**Chem-e- car**

**About**

The need for affordable and efficient alternative energy sources is a defining issue of the twenty-first century. The consequences of using conventional energy sources to the end will be unprecedented, both for the environment and the global economy. Thus, it is clear that the world needs to find a feasible alternative. While substantial advances in alternative energy have recently been made in the automobile industry, current alternative energy sources for powering vehicles are either expensive or not widely accessible to all.
ChemClave, the Annual Chemical Engineering Symposium organized by the Chemical Engineering Association of IIT Madras proudly presents its first ever Chem-E-Car competition. "Chem-E-Car" competition, an internationally acknowledged competition where the challenge involves employing non-conventional energy sources in a car powered entirely by chemical reactions, which will safely carry a specified load over a given distance and stop. In addition, the goal is to gain a better understanding of how chemical reactions can be calibrated to automate processes and how engineers optimize what is available to achieve the intended goal. The biggest annual Chem-E-Car competition encourages chemical engineering enthusiasts to pour their innovative ideas to make a Chem-e-car!

**The Challenge-**

To design and construct a car that is powered with a chemical energy source that will carry a specified load over a given distance and stop.

**Registration** –

Teams must register on our website www.chemclave.org before 10 pm of 9th march in order to participate in Chem-e-car competition.

**Date and venue for competition-**
Competition will be held on 10th March from 9 am onwards
Venue- MSB

**Competition rules-**
1. **The load and distance will be announced one hour before the competition starts.**
2. The first team is given a one-minute warning before the competition starts. An hour will be provided for all teams to conduct trial runs before beginning of competition. One reset is permissible if car goes out of track. Again if the car goes out of track, better of the two measurements will be considered.
3**. A team can have maximum of three members**. **Two minutes** would be provided for **setup** of your model. **Once the car crosses the starting line, team members cannot touch their vehicle i.e. no chemicals can be added**. Any type of contact with the car thereafter will lead to

disqualification and/or heavy penalization. Pushing the vehicle or a mechanical starting device is not allowed (it will lead to penalty).

4. An objective of this contest is for students to demonstrate the ability to control a chemical reaction. **The only energy source for the propulsion of the car is a chemical reaction. The distance a vehicle travels must also be controlled by a chemical reaction, based on a quantifiable change and direct control of the concentration of a chemical species. This chemical reactant species must be a solid, liquid, or vapor.**

5. Vehicle Design: Vehicles entered into the competition must have a significant and demonstrable student design component, particularly with respect to the vehicle drive system, and the starting and stopping mechanisms. Both the chemical reaction propelling the vehicle and the start/stop reaction (if there is one) must be physically on the vehicle during the competition. The vehicle must be powered by a chemical reaction and must be stopped by a quantifiable change, and direct control, of the concentration of a chemical species. This chemical reactant species must be a solid, liquid, or vapor. Any vehicle that is purchased from a vendor without major modifications to its operation will be disqualified. For example a team could not purchase a fuel cell car and race this car without any modifications.

6. **No commercial batteries of any kind (for example, AA batteries) are allowed as the power source**. Commercial batteries are allowed for specialized instrumentation (e.g. detectors, sensors).

7. **The car must be an autonomous vehicle and cannot be controlled remotely**. **Pushing to start the vehicle or using a mechanical starting device is not allowed**. "Bleeding" the time off at the starting line or prior to the starting line is prohibited.

8. On-board computer control or programmable controllers are allowed but must not in any way control or measure the distance traveled. The program must be loaded onto the controller/computer/processor prior to the competition, and the settings may not be changed or communicated with after the competition begins. Wired or wireless communication with the onboard computer/controller is not allowed once the competition begins and during the competition. Teams may be asked to provide a copy of their complete programs to the rules committee on the competition day. Examples of an on-board programmable system might be an Arduino or Raspberry Pi unit

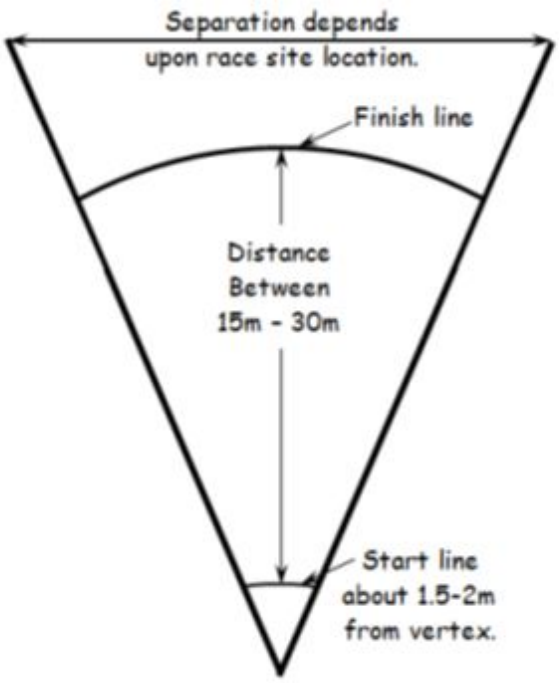
9. No mechanical force can be applied to the wheel, gears, driveshaft, etc., or ground to slow or stop the car (e.g. no brakes).

10. There can be **no mechanical or electronic timing device(s) to stop the chemical reaction or stop the car**. In addition, a timing device cannot utilize what is normally considered as an instantaneous reaction. For example, a constant or draining liquid feed to a sensing cell that employs an instantaneous reaction (such as acid-base or precipitation) would not be allowed. Another example would be a liquid draining out of a vessel to serve as a stop switch. This would be considered a mechanical timing device and would not be allowed.

11. ICE: Internal combustion engines using an alternative fuel (e.g., biodiesel, ethanol, etc.) are allowed. The fuel MUST be completely synthesized by the students (no additive blending is allowed). Succinct safety procedures for the maintenance and operation of this engine must be demonstrated by the team, with considerations to indoor operation.

13. All components of the car must fit into a box of dimensions no larger than **40 cm x 30 cm x 20 cm**. The car may be disassembled to meet this requirement. If the judges are uncertain whether the car will fit inside the box when dissembled, they may request that the team demonstrate that they can do this.
14. The car must carry a **container that holds up to 500 mL of water** without spilling. An example container is a Nalgene Low-Density Polyethylene Narrow-Mouth Bottles (500 mL**). At the competition, only the water will be supplied, thus each car must already have its own container.**
15. **The cost of the contents of the "shoe box" and the chemicals must not exceed INR 5000.**

***Track Details***




**Race Logistics-**

A Chem-E-Car Competition coordinator will announce each team just prior to the start of their run. Each car will be given up to two opportunities to traverse a specified distance carrying a specified load of water. The required load and distance will be given to each team one hour prior to the start of the performance competition. The distance will be between **15 and 30 m ± 0.005 m**, and the load will be between **0 and 500 ml of water**. Teams may not add or remove any "load" (or other inert items) to adjust the weight of their vehicle once the car starts.
Each attempt is limited to **two (2) minutes** from the time the coordinator announces “Your time starts now” till the car comes to a complete stop. The **best score of the two attempts** will be used to determine the winner. The competition starts when the coordinator signals the timing to

begin. The first team is given two (2) minutes for the car to start moving, traverse the distance and stop. When the car stops, the timer is reset for the next competitor.
After the car for team stops, the distance traveled is measured.

**Judging Criteria-**

Each team should submit the abstract of making of their vehicle to event coordinators in printed format on A4 size papers on the day of competition. The abstract should include following things in it -

1. Names of the team members
2. Details of the structure of the model including dimensions
3. Description of mechanism used for Starting, Propagation and Stopping of the vehicle.
4. Names of chemicals required and their individual costs for the above three mechanisms
5. Design creativity and unique features of the vehicle and safety considerations

Each car will be given up to two opportunities to traverse a specified distance carrying a specified load of water. The **best score of the two attempts** will be used to determine the winner.

**The winning team is the car that stops closest to the finish line. This is defined as the absolute value of the distance between the front-most part of the car and the finish line, whether or not the car stops before or after the finish line. In case of ties, at the discretion of the Chemclave Chem-e-car competition coordinators, the team with the best average from the two runs will be declared as the winner.**