Creighton University Society of Physics Students

PHYSICS FIELD DAY

RULEBOOK

2011
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 2011 Physics Field Day is "Energy of the Future."

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 erichauger@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 our 2011 Physics Field Day and I look forward to seeing you compete! Good luck!

Eric Hauger
President, C.U.S.P.S.
**REGISTRATION**

CUSPS 38th Annual Physics Field Day  
Saturday April 16, 2011  
8:00 AM - 3:00 PM

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

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

1. School Name  
2. Advisor's Name  
3. Number of Teams

You may also mail the information to:  
Eric Hauger  
Department of Physics  
2500 California Plaza  
Omaha, NE 68178  
Or fax it to (402) 280-2140

We request your registration information by March 28, 2011.

Please do not hesitate to contact Eric Hauger 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.

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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:
A.) Each team will aim the beam blindly (with the laser shutter closed) except for three optional wild card 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.

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.
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.
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 by 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.

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 of the water the most in 5 minutes, or the team that heats the water to 100°C in the fastest amount of time.
CIRCUIT BUILDING

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, including a variety of strengths for resistors, capacitors, different types of switches, light bulbs and power source.
2. Teams will be judged on accuracy and effectiveness
3. There will be 3 rounds of circuit building with a new circuit for each round.
4. If needed, additional teams will construct additional circuits in the case of a tie.

Let's see here... to make it to light speed I need to do what exactly?
CHALK TALK

Topic: Energy of the Future

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:
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.
ENERGY 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 then 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.
SOLAR OVEN

Purpose: Each team shall construct a device prior to field day that will utilize solar thermal energy to hold and heat an enclosed space with a minimum volume of 1 cubic foot.

I.) Team:
Each team may consist of up to 2 people, with only 1 entry per team.

II.) Rules:
A.) Construction:
1. Only solar thermal energy may be used as a source of energy.
2. No combustible materials or additional energy sources may be used (The use of photovoltaic panels will not be permitted).
3. Solar oven must be able to open and allow a thermometer to be inserted into oven prior to heating for temperature measurement.
4. Solar ovens may not utilize parts or entire structures that are commercially sold/marketied as designated for solar ovens.

B.) Competition:
1. Students will be given no more than five minutes to set up their solar oven. Upon completion of setup, students will have 5 minutes to allow their solar oven to heat. The total time to set up and heat the solar oven will NOT exceed 10 minutes (excess setup time will deduct from heating time).

2. At the end of heating time, the resultant temperature will be taken for scoring.

III.) Scoring:
A.) Scores will be based on the following factors:
1. Ease of setup – how easy the device is to set up and get it heating (up to 5 minutes)
2. Internal temperature – how hot it gets in 5 minutes
MOUSE TRAP CAR RACE

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

I.) Teams:
Each team will consist of two members.

II.) Rules:
A.) Construction:
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 rattaps 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.

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

IV.) Suggestions:
A.) Parts of Lego or toy cars work well as additions to the mousetrap.
B.) A long lever arm allows for slow release of the car.
OPTIONAL INSTRUCTORS
FAVORITE DEMO

Instructors are encouraged to bring their favorite demo to field day that will be performed before the winners of the event are announced.

Demos can be from any branch of science. If you have any questions/concerns about your demo please feel free to contact me at erichauger@creighton.edu or Dr. Jack Gabel at jackgabel@creighton.edu

If you are bringing a demo please indicate this on a separate sheet of paper and send with your registration for the event.
PREVIOUS FIELD DAYS

2010
Theme: Lasers
First Place: Mount Michael (Team 3)
Second Place: Gross Catholic (Team 2)
Third Place: Gross Catholic (Team 1)

2009
Theme: Space Physics as Portrayed in Film
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)

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