

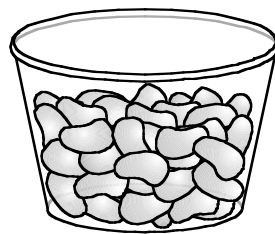
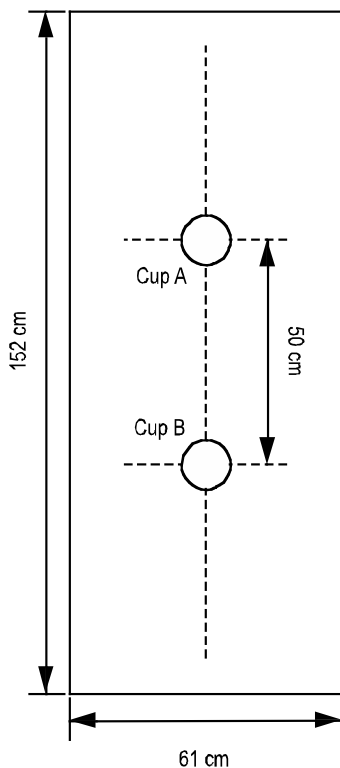
4th Annual LHS Honors Physics Engineering Challenge

2006-2007

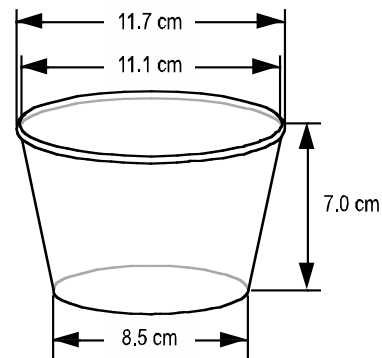
The Challenge:

Two cups, A and B, are placed 50 cm apart on a standard lab table. Cup A will initially contain 200 g of dried lima beans. Individuals or teams of two will construct a device for placing the greatest mass of lima beans into Cup B. Groups who successfully complete the challenge in the shortest amount of time will receive special recognition and added points.

Lab Table (top view)



Cup A



Cup B

Take-Out Food Cups

Medium-sized plastic containers from the Lexington Stop & Shop deli counter.

Large Lima Beans

200 grams Stop & Shop brand dried "Large Lima Beans."

Playing Field:

The dimensions of the cups, along with their positions on the table, are depicted above.

Materials:

- 1) Your device may be powered by any combination of the following: no more than six (6) AA batteries and any number of mechanisms for the storing of potential energy (e.g., springs, weights, rubber bands, etc.).
- 2) Your device may make use of no more than three (3) electric motors. Only Radio Shack motors #273-258 and #273-223 are acceptable. No additional motors of any kind are permissible. See specifications on the reverse side of the Challenge Scoring Sheet for more details.

Rules of the Challenge:

- 1) Your device must be delivered to Ms. Abbot's room (407) by 7:30 am on the date of the competition. It must be contained in a 45 cm x 30 cm x 23 cm standard copy-paper box with lid (or similar). The box must be clearly labeled with names of team members and their teachers.
- 2) You will be given 5 min to assemble your device on site if necessary.
- 3) Your device must touch only the table at the start of its run. It cannot be in contact with the cup, the beans, or the floor, walls or ceiling.
- 4) You must activate your device via a simple one-step action (flipping a switch, cutting a string, releasing a latch, throwing of lever, etc.). No 'hot starts' are allowed (connecting bare wires).
- 5) Your device must work without aid. Once you have activated the device, you may not touch or actively control it.
- 6) Runs will be timed and judged by the honors physics teachers. Runs will start and end when indicted by the student(s). In the event of a failed first start, approximately 5 min will be allowed for adjustments or repairs before a second and final attempt.
- 7) At the end of the testing window, the table must be returned to its original condition (no residue, glue, nails, liquids, etc.).
- 8) Any questions that arise concerning the rules or scoring of this event must be submitted in writing to your teacher. The physics teachers will discuss these questions and respond in writing, posting both Q's and A's online at <http://lexchallenge.blogspot.com/>.

Pre-Competition Milestones:

Friday, November 3rd: Preliminary project plan, 5% of project grade.

Students will describe the key aspects of the design approach they are pursuing and turn in the signed Honor Code.

Tuesday, February 27th: Project update, 20% of project grade.

Your first prototype device must be completely assembled, and you should already be testing and improving your model. A typed progress report of about two pages, including photos is required. This report should describe your strategy, and include a description of the device's present performance and needs for improvement.

The Competition:

Friday, March 16th: Final score, 75% of grade.

The grade will be based on the scoring of the device in the challenge, as detailed below and shown in the attached Scoring Sheet.

Competition Scoring: 75 points maximum

- 1) If your device moves even a single bean from its initial position, +10 points are awarded.
- 2) If your device gets even a single bean to within a 15 cm radius of the center of Cup B, an additional +20 points are awarded.
- 3) If your device gets even a single bean into Cup B, an additional +20 points are awarded.

- 4) If your device gets two or more beans into Cup B, an additional +1 to +20 points are awarded, depending on the total mass of beans moved. Each additional 10 grams is worth one additional point. See the scoring sheet for details.
- 5) If your device completes the challenge by moving 190 to 200 grams of beans into Cup B, you are eligible for incentive points based on speed. The five fastest groups will receive an additional +1 to +5 points, with the fastest group receiving the +5 points.
- 6) Please note that it is possible to get an A (95%) without performing the task quickly. However, students with the fastest and most effective designs will be recognized with top points, cash prizes, and an announcement in the school bulletin.

Words of Wisdom

- If you are using a motor(s) order it early.
- Think before you build. Generate multiple design ideas before selecting a design strategy to pursue.
- Build your first prototype and test it repeatedly.
- Make some changes, and then test again...and again. If it can go wrong, it probably will, but just relax, it's a normal part of engineering.
- Make it robust. It should work every time, even after being transported.
- Bring repair materials on the day of the competition (tape, extra batteries, etc.)
- Keep it simple, student (KISS). Fewer things can go wrong.
- If you are using a motor(s) order it early.

Acceptable Motor Specifications -- <http://www.radioshack.com/>



1.5-3VDC Metal Gear Motor

\$3.29

Model: 273-258

Catalog #: 273-258

Rev it up.

Add motion to projects! This motor is perfect for solar power demonstrations, robotics, models, science projects and more.

- 1.5-3VDC voltage range
- 8700+/-12% RPM at no load, 5800+/-12% RPM at max efficiency speed

What's in the box

- 1.5-3V DC Metal Gear Motor (1)

You'll also need

- 1.5V - 3V DC Power



1.5 to 3VDC Hobby Motor

\$2.29

Model: 273-223

Catalog #: 273-223

Get your motor running.

Add motion to projects! This motor is perfect for solar power demonstrations, robotics, models, science projects and more.

- Up to 8,300RPM at no load
- About 1-1/2" long by 15/16" diameter

What's in the box

- 1-1/2 to 3V DC Hobby Motor (1)

You'll also need

- 1.5V - 3V DC Power

LHS Honors Physics Engineering Challenge

2006-2007 - Scoring Sheet

Team member(s): _____

First Milestone	
Preliminary project plan	(+5) _____

Second Milestone	
Project update with photo(s)	(+20) _____

Challenge	
Starter Points	
1) Displace a bean from its initial position	(+10) _____
2) Get a bean within 15 cm of the center of Cup B	(+20) _____
Bean Points (based on M_{bean} in cup B)	
Gets one bean into Cup B.	(+20) _____
More than one bean into cup B _____ grams	(up to +20) _____
2 beans $< M_{\text{bean}} < 10\text{g}$ = +1	
$10\text{g} \leq M_{\text{bean}} < 20\text{g}$ = +2	
$20\text{g} \leq M_{\text{bean}} < 30\text{g}$ = +3	
.	
.	
.	
$190\text{g} \leq M_{\text{bean}} \leq 200\text{g}$ = +20	
Incentive Points	
Only groups who receive all 40 bean points are in the running for these points, which are based on time.	
Run Time(s) _____	(possible +5) _____
Deductions	
You did not correctly impound your device	(-10) _____
Your device makes use of an unacceptable motor.	(-40) _____
Your group violates any one of the following rules	(-10) _____
Uses "hot start"	
Exceeds allowable time limits for set-up, second runs, or cleanup	
Fails to return the table to its original condition	
.	

Total Points/Final Score

LHS Physics Department Engineering Design Competition Code of Honor

I hereby pledge to observe the following rules and regulations for the duration of the planning, research, design, and construction phases of the LHS Science Department Engineering Design Competition, and to compete in a spirit of fair play and respect for my classmates.

- I WILL work alone or with not more than one partner.
- My partner and I WILL generate all our own design ideas. We WILL NOT share our design ideas with any other participants. We WILL NOT seek out or accept help on the design approach from parents and guardians, classmates, or others.
- We CAN ask others about or do any necessary research on specific design elements that we may decide to employ (such as switches, relays, motors, pumps, electromagnets, capacitors, springs, pulleys, etc.) We WILL NOT seek out or accept advice on how to employ these elements to achieve the specific design task of the contest.
- My partner and I will do all our own construction. We CAN seek out help in learning basic construction techniques if needed. For example, if we decide we need to do soldering or use a power tool, we CAN ask someone to teach us a specific skill or the proper and safe use of a specific tool.
- We CAN use any construction materials we wish, including construction toys such as Legos, cardboard, balsa wood, sheet metal, plastic, scavenged parts, any type of fasteners, gorilla glue or tape, etc., except as noted in the contest rules.

Signatures

Participant: _____ Date: _____
Parent or Guardian: _____ Date: _____