CIRCUIT LAB B

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Participants must complete tasks and answer questions about electricity and magnetism.
   A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minutes
   CALCULATOR: Class III

2. **EVENT PARAMETERS:**
   a. Each team may bring a collection of notes and resources, written/printed on paper, of any size containing information in any form and from any source. Binders, notebooks, folders, sheet protectors, lamination, tabs, and labels are permitted. Participants are responsible for organizing and containing their notes efficiently. They may separate or remove the pages from containers for use during any part of the event.
   b. Each team may also bring writing utensils and two Class III calculators for use during any part of the event.
   c. Event Supervisors must provide all supplies and 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 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 only:
      i. Properties of electric charges/fields, sources/hazards of static electricity, Coulomb's Law, capacitance
      ii. Direct current (DC) characteristics, sources, uses, DC hazards
      iii. Alternating current (AC) characteristics, sources, uses, AC hazards, common household AC components
      iv. Concepts and units of current, voltage, resistance, power, energy, and using Ohm's law
      v. Magnetic poles/fields, electromagnets, transformers, motors/generators, right-hand rule
      vi. Electrical control devices including switches, relays, fuses, ground fault circuit interrupters, and breakers
      vii. Simple calculations, constructions, and configurations of a circuit and individual components, including simple circuit diagrams
      viii. Historical perspective of the electricity and magnetism discoveries made by Ampere, Coulomb, Kirchhoff, Volta, Ohm, Tesla, & Faraday
      ix. States/Nationals only:
         (1) Simple circuit analysis using Kirchhoff's Voltage & Current Laws
         (2) Fundamental characteristics and operation of a light emitting diode (LED)
   d. Topics not included in the competition are: semiconductors (beyond those listed above), AC circuit theory, frequency analysis, inductance, calculations involving direct use of calculus and/or differential equations, non-linear devices, 3 Phase Power, and oscilloscopes.

Part II: Hands-On Tasks

   a. The hands-on portion will consist of at least one task for the teams to complete.
   b. Participants must be familiar with the operation of breadboards and multimeters and how to use them. Participants may ask event supervisors for details of the internal wiring of any breadboards used for the tasks.
   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.
      v. Given a USB charger, read the label and provide details of the various output power levels it can provide and calculate how long it would take to charge a specific battery.

4. **SCORING:**
   a. High score wins.
   b. Points will be awarded for correct answers, measurements, calculations, and data analysis.
   c. The written portion of the competition will account for 50-75% of each team's score.
   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 may be noted on the written test.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries a variety of resources to purchase; other resources are available on the Event Pages at soinc.org.