and opposite reaction force propelling the rocket upward (Third Law).

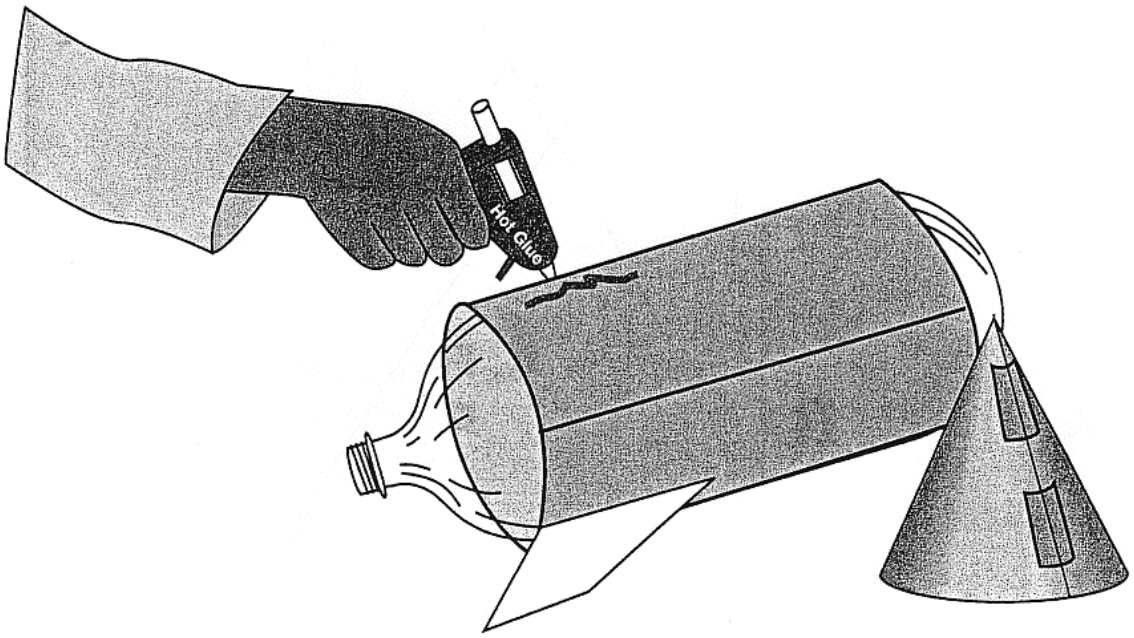
Students can press modeling clay into the nose cone of the rocket. Placing 50 to 100 grams of clay into the cone helps to stabilize the rocket by moving the center of mass farther from the center of pressure.

Assessment:
Evaluate each bottle on its quality of construction. Observe how well fins align and attaché to the bottle. Also observe how straight the nose cone is at the top pf the rocket. If you choose to measure how high the rockets fly, compare the altitude the rockets reach with their design and quality of the construction.

Extensions:
- Challenge rocket teams to invent a way to attach a parachute to the rocket that will deploy on the rocket's way down.
- Parachutes for bottle rockets can be made from a plastic bag and string. The nose cone is merely placed over the rocket and parachute for launch. The cone needs to fit properly for launch or it will slip off. The modeling clay in the cone will cause the cone to fall off, deploying the parachute or paper helicopters, after the rocket tilts over at the top of its flight.
- Extend the poster board tube above the rounded end of the bottle. This will make a payload compartment for lofting various items with the rocket. Payloads might include steamers or paper helicopters that will spill out when the rocket reaches the top of its flight. Copy and distribute page 72 on how to make paper helicopters. Ask the students to identify other possible payloads for the rocket. If students suggest launching small animals with their rockets, discuss the purpose of flying animals and the possible dangers if they are actually flown.
- Conduct flight experiments by varying the amount of air pressure and water to the rocket before launch. Have the students develop experimental test procedures and control for variables.
- Conduct spectacular nighttime launches of bottle rockets. Make the rockets visible in flight by taping a small-size chemical light sick neat the nose cone of each rocket. Light sticks are available at toy and camping stores and can be used for many flights. This is an especially good activity for summer "space camp" programs.

Building a Bottle Rocket

1. Wrap and glue or tape a tube of poster board around the bottle.
2. Cut out several fins of any shape and glue to the tube.
3. Form a nose cone and hold it together with tape or glue.
4. Press a ball of modeling clay into the top of the nose cone.
5. Glue or tape nose cone to upper end of bottle.
6. Decorate your rocket



Background Information on Rocketry and Newton's Laws of Motion:

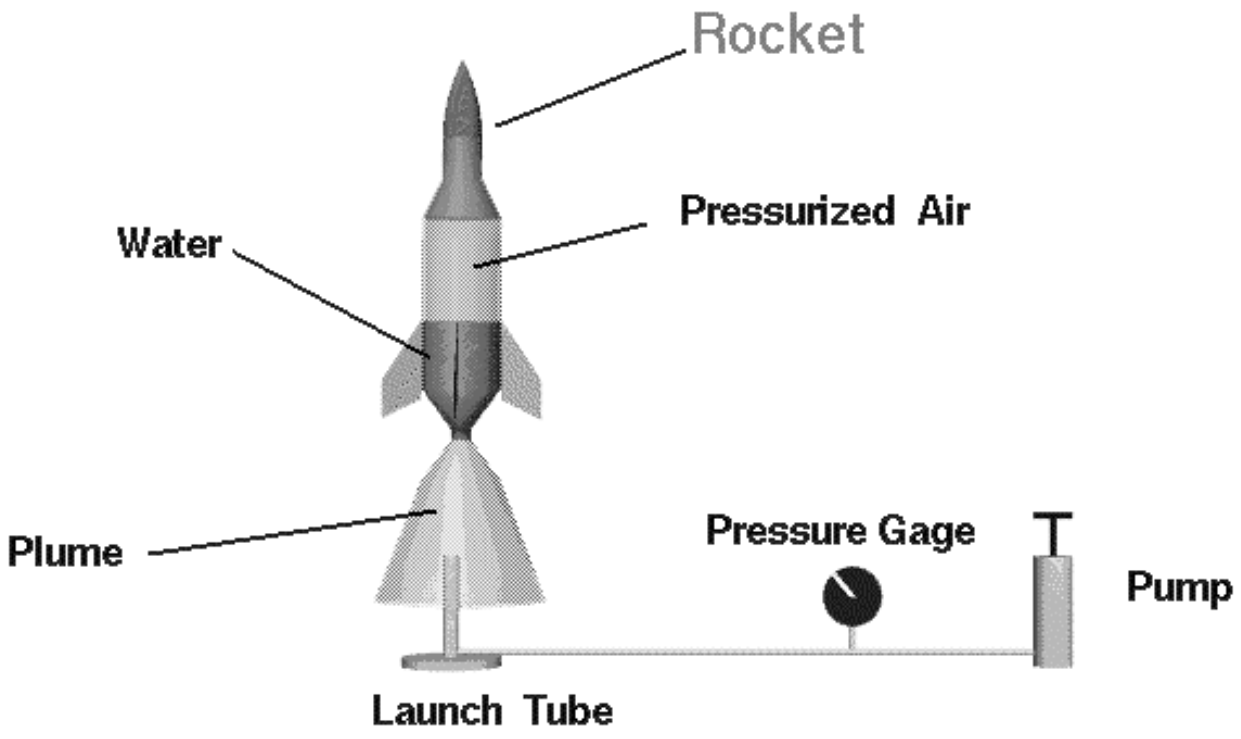
Bottle rockets are excellent devices for investigating **Newton's Three Laws of Motion**:

First Law—A rocket will remain on the launch pad until an unbalanced force is exerted, propelling the rocket upward.

Second Law—The amount of force depends upon how much air is pumped inside the rocket. You can increase the force further by adding a small amount of water, which increases the mass the rocket expels by the air pressure.

Third Law—Finally, the action force of the air (and water) as it rushes out the nozzle creates an equal and opposite reaction force propelling the rocket upward.

As with a balloon, air pressurizes the bottle rocket. Adding a small amount of water to the bottle increases the action force. The water expels from the bottle before the air does, turning the bottle rocket into a bigger version of a water rocket toy (available in toy stores).



Water Rocket

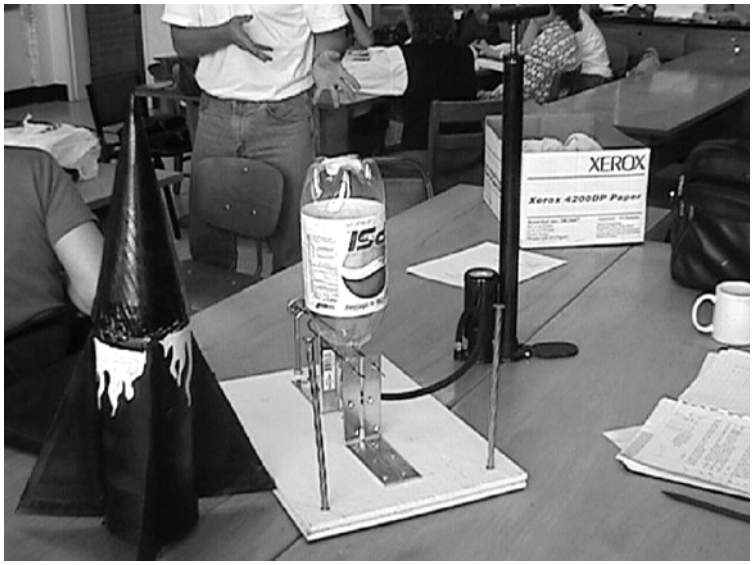
In order to learn more about model rockets and how they work, follow these links to information on rocketry:

Flight of a Model Rocket
http://exploration.grc.nasa.gov/education/rocket/rktflight.html

Parts of a Model Rocket
http://exploration.grc.nasa.gov/education/rocket/rktbot.html

Instructions:

1. You will work in teams to construct a soda bottle rocket with an empty 2-liter soda bottle. You and your team members must decide on the materials you will use for the body, fins, and cone of the rocket (which is then placed over the empty 2-liter soda bottle to be launched). You will then predict how well your rocket will fly and record your prediction on a worksheet. You may want to customize your rockets by decorating them in some way. An example is shown below:



2. One bottle rocket launcher (which can be constructed according to the instructions shown below or bought from a science supply catalog) is needed for the class. While one team launches their rocket, another team can assist them by tracking the rocket, determining how high it flew, and recording the information on a worksheet. Follow this link to learn how to measure the altitude reached by your rockets: http://exploration.grc.nasa.gov/education/rocket/rkthowhi.html. You will then compare your prediction with the rocket's actual performance and compare the flight of your rocket with other rockets. Your final assignment will be a journal entry giving details on your design, the comparisons you made, and your conclusions on the reasons for the rockets' performances.

3. It is important to follow safety rules when launching bottle rockets. Countdowns help everybody to know when the rocket will lift off. Using the launch safety instructions shown below, develop specific launch safety rules through group discussions. In the rules, include how far back observers should stand, how many people should prepare the rocket for launch, and who should retrieve the rocket.

<u>Launch Safety Instructions</u>:

1. Select a grassy field that measures approximately 30 meters in width. Place the launcher in the center of the field and anchor it in place with the spikes or tent stakes. (If it is a windy day, place the launcher closer to the side of the field from which the wind is blowing so that the rocket will drift onto the field as it descends.)
2. As you set up your rocket on the launch pad, observers should stand back several meters. It is recommended that you rope off the launch site.
3. The team member responsible for pumping air into the rocket should wear eye protection. The bottle rocket should be pumped no higher than about 50 pounds of pressure per square inch.
4. When pressurization is complete, everyone should stand in back of the rope for the countdown.
5. Continue to count down and launch the rocket only when the recovery range is clear.
6. A team member should retrieve the rocket.

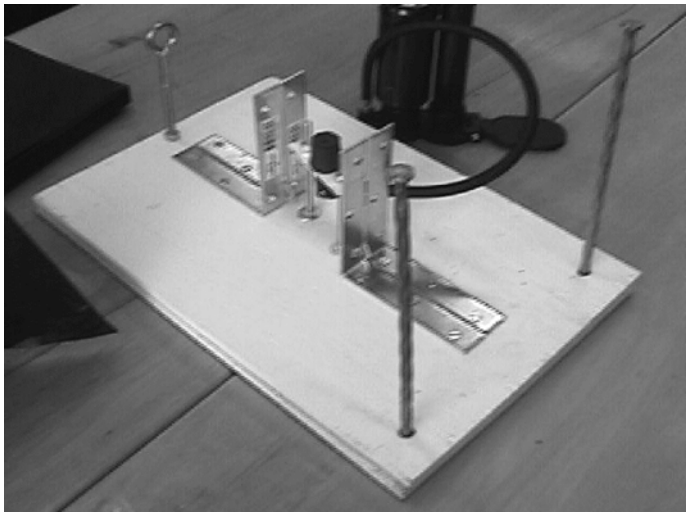
<u>Instructions for Building the Launcher</u>:

The launcher is simple and inexpensive to construct. Most needed parts are available from hardware stores. In addition you will need a tire valve from an auto parts store and a rubber bottle stopper from a school science experiment. The most difficult task is to drill a 3/8-inch hole in the mending plate. An electric drill is a common household tool. If

you do not have access to a drill or do not wish to drill the holes in the metal mending plate, find someone who can do the job for you. Ask a teacher or student in your school's industrial arts shop or the parent of a student to help.

Materials Needed

· Four 5-inch corner irons with twelve 3/4-inch wood screws to fit
· One 5-inch mounting plate
· Two 6-inch spikes
· Two 10-inch spikes or metal tent stakes
· Two 5-inch by 1/4-inch carriage bolts with six 1/4-inch nuts
· One 3-inch eyebolt with two nuts and washers
· Four 3/4-inch diameter washers to fit bolts
· One #3 rubber stopper with a single hole
· One snap-in tubeless tire valve (small 0.453 inch hole, 2 inches long)
· Wood board 12 by 18 by 3/4 inches
· One 2-liter plastic bottle
· Electric drill and bits including a 3/8-inch bit
· Screw driver
· Pliers or open-end wrench to fit nuts
· Vice
· 12 feet of 1/4-inch cord
· Pencil



Construction of the Launcher

1. Prepare the rubber stopper by enlarging the hole with a drill. Grip the stopper lightly with a vice and gently enlarge the hole with a 3/8-inch bit and electric drill. The rubber will stretch during cutting, making the finished hole somewhat less than 3/8 inches.
2. Remove the stopper from the vice and push the needle valve end of the tire stem through the stopper from the narrow end to the wide end.

3. Prepare the mounting plate by drilling a 1-3/8 inch hole through the center of the plate. **(*As a safety precaution, hold the plate with a vice during drilling and wear eye protection.*)** Using a drill bit slightly larger than the holes, enlarge the holes at the opposite ends of the plates. The holes must be large enough to pass the carriage bolts through them.
4. Lay the mending plate in the center of the wood base and mark the centers of the two outside holes that you enlarged. Drill holes through the wood big enough to pass the carriage bolts through.
5. Push and twist the tire stem into the hole you drilled in the center of the mounting plate. The fat end of the stopper should rest on the plate.
6. Insert the carriage bolts through the wood base from the bottom up. Place a hex nut over each bolt and tighten the nut so that the bolt head pulls into the wood.
7. Screw a second nut over each bolt and spin it about halfway down the bolt. Place a washer over each nut and slip the mounting plate over the two bolts.
8. Press the neck of a 2-liter plastic bottle over the stopper. You will be using the bottle's wide-neck lip for measuring in the next step.
9. Set up two corner irons so that they look like bookends. Insert a spike through the top hole of each iron. Slide the irons near the bottleneck so that the spike rests immediately above the wide-neck lip. The spike will hold the bottle in place while you pump up the rocket. If the bottle is too low, adjust the nuts beneath the mounting plate on both sides to raise it.
10. Set up the other two corner irons as you did in the previous step. Place them on the opposite side of the bottle. When you have the irons aligned so that the spikes rest above and hold the bottle lip, mark the centers of the holes on the wood base. (*For more precise screwing, drill small pilot holes for each screw and then screw the corner irons tightly to the base.*)
11. Install an eyebolt to the edge of the opposite holes for the hold-down spikes. Drill a hole and hold the bolt in place with washers and nuts on top and bottom.
12. Attach the launch “pull cord” to the head end of each spike. Run the cord through the eyebolt.
13. Make final adjustments to the launcher by attaching the pump to the tire stem and pumping up the bottle. Refer to the launching instructions for safety notes. If the air seeps out around the stopper, the stopper is too loose. Use a pair of pliers or a wrench to raise each side of the mounting plate in turn to press the stopper with slightly more force to the bottleneck. When satisfied with the position, thread the remaining hex nuts over the mounting plate and tighten them to hold the plate in position.
14. Drill two holes through the wood base along one side. The holes should be large enough to accommodate large spikes (metal tent stakes). When the launch pad is set up on a grassy field, the stakes will hold the launcher in place as you yank the pull cord to launch the rocket.
15. The launcher is now complete.

Rubrics:

Use the rubrics shown below as a guide when completing the activity.

Rubric for constructing the bottle rocket and recording observations
(30 points max.)

	Yes	No
Team carries out assignment criteria	3 points	0 points
Team performs testing safely	1 point	0 points
Records observations and findings are correct	3 points	0 points
Team demonstrates proper science process skills	3 points	0 points
Participates in class discussions	5 points	0 points
Team kept on task	5 points	0 points
Bottle rockets fins aligned properly	3 points	0 points
Nose cone straight on rocket	3 points	0 points
Team contributes ideas to the class	4 points	0 points

Rubric for journal writing (Worksheet Question 6)
(*12 points max.*)

	Yes	No
Carries out assignment criteria	3 points	0 points
Records observations and findings are correct	3 points	0 points
Demonstrates proper science process skills	3 points	0 points
Spelling, grammar, and punctuation correct	3 points	0 points

Alternative Recommended Assessments:

1. Evaluate each bottle rocket on its quality of construction. Observe how well the fins align and attach to the bottle. Also observe the alignment of the nose cone at the top of the rocket.
2. Evaluate the design and quality of construction of each bottle rocket by measuring and comparing the altitudes that the rockets reached.

Bottle Rockets and Propulsion Worksheet

1. Construct your rocket according to the directions given.

2. Based on the data collected from WaterRocketSim predict how high your “best” design (Design 1) will fly.

3. Test fly Design 1 and record altitude it attains.

4. What is the difference between your prediction and the actual altitude?

5. Test fly Design1 two more times and record the actual altitude it attains each time.
   (a)

   (b)

6. What is the difference between your prediction and the actual altitude?
   (a)

   (b)

7. What is the “best” altitude attained with Design 1?

8. Modify your rocket so that it matches the “best” design of a teammate or start over by constructing a new rocket.

9. Based on the data collected from WaterRocketSim, predict how high Design 2 will fly.

10. Test fly Design 2 three times and record the actual altitude it attains each time.
    (a)

    (b)

    (c)

11. What is the difference between your prediction and the actual altitude?
    (a)

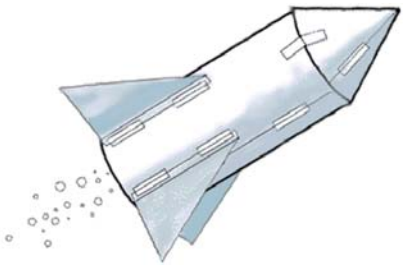
    (b)

    (c)

12. What is the difference in altitude attained between the “best” altitude attained for Designs 1 and 2?

13. Compose one paragraph in an e-mail giving details on how you decided on your final rocket design. Justify your ideas. Describe the differences in Designs 1 and 2 and how they affected your rocket’s performance.

APPENDIX D



Build a Bubble-Powered Rocket!

Build your own rocket using paper and fizzing tablets! Watch it lift off. How high does your rocket go? Print this page for the instructions.

Suggestion: Find a grownup to do this activity with you.

Materials:

- Paper, regular 8-1/2- by 11-inch paper, such as computer printer paper or even notebook paper
- Plastic 35-mm film canister (see hints below)
- Cellophane tape
- Scissors
- Effervescing (fizzing) antacid tablet (the kind used to settle an upset stomach)
- Paper towels
- Water

Eye protection (like eyeglasses, sunglasses, or safety glasses)

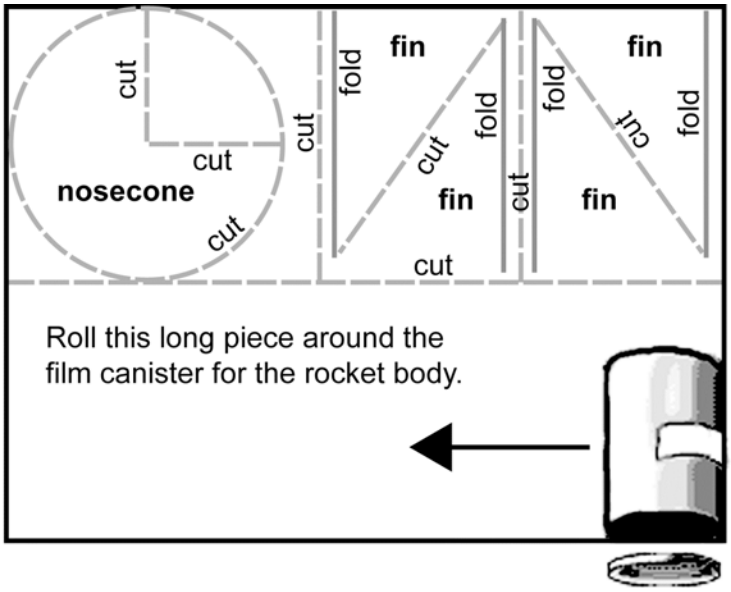
Hints:
The film canister MUST be one with a cap that fits INSIDE the rim instead of over the outside of the rim. Sometimes photography shops have extras of these and will be happy to donate some for such a worthy cause.
Keep in mind: Just like with real rockets, the less your rocket weighs and the less air resistance (drag) it has, the higher it will go.

Making the Rocket

You must first decide how to cut your paper. You may cut it the short way or the long way to make the body of the rocket. There is no one right way to make a paper rocket. Try a long, skinny rocket or a short, fat rocket. Try a sharp nose cone or a blunt nose cone. Try it with fins or without fins. Experiment!

Here's just one idea for how you might cut your whole rocket from one piece of paper:

For nosecone, use a jar lid or something similar to trace the shape.



Tape canister to edge of paper before you start rolling paper around canister.

Here are the basic steps:

1. Cut out all the pieces for your rocket.
2. Wrap and tape a tube of paper around the film canister. **Hint:** Tape the canister to the end of the paper before you start wrapping.

   Important! Place the lid end of the canister **down**.

3. Tape fins to your rocket body, if you want.
4. Roll the circle (with a wedge cut out) into a cone and tape it to the rocket's top.

Blasting Off

1. Put on your eye protection.
2. Turn the rocket upside down and remove the canister's lid.
3. Fill the canister one-third full of water.

Now work quickly on the next steps!

1. Drop one-half of an effervescing antacid tablet into the canister.
2. Snap the lid on tight.
3. Stand your rocket on a launch platform, such as your sidewalk or driveway.
4. Stand back and wait. Your rocket will blast off!

So, Dr. Marc, how does the pop-rocket work?

When the fizzy tablet is placed in water, many little bubbles of gas escape. The bubbles go up, instead of down, because they weigh less than water. When the bubbles get to the surface of the water, they break open. The gas that has escaped from the bubbles pushes on the sides of the canister.

Now when you blow up a balloon, the air makes the balloon stretch bigger and bigger. But the little film canister doesn't stretch and all this gas has to go somewhere!

Eventually, something has to give! So the canister pops its top (which is really its bottom, since it's upside down). All the water and gas rushes down and out, pushing the canister up and up, along with the rocket attached to it.

Real rockets work the same way. But instead of using tablets that fizz in water, they use rocket fuel.

Delta rocket similar to the one that launched the Deep Space 1 spacecraft from Cape Canaveral, Florida, in October 1998.

The rocket that launched Deep Space 1 on October 24, 1998, had four different kinds of engines. Some pushed the rocket off the ground. Then some helped it continue its climb into space. Others gave the Deep Space 1 spacecraft its final push away from Earth. But all of them forced a gas to shoot out of the rocket, thus pushing the rocket the other way.

We call this wonderful and useful fact the **law of action and reaction**. The **action** is the gas rushing out of the rocket. The **reaction** is the rocket taking off in the other direction. In other words, for every action there is an equal and opposite reaction. The rocket goes in the opposite direction from the gas, and the faster the gas leaves the rocket, the faster the rocket gets pushed the other way.

APPENDIX E

Land Your Skydiver Safely

Introduction: Have you ever seen anyone parachute out of a plane? Do they rocket to the ground or gracefully float down? Of course, rocketing to the ground would be very dangerous! Parachute companies are always looking for the perfect design that will allow the skydiver to gracefully and safely float to the ground.

Question: As a member of a team for a parachute design company, your mission is to find the best design for a parachute that will allow the skydiver to successfully land. To add to the design problem, the company is looking for a parachute that will allow the beginning skydiver to very slowly reach the ground.

Prediction/Hypothesis: what design does our team feel will be the best? Sketch your idea.

How many strings should be attached to your skydiver for maximum slow decent?

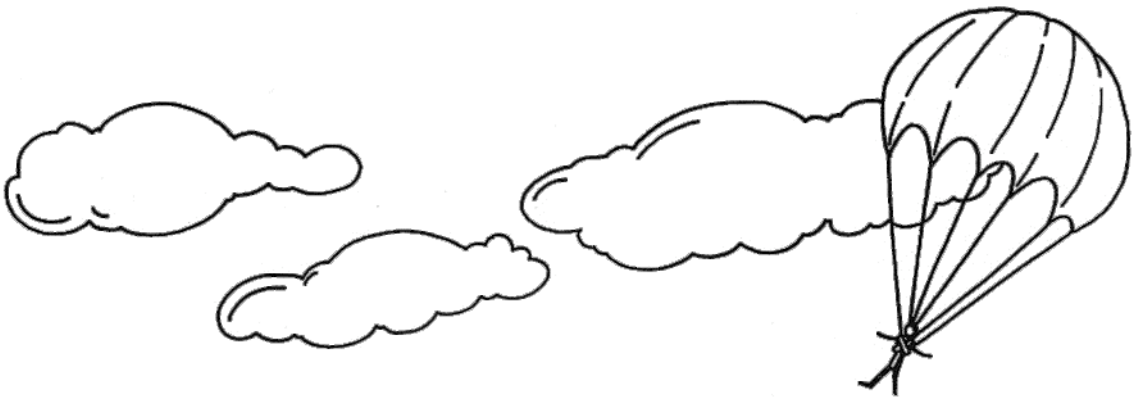
Procedure: With your team members, determine a procedure to test our design(s), be sure to keep these points in mind:

1. With your team, test your parachute design. Drop our plastic figures from a high area.

2. Be sure to record the time it took your “skydiver” to reach the ground.

3. Average your trials.

4. Use the plastic garbage bags and string provided.



Design Chart

Design 1 _____ Number of strings used: _____ Length of each string: _____ Length and width of the parachute: _____ Illustration of the design:	**Design 2**_____ Number of strings used:_____ Length of each string:_____ Length and width of the parachute:_____ Illustration of the design:	**Design 3**_____ Number of strings used:_____ Length of each string:_____ Length and width of the parachute:_____ Illustration of the design:

Fall time in seconds

	Trial 1	**Trial 2**	**Trial 3**	**Average**
No parachute				
Design 1				
Design 2				
Design 3				

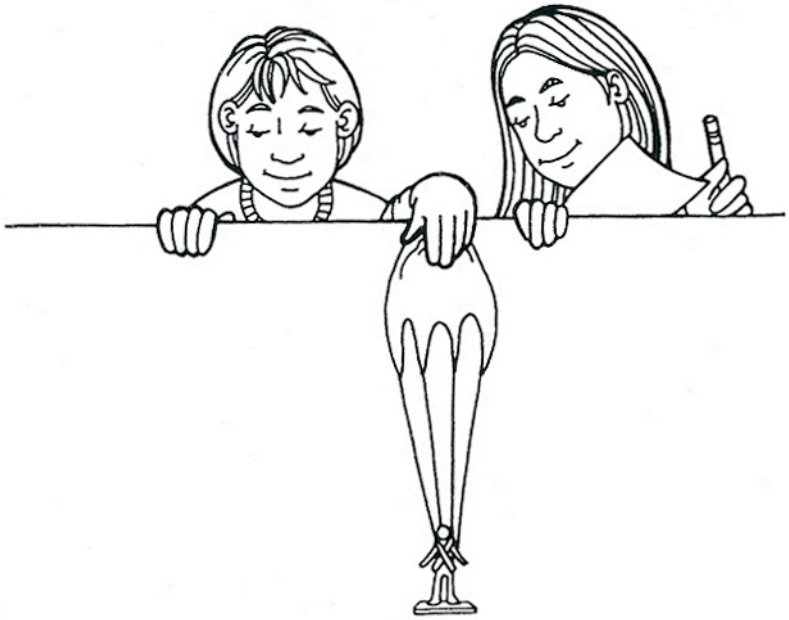
Results:

1. Keep a detailed design chart, an example is given on the previous page. Your team can design a better one, if you wish!

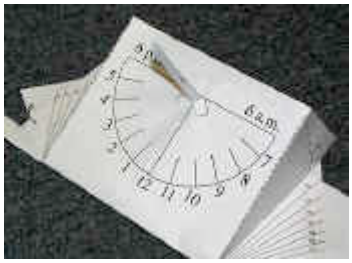
2. Design a way to record your times.

Conclusions:

Prepare a presentation using technology (very professional) that will convince the president and vice-president of the parachute company to use your design for the beginning skydiver parachute.



APPENDIX F



Building a Simple Sundial

1. Determine your latitude. Using a map for your area, estimate your latitude (most road maps indicate latitude and longitude). Your latitude will be the number of degrees north if you live in the northern hemisphere, or south if you live in the southern hemisphere.

Or, you can locate your latitude using the URL below:

- U.S. Census Bureau: http://www.census.gov/cgi-bin/gazetteer

2. Print the sundial construction template. Choose a template based on your hemisphere (e.g., if you live above the equator, choose Northern Hemisphere).

Download your sundial template by using the URLs below:

- Northern Hemisphere:
  http://liftoff.msfc.nasa.gov/academy/earth/sundial/sundialn.pdf

- Southern Hemisphere:
  http://liftoff.msfc.nasa.gov/academy/earth/sundial/sundials.pdf

3. Construct the sundial. You will need scissors and some tape. The more carefully you make the folds, the more accurate your sundial will be.

4. Align the sundial. Take your sundial outside, place it on a level surface, and aim the style due North. You now have a working sundial! When you read the time, remember to take Daylight Savings Time into account (during Daylight Savings Time, the sundial will be an hour behind your clock).

Pondering Sundials

Now that your sundial is working, here are some things to think about.

1. When doesn't a sundial work?

2. Does your sundial match your watch time? Why?

3. If the Earth rotates every 24 hours (approximately), how many degrees does the Sun appear to move in 1 hour? In four minutes? (Hint: one full rotation of the Earth is 360°).

4. The Sun's diameter in the sky is about 0.5°. About how long does it take for the Sun to appear to move its own diameter across the sky?

5. Why don't we use local solar time instead of time zones in our everyday lives? Would it be easy to know what time your favorite TV program starts?

6. Why do time zones generally run north-south instead of east-west?

7. Does a sundial work the same north and south of the equator?

8. What would be different about a sundial at the North Pole? The South Pole?

9. Why didn't the ancient Egyptians use watches instead of sundials and obelisks?

10. Would your sundial read the same time as another sundial 100 miles directly north of you? Would the shadows be the same length?

.

Pondering Sundials (Answer Key)

1. A sundial requires a clear unobstructed view of the Sun to cast a shadow. On cloudy days, or at night when the Sun is not visible to cast a shadow, the sundial will not work.

2. Generally speaking, no. The Sun does not keep a precise 24-hour day. Sometimes it is early, sometimes late, by a few seconds or minutes depending on the time of year. The reason for this discrepancy is the fact that Sundials tell "solar time" and clocks and watches tell "clock time". ***Solar Time*** is based on the idea that when the Sun reaches its highest point in the sky, it is noon, and the next day, when the Sun reaches its highest point in the sky, it is noon again. The time that elapses between successive noons is sometimes more than 24 hours and sometimes less than 24 hours. ***Clock Time*** is based on the idea that each day is exactly 24 hours long. This is not actually the case, but it is much more convenient to assume each day is 24 hours long for mechanical clocks and watches. The differences between Sun time and clock time are related to the Earth's tilted axis and its elliptical orbit around the Sun. For sundial scholars, this produces something called the *Equation of Time*, and it means that even an accurate sundial will gain 16 minutes in the weeks leading to Halloween and lose almost 15 minutes by Valentine's Day. Based upon the Earth's movement around the Sun and the Equation of Time, clocks and watches tell solar time exactly right only four times a year.

3. 15 degrees, 1 degree

4. 2 minutes

5. Local Solar Time (Solar Time) is the time according to the position of the Sun in the sky relative to one specific location on the ground. In solar time, the Sun is always due south (or north if you live in the southern hemisphere) at exactly noon. While this might work well for someone living in a specific location, it means that someone else living just a few miles east or west of the first person would realize a slightly different solar time. The greater the distance between the two people, the greater difference in solar time. An example of some of the challenges that one might face if we still relied on local solar time instead of the standard time zones that we use today might be the following: You and your family take a trip to visit a relative who lives nearly 200 miles west of your home. Before leaving, you tell your best friend that you will call them at noon solar time the next day. The following day, your friend waits, checks their sundial and waits by the phone at solar noon. The problem is, it's not yet solar noon where you are. Since the majority of television broadcasts originate in New York City, it could be very difficult to know what time your favorite show starts. Standardized time zones make it easier to coordinate activities and events over long distances.

   Special note: *Prior to the industrial age, every municipality around the civilized world set its official clock, according to the local position of the Sun at noon. But, with the introduction of the steam engine, which was used in rail travel, passengers found themselves having to constantly re-set their watches as a train progressed East and West through the neighboring towns on its daily run.*

Standard time, where all clocks in a large region are set to the same time, was established to solve this problem.

6. Standard time zones, as originally proposed in 1879, divided the world into twenty-four zones, each one covering exactly 15 degrees of longitude. All clocks within each of thes zones would be set to the same time, but differed by one hour from those in the neighboring zones. Since the clocks within each time show the same time as one moves along north-south longitude lines, time zones generally run north-south of the equator. As one moves along east-west latitude lines clocks do not indicate the same time.

7. Standard time, as originally proposed in 1879, divided the world into twenty-four time zones, each one covering exactly 15 degrees of liongitude. All clocks within each of thes zones would be set to the same time as the others, but differed by one hour from those in the neighboring zones. The local time at the Royal Greenwich Observatory in Greenwich, England was choosen as standard at the 1884 International Meridian Conference, leading to the widespread use of Greenwich Mean Time in order to set local clocks. This location was chosen because by 1884 two-thirds of all charts and maps already used it as their prime meridian. By 1929 all of the major countries in the world had adopted standard time zones. Today, political considerations have increased the number of standard time zones to 39.

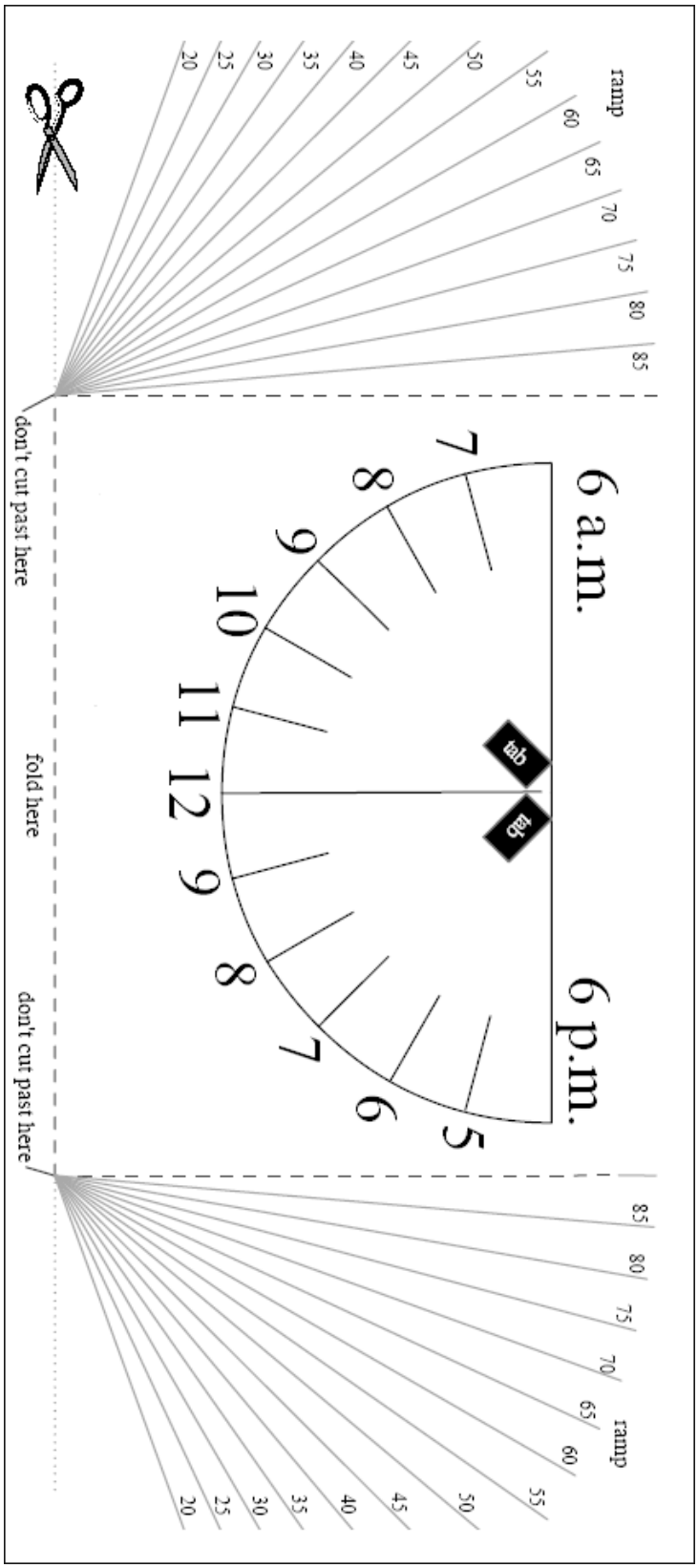
8. No. North of the equator, the shadow cast by the gnomon progresses clockwise around the sundial. South of the equator, the shadow cast by the gnomon progresses counterclockwise. (Special note: a gnomon is the shadow casting post of the sundial.)

9. As the Earth moves around the Sun on it's year-long orbit, one of the Earth's poles is pointed towards the Sun while the other is pointed away. During the spring and summer months in the Northern hemisphere, someone living at the North Pole would experieince 6 months of sunlight wiile a friend living at the South Pole would experience 6 months of darkness. During the fall and winter months in the Northern hemisphere the person at the North Pole would experince 6 months of darkness while their friend at the South Pole would experience 6 months of light. In each case, the person at the pole in the sunlight would observe the shadow moving very slowly around the sundial. It would take weeks to move, not hours. For their friend at the oppostie pole it would stilll be night and their sundial would not work at all.

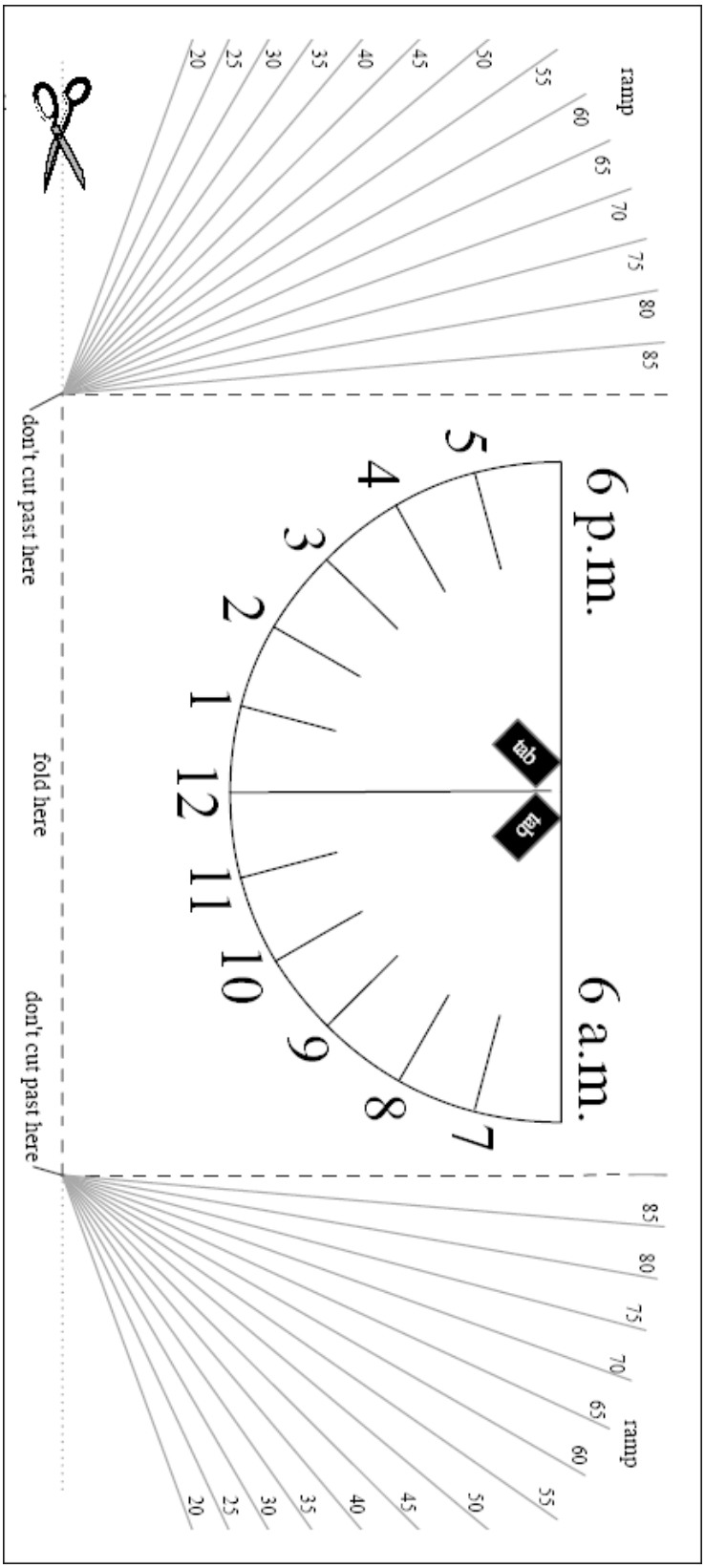
10. Watches had not been invented yet.

11. Yes, although the shadow would be shorter. The exception to this would be if the gnomon is parrallel with the earth's axis in rotation, then the shadows would be the same length. If the gnomon is tangent to the earths surface, the length of the shadow would decreas as one progessers from north to south in the Northern hemisphere, or increase if the observer is in the Southern hemisphere.

SOUTHERN HEMISPHERE



NORTHERN HEMISPHERE



APPENDIX G

Employer Expectations on the Job

Appearance:

- Self Image
- Dress and Grooming
- Personality
- Communications
- Behavior

Dependability:

- Be at work on time.
- Follow the expected work schedule.
- Know the duties associated with your job.
- Don’t miss work.
- Call if you will be absent or late.

Skills:

- Show that you have the skills required for the job.
- Strive to improve your skills.
- Seek ways to learn new skills.
- Accept responsibility.
- Work fast but carefully.
- Be willing to take on additional responsibilities.

Power Words

In any interview the fear of saying the wrong things are in your mind. All too often you are unsure of the right words to use. Well, don't be surprised to know that there are no right words. However, there are things called **power words**. Below is a list of some power words that can be used when answering questions during an interview. The purpose of the words is to ensure that your future employer is given a strong first impression of you, your capabilities, and attributes. (Words and definitions taken from Merriam-Webster Dictionary, 1997).

Words	**Definitions**
Acquire	Gain possession of; to get
Adjust	To bring to agreement; settle
Administer	Manage; dispense; to give ritually or remedially
Arrange	To put in order; to come to an agreement; settle
Assemble	To collect in one place; to fit together the parts of; convene
Calculate	Compute; rely; to design or adapt for a purpose; process
Collect	To gain control of; gather
Compliant	A disposition to yield
Confidence	Trust; reliance; self-assurance; boldness
Cooperate	To act jointly with another or others; willing to work with others
Coordinate	To work or act harmoniously; joining groups
Create	Make; produce; bring into being; cause to exist
Design	To conceive and plan out of mind; to devise for a specific function
Develop	To unfold gradually or in detail; to bring out the possibilities of
Forecast	Predict; to indicate; likely to occur; calculate
Formulate	Design; devise; to express
Generate	To bring into existence; produce; create
Identify	Associate; to establish the identity of
Implement	Carry out; to put into practice
Leader	To direct the operations, activity, or performance of
Notify	Report the occurrence of
Obtain	To gain or attain usually by planning or effort
Outspoken	Direct and open in speech or expression
Personable	Pleasant in person; attractive
Plan	A method for accomplishing an objective; goal
Produce	To give being or form to; bring about
Recommend	To make acceptable; advise
Report	To give an account of; to prepare or present; communicate
Review	A critical evaluation; to examine or study
Schedule	To appoint, assign, or designate for a fixed time; timetable
Specify	To mention or name explicitly
Survey	To look over and examine closely; examine, inspect, and study
Train	To make or become prepared; to aim or point at an object
Update	To bring up to date; to communicate previous or new information
Write	To make up and set down for others to read; correspond

What Do I Want From a Job?

Everyone wants different things from a job. Some people want money, others want security, and others want status or prestige. In considering jobs it is important to know what you want from a job. The following is a list of factors that may be important to you. Rank these factors from 1 to 11 in the order of most importance to you, number one being the most important.

— Friendly people to work with

— An understanding supervisor

— Money

— Pleasant working conditions

— Security

— Steady hours

— Promotional possibilities

— Closeness to home

— Interesting work

— Status or prestige

— Good fringe benefits (health insurance)

Resume Profile

Name: _____
Full Address: _____
Phone: _____–_____–_____

Objective: Identify what type of position you are seeking.

_____

Education:

Indicate Highest Level of School Completed: _____

Name of School: _____

Dates of Attendance: _____

Type of Degree or Diploma: _____

Indicate any Special Training: _____

Name of School:_____

Type of Training: _____

Dates of Attendance: _____

Experience: List jobs, internships, and volunteer work. Start with the most recent.

Full Company Name: _____

Company Address:

_____

_____

_____

Dates of Employment (Month/Year) From: _____ /_____ **To:** _____/_____

Job Title: _____

Job Responsibilities:

_____

_____

_____

Full Company Name: _____

Company Address:

_____

_____

_____

Dates of Employment (Month/Year) From: _____ /_____ To: _____/_____

Job Title: _____

Job Responsibilities:

_____

_____

_____

Full Company Name: _____

Company Address:

_____

_____

_____

Dates of Employment (Month/Year) From: _____ /_____ To: _____/_____

Job Title: _____

Job Responsibilities:

_____

_____

_____

Clubs/Teams: (state name, month/year of membership, and role held)

Club/ Team: _____From:_____/_____To:_____/_____
Role:_____

Responsibilities:_____

Club/ Team: _____From:_____/_____To:_____/
Role:_____

Responsibilities:_____

Special Skills: (Identify any skills that may be applicable for to the position sought.)

_____

Computer Skills: (Specify proficiency or familiarity with software or hardware.)

_____

Certificates, Licenses, Awards, or Honors: (Specify if still valid.)

_____

Languages: (Specify if fluent and also if able to read and write language.)

_____

Hobbies/Interests: (List any that can serve as an icebreaker during interviews.)

_____

References: (Do not list relatives, only professionals.)

_____

Full Name:

_____

Job Title:

_____

Company Name:

_____

Address:

_____

Phone: _____–_____–_____

APPENDIX H

What is Your Individualized Mission Statement?

Now you are ready to draft a personal mission statement. The format is unimportant. The length is unimportant. The literary value is unimportant. The values and goals it expresses, and your commitment to them, are key to understanding how you will formalize and execute it to bring structure and harmony in your home.

Name:

Review your individualized mission statement frequently to rediscover your important values and direction for an enhanced quality of life.

Changing the Challenging Role of Parenting for Desired Outcomes

Expected challenges affecting your home over the next 5 years as you execute your mission

Based on your experiences so far or based on how well you know your child(ren), identify and list at least three challenges you expect to encounter. Put an asterisk next to the challenge that you are already prepared for and explain your preparation plan.

Insert NES Site Name and/or Title of Family Involvement Model

Personal Timeline for: _____
School: _____

Current Grade: _____ Completed By: _____
Relationship: _____ Date: _____

Present Date Where are you?	**Upcoming Plans** 6 months–2 years What do you expect or hope for?	**Graduation Date** 2006–2007 2008–2009 What do you need?	**5 Years After** 2010–2011 2012–2013 What do you want?
1)	1)	1)	1)
2)	2)	2)	2)
3)	3)	3)	3)