



READY, AIM, LAUNCH!

Teacher's Guide Notes



Junkyard Wars

This popular television show is anything but trashy entertainment. Each episode takes place in a huge, specially constructed junkyard, where two teams of engineers and mechanics get 10 hours to build machines scrounged from junk. Later the teams put their contraptions to the test in a competition. Viewers watch as the teams work to meet the same challenge in different ways.

First comes a challenge: Build an object to perform a specific task. Then the teams swing into action, struggling to beat the clock. They revise their plans as necessary. Throughout the show, an expert gives opinions and evaluations of projects. The hosts make diagrams to describe engineering principles behind each team's efforts.

Using the Videos

Each of the enclosed two videos (about 45 minutes each) features an episode of *Junkyard Wars*. On the following page are onscreen discussion questions for students to discuss and answer. These and additional questions for students are on the reproducible pages at the end of this teacher's guide.

In a 45-minute class period, you will not have enough time to show an entire episode and have students work on their reproducibles. You may show the first segments and allow students to make hypotheses, answer questions, and evaluate some program events. Show the final segment featuring the outcome of the program challenge during the next class period.

In 60-minute class periods, you can show an entire episode and take sufficient time for students to complete their reproducibles. In 90- to 120-minute blocks, you can also conduct one of the four Classroom Challenges (laboratory experiments, projects, and demonstrations) included herein.

You may start some Classroom Challenges before or after you show the videos in class. You will want to assign the more substantial challenges after watching the videos.

It is helpful to keep some classroom lights on while watching a video so students can answer the onscreen discussion questions and make drawings on the reproducible pages. Pause the video when these questions appear.

Teacher's Guide Notes (cont.)



Episodes in This Kit

Episode I: Ballistic Missiles

Episode challenge: Build a pumpkin launcher.

Program overview: To build a machine that can fire a pumpkin into a target 50 yards away, one team builds an air-powered cannon and the other constructs a medieval-style trebuchet.

Episode II: Sky Rockets

Episode challenge: Build a rocket.

Program overview: To launch an ostrich egg and return it safely to the ground, one team builds an aerodynamic rocket with several motors and the other builds a cone-shaped rocket with a single motor.

Target Grades: 6–12

Curriculum Focus: physics, physical science, technology, mathematics

Scientific Principles: simple machines, air pressure, Newton's Laws, projectiles, catapults, aerodynamics, acceleration, and surface area and drag

Onscreen Discussion Questions

(Note: Pause the video so students can answer questions on the reproducibles found on pages 14 and 15 in this teacher's guide. To match these time codes, set your VCR counter to zero at the beginning of the tape.)

Episode I: Ballistic Missiles

After Segment 1 (3:12)

- What kind of device would you design to fire the pumpkin a long but specific distance? (Remember: No motors or explosives are allowed.) Sketch your design.
- Look for evidence of teamwork during the video. Are conflicts resolved successfully?

After Segment 2 (19:02)

- After five hours, how have the teams' plans changed because of materials or time limitations?
- Each team at this point has a major problem to solve (listen for the judge's comments). Watch the next segment to see if and how the teams correct these design flaws.

After Segment 3 (33:09)

- In your opinion, which team has the best-built "punkin-chunkin" device? Which team has the best overall design? Give evidence to support your answers.

After Segment 4 (38:10)

- Have you changed your prediction after initial testing? Why or why not?

Episode II: Sky Rockets

After Segment 1 (4:02)

- How can the rocket safely carry an ostrich egg during the launch and landing?
- Compare the designs the experts developed. Sketch and describe each team's basic design.
- What basic materials will each team need, in addition to the rocket motors?
- Look for evidence of teamwork during the video. Are conflicts resolved successfully?

After Segment 2 (8:24)

- How does a rocket engine work? What provides the thrust?

After Segment 3 (15:12)

- What concerns does the judge have about each team's design?
- What are the two purposes of the altimeter?

After Segment 4 (19:10)

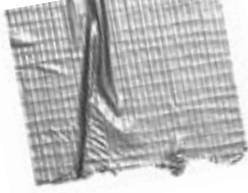
- With four hours left, which team is further ahead in their construction?
- How have the teams' plans changed because of materials or time limitations?

After Segment 5 (33:46)

- In your opinion, which team has the best-built rocket? Which team has the best protection for its ostrich egg? Give evidence to support your answers.
- Predict which team's rocket will travel higher. Which team's egg is more likely to break? Give reasons for your choice.

Safety Considerations

Please do not send your students into junkyards for these or any other projects! Designing and building objects is a great way for students to learn engineering skills and apply science and design principles, but you must give them ways to do this safely.



Some options:

- Provide materials and building time in class (especially for younger students).
- Allow students to purchase their supplies or use supplies from around the house (with permission, of course) within strict guidelines set up in advance, including types of materials and cost.
- Encourage parents to teach their children correct use of tools, forbidding all power tool use except while an adult is present. Never use welding torches or chain saws!

Do not assign projects that use explosives, very large forces, extremely high air pressures, or unprotected sharp objects. Consider all the worst-case scenarios and set your guidelines accordingly. As a general principle, design projects that are based on finesse or accuracy instead of raw power.

Assessments

Included in this curriculum guide are two rubrics: one for the general evaluation of students in laboratory situations and one developed for “Project Your Grade,” a catapult project. Make a transparency or copy of the

rubric to share with the students ahead of time; they must know the criteria on which they will be evaluated.

The general rubric titled “Indicators of Student Involvement” is designed to be used for Classroom Challenges #1-3. Realistically, you can evaluate two to four students per lab period. During the course of a quarter, make sure every student is evaluated at least once. But here’s the key: Don’t let the students know who is being observed in any particular lab period.

For the catapult project, feel free to weight the different criteria shown along the left column as you see fit. You may wish to emphasize or de-emphasize the importance of the journals, or replace the journals with formal lab reports, technical drawings, etc. You may also wish to replace the numerical goals for the students with a more general ranking among the projects in your class that year.

For help in developing your own rubrics, visit the Web site <http://rubistar.4teachers.org/>. You’ll find dozens of sample rubrics that you can adapt for many different applications in your classroom.

National Science Education Standards

The National Science Education Standards, published by the National Academy of Science, provide guidelines for teaching science in grades K–12, as well as a coherent vision of what it means to be scientifically literate. To order the Standards, contact the National Academy Press, 2101 Constitution Ave. NW, Lockbox 285, Washington, DC 20005; <http://books.nap.edu>. The activities in this teacher’s guide address the following national content standards:

Science as Inquiry (grades 5–12)

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Physical Science (grades 5–12)

- Structure of atoms
- Structure and properties of matter
- Chemical reactions
- Motions and forces
- Conservation of energy and increase in disorder
- Interactions of energy and matter

Science and Technology (grades 5–12)

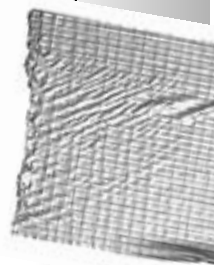
- Abilities of technological design
- Understandings about science and technology

National Council of Teachers of Mathematics

The National Council of Teachers of Mathematics (NCTM) has developed national standards to provide guidelines for teaching mathematics. To become a member of the NCTM, or to view the Standards online, go to <http://www.nctm.org>.

This lesson plan addresses the following math standards for grades 9–12:

- *Algebra Standard: Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols; use mathematical models to represent and understand quantitative relationships.*
- *Measurement Standard: Understand measurable attributes of objects and the units, systems and processes of measurement; apply appropriate techniques, tools, and formulas to determine measurements.*



CLASSROOM CHALLENGES

#1: BALLOON ROCKETS

Background Information

This lab explores action-reaction forces; it is also a good contest because it challenges small groups of students to think creatively and quickly. You may wish to supply a variety of balloon types and allow students to explore their properties. But long, narrow, or oblong balloons work best. For wires, monofilament fishing line and fine wire work well. *Stay safe:* Make sure no wires are strung so low that someone could walk into them.

Materials

- balloons
- straws
- paper clips
- tape
- wire or smooth string
- scissors



Objective

Design a rocket system that can travel across the room...and back!

Procedure

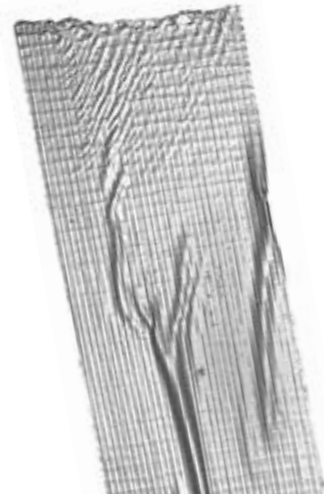
1. String a wire across the room above the head level of every student and teacher. Using the available supplies, have students design a balloon rocket that will propel itself all the way across the classroom. The rocket must move without assistance after the launch. Have students draw their successful designs or describe them in sentences.
2. Challenge students to improve their designs to allow for a return launch. The new balloon rockets must reach the other side of the room and return, allowing only a minor adjustment (or re-launch) at the far side, but no refueling is allowed. For the return trip, students will probably find that they need a second "fuel tank" (balloon), with some way to keep it from

releasing its air pressure too soon. An adjustment such as releasing a paper clip at the far side of the room is allowed, but blowing up the balloon again is not. Have students draw their successful new designs or describe them in sentences.

Analysis

Students must write answers to the following questions:

1. Critics ridiculed early rocket designers about their plans to send rockets to the moon because they said the rockets wouldn't have anything to "push against" in the vacuum of space. Explain why your rocket moves as the air escapes from the inflated balloon.
2. Would your rocket work in vacuum? Why or why not? Explain the design modifications you'd have to make to launch your rocket in space.



#2: HOW FAR CAN YOU GO?

Background Information

This lab focuses on projectiles and angle of launch. Many sources offer launching devices. Budget permitting, you can purchase extremely reliable projectile launchers. These include a built-in protractor and plumb bob for angle measurement and can be clamped to a table in several orientations, allowing you to measure maximum range for either a ground-level launch or a table-to-floor launch.

Although it may be the least reliable, the simplest device is elastic or rubber tubing attached to a board. Students can collect data for this experiment by holding the board at different angles and pulling the elastic back to the same point each time. This method will require a measure of ingenuity to control the variable of initial launch height.

Try building a launcher that attaches to a leaf blower. An electric blower with two speeds and a round nozzle works best, but you can make adaptations for any type. The launcher is detachable from the leaf blower. The launcher shown here can be made for about 15 dollars, not including the leaf blower. You may work with other teachers and build several launchers in an assembly line; it's more fun and makes the best use of the materials.

Construction Materials

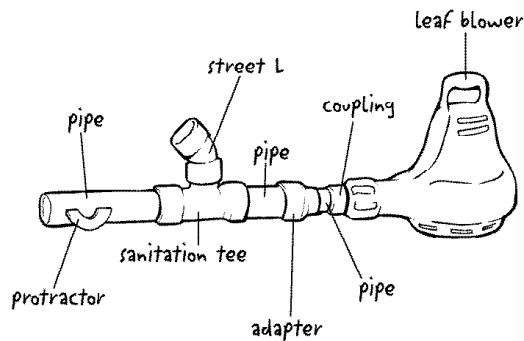
- (PVC and ABS plastic pipe is available in the plumbing section of most hardware stores.)
- one two-inch (2") pipe-to-pipe coupling (or a soft rubber coupling that is adjustable if the leaf-blower nozzle is not two inches or is not round)
 - one 2–3-inch adapter (2–3")
 - six inches (6") of three-inch (3") pipe
 - sanitation tee
 - one street L (a 22.5° turn)
 - 4.5 feet of three-inch (3") pipe for the muzzle
 - PVC or ABS cement
 - hacksaw and sandpaper
 - protractor and plumb bob



Instructions

Cut the pipes to length with the hacksaw; smooth the edges with sandpaper. Fasten the pieces together as shown using PVC or ABS cement, except for the muzzle and the leaf blower. You may need to wrap duct tape around the coupling for a tight fit on the leaf blower. Attach the protractor and plumb bob to the muzzle for angle measurements.

Leaf Blower Launcher



To use the launcher, attach it to the leaf blower so that the street L is facing upward. Turn on the blower and drop a tennis ball into the street L. Quickly cover the street L (with an empty CD case), and the ball is projected. In the model illustrated above, the ball traveled about 10 meters.

(Launcher design by Carl Johnson, Saguaro High School, Scottsdale, Arizona)

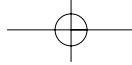
Objective

Use a launcher to explore the relationship between the launch angle and the range of a projectile.

Materials

- launcher (such as Leaf Blower Launcher above, catapult, or slingshot)
- ball
- metric tape or meter sticks





Procedure

Part I: Launching on a level surface

1. Situate your launcher so that the ball will be released at the height of a tabletop (for a small launcher) or at the height of a bench in the bleachers in the gym or football stadium (for a larger launcher). It is crucial that the release height of the ball remains constant throughout this lab, even as you change the launch angle.
2. Fire one shot to locate the approximate landing position of the ball. The ball must land at the same height as the launcher (on the same tabletop or bench).

Determine a way to safely locate the landing position; try carbon paper face-down on butcher paper, or use a slightly damp ball that leaves a mark.

3. For each angle listed below, fire three to five shots, measuring the distance from the launcher's release point to the landing position of the ball. Calculate the average range for each angle.
4. Make a graph of average range (on the y-axis) vs. angle (on the x-axis). Draw a smooth curve through your points.

Angle	10°	20°	30°	40°	50°	60°	70°	80°
1								
2								
3								
4								
5								
Average range (m)								

Part II: Launching from a higher position

1. Arrange the launcher so that the ball will land lower than its launch height. You can fire the ball off a table or from the bleachers onto the floor of the gym.

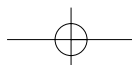
Again, make sure that the release point of the ball is a constant height throughout this experiment.

2. Repeat steps 2 and 3 above for each angle. Make a second graph of this data.

Angle	10°	20°	30°	40°	50°	60°	70°	80°
1								
2								
3								
4								
5								
Average range (m)								

Questions

1. Based on the data in your graphs, what angle gives the maximum range for each type of launch?
2. Is the angle for maximum range greater or less for launching from a higher position, compared to launching from a level surface?
3. Is the maximum range further when the ball is launched from a higher position or from a level surface?



#3: PROJECT BOTTLE ROCKET

Background Information

For this engineering design project, several sources provide equipment for rocket-launch pads, but I highly recommend NERDS, Inc. (Nebraska Educators Really Doing Science at www.nerdsinc.com/rock_prod.html). In addition to the rocket launchers, you'll need an air compressor or a very energetic person using a bicycle pump.

Try to complete your rocket launchers in the middle of a large area, away from trees, poles, and overhead power lines. Students standing near pressurized bottles and air compressor must wear eye protection, but *every student must remain alert and aware at all times*. If the parachutes do not open, the bottles fall to the ground very quickly, and the nose cones could cause damage.

Materials

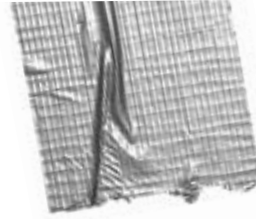


- rocket bodies: two-liter plastic soda bottles (no commercially finished or model products)
- other appropriate materials: Students will find lots of information on the Internet about designing and constructing bottle rockets. *Metal and heavy wood pieces are not allowed: These materials are dangerous if they come off during a launch. Students must not alter bottles that could break when pressurized.*
- additional details (see Rules of Competition)

Objectives

Students will design, construct, and test rockets, which should fly as high as possible and descend as slowly as possible. Every group will launch their rocket three times. Students must not use the same rocket body for more than two launches. The first two launches will be tests. A group must choose one or more aspects of the rocket to test. After each test they must analyze what hindered their rocket the most and redesign it before the next launch. Their goal is to have the best possible rocket by the final launch day.

Several variables determine how long a rocket will remain aloft. The most common rocket design will utilize fins to keep it flying straight, a nose cone to reduce air resistance, a parachute to slow the descent, and the right amount of water to provide adequate thrust. Other than the water, rocket design is not required to have any of these components, and the design should be left to the team members. Encourage them to practice at home.



Rules of Competition

1. Teams should include two or three students in the same class period.
2. Students will bring one completed bottle rocket to each launch. (Rockets must be labeled with students' names and class-period numbers.)
3. Tell students that the main body of the rocket must be intact: They may not punch holes in or cut the bottle, no metal parts will be allowed, and the mass of the empty rocket assembly cannot exceed 450 grams.
4. All energy imparted to the rocket must originate from the combination of water and air pressure provided by the instructor; no other gases may be used.
5. Timing of the rocket begins at launch. It ends when the first part of the rocket hits the ground, when the rocket disappears from the judge's sight, or when the rocket hits an object or gets entangled in it. (Example: The rocket collides with a tree.)
6. All rockets will be launched with a maximum pressure of 75 pounds per square inch (psi).
7. All contestants must register their rockets with the instructor prior to the launch. There they must explain the rocket's design and the reasoning. No physical alterations may be made to the rocket once it has been registered, but fine-tune adjustments are allowed. After inspection, the contestants may add a desired amount of water to the rocket from the supply provided.
8. Each team will get one launch; five minutes are allowed to prepare the rocket.
9. Rocket components may separate during the flight, but they must remain linked together with a maximum length of three meters. For example, if a nose cone separates from the bottle, it must remain attached to the rocket body. If any parts become detached during the take-off or flight, the rocket will be disqualified.
10. Rockets will be launched near the softball field, or a similar large, open area.
11. Aesthetics and design of the final rocket make up 10 percent of a group's grade. Encourage students to design their rockets creatively.



Scoring

This project is worth 100 points: 40 points come from the reports, 50 points for the rocket's time aloft, and 10 points for aesthetics and design. The report consists of two small reports (10 points each) written after each test launch (at right) and one larger report (20 points) written after the final launch (on page 9).

The winning rocket will be determined by the greatest time aloft (recorded to the nearest hundredth of a second). It will receive 55 points for time aloft; all other rockets will be scaled from there, with the lowest grade being 25 points for the rocket with the shortest time aloft. Disqualified rockets will score below 25 points. If, for reasons of disqualification or just plain bad luck, a final launch does not score better than one of the test launches (in time aloft), students may average their final launch time with one of the test launch times to improve their grade. Interesting and unique designs will receive the maximum number of aesthetic points.

Timeline

The schedule for two required trials and the final launch will include three classes about one week apart. You may want to schedule additional before- and after-school optional test launches. Students must have their rockets ready to launch and in class on the scheduled days.

Reports

After each launch teams will be required to analyze the performance of the rocket components. Each group member will fill out a Report for Test Launches after both trials. (These are the two small reports.) Reproduce the report questions for every student and challenge students to give thorough answers; allow them to attach separate sheets for additional information or drawings. Have the students turn in the small reports a few days after each test launch to receive a completion stamp; all the reports should be turned in together at the conclusion of the project.

REPORT FOR TEST LAUNCHES

(Students answer questions individually.)

1. How long was your rocket in the air?
2. What components of your rocket worked well?
3. Describe how each of the rocket components performed in relation to your expectations and to the other rockets in your class.
 - Nose cone:
 - Parachute:
 - Fins:
 - Amount of water:
 - Other:
4. Describe in detail how you plan to change each of the following rocket structures before the next test launch.
 - Nose cone:
 - Parachute:
 - Fins:
 - Amount of water:
 - Other:
5. Describe your group's dynamics. How do you and the others get along? Do you have any difficulties finding time and places to get together? Does your group work better or worse together than you expected?



REPORT FOR FINAL LAUNCH

This two-part report evaluates how well the rockets performed finally; it is also a summary of the project and an analysis of the winning rocket. (The winning group need not conduct further analysis.)

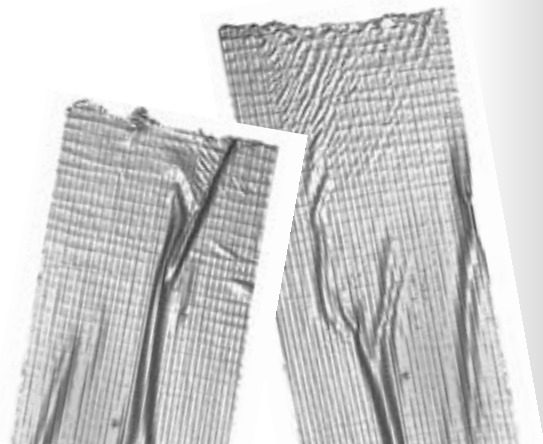
Part I (Students answer the questions as a group.)

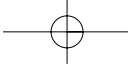
1. How long was your rocket in the air?
2. What components of your rocket worked well?
3. Describe how each of the rocket components below performed:
 - Nose cone:
 - Parachute:
 - Fins:
 - Amount of water:
 - Other:
4. List launch times from all your launches.
 - Test launch #1: _____
 - Test launch #2: _____
 - Test launch #3: _____ (optional)
 - Final launch: _____
5. If your rocket did not perform better on the final launch than on the test launches, explain why.





6. What component of your rocket did you modify the most? Explain how and why.
7. What component performed the best? What is your evidence?
8. What component performed the worst? What is your evidence?

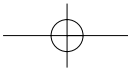
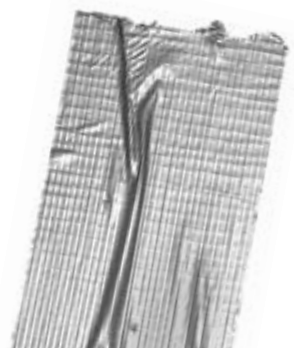
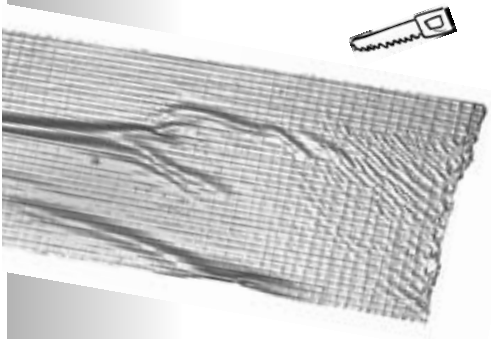
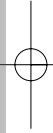
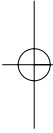
Part II (Students answer the questions individually.)

1. Tell the story of your rocket's design. How was your rocket originally formed and modified? List when, where, and how often your group worked together; include anything interesting that happened.
2. Approximately how much time did your group spend planning and building the bottle rockets?
3. Did all group members put in equal amounts of time, effort, and worry? If not, explain. (This is your chance to mention with complete confidentiality any member who may have let the group down in any way.)
4. What is your estimate of the percentage of work you did?
5. Did you enjoy this assignment? Mention anything you liked or disliked. What would you do to improve the rocket-building process in the future?





  <h2 style="text-align: center;">RUBRIC</h2>   <p style="text-align: center;">Classroom Challenges #1-3 Indicators of Student Involvement</p>			
Categories	0-1 point	2-3 points	4-5 points
Intellectual Curiosity and Spirit of Investigation	<ul style="list-style-type: none"> ● Fills in lab sheet only ● Asks no questions or irrelevant questions; answers no questions ● Not involved with lab ● Does not complete experiment 	<ul style="list-style-type: none"> ● Makes effort to understand the lab ● Asks and answers clarifying questions about the lab ● Mostly involved ● Completes lab as directed ● Passive participation 	<ul style="list-style-type: none"> ● Strives for complete understanding ● Asks and answers probing questions that extend understanding ● Full, active participation ● Goes beyond intended activity
Personal Responsibility	<ul style="list-style-type: none"> ● Tardy or significant time wasted ● Careless with equipment or does not handle equipment at all ● Does not follow safety ● Cleans up insufficiently ● Unprepared for lab activity 	<ul style="list-style-type: none"> ● Time wasted or does not complete lab ● Some carelessness or risky procedures ● Cleans up partially 	<ul style="list-style-type: none"> ● Makes good or excellent use of time ● Uses lab equipment and facilities responsibly ● Cleans up completely ● Prepared for class, has needed materials for activity
Group Dynamics and Interaction	<ul style="list-style-type: none"> ● Does not contribute to group ● Minimal or negative interactions ● Creates or encourages unrelated activities or discussions 	<ul style="list-style-type: none"> ● Some contribution to group understanding ● Mostly receptive to ideas and opinions of others ● Creates some distractions 	<ul style="list-style-type: none"> ● Contributes to group understanding through questions or explanations ● Makes sure everyone in group understands ● Receptive to ideas and opinions of others ● Makes effort to reduce group distractions



#4: PROJECT YOUR GRADE

Objective

In this engineering challenge, teams of one to three students will design, construct, calibrate, and use a device that can launch a tennis ball at a specific target. Two targets will be placed between two and seven meters from the launcher, but here's an extra challenge: The distances will not be announced until just before the launches take place, and they will be different for each team.

Materials

- Have ready
- paper plates
 - metric tape measure or meter stick



Students must bring

- tennis balls
- launching devices (see #3 below)

The Competition

1. A day or two before the competition, have students develop and practice using calibration graphs. They will use them on the day of the event.
2. At the competition, have ready your targets (paper plates) and a metric tape measure or meter sticks. Mark the start line.
3. Each team must have its launching device and standard tennis balls. The launching force must be provided by elastic solids (springs, rubber bands, fabric elastic, etc) or gravity. Students may not use explosives, pressurized gases, or electricity. The launching device will rest on the ground with its front edge at the start line.

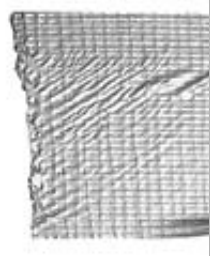
4. Place the targets in a straight line in front of the launching site. Students will measure the distance to the targets and use their launcher to hit them. They will have one launch attempt for each target.
5. The measured distance recorded for each launch is from the target to where the tennis ball hits. If this distance is greater than 75 cm, then use 75 cm in the score calculation below.
6. Each team will have 10 minutes to set up their launching device and complete two launches—one at each target. No practice shots are allowed once the targets are placed on the ground. Students should use their calibration graphs.

Scoring

The total of both distances from the target to the tennis ball-landing location will determine ranking in this competition. The smaller the total, the higher the ranking.

Each student will also turn in a calibration curve and an individual log with the following items:

1. amount of time spent working alone on the project
2. amount of time spent working with team members
3. record of activities during #1 and #2 above
4. sketches of the project design





EVALUATION RUBRIC

Project Your Grade



Categories	0-1 point	2-3 points	4-5 points
Function (Quantitative: total distance)	1.01 - 1.50+ meters	0.26 - 1.00 meters	0 - 0.25 meters
Function (Action and Reliability)	Tennis ball not tossed, or tossed randomly or extremely inaccurately.	Tennis ball tossed, but with some uncertainty on location.	Tennis ball tossed predictably and reliably.
Plan and Technical Drawing	Plan does not show measurements correctly, is not to scale, or is inaccurately drawn or labeled.	Plan provides clear measurements and labeling for most components. Drawing is clear, though scale may be slightly inaccurate.	Plan is neat with clear measurements, labeling and scale correct for all components.
Construction	Construction appears careless or haphazard. Many details need refinement for an efficient or attractive launcher.	Construction was fairly careful and accurately followed plans, but 2-3 details need refinement for an attractive and efficient product.	Great care taken in construction so the plane is neat, attractive and follows plans accurately.
Scientific Knowledge	Explanations by the majority of group members do not illustrate much understanding of the scientific principles applied in the launcher's design and construction.	Explanations by the majority of group members illustrate mostly accurate understanding of the scientific principles applied in the launcher's design and construction.	Explanations by all of the group members illustrate clear and complete understanding of the scientific principles applied in the launcher's design and construction.
Individual Journal (Content)	Journal provides very little detail about the planning, construction, and testing process of the launcher. Does not reflect group dynamics and division of labor.	Journal provides lots of detail about the planning, construction, and testing process of the launcher and provides some reflection on group dynamics and division of labor.	Journal provides a complete record about the planning, construction, and testing process of the launcher, including reflection on strategies and the reasons for modifications and innovations. Clearly discusses group dynamics and division of labor.
Individual Journal (Appearance)	Few entries made; they are not dated or are too messy to read.	Several entries made; most are dated and legible.	Several entries made; all are dated and neat.

WEB SITES

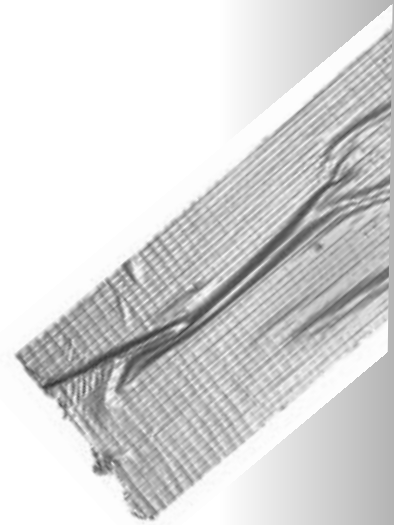
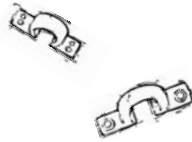
Teachers and students may find the following Web sites informative while working on the Classroom Challenges.

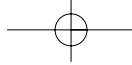
- <http://www.worldchampionshippunkinchunkin.com/index.htm> (An informative “punkin-chunkin” Web site)
- http://family.go.com/raisingkids/learn/activities/feature/famf199611_learnproj1/famf199611_attendants.html (A mini-catapult activity)
- <http://www.howstuffworks.com/question502.htm> (What types of punkin’ chunkers work best?)
- <http://www.askeric.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Science/Physics/PHS0040.html> (A balloFrocket project)
- http://www.nerdsinc.com/rock_prod.html (Good source for bottle-rocket launchers)
- <http://ourworld.compuserve.com/homepages/pagrosse/h2oRocketIndex.htm> (A detailed bottle-rocket site)
- <http://quest.arc.nasa.gov/space/teachers/rockets/> (Lots of rocket projects from NASA)

- <http://library.thinkquest.org/50109/> (A student outline for projects and resources for physics, including a traditional rocket project)
- <http://www.estesrockets.com> (A major supplier for model-rocket engines, kits, and parts; see the troubleshooting guide and safety code.)
- <http://www.pitsco.com/> (A great source of materials for all kinds of rocket launchers and other projects; look at the “Rules” section for free information.)

To see Junkyard Wars on DiscoverySchool.com, visit the Web site below.

- <http://school.discovery.com/networks/junkyardwars> (Interactive games and puzzles; ideas for challenges, projects, and activities; and other teacher resources support the Junkyard Wars Classroom Video Kits.)





Episode I: Ballistic Missiles

Name _____

After Segment 1

- What kind of device would you design to fire the pumpkin a long but specific distance? (Remember: No motors or explosives are allowed.) Sketch your design.

- Look for evidence of teamwork during the video. Are conflicts resolved successfully?

After Segment 2

- After five hours, how have the teams' plans changed because of materials or time limitations?

- Each team at this point has a major problem to solve (listen for the judge's comments). Watch the next segment to see if and how the teams correct these design flaws.

After Segment 3

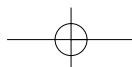
- In your opinion, which team has the best-built "punkin-chunkin" device? Which team has the best overall design? Give evidence to support your answers.

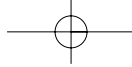
After Segment 4

- Have you changed your prediction after initial testing? Why or why not?

- Record the distance from the castle for each launch in the table below.

Launch	Three Rusty Juveniles		Young Guns	
	Distance	Points	Distance	Points
1				
2				
3				





Episode II: Sky Rockets

Name _____

After Segment 1

- How can the rocket safely carry an ostrich egg during the launch and landing?

- Compare the designs the experts developed. Sketch and describe each team's basic design.

After Segment 2

- How does a rocket engine work? What provides the thrust?

After Segment 3

- What concerns does the judge have about each team's design?

- What are the two purposes of the altimeter?

After Segment 4

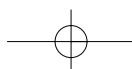
- With four hours left, which team is further ahead in their construction?

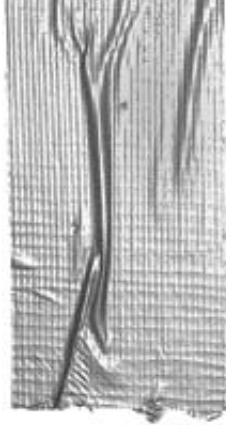
- How have the teams' plans changed because of materials or time limitations?

After Segment 5

- In your opinion, which team has the best-built rocket? Which team has the best protection for its ostrich egg? Give evidence to support your answers.

- Predict which team's rocket will travel higher. Which team's egg is more likely to break? Give reasons for your choice.





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Junkyard Wars airs weekly on TLC.



TLC connects viewers to the human experience through its Life Unscripted approach to storytelling. For more information on *Junkyard Wars*, go to discovery.com and click on TLC.

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