

ELECTRICAL APPLICATIONS



OVERVIEW

Participants take a test of basic electrical and electronic theory to qualify as semifinalists. Applying leadership and 21st century skills, 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

One (1) team of two (2) individuals per chapter may participate. No individuals will be allowed to compete.

TIME LIMITS

PRELIMINARY ROUND

- A. One (1) hour is allowed for the test. Both members must be present at the same time and take the test individually.

SEMIFINAL ROUND

- A. Semifinalists are allotted 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.

ATTIRE

TSA competition attire is required.

PROCEDURE

PRE-CONFERENCE

- A. Participants review the TSA Honor Statement for Competitive Events found in the General Rules and listed in the individual competitive event rules.

PRELIMINARY ROUND

- A. Participants report to the event area at the time and place stated in the conference program for the test.
- B. Participants follow the specific regulations and adhere to the directions provided on-site by the event coordinator.

- C. Team members take the test individually within the time limit.
- D. The top twelve (12) teams qualify as semifinalists.
- E. The preliminary round score will be the average test score for the two (2) members.
- F. A semifinalist list (in random order) is posted.

SEMIFINAL ROUND

- A. Participants report to the event area at the time stated in the conference program.
- B. Participants 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.
- C. The semifinalist teams are interviewed before they leave.
- D. Ten (10) finalists are announced during the conference award ceremony.

REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21st century skills in the process of preparing for and participating in this TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

PRELIMINARY ROUND

- A. Team members take the test individually.
- B. Tests will be administered online only. Written (paper) tests will not be used unless deemed necessary prior to, or on-site at the national conference. Online testing will require each member to provide a laptop, and all members must take the test online. Please review the [National TSA Conference Competition Requirements](#).
- C. Participants are responsible for bringing two (2) sharpened No.2 pencils to the test site.
- D. In the event the test must be administered using a hard copy and scantron:
 - 1. Student identification numbers must be entered on the scantron form in the space indicated.
 - 2. Participants must stop work immediately when time is called.

3. Should a participant complete the test before the time allocated is over, the participant will submit the test and scantron form to the coordinator without any form of communication with any other member. Failure to do so results in disqualification of the participant.
 4. All tests and scantrons must be turned in before leaving the test area.
- E. The average of the scores of the two (2) team members determines team ranking.
- F. These same two (2) team members compete in the semifinal round, should the team qualify.

SEMIFINAL ROUND

- A. All work must be completed in the event area during the time specified for the event.
- B. Semifinalists provide:
1. A toolkit with identification (school name, address, and advisor cell phone number). Each toolkit must contain all required materials to fabricate the solution. The following is a suggested list of materials:
 - a. (Minimum) 1.375" x 3.25" solderless circuit breadboard 10 x 30 pin positions
 - b. One (1) 9-volt battery with snap-on battery connector
 - c. One (1) speaker (wires pre-soldered)
 - d. Two (2) LEDs
 - e. Twelve (12) connector wires
 - f. Pushbutton switch (wires pre-soldered)
 - g. One (1) photocell
 - h. One (1) potentiometer
 - i. One (1) IN4003 diode
 - j. One (1) IC555 integrated circuit
 - k. One (1) 2N3906 transistor
 - l. One (1) 2N3904 transistor
 - m. Resistors (minimum of one [1] each, ohms): 10, 10K, 47, 100, 220, 1K, 2.2K, 3.3K, 6.8K, 16K, 33K, 120K, 330, 470K

- n. Capacitors (in microfarads): .01, .1, 10, 100, 1000
- o. S106B1 SCR
- p. Wire strippers
- q. Standard 4-function calculator (scientific calculators will not be permitted)
- r. Digital multimeter

- C. Paper to complete on-site calculations is provided by TSA.
- D. All other equipment necessary to solve the on-site problem is provided by the coordinator.
- E. Semifinalists remain with their circuit solution until the judges have completed the interview.

EVALUATION

PRELIMINARY ROUND

- A. The average of the team members' scores is factored into the final total score.

SEMIFINAL ROUND

- A. The accuracy and degree of completion of the circuit problem in the allotted time, and the exit interview, determine the final standings.

Refer to the official rating form for more information.

TSA HONOR STATEMENT

All work must be created and completed by individual competitors or teams. Plagiarism, the use of Generative Artificial Intelligence (GenAI) software, copyright violation, cheating, and falsification of information are prohibited. Participants may NOT use any generative artificial intelligence (GenAI) tools (e.g. ChatGPT, Google Gemini, GitHub Copilot, etc.). Any attempt to gain an unfair advantage will not be tolerated. Competitors at any level of TSA competition understand and agree to abide by the TSA Honor Statement.

If it is determined that a student violated the TSA Honor Statement, a rules violation of twenty percent (20%) will be incurred.

STEM INTEGRATION

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

LEADERSHIP AND 21ST CENTURY SKILLS

This event provides opportunity for students to build and develop leadership and 21st century skills including but not limited to – Communication, Collaboration/Social Skills, Initiative, Problem Solving/Risk Taking, Critical Thinking, Perseverance/Grit, Creativity, Relationship Building/Teamwork, Dependability/Integrity, and Flexibility/Adaptability

CAREERS RELATED TO THIS EVENT

This competition has connections to one (1) or more of the careers below:

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

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2026 & 2027 OFFICIAL RATING FORM MIDDLE SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, 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.

Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

- ☐ Toolkit is present
☐ ENTRY NOT EVALUATED

WRITTEN TEST SCORE (50 points)

AVERAGE OF THE TWO (2) TEAM MEMBER'S WRITTEN TEST SCORE SUBTOTAL (50 points)

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, 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 (90 points)

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	Record scores in the column spaces below.
	1-4 points	5-8 points	9-10 points	
Solution Accuracy (X2)	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.	
Proper Use of Components (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.	
Accuracy of Measurements (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.	
Articulation (X1)	The interview is full of illogical thoughts that lack clarity, and/or there is insufficient information provided describing the solution; leadership and/or 21 st century skills are not evident.	The interview is somewhat logical, easy-to-follow, and/or there is sufficient information provided that describes the solution; leadership and/or 21 st century skills are somewhat evident.	The interview is clear, concise, and there is ample information provided that describes the solution; leadership and/or 21 st century skills are somewhat evident.	

SEMIFINAL SOLUTION TO ON-SITE PROBLEM (90 points) – continued			
Delivery (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.
Organization (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.
Knowledge (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.
SEMIFINAL SOLUTION TO ON-SITE PROBLEM SUBTOTAL (90 points)			
<p>Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.</p> <p>Indicate the rule violated: _____</p>			
SEMIFINAL SUBTOTAL (90 points)			
<p>To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. TOTAL (140 points)</p>			

Comments:

I certify these results to be true and accurate to the best of my knowledge.

JUDGE

Printed name: _____ Signature: _____

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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 for each judge
 - 2. TSA Event Coordinator Report
- B. Stopwatch for the assistant/timekeeper
- C. On-site problem:
 - 1. Twelve (12) copies of the on-site circuit diagram problem, one (1) for each team
 - 2. Twelve (12) copies of the calculation worksheet, one (1) for each team, if necessary
 - 3. Any additional electrical components needed for the on-site problem
- D. Adequate conditions (inside or outside) for on-site testing devices as needed for the designated circuit
- E. Tables and chairs for the participants, event coordinator and judges

RESPONSIBILITIES

AT THE CONFERENCE

- A. Attend the mandatory event coordinator's meeting at the designated time and location.
- B. Report to the CRC room and check the contents of the coordinator's packet.
- C. Review the event guidelines and check to see that enough personnel have been scheduled.
- D. 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.

- E. At least one (1) hour before the event is to begin, meet with judges and assistants to review time limits, procedures, regulations, evaluation, and all other details related to the event. If questions arise that cannot be answered, speak to the event manager before the event begins.
- F. Ensure the judges have access to the online judging system.

PRELIMINARY ROUND

- A. Prior to the conference, the event coordinator shall become familiar with the format of the exam (refer to the [National TSA Conference Competition Requirements](#)).
- B. Begin the event at the scheduled time by closing the doors and checking the entry list.
- C. Late participants and/or entries are considered on a case-by-case basis and only when lateness is caused by events beyond the participant's control.
- D. In order to compete, participants must be on the entry list or must have approval of the CRC.
- E. All participants and judges should be in the room at this time.
- F. Manage the one (1)-hour test.
- G. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:
 - 1. To deduct twenty percent (20%) of the total possible points in this round
 - 2. To disqualify the entry

The event coordinator, judges, and CRC manager must initial either of these actions on the rating form.

SEMIFINAL ROUND

- A. Participants report at the time and place stated in the conference program for the semifinal challenge.
- B. Provide the on-site circuit problem, any additional electrical components, and the worksheet to the semifinalists.
- C. Supervise the one (1)-hour on-site circuit problem.
- D. Judges conduct semifinalist interviews at a location separate from the other semifinalists
- E. Discuss rule violations (e.g., 20% deduction, disqualification) and have all relevant parties initial the rating form.
- F. Manage security and the removal of materials from the event area.