



# ELECTRICAL APPLICATIONS

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## OVERVIEW

Participants take a written test of basic electrical and electronic theory to qualify as semifinalists. Semifinalists assemble a specific circuit from a schematic diagram using their own kit and make required electrical measurements. Semifinalists explain their solution during an interview.

## ELIGIBILITY

A team of two (2) individuals per chapter is allowed to participate.

## TIME LIMITS

1. Preliminary Round: Participants are allowed one (1) hour to complete the written test.
2. Semifinal Round:
  - a. Semifinalists are allowed one (1) hour to solve the circuit problem.
  - b. Upon completion of the circuit, or at the end of the time limit, semifinalists are questioned about their solution in an interview.

## LEAP

A team LEAP Response is required for this event and must be submitted at event check-in (see LEAP Program).

## ATTIRE

TSA competition attire is required.

## PROCEDURE

### Preliminary Round

1. Participants report to the event area at the time and place stated in the conference program and submit their LEAP Response.
2. Both team members take the test within the time limit.
3. The top twelve (12) teams with the highest averaged scores qualify as semifinalists.
4. A list of semifinalist teams (in random order) will be posted.

### Semifinal Round

1. Semifinalists report to the event area at the time stated in the conference program.
2. Semifinalists will build a circuit from the provided schematic diagram and make electronic measurements with their multimeter at the designated positions in the circuit, within the time limit, using their own kit.
3. The LEAP Response will be judged in addition to the semifinalist interview.
4. Ten (10) finalists will be announced during the conference award ceremony.



## REGULATIONS

### Preliminary Round

A. An answer sheet (scan-type) and paper are furnished to each participant at the test site.

### Semifinal Round

- A. All work must be completed in the event area during the time specified for the event.
- B. Semifinalists provide their own standard calculator (no scientific calculators) and a battery-operated multimeter.
- C. Semifinalists are required to provide their own tool kit with identification (school name, address, and advisor cell phone number).
- D. Each tool kit must contain all required materials to fabricate the solution. The following is a suggested list of materials:
1. (Minimum) 1.375" x 3.25" solderless circuit breadboard 10 x 30 pin positions
  2. One (1) 9-volt battery with snap-on battery connector
  3. One (1) 9-volt battery clip
  4. One (1) speaker (wires pre-soldered)
  5. Two (2) LEDs
  6. Twelve (12) connector wires
  7. Pushbutton switch (wires pre-soldered)
  8. One (1) photocell
  9. One (1) potentiometer
  10. One (1) IN4003 diode
  11. One (1) IC555 integrated circuit
  12. One (1) 2N3906 transistor
  13. One (1) 2N3904 transistor
  14. Resistors (minimum of one [1] each, ohms): 10, 10K, 47, 100, 220, 1K, 2.2K, 3.3K, 6.8K, 16K, 33K, 120K, 330, 470K
  15. Capacitors (in microfarads): .01, .1, 10, 100, 1000
  16. S106B1 SCR
  17. Wire strippers
  18. Standard 4-function calculator
  19. Digital multimeter
- E. Worksheets to complete on-site calculations will be provided by TSA.
- F. All other equipment necessary to solve the on-site problem is provided by the coordinator.
- G. Semifinalists remain with their circuit solution until the judges have completed the interview.



H. The LEAP Response:

1. Participants document the leadership skills they have developed and demonstrated while working on this event, and on a non-competitive event leadership experience.
2. Find specific LEAP Response regulations in the LEAP Program section of this guide, and on the [TSA website](#).

## EVALUATION

Evaluation is based on

1. Preliminary Round: The averaged team score earns points for the written test
2. Semifinal Round: The accuracy and degree of completion of the circuit problem in the allotted time, the interview, and the content and quality of the LEAP Response

Refer to the official rating form for more information.

## NOTE

1. Participants should have a basic knowledge of electrical theory.
2. The written test consists of a variety of questions about electrical and electronic theory. Participants may want to research the type of content to expect on the test.

## STEM INTEGRATION

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

## CAREERS RELATED TO THIS EVENT

This competition connects to one or more of the careers below:

- Electrical engineer
- Electrical technician
- Electrician
- Electronic analyst
- Electronic designer
- Research assistant



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## EVENT COORDINATOR INSTRUCTIONS

### PERSONNEL

- A. Event coordinator
- B. Judges, semifinal round, two (2) or more
- C. Proctors, preliminary round to administer the written test, two (2) or more
- D. Assistants, two (2)

### MATERIALS

- A. Coordinator's packet, containing:
  - 1. Event guidelines, one (1) copy for the coordinator and each judge
  - 2. TSA Event Coordinator Report
  - 3. List of judges/assistants
  - 4. Sick-on labels for identifying entries
  - 5. Copies of the written test for each participant
  - 6. Results envelope with coordinator forms
- B. Stopwatch for the assistant/timekeeper
- C. Twelve (12) wire strippers
- D. On-site problem:
  - 1. 12 copies of the on-site circuit diagram problem, one (1) for each team
  - 2. 12 copies of the calculation worksheet, one (1) for each team
- E. Adequate conditions (inside or outside) for on-site testing devices as needed for the designated circuit
- F. Tables and chairs for the participants, event coordinator and judges

### RESPONSIBILITIES

- A. At the conference:
  - 1. Attend the mandatory coordinator's meeting at the designated time and location.
  - 2. Report to the CRC room and obtain the coordinator's packet; check the contents.
  - 3. Review the event guidelines and check to see that enough judges/assistants have been scheduled.
  - 4. Inspect the area or room in which the event is to be held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
  - 5. At least one (1) hour before the event is scheduled to begin, meet with judges/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
- B. Preliminary Round:
  - 1. Begin the event at the scheduled time by closing the doors and checking the entry list.
  - 2. All participants and judges should be in the room at this time.
  - 3. In order to compete, participants must be on the entry list or must have approval of the CRC.
  - 4. Monitor the one (1)-hour written test.
  - 5. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either



- to deduct twenty percent (20%) of the total possible points in this round or
  - to disqualify the entry
  - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
6. Judges determine the twelve (12) semifinalists and discuss and break any ties.
  7. Submit semifinalist results and all related forms in the results envelope to the CRC room.
- C. Semifinal Round:
1. Provide the on-site circuit problem and worksheet to the semifinalists.
  2. Supervise the one (1)-hour on-site circuit problem.
  3. Judges conduct semifinalist interviews in an area away from the other semifinalists.
  4. Judges determine the ten (10) finalists.
  5. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either
    - to deduct twenty percent (20%) of the total possible points in this round or
    - to disqualify the entry
    - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
  6. Any ties should be broken on: first, test scores; second, interview points; third, electronic measurement accuracy.
  7. Submit the finalist results and all related forms in the results envelope to the CRC room.
  8. Manage security and the removal of materials from the event area.



Participant/Team ID# \_\_\_\_\_

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2018 & 2019 OFFICIAL RATING FORM

MIDDLE SCHOOL

## Go/No Go Specifications

Before judging an entry, ensure all items are present; indicate presence with an "X" in the box. If an item is missing, leave the box blank and place an "X" in the box labeled ENTRY NOT EVALUATED; this disqualifies the entry and it is not to be judged.

- Toolkit is present
- Completed LEAP Response is present
- ENTRY NOT EVALUATED

## Written Test Score (50 points)

WRITTEN TEST SUBTOTAL (50 points)

Rules violations (a deduction of 20% of the total possible points for the semifinalist section) must be initialed by the evaluator, coordinator and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: \_\_\_\_\_

PRELIMINARY SUBTOTAL (50 points)

## Semifinal Solution to On-site Problem and Interview (93 points)

### Criterion Performance Levels

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
Evaluators: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion = 7 points; an "adequate" score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.			
<b>Solution accuracy</b> (X1)	Solution attempt is evident but the solution is not complete, and/or there is no final solution.	Solution is not complete, though some measurements can be taken.	Solution is accurate and complete.
<b>Proper use of components</b> (X1)	Components are not used properly, and/or they are placed in the wrong sequence.	Components are used correctly, however, they may be placed in the improper sequence.	Components are used correctly and they are in the proper sequence and arrangement.
<b>Accuracy of measurements</b> (X1)	Measurements taken and calculated are 0-49% accurate.	Measurements taken and calculated are 50-89% accurate.	Measurements taken and calculated are 90-100% accurate.
<b>Articulation</b> (X1)	The interview is full of illogical thoughts that lack clarity, and/or there is insufficient information provided describing the solution.	The interview is somewhat logical, easy-to-follow, and/or there is sufficient information provided that describes the solution.	The interview is clear, concise, and there is ample information provided that describes the solution.
<b>Delivery</b> (X1)	Participants are verbose and/or uncertain in the interview; participant's posture, gestures, and lack of eye contact diminish the interview.	Participants are somewhat well-spoken and clear in the interview; participant's posture, gestures, and eye contact are acceptable in the interview.	Participants are well-spoken and distinct in the interview; participant's posture, gestures, and eye contact result in a polished, natural, and effective interview.
<b>Organization</b> (X1)	The team seems unorganized and unprepared for the interview; an illogical explanation of the solution is presented.	The team is generally prepared for the interview; an explanation of the solution is communicated adequately.	The interview is logical and easy to follow; the solution is communicated in an organized and concise manner.
<b>Knowledge</b> (X2)	The team seems to have little understanding of the necessary concepts; answers to questions may be vague.	The team exhibits understanding of the concepts involved in the solution.	The team shows clear evidence of a thorough understanding of the concepts involved in the solution.

Record scores in the column spaces below.



Semifinal Solution to On-site Problem and Interview continued (93 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>LEAP Response</b> (10% of the total event points)	The team's efforts are not clearly communicated, lack detail, and are unconvincing; few, if any, attempts are made to identify and incorporate the SLC Practices.	The team's efforts are adequately communicated, include some detail, are clear, and are generally convincing; identification and incorporation of the SLC Practices are satisfactory.	The team's efforts are clearly communicated, fully-detailed, and convincing; identification and incorporation of the SLC Practices are excellent.
<b>SEMIFINAL SOLUTION TO ON-SITE PROBLEM AND INTERVIEW SUBTOTAL (93 points)</b>			
Rules violations (a deduction of 20% of the total possible points for the semifinalist section) must be initiated by the evaluator, coordinator and manager of the event. Record the deduction in the space to the right.			
Indicate the rule violated: _____			
<b>SEMIFINAL SUBTOTAL (93 points)</b>			
(To arrive at the TOTAL score, add the PRELIMINARY SUBTOTAL and the SEMIFINAL SUBTOTAL )			<b>TOTAL (143 points)</b>
Comments:			
I certify these results to be true and accurate to the best of my knowledge.			
<u>Evaluator</u>			
Printed name: _____		Signature: _____	