

42nd Annual Physics Field Day
Presented by Creighton
University's Society of Physics
Students
Saturday, March 28, 2015
Condensed Matter

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Greetings!

You are invited to the Creighton University Physics Department's Physics Field Day 2015! On Saturday, March 28, 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 "Condensed Matter," 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, Katherine Bauer (kmb32423@creighton.edu) and she will get back to you as soon as possible. Additional details and updates on Physics Field Day can always be found online at:

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

Katherine Bauer—Creighton University SPS
President
Danielle Desa—Creighton University SPS
Vice President

Registration 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 kmb32423@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, 2015.

Events

Chalk Talk

Topic: Condensed Matter

In accordance with the theme of Field Day, each team will be assigned a team name based on Condensed Matter physics: (Superconductors, LEDs, speed of sound, etc.). This topic 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 topic is not encouraged, whereas a summary of the important physical concepts is much preferred. This event is meant to be an 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)

III. Questioning:

- a. 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.

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 lenses), meter sticks, protractors, and 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. Bonus points will be given for the use of advanced optical elements such as prisms.

Egg Drop

Purpose: Build a structure capable of containing and protecting an egg from a one, two, or three story drop.

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

II. Rules:

- a. The structure must consist of only the materials provided.
- b. Each team will have 20 minutes to complete their containers.
- c. Each team will choose to drop their egg containers from one, two, or three stories in a designated area.

III. Scoring: The team's score will be based on the egg's state after the drop. At minimum, students will drop their contraptions from a one-story height, but additional points will be granted for higher drops. No points will be awarded for broken or damaged eggs.

Structure Smash

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 a basic structure. We will then smash each structure to see which one holds up the best!

I. Team: Each team will bring one pre-built structure.

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 structure are foam, cardboard, balsa wood, paper, and tape.
- b. Dimensions: The bottom of the

structure may be 1 foot by 1 foot, while the top must be 5 inches across or less (i.e. some sort of tower shape).

III. Judging: These projects will be judged on the following criteria

- a. Load required to smash the structure
- b. Design aesthetics
- c. Creativity

Quiz Bowl

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.

- a. 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.
- b. 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.
- c. 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:

- a. Students may not bring anything into the exam except a pen, pencil, scratch paper and calculator.
- b. Programmable calculators may be used, but their memory will be erased at the start of the exam.
- c. 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:

- a. Commonly used formulas and constants will be provided.
- b. Proper use of these formulas should enable the team members to solve all of the problems.
- c. Students are expected to solve basic problems in mechanics (kinematics, forces and energy), electricity and magnetism, simple circuits and, in accordance with the theme, general knowledge pertaining to Condensed Matter.

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. All circuit elements will be provided. Contestants must bring all other equipment they deem necessary.

IV. Scoring: Scoring will be based upon how many circuit elements are successfully used, the number of unused wildcards, and the number of lit LEDs.

Circuit Challenge

Purpose: Using the basic principles of electronics, participants will use the circuit elements provided to light up as many LEDs as possible.

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

II. Rules:

- a. Each team will set up the circuit elements without electricity during the setup process.
- b. The team will have two wildcards, in which the moderator will connect the circuit to electricity, and tell the team how many LEDs are lit.
- c. Once the team has signified that they are satisfied with the placement of all the circuit elements, the circuit will be

turned on for scoring. At that time no circuit elements may be moved, added, or subtracted.