

1. **DESCRIPTION:** Participants must complete tasks and answer questions about electricity and magnetism.

A TEAM OF UP TO: 2 **EYE PROTECTION:** None. **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**

- a. Each team may bring one three-ring binder of any size containing information in any form and from any source attached using the available rings. Participants may remove information or pages for their use during the event.
- b. Each team may also bring writing utensils, and two stand-alone calculators of any type for use during any part of the event.
- c. Event supervisors must provide any material & measurement devices required for the hands-on tasks.
- d. Participants may bring their own basic multimeters for use in place of provided ones at the discretion of the event supervisor.

3. **THE COMPETITION:**

Part I: Written Test

- a. The written test consisting of multiple choice, true-false, completion, or calculation questions/problems will assess the team's knowledge of electricity and magnetism.
- b. Unless otherwise requested, answers must be in metric units with appropriate significant figures.
- c. The test will consist of at least one question from each of the following areas:
 - i. Historical perspective of the electricity discoveries made by Volta, Ohm, Tesla, Hertz, & Faraday
 - ii. Properties of electric charge/fields, sources/hazards of static electricity, Coulomb's Law, capacitance
 - iii. Direct current (DC) characteristics, sources, uses, simple circuit diagrams, DC hazards
 - iv. Alternating current (AC) characteristics, sources, uses, AC hazards
 - v. Concepts and units of current, voltage, resistance, power, energy, and using Ohm's law
 - vi. Magnetic poles/fields, electromagnets, transformers, motors/generators, right-hand rule
 - vii. Electrical control devices including 3-way light switch circuits
 - viii. Simple measurements, constructions, and configurations of a circuit and individual components
 - ix. Fundamental characteristics and operation of a light emitting diode (LED)
 - x. **Division C only** - Simple circuit analysis using Kirchhoff's Voltage & Current Laws
 - xi. **Division C only** - Basic digital logic and digital logic operations
 - xii. **Division C only** - Time constant of a RC circuit
 - xiii. **Division C only** - Electrical characteristics of a silicon PN junction
 - xiv. **Division C only** - Basics and application of Operational Amplifiers (OpAmps)
- d. Topics not included in the competition are: semiconductors, AC circuit theory, inductance, non-linear devices, three-state logic gates, sequential logic, and oscilloscopes.

Part II: Hands-On Tasks

- a. The hands-on portion will consist of at least one task at a station(s) for the teams to complete.
- b. Participants must be familiar with the operation of breadboards and how to use them.
- c. The hands-on tasks, or stations, may include but are not limited to:
 - i. Determine the value of a mystery resistor in a circuit using only voltage measurements.
 - ii. Calculate the power supplied to a circuit.
 - iii. Given some wires, batteries, resistors, and 2 LEDs, hook them up so the LEDs are equally bright.
 - iv. Construct an electromagnet using some wire, a bolt and battery.

4. **SCORING:**

- a. High score wins.
- b. Points will be awarded for correct answers, measurements, calculations, and data analysis. Supervisors are encouraged to provide a standard form for competitors to show measurements/calculations.
- c. The written portion of the competition will account for 50-75% of each team's score. No single question will count for more than 10% of the total points possible on the written test.
- d. The hands-on portion of the competition will account for the remaining 25-50% of each team's score.
- e. Ties will be broken using pre-selected task(s)/question(s) that will be noted on the written test.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Chem/Phy Science CD; other resources are on the event page at soinc.org.

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