



**ChemCar**

## **Set of Rules 2014**

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## 1 Preface

The **ChemCar**-competition has been carried out by the “kreative junge Verfahreningenieure” (kjVIs) of the VDI-GVC in co-working with DECHEMA e.V since 2006. In 2014 the Competition will take place at the annual “ProcessNet” in Aachen. Aim of this competition is the accurate design of the reaction to achieve a certain distance, for example by adjustment of a specific reactant.

Students of chemical and process engineering, chemistry and further study courses are invited to contribute their know-how, creativity and ability to work in a team to succeed the provided task. The **ChemCar**-competition consists of two parts, the poster presentation and the race. This set of rules describes the procedure of the competition as well as the determination of the winning team. To focus the project on the chemical reaction, several technical requirements and restrictions to the model car have been imposed. In case of non-compliance to the rules in the following either points may be deducted or the team will be disqualified by the jury or the host.

## 2 Overview: Deadlines

Registration and concept submission:	23.03.2014
Notification of nomination:	07.04.2014
Submission of all relevant safety data sheets:	15.06.2014
Poster presentation and race:	30.09-01.10.2014

### **3 Prerequisite**

For the competition eight teams will be nominated at maximum by the jury. Creative and original concepts will be favored. Concepts which raise concern in safety matters will be denied. For the registration the following points should be taken into account:

1. Correct and punctual registration (point 4 registration).
2. Used chemical reaction contains neither safety nor environmental risks (point 6 safety and additional safety sheets).
3. Members have signed, that they read, understood and are willing to follow the regulations.
4. The team may consist of 7 students at maximum, who all must not have any degree as master or diploma. The students may be enrolled in different study courses. One member must be announced as contact person / team leader.
5. The team should be supervised by a qualified person from the university, who has a degree in the following or comparable courses of studies: process engineering, mechanical engineering, chemistry.
6. At least 2 team members, including the team leader, have to attend to the competition on 01.10.2014.
7. Due to space limitations at the competition's location, the number of team members allowed in the preparation room may be limited.
8. One participant must not take part at more than two competitions.

## 4 Registration and concept submission

The registration and the concept submission have to be done until 23.03.2014 by email at [chemcar@googlemail.com](mailto:chemcar@googlemail.com). A template can be found at [www.chemcar.de](http://www.chemcar.de). Registrations after this deadline will not be taken into account.

The concept has to contain:

1. Description of the functionality of the model car including a sketch. The description has to be technical comprehensible – especially the chemical reaction and the conversion into kinetic energy and has to contain a list of all used chemicals, their proposed amounts, expected pressures and temperatures (This information will be used to determine the risk potential of your ChemCar).
2. First estimation of possible emissions and how those may be avoided.
3. The first registration needs to contain a flowsheet of the estimated process used in the ChemCar.
4. Furthermore the registration has to contain the complete contact information of the qualified supervisor from the university (name, university, address, phone number, e-mail), the contact information of the team leader (name, university, address, phone number, e-mail) and a list of all team members (name, e-mail, studies, semester, university).

After approved registration the supervisor will obtain a summary of the team data including a declaration, that the rules have been accepted. This declaration has to be signed by every single team member. The scanned sheets as well as the actual certificate of enrolment of each member have to be sent to the kjVIs by email.

## 5 Rules

1. The energy source for running the ChemCar must only be predicated by a (bio)chemical reaction. The powering of the ChemCar's engine has to be stopped by exhausting of the main reaction.
2. Any device or physical principle for stopping the chemical reaction and/or the ChemCar is not allowed. This includes mechanical brakes, any electrical or mechanical device for measuring the distance or time travelled in any way. In case of doubts please refer to the organizers before submitting your concept.
3. The run of the ChemCar has to be started by performing a starting mechanism, which is based on pushing a button/switch or similar *single-action* mechanism. Manual mixing (shaking) as well as addition of chemicals directly before the start is absolutely prohibited. As a result a proper starting mechanism has to be constructed to take place in the competition.
4. Commercial acquirable batteries or fuel cells must not be used to power the ChemCar. Excluded are energy sources for secondary equipment (i.e. mixers).
5. Mechanical or electrical disengagement of the energy source from the drive mechanism is not allowed.
6. Any material or electrical circuit in the "ChemCar-System" must not be manipulated during the race. This means that any electrical switches, relays or similar components and material connections (wires, valves, tube, electrolytes,...) must not be manipulated for controlling the distance or time traveled by the ChemCar. Any components detecting a special current or potential level, or elements using this parameters for regulate the powering reaction, are not allowed.
7. Operating the ChemCars by remote controls is not allowed.
8. It has to be possible to disassemble the ChemCar in its main parts within 10 minutes which need to fit in a (Curver-) Box of the size 526 mm x 436 mm x 285 mm (Curver UNIBOX III, 50 l). In case of reasonable doubts the jury can ask the participants to disassemble their car and check if it fits. Non-fulfillment will be punished with a five point deduction.
9. The ChemCar must weigh at least 2 kg and must not exceed 30 kg. During the race an additional weight of up to 30% of the ChemCar's empty weight has to be carried.

## 6 Safety

As a result of the increased demands concerning the operational safety of the ChemCars revised safety rules including a guideline for the safety analysis will be published. The safety rules are published on [www.chemcar.de](http://www.chemcar.de). All requirements described in the file "ChemCar Safety Rules Rev.1.0.2014.pdf" are part of the official rules and must be strictly adhered.

Three main rules should be noticed at this point:

1. The registration has to contain a list of all used chemicals, their proposed amounts, expected pressures and temperatures (This information will be used to determine the risk potential of your ChemCar).
2. Changes to the safety-relevant equipment are strictly prohibited after the safety revision by the official technical partner. Neglect leads to disqualification from the competition.
3. The safety documentation needs to be signed by an official safety inspector from your university. Also the contact data and the full name of the safety inspector have to be attached to this document. Further instructions will be included in the safety documentary.

## 7 Competition Instructions

***The competition consists of two parts: the poster presentation and the race.***

### 7.1 Poster

On the basis of a poster in DIN A0 the concept of the model car should be illustrated to the jury and the audience. The poster presentation takes place on 30.09.2013. The exact time will be announced beforehand. If the given space is sufficient it is possible to present the **ChemCar** as well. Every team has to provide two copies of the poster.

The poster should contain the following content:

1. Name of the team and its members
2. An image of the model car
3. Technical description of the chemical reaction (How is the car powered? How is the distance determined which has to be run?)
4. The Originality of the concept
5. Abstract of the constructional processing including a process flow sheet

### 7.2 Race

1. Goal of the race is to reach the finishing line as close as possible under the conditions drawn by the jury (specified distance with additional weight). The distance

between finishing line and the leading edge of the model car will be measured. Winner of the race is the team with the smallest distance to the finishing line.

2. The model cars must not leave the track or touch the track's boundaries. The dimensions of the track are 20 m in length and 4.5 m in width.

3. One hour before starting the jury will announce the conditions of additional load (0-30% of own mass) as well as the range (5-15 meter). Both parameters will be drawn, whereas the additional mass will be rounded down at full 100 g. These weights with a maximum diameter of 80 mm and a bore with a diameter of 8 mm will be provided by the kJVs. Figure 2 shows the differentiation of the weights. Sufficient space for the weights needs to be considered designing the ChemCar.



Figure 2: Used weights provided by the kJVs

4. The starting order of the teams will be drawn after their nomination by the kJVs and will be the same in both attempts. The starting order will be communicated to the team leaders.

5. The first three starting-teams have to be ready 5 min before the start. After the first team finished the run, the fourth team needs to be ready and so on. This means that starting times are flexible and no explicit starting times will be assigned to the teams.

6. Each team has 3 minutes to carry out its attempt. The run starts when the starting mechanism is activated and ends when the car stops. If the time exceeds the time limit, there will be a penalty of 1 meter for each started 10 seconds. From the beginning of the 4<sup>th</sup> minute the attempt will be invalid.
7. After the starting mechanism is activated, the ChemCar must not be touched by anybody until the run is completed. Otherwise the team will be disqualified for this run.
8. At the start no part of the car may stick out beyond the starting line.
9. To determine the traveled distance the leading edge of the car will be used.
10. Each team has two attempts. For the score the superior result will be counted. Additionally a Bonus of 5 Points will be given to those teams whose deviation of the travelled distance from the distance to travel is smaller or equal to 10 % within both runs.
11. Each team has at least 15 minutes preparation time at minimum for the 2<sup>nd</sup> run.
12. The teams must use common protective clothing (especially safety goggles) during preparation and running of the model cars. Lab coats and safety goggles have to be organized by the teams. Also refer to the additional safety rules.
13. The jury or host have the right to deny the start of any team due to safety doubts at any time.

### 7.3 Points allocation – Overview

The maximum available number of points is 50, which is composed of the following parts (Fig. 3):

- maximum 25 points for the poster presentation
- maximum 25 points for the race

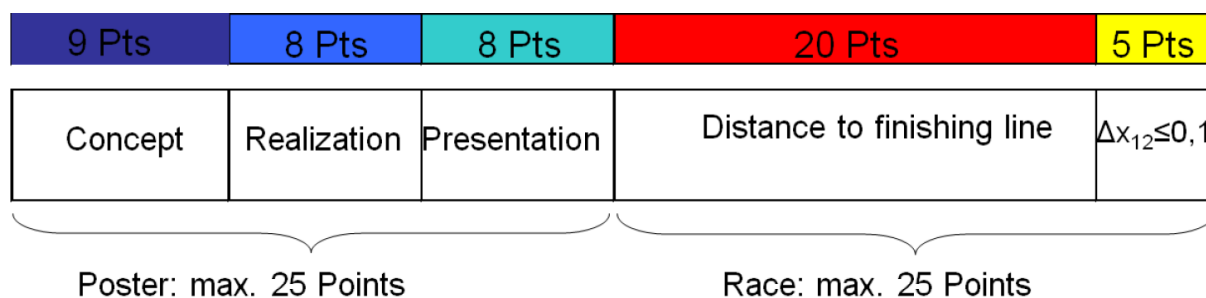


Figure 3: Overview over point allocation

The 25 points for the poster presentation consist of following parts:

1. Concept (9 points)
2. Realization (8 points)
3. Presentation (8 points)





The 25 points from the race are distributed as followed:

1. The model car with smallest distance to the finishing line gains 20 points. Every following car obtains 2 points less
2. If a car accomplish in both attempts within a distance of  $\pm 10\%$  of the distance to travel, the team will obtain 5 extra points.
3. If two or more teams achieve the same distance to the finishing line in their superior attempt, their 2<sup>nd</sup> best attempt will be counted for the comparison of both teams. If there is no difference as well, both teams obtain the same score.

The team with the most points will win the competition. At a tie, the result in the race decides about the ranking.

Immediate disqualification occurs at:

- smoke emission (ChemCar Safety Rules Rev.1.0.2014.pdf)
- loss of any liquids (including water!)
- safety doubts by jury or host

## 8 Prizes

The winners of the competition will receive the following prizes:

1. place: 2000 € and the **ChemCar** – trophy
2. place: 1000 €
3. place: 500 €

## 9 Contact

- Current information: [www.chemcar.de](http://www.chemcar.de)
- Registration and questions: [chemcar@googlemail.com](mailto:chemcar@googlemail.com)
- General requests: [kjVI@vdi.de](mailto:kjVI@vdi.de)