#### **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