The Physics of Every Day Objects

41st Annual Physics Field Day

Presented by Creighton University's Society of Physics Students

Saturday, March 22, 2014

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Greetings!

You are invited to the Creighton University Physics Department's Physics Field Day 2014! On **Saturday, March 22**, you and your team of high-school physics students will duke it out with other local high schools for the title of "Field Day Champion." This year's theme is "The Physics of Everyday Objects," where we will explore physical principles that we encounter on a daily basis—though perhaps we do not think about them explicitly.

If you have *any* questions, please email SPS President, Nathan Horst (nathanhorst@creighton.edu) and he will get back to you as soon as he can. Additional details and updates on Physics Field Day can always be found online at: http://physicsweb.creighton.edu/content/field-day-hallfame.

Nathan Horst—Creighton University SPS President
Katie Bauer—Creighton University SPS Vice-President

Creighton
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Registration

CUSPS 41st Annual Physics Field Day
Saturday, March 22nd
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 nathanhorst@creighton.edu:
1. School Name
2. Advisor's Name
3. Number of Teams

You may also mail the information to:
Patricia Soto
Department of Physics
2500 California Plaza
Omaha, NE 68178

Or fax it to (402) 280-2140

We request your registration information by March 7, 2014.

Chalk Talk

Topic: The Physics of Every Day Objects.

In accordance with the theme of Field Day, each team will be assigned a team name of an everyday object: (Combustion Engine, Computer, hearing aid, etc…). This object will also be the subject of the Chalk Talk from the representative of each team. It is important to note that presenting a mere history of the object is not encouraged, whereas a summary of the important physical concepts used by that object is much preferred. This event is meant to be and opportunity for students to practice a technical presentation of the research they have done on the subject.

I. Procedure:
   a. One contestant per team.
   b. Each contestant is allowed to bring no more than two five-by-seven inch index cards with notes.
   c. The contestant will present his/her talk to three judges. The room will be open to students and teachers who are not giving a talk.
   d. 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:
      i. The amount of material covered.
      ii. The logical flow of ideas.
      iii. The quality of material covered.
      iv. 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:
      i. The accuracy of the answer.
      ii. The relevance of the answer to the question.
      iii. The ability to think about questions in unfamiliar areas of topic.
      iv. Originality.

Car Construction

I. Teams: Each team will consist of three to five individuals.

Automobiles are something that many of us use on a daily basis – this activity gives each group the chance to construct a miniature car from given materials.

II. Objective: Build a **self-propelled** car from the provided materials that is able to travel the farthest distance from the starting line.

a. Construction
    i. Students will not be permitted to use any materials that are not provided to them while constructing their car.
    ii. The construction session will last 25 minutes maximum.
    iii. Cars will be judged at a later time, so the entire time may be used for construction.

III. Scoring: The car will be judged primarily on distance traveled, with a small percentage of the score devoted to the car's aesthetic value to be used as a tiebreaker.

Magnifying Eyeglasses

Purpose: Using the principles of geometric optics, participants will use the optical elements provided to properly magnify and focus onto a distant object.

I. Team: Each team will consist of two or three members.

II. Rules:
    a. Each team will set up the optical elements with the target removed during the setup process. However, the location of the target object will be disclosed to the participants.
    b. The team will have two wildcards, in which the moderator will place the object, look through the elements and tell the team what the object looks like. After telling them, the object will be removed and the construction can resume.
    c. Once the team has signified that they are satisfied with the placement of all the optical devices, the object will be placed for scoring. At that time no optical elements may be moved, added, or subtracted.
    d. 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. (One integral equation to know is the Thin Lens Equation).

IV. Scoring: Scoring will be based upon how many optical elements are successfully used, the number of unused wildcards, whether the object is in focus, and whether the object is oriented right side up. Bonus points will be given for the use of advanced optical elements such as prisms.

Boat Building

Purpose: To build a boat capable of floating while bearing the greatest possible amount of weight.

I. Teams: Each team will consist of two to four individuals.

II. Rules:
    a. The structure must consist of only the materials provided.
    b. The boat must float under the load for a minimum of 5 seconds.
    c. Each team will have a 20 minute time limit to build their boat.

III. Scoring: The team's score will be the amount of weight that the boat can bear while still floating.

Tiebreakers will be given based on the boat's aesthetic qualities.

Insulation

Purpose: To insulate a thermometer using the provided materials, in order to keep the temperature as high as possible after the structure is placed in a refrigerated area.

I. Teams: Each team will consist of two to four individuals.
II. Rules:
   a. The structure must consist of only the materials provided.
   b. The structures will all be tested at the same time, and the results disclosed to teams at a later time.
   c. Each team will have a 15 minute time limit to insulate their thermometer.
III. Scoring: The team's score will be the temperature of the thermometer at the time of measurement, after cooling. Tiebreakers will be given based on the aesthetic qualities of the insulating structure.

Bridge Building

Purpose: Teams will construct bridges from the materials provided that are able to bear the greatest load of weight when they are tested.

I. Team: Each team may consist of up to three people.
II. Rules:
   a. Construction: Each team will be given the same materials for constructing a bridge, and will have 25 minutes to complete this task.
   b. Competition:
      i. Bridges will be judged based on the amount of weight that they can bear hanging from them.
      ii. In the case of a tie, tiebreakers will be given based on aesthetic qualities of the bridge.

Paper Airplanes

Purpose: Each year, an intensive project that requires construction and planning prior to Field Day is designed. This project allows students to exercise creativity that goes above and beyond the time limitations of Field Day. This year's project will be building paper airplanes.

I. Team: This event is designed so every single individual can participate, and build their own paper airplane.
II. Construction: There are only a few specific requirements regarding construction that must be met, but failure to comply with these specifications will result in a disqualification.
   a. Materials: In order to standardize the competition, so no individual has unfair advantages, the only materials that will be allowed for building the paper airplane are paper, staples, paperclips and scotch tape.
   b. Weight: the paper airplane may have a maximum weight of 50 grams, and must be

equal to or less than this weight value to be eligible.

III. Judging: These projects will be judged on the following criteria
   a. Distance travelled by the paper airplane
   b. Hang time of the paper airplane
   c. Design aesthetics
   d. Creativity

IV. Competition:
   a. The highest scoring airplane from each team will be entered as the score for that team.