



Creighton
UNIVERSITY



PHYSICS FIELD DAY

RULEBOOK

2010



DAY WINNERS

2006

Theme: Physics of Amusement Parks

**First Place: Tie! Gross Catholic Team II Mount Michael
Team X**

**Third Place: Tie! Gross Catholic Team I Mount Michael
Team Y**

2005

Theme: Einstein in the 21st Century

First Place: Mount Michael Team II

Second Place: Mount Michael Team I

Third Place: Gross I Data Masters

2004

Theme: Physics of Buildings

First Place - Gross Catholic High School

Second Place - Mount Michael

Third Place - Mount Michael

PREVIOUS FIELD

2009

First Place: Central Academy (Team 1)

Second Place: Gross Catholic (Team 5)

Third Place: Central Academy (Team 2)

2008

Theme: Physics of Pirates

First Place: Gross Catholic (Team 1)

Second Place: Gross Catholic (Team 2)

Third Place: Mount Michael (Team 2)

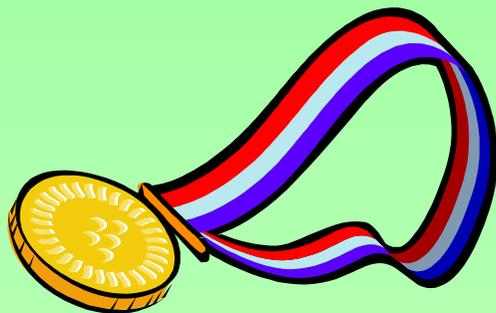
2007

Theme: Physics of Superheroes

First Place: Abraham Lincoln High School (Team A)

Second Place: Mount Michael (Team A)

Third Place: Gross Catholic (Team A)



This Spring Creighton University Society of Physics Students (CUSPS) will be sponsoring the 37th annual Physics Field Day, a day of activities and excitement for high school students. Students will compete in events that require understanding and application of basic physical principles. We in the CUSPS believe that physics can be enjoyed in a hands-on, competitive spirit. There is an event for everyone! It is our hope that the diversity of the Physics Field Day events will encourage many students to participate and challenge themselves.

The theme of the 2010 Physics Field Day is Lasers in celebration of the 50th anniversary of the laser.

The following pages contain descriptions and a full set of rules for the events that we have chosen for this year's Field Day. Please read these rules carefully and prepare well for the flurry of events and excitement that make Field Day an educational, and more importantly, fun experience.

If you have any questions regarding the rules or operation of any event, please do not hesitate to contact myself at anyaburkart@creighton.edu or Dr. Jack Gabel at jackgabel@creighton.edu. Additional details and updates on Physics Field Day can always be found online at:

<http://physicsweb.creighton.edu/content/field-day-hall-fame>

I thank you for your interest in Physics Field Day and I look forward to seeing you compete! Good luck!

Anya Burkart
President, C.U.S.P.S.

REGISTRATION

CUSPS 37th Annual Physics Field Day

Saturday April 17, 2010

8:00 AM – 3:00 PM

Cost: The registration fee is \$15 per team plus \$3 per person. Breakfast and lunch will be provided for both teachers and students.

To register, please email the following information to anyaburkart@creighton.edu:

1. School Name
2. Advisor's Name
3. Number of Teams
4. Names of students in each event for each team

You may also mail the information to:

Anya Burkart

Department of Physics

2500 California Plaza

Omaha, NE 68178

Or fax it to (402) 280-2140

We request your registration information by March 19, 2009.

Please do not hesitate to contact Anya Burkart if you need additional time or you are interested in attending but the deadline has passed.

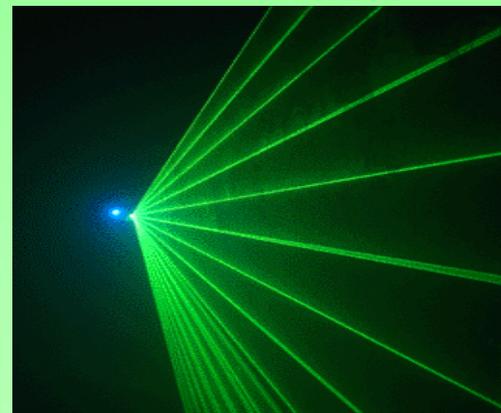
An accurate headcount of each team is imperative to developing a functional schedule.

OPTIONAL VIDEO SUBMISSION

Teams are encouraged to submit videos:

- about your school
- introducing your team
- sharing why physics is awesome

Films should be from 2 to 5 minutes in length. Prepare your film in DVD format and submit the film at registration on the morning of Physics Field Day. The films will be shown later while results are being tallied. Submission of a team video will not contribute points to the team's score. Team video submissions are meant to add to the spirit of Physics Field Day.



MYSTERY TEACHER EVENT

Why only let the students have fun competing? In this new event this year, one teacher per team will compete. Teachers from schools with multiple teams will compete for all teams at the same time No prior preparation is required. The event and its rules will be disclosed at the beginning of this event.

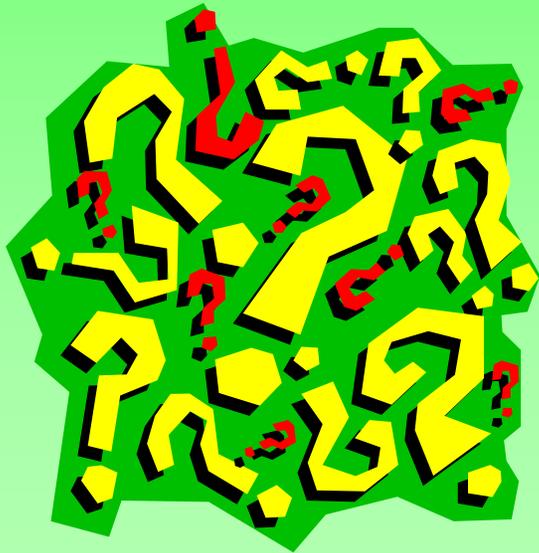


TABLE OF CONTENTS

<i>Page</i>	<i>Subject</i>
3	Introduction
4	Registration Information
5	Table of Contents
6	Chalk Talk
8	Quiz Bowl
10	Optical Slalom
12	Bridge Building
16	Mouse Trap Car Race
18	Student Powered Water Heater
20	Mystery Teacher Event
21	Optional Video Submission
22	Field Day Hall of Fame

CHALK TALK

Topic: *Lasers!*

I) Procedure:

One contestant per team will present a talk about the topic to three judges. Each contestant is allowed to bring no more than two five-by-seven inch index cards with notes. The room will be open to professors, teacher and all students who are not giving a talk themselves.

The speaker will be given no more than five minutes to present his/her talk. The judges will give the speaker a warning at four minutes in order to let the speaker finish within the time limit. The speaker will not be allowed to continue after five minutes have expired.

II) Judging:

A) Delivery:

In the delivery of the talk, the contestant should use smooth, concise English and maintain eye contact with the judges. A contestant's poise during his/her presentation is also part of the judging criteria.

B) Content:

During talk itself, the following will be considered:

- 1. The amount of material covered.**
- 2. The logical flow of ideas.**

C) The thermometer will be immediately inserted into the insulated container, and the temperature will be measured after stirring to ensure a homogeneous temperature.

D) The highest temperature measured will be recorded. The winner will be the team that raises the temperature the of the water the most in 5 minutes, or the team that heats the water to 100°C in the fastest amount of time.



STUDENT POWERED WATER HEATER

Purpose: Each team shall construct a device prior to Field Day that will hold and heat 1 liter of water.

I) Team:

Each team may consist of up to two people, and only one entry per team is allowed.

II) Rules:

A) Only human body energy supplied by the two students will be the source of energy. This energy can be changed into other forms in order to heat the water. No heat pumps are allowed.

B) No combustible materials or solar energy may be used.

C) The test water will be tap water at room temperature and will be measured the judges in an insulated container.

III. Scoring:

A) The test water will be poured into the teams container and they will have 5 minutes to heat the water. At the end of 5 minutes the water will be returned to an insulated container, and the temperature will be measured.

B) If more than 50 milliliters of water was lost during competition, all the lost water will be replaced by tap water.

3. The quality of material covered.
4. The creativity and originality of the talk.

C) Questioning:

After the talk the judges will take five minutes to ask the contestant relevant questions pertaining to the topic. The speaker's answers will be judged on the following criteria:

1. The accuracy of the answer.
2. The relevance of the answer to the question.
3. The ability to think about questions in unfamiliar areas of topic.
4. Originality.



LASER BOWL

Purpose: This game is used to test the subtle points of physics and a team's ability to deal with physics problems of various levels.

I) Teams:

Each team will consist of three individuals.

II) The Game:

Depending on attendance, the rounds will consist of two or four teams. The game is comprised of three rounds:

The first round will have 10 questions each worth 50 points. There will be an 8 second time limit to buzz in and a 5 second time limit to answer.

The second round will have 5 questions worth 70 points. There will be a 15 second time limit to buzz in and a 5 second time limit to answer.

The third round will have 1 question worth 150 points. Each team will have 2 minutes to work a problem and write down an answer. More than one team can score on the last question. Each team should have a captain who will give the answer.

III) Equipment:

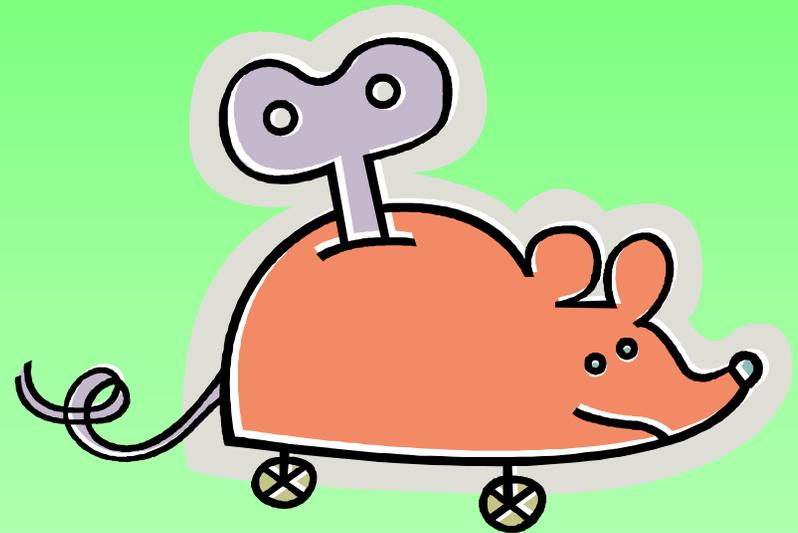
Students may not bring anything into the exam except a pen, pencil, scratch paper and calculator. Programmable calculators may be used, but their memory will be erased at the start of the exam. Books or notes are not permitted.

III) Scoring:

Scoring will be based upon how far the car traveled (70%) and the creativity of the design (30%).

IV) Suggestions:

1. Parts of Lego or toy cars work well as additions to the mousetrap.
2. A long lever arm allows for slow release of the car.



MOUSE TRAP CAR RACE

Purpose: To build a car prior to field day using a mousetrap as the source of propulsion.

I) Team:

Each team will consist of two members.

II) Rules:

A) Building:

- 1. The mousetrap must be the sole source of propulsion. You may connect the lever arm by a string to the axle of the car (no other springs, rubber, bands, etc. are allowed, unless the rubber bands are used for traction on the wheels).**
- 2. The car must have wheels**
- 3. The car must remain on the ground**
- 4. Participants must use a mousetrap. No rattraps will be allowed.**

B) Competition:

- 1. Two trials with three minutes in between each trial to reset the trap.**
- 2. The car must travel down a long hall**
- 3. If the car hits the wall it is dead**
- 4. The distance will be measured from the starting point to the end point.**

IV) Scoring:

There will be a penalty of 25 points for a wrong answer in round one and 35 points for wrong answers in round two. There will be no penalty for wrong answers in round three.

V) General Information:

Commonly used formulas and constants will be provided. Proper use of these formulas should enable the team members to solve all of the problems.



OPTICAL SLALOM

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Purpose: Using the principles of geometric optics, participants will maneuver a beam of light to hit a specified target by reflecting and refracting the beam off and through a series of optical elements.

I) Team:

Each team will consist of two members.

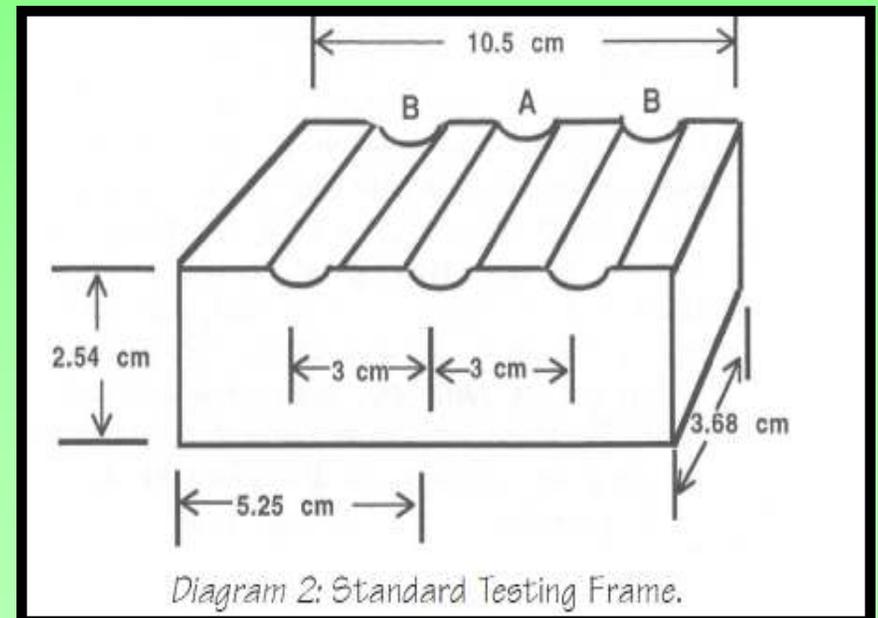
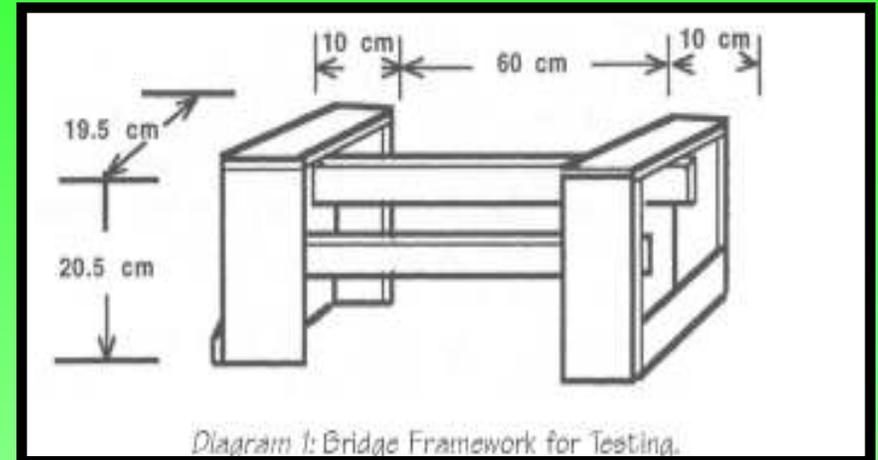
II) Rules:

A) Each team will aim the beam blindly (with the laser shutter closed) except for three optional wild card laser shots of 5 seconds in duration.

B) Once the team has signified that they are satisfied with the placement of all the optical devices, the shutter is opened for scoring. At that time no optical elements may be moved, added, or subtracted.

C) Contestants are allowed to choose any appropriate path for the beam.

D) The path of the beam must be continuous. It must avoid touching anything other than optical elements. Support structures for apertures and previously positioned optical elements are considered immovable obstructions and must be maneuvered around.



- 4. The bridge falls from the support structure.
- 5. In the opinion of the judges, the bridge has failed.
- B.) The successfully suspended mass will be measured as well as the mass of the bridge.
- C) Bridges will be ranked by the in order of the supported mass to bridges mass ratio.
- D) The judges will disassemble every bridge into at least 2 pieces in order to verify compliance with the rules.
- E) In the event that more than one bridge does not fail under the maximum testing weight available to the judges, the lightest bridge would break the tie.



E) The beam may strike any part of the optical element.

F) There will be a time limit in which to hit the target. Be ready to start on time!

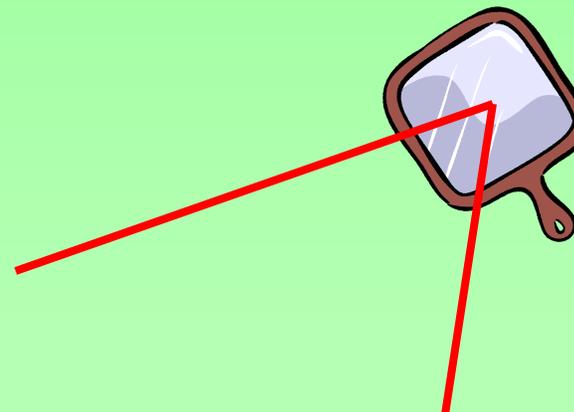
III) Equipment:

Teams may bring in relevant texts, tables, calculators and pencils. Optical elements (lasers, mirrors, and prisms), meter sticks, protractors, and scratch paper will be provided.

Contestants must bring all other equipment they deem necessary.

IV) Scoring:

Scoring will be based upon how many optical elements are successfully used as well as the radial distance from the beam to the center of the target. Bonus points will be given for unused wild card shots as well as the use of advanced optical elements such as prisms.



BRIDGE BUILDING

Purpose: Using the principles of static mechanics the contestants are to design and construct a bridge of toothpicks and glue prior to Field Day. On the day of competition, each bridge will be tested for strength and design according to the rules.

I) Teams:

Teams may consist of up to two people, and only one entry is allowed per team.

II) Construction:

A) Construction Materials: Bridges may only be constructed of:

1. Wooden, flat toothpicks of the variety sold in grocery stores (no homemade toothpicks).
2. Elmers Glue-All, for porous materials (white, water soluble glue). No other adhesive of any kind is allowed.
3. No thread, staples, wire, or any other type of reinforcement is allowed.

B) Dimensions of the Bridge:

1. The bridge must be between 70 and 80 centimeters long and between 4.6 and 19.5 centimeters wide. The gap to be spanned is 60 cm and thus please make your bridge at least 70 cm to guarantee that the bridge will span the gap.
2. A continuous level roadway of toothpicks with no gaps must be completed. The roadway must lie in a horizontal plane. It may not deviate, at any point, more than 1 centimeter above or below the horizontal plane connecting the two ends of the bridge.

3. The total mass of the bridge, including glue, cannot exceed 125 grams.

4. The bridge may not have any supports extending below the roadway.

III) Judging:

A) The bridge must be able to hold at minimum 4 kilograms (the mass of the testing apparatus).

B) The bridge will be placed upon a rigid framework (as seen in diagram 1).

C) The bridge must rest upon the surface of the supports and will not be affixed to the support structure in any way.

D) The standard testing frame (see diagram 2) shall be placed on the roadway surface over the center of the span with either one or two 1/2" diameter rods extending beyond the side of the bridge. The load applied to the bridge shall be suspended from either the single rod placed in slot A of the test frame or the two rods placed in the B slots. (The method used will depend on the design of the bridge. If either option works, the two rod method will be used.)

IV) Scoring

A) Sand will slowly be added to the suspended bucket (itself weighing 4 kg) hanging from the rod/s until one of the following occurs:

1. The structure collapses
2. The bridge sags or flexes more than 3 centimeters.
3. The bridge leans or tips such that the sand bucket is lowered more than 3 centimeters.