

### CIRCUIT LAB

1. **DESCRIPTION:** Students will demonstrate their understanding of direct current (DC) electrical circuits.  
**A TEAM OF UP TO:** 2 **APPROXIMATE TIME:** 50 minutes
2. **EVENT PARAMETERS:**
  - a. Students are allowed to use any notes and/or calculators. Notes must be secured in a 3-ring binder of any size, so that regardless of orientation nothing falls out. Calculators must not have external probes or sensors of any type attached to them.
  - b. The event supervisor must provide any needed measurement equipment such as multimeters or probes. Students may bring their own basic multimeters for use in place of event supervisor provided ones.
3. **THE COMPETITION:**
  - a. The competition must consist of both hands-on tasks and questions related to DC electrical circuits. **25-50%** of the score must be from the practical portion (hands-on tasks), and **50-75%** must be from the theoretical portion (written questions). **No single question may count for more than 10% of the score.**
  - b. Supervisors are encouraged to use measurement equipment (e.g., computer or calculator sensors/probes, multimeters, etc.) wherever possible or provide students with data sets collected by equipment following demonstration of the data collection. If used, data must be presented in a tabular and/or graphic format and students will be expected to interpret the data.
  - c. The event supervisor may provide some mathematical relationships, but the students are expected to know and understand the concepts outlined below. The competition must consist of at least one task/question from each of the following areas:
    - i. DC circuits concepts, definitions and principles (e.g., voltage and current sources, EMF, resistance, applications of series and parallel circuits, voltage dividers, impedance matching, **history**)
    - ii. DC circuit analysis theory (e.g., Ohm's Law, parallel and series resistors, Kirchhoff's Laws, node and mesh analysis, Norton and Thevenin equivalents)
    - iii. DC circuit analysis practice (e.g., the use of voltmeters, ammeters, ohmmeters and multimeters, resistor color codes and their uses in series and parallel circuits, **Wheatstone bridges**)
    - iv. Intermediate DC circuits concepts, definitions and principles (e.g., electrical SI base and derived units, capacitance, ideal diodes, electron current, RC circuits, **digital logic**)
  - d. **Digital logic may be included only in the theoretical portion and is limited to: ideal basic two-state logic gates (AND, OR, NOT, NAND, NOR), Boolean algebra, truth tables, logic formula minimization, and Venn diagrams. Three-state logic gates, latch circuits, flip flops, sequential logic, and other digital logic concepts are prohibited.**
  - e. **Historical items are limited to items related to named SI units (e.g. namesakes, related laws).**
  - f. Topics that must not be included in the competition are: semiconductors, AC circuit theory and devices, inductors, **transformers, and non-linear devices.**
  - g. **Light Emitting Diodes (LEDs) may be used in the practical portion as a light bulb equivalent only.**
4. **SCORING:**
  - a. Points will be awarded for correct answers and/or proper technique.
  - b. Ties will be broken using a designated task or question(s), **which will be the same for all teams and will be identified before all periods.**

**Recommended Resources:** All reference and training resources including the **Chem/Phy Sci CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>