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**OFFICIAL RULES FOR THE  
2018 TULSA ENGINEERING CHALLENGE**

*Sponsored by the Tulsa Engineering Foundation*

**CHEMICAL SWITCH COMPETITION**

**Important Notice: Only Middle and Upper Divisions may enter.**

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**OBJECTIVE**

To turn off a light bulb using a chemical reaction.

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**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.

The contest is limited to four (4) entries per school.

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**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.

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.

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.

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## CONSTRUCTION SPECIFICATIONS

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

Middle Division (7<sup>th</sup> – 8<sup>th</sup> 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 wiring will be provided. The entry must be connected to the circuit through the alligator clips that will be part of the provided circuit. 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.

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## 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.

| <b>Chemical Label for Chemical Switch Competition</b> |  |
|---|--|
| Chemical Name   |  |
| Concentration   |  |
| Student's Name  |  |
| School  |  |
| Teacher's Name  |  |
| Teacher's Cell Number                                 |  |
| Teacher's Signature                                   |  |

Appropriate gloves and safety goggles must be 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.

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## 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.

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## 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 entry 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](http://www.tulsaengineer.org).** Questions? E-mail: [tulsatechchallenge@gmail.com](mailto:tulsatechchallenge@gmail.com)

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## PRIZES

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

|               |   |
|---------------|---|
| 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](mailto:info@tulsaengineer.org) with your team name, school, and competition won.

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**2018 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.

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