

Physics Field Day

Rulebook 2007



creighton university



This spring, the Creighton University Society of Physics Students (CUSPS) will again sponsor *Physics Field Day*, a day of activities and excitement for high school students. The day is filled with competitions 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 2007 Physics Field Day is the "Physics of Superheroes."

In the following pages are 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 NishantChauhan@Creighton.edu or Dr. Gintaras Duda at GKDuda@Creighton.edu. Additional details and updates on Physics Field Day can always be found online at <http://physics33.creighton.edu/>.

I thank you for your interest in our 2007 Physics Field Day and I look forward to seeing you compete! Good luck!

Regards,

Nishant Chauhan



REGISTRATION

CUSPS 33rd Annual Physics Field Day

Saturday March 24th, 2007

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 professors and students.

To register, please email the following information to NishantChauhan@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:

Nishant Chauhan
Department of Physics
2500 California Plz
Omaha, NE 68178

Or fax it to (402) 280-2140

I apologize for the delay in providing you with the rulebooks and registration forms, but we respectfully request your registration information by March 19, 2007.

Please do not hesitate to contact Nishant Chauhan if you need additional time or are interested in attending and the deadline has passed.

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



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BRICK IN THE WALL

Purpose: *To construct a brick structure on one side of a reference line with the largest overhang over the line.*

I.) Teams:

Each team will consist of two individuals.

II.) Rules:

- A.) The structure must consist of only the materials provided.
- B.) The bricks may only touch the ground on one side of the reference line. The bricks overhanging the reference line may not touch the ground.
- C.) The overhang is defined as the horizontal distance from the reference line to farthest brick past the reference line without touching the ground.
- D.) Any number of attempts may be made with each being measured by the judge.
- E.) The structure must stand for 10 seconds before it will be measured.
- F.) Each team will have a 15 minute time limit.

III.) Equipment:

Bricks will be provided.

IV.) Scoring:

The team's score will be the largest distance they obtained.



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

III.) Suggestions:

- A.) The talk should concentrate on the physics of Superheroes. Do not dwell on material not related to physics. In the presentation of your material, do not attempt to explain phenomena that are beyond your mathematical and physical comprehension. Know your ideas with as much depth as possible.
- B.) In preparation for the question period, familiarize yourself with the basic physical principles that relate to the physics of Superheroes.
- C.) Remember that the judges are trying to evaluate your speech fairly. They are not trying to exploit the speech or the speaker.



CHALK TALK

Topic: *The Physics of Superheros.*

I.) Procedure:

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

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

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:



BOAT BUILDING

Purpose: *Using a knowledge of buoyancy, each team will construct a boat out of the provided materials. The boat will be built on the day of the competition. Each boat will be tested to see how much weight it can hold before sinking. The boat that holds the most sand will win.*

I.) Teams:

Each team may consist of up to three people, and only one entry will be accepted from each team.

II.) Construction

A.) *Construction materials:*

One square of aluminum foil 1/2meter by 1/2meter and 8 paperclips

B.) *Dimensions:*

The boat may be any shape, size or design.

C.) Boats must be constructed on the day of the event, with materials provided.

D.) Students will have 25 minutes to construct the boats.

III.) Judging:

In order to be considered the boat must be able to float on the water before the weight is added.



CIRCUITS

Purpose: *To construct a circuit that meets certain specifications using simple combinations of resistors, capacitors, switches, and voltage sources.*

I.) Team:

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

II.) Rules:

A.) Construction:

Each team will be given the same instructions for constructing a circuit that will have to perform a specific function.

B.) Competition:

1. All materials will be provided.
2. Teams will be judged on accuracy and effectiveness
3. There will be 3 rounds of circuit building.
4. If needed, additional teams will construct additional circuits to break a tie



D.) Suggestions:

Each group should know how to obtain the necessary power from their catapult while maintaining accuracy. Remember that the base of the catapult can be as large or as small as you would like so long as it remains behind the line.



CATAPULT

Purpose: To build, prior to field day, a catapult to fling eggs at two targets, 30 meters and 60 meters respectively, with the most accuracy.

I.) Team:

Each team may consist of up to four people with only one entry per team.

II.) Rules:

A.) Construction:

The catapult may be any size, built of any material, and operate on any principle with three exceptions:

- Student may not incorporate any item sold commercially as a catapult.
- No explosives may be used.
- All catapults must utilize a throwing arm and a traditional arched trajectory (e.g. slingshots and air cannons may not be used but trebuchets are acceptable). Catapults must be gravity powered!

B.) Competition:

The catapult will be fired from behind a line at a first target 30 meters away, and a second target 60 meters away. The entire catapult must be behind the line before and after firing. Each catapult will be allowed two attempts at each target. The device may be modified in-between firings as desired but must be ready to fire within 3 minutes. Eggs will be provided.

C.) Scoring:

The score for each group will be based only on accuracy. The group that comes closest to hitting the target will earn the maximum points. Points will be subtracted as a

function of the distance from the target.



OPTICAL SLALOM

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:

- Each team will aim the beam blindly (with the laser shutter closed) except for three optional wild card shots of 5 seconds in duration.
- 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.
- Contestants are allowed to choose any appropriate path for the beam.
- 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.
- The beam may strike any part of the optical element.
- 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.



QUIZ 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 worth 25 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 4 questions worth 50 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 100 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 answers.

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.

IV.) Scoring:

There will be a penalty of 10 points for a wrong answer in round one, and 20 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.