
OFFICIAL RULES FOR THE 2024 TULSA ENGINEERING CHALLENGE

Sponsored by the Tulsa Engineering Foundation

CHEMICAL SWITCH COMPETITION

Important Notice: Only Middle and Upper Divisions may enter.

OBJECTIVE

To turn off a light bulb using a chemical reaction.

COMPETITION ENTRY REQUIREMENTS

Each registered entrant (individual or team) may submit one (1) chemical switch into the competition. Each entry must be accompanied by design documentation. The design documentation must use the form at the end of these official rules. No entry will be accepted without completed design documentation. An entrant will have the opportunity to resubmit incomplete documentation. The design documentation will be used to judge the safety of the design.

CHEMICAL REACTION OPTIONS

The students may use any chemical reaction that can be safely operated indoors. Entries using open flames or reactions that release smoke or spray will be disqualified. The Officials have the right to rule that a chemical reaction is unsafe for indoor operation. Since no fume hood will be available, chemicals must not require the use of a fume hood. A fan must be provided by the team for any hydrochloric acid stronger than 6 molar. Any dilutions should be done before transporting chemicals to the site. Containers for the disposal of acids and bases will be provided, but entrants must make arrangements for the disposal of other chemicals.

The entry must not leave any residue on the table or surrounding area. The entry must not spill any liquids or release any sprays. The light bulb may not be turned off by destroying it.

Electronic and mechanical timers are not allowed. A system which uses a chemical reaction as an instantaneous switch without control of the chemical reaction does not satisfy the spirit of this competition and will be disqualified.

Sample ideas: Students may use gas-producing reactions and harness the gas to turn the light bulb off. A wire in the circuitry may be dipped in acid, which will react with the wire and eventually break the circuit. An iodine clock reaction may be used to trigger a switch.

CONSTRUCTION SPECIFICATIONS

Upper Division (9th – 12th grades): High school students must use a chemical reaction. Dissolution and phase changes are not allowed as the sole process.

Middle Division (7th – 8th grades): Middle school students may use a chemical reaction, dissolution, or phase change.

A circuit containing a light-emitting diode as a light bulb, a 9-volt battery as a power source and associated non-consumable wiring will be provided. This circuit is shown in Figure 1. The entry must be connected to the circuit through the alligator clips that are part of the provided circuit. No part of the provided circuit may be damaged by the student entry. If you choose to provide your own light bulb, it must be easily visible in a bright room. Light-emitting diodes are better for the light bulb because incandescent bulbs tend to fade slowly, which makes timing difficult. The entry must be self-contained and must fit on a table two feet (2') wide and four feet (4') long.

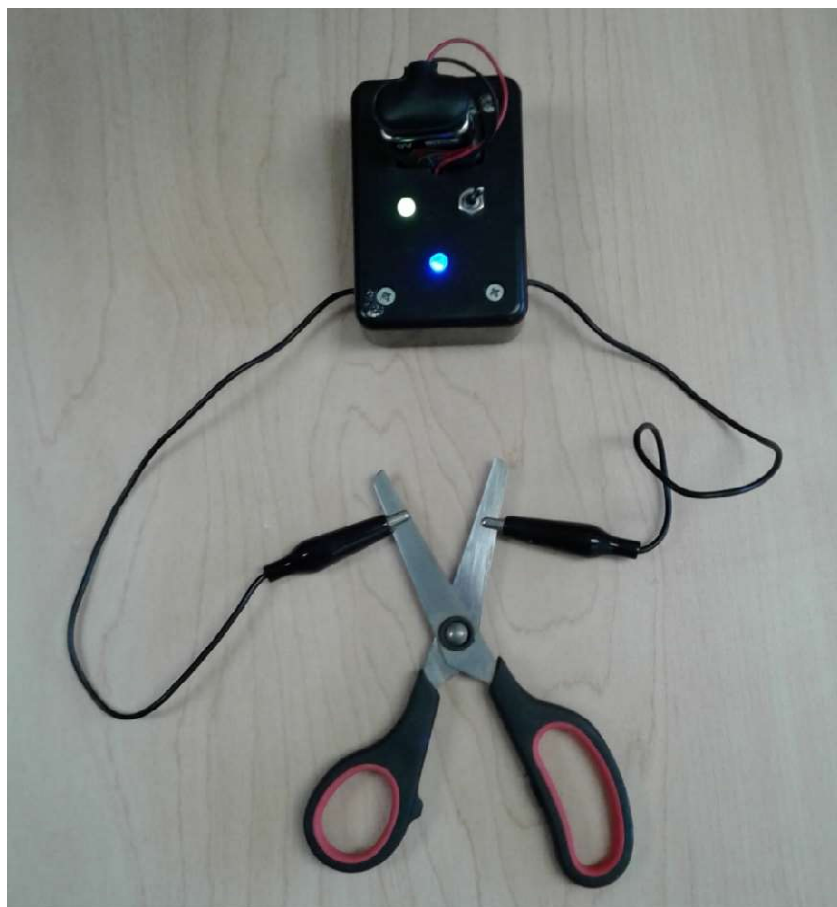


Figure 1. The circuit provided for the competition includes a green LED that indicates the unit is working, a blue LED to turn off, and alligator clips to connect to the student entry. The scissors are where the student entry should be.

COMPETITION SPECIFICATIONS

During all phases of the competition, the decisions of the Judges are FINAL.

Students may bring no more than 250 mL of each chemical. Chemicals must be transported safely to the site – unsafe transportation will result in disqualification. Each container must be clearly and legibly labeled with the name of the chemical, the concentration, the student's name, the school name, the teacher's name, and a phone number. Print as many of the labels below as needed and tape to the containers. Chemicals must be brought to the event table immediately upon arrival and will be stored there until the group is ready to leave. Bring enough chemicals for two runs in case the first run does not turn the light off within 90 seconds.

Chemical Label for Chemical Switch Competition	
Chemical Name	
Concentration	
Student's Name	
School	
Teacher's Name	
Teacher's Cell Number	
Teacher's Signature	

Appropriate gloves and safety goggles must be provided by the team and used during the setup and operation of the entry.

When the competition officials have decided that an entry has met the safety requirements of the competition, the entrant will be allowed to start the chemical reaction. The judging official will start timing at the point indicated on the design documentation. Timing must begin within one minute of mixing the chemicals. **Once the timing has begun, the students may not touch the entry.** The competition official will time the entry with a stopwatch. If the entry does not turn off the light bulb within ninety seconds (90 s), a second attempt may be made.

JUDGING AND SCORING

For each entry, the time required to turn the light bulb off will be recorded. The goal is to turn off the light as close to 20.0 seconds as possible (without turning it off before 20.0 seconds). Time is equal to t in seconds.

Any entries that turn the light bulb off before ten (10.0) seconds will be disqualified.

For entries that turn off the light bulb $10.0 \text{ s} \leq t < 20.0 \text{ s}$, the score will be $90 \text{ s} - t$. For entries that turn off the light bulb $20.0 \text{ s} \leq t < 90.0 \text{ s}$, the score is $t - 20 \text{ s}$. Any entries that do not turn off the light bulb within 90 seconds will be allowed one second attempt.

The lowest score wins.

The Officials will determine a First, Second, and Third Place winner for each of the two student divisions. When the winners are announced, at the end of the competition, the winning team members need not be present. In the event of a tie, the judges will award the prize to the entrants deemed to have had the most fun during the competition.

Any appeals are to be brought to the attention of the TECh Chair as soon as possible on the day of the competition. The TECh Chair and 2 advisors will collect relevant information from the student and the judges and will make a decision on how to proceed.

GENERAL

The contest is limited to four (4) entries per division per school. Each entry may be an individual or a team project. The team size may be as large as an entire classroom.

A team may enter only one design. Each apparatus may be used by one and only one team or individual.

Registration will be done via the TECh website which can be accessed through www.tulsaengineer.org.

Questions may be sent directly to the lead judge at laura-ford@utulsa.edu. Please cc: Tulsatechchallenge@gmail.com.

The judges are offering consultations with teams prior to the competition. Team members can contact Dr. Laura Ford at laura-ford@utulsa.edu or Dr. Christi Luks at lukc@mst.edu if they would like to arrange a virtual consultation.

PRIZES

Prizes will be awarded for two divisions as follows: Upper Division (9th thru 12th) and Middle Division (7th thru 8th).

First Place:	\$100 cash and \$25 cash for their classroom.
Second Place:	\$75 cash and \$25 cash for their classroom.
Third Place:	\$50.00 cash and \$25 cash for their classroom.

Cash prizes will be awarded by a bank check and issued to the teacher/school listed on the registration to be cashed and distributed to the winning student(s). We will mail a check to the address listed on the registration within a few weeks of the competition. If you do not receive your prize within a few weeks, please email info@tulsaengineer.org with your team name, school, and competition won.

2024 TULSA ENGINEERING CHALLENGE DESIGN DOCUMENTATION

CHEMICAL SWITCH COMPETITION

PLEASE TYPE OR PRINT CLEARLY AND LEGIBLY

Name of school: _____

Division: Middle Upper

Sponsoring teacher: _____

Phone number: _____

Name(s) of entrant(s):(1) _____

(2) _____

Chemicals used (name, concentration, and amounts)

Balanced chemical reaction (HS); chemical reaction or chemical process (MS)

Chemical switch mechanism: describe how the chemicals above are used to turn off the light bulb:

Timing start point: The competition officials will start timing your entry at this designated point. This should be something like when you have shaken up your chemicals and set the entry down to react, or when you drop a wire into an acid bath, or start dripping a second reactant into the first.
