



ChemCar 2011: Set of rules



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1 Preface

The **ChemCar**-competition has been carried out by the “kreative junge Verfahrensingenieure” (kjVIs) of the VDI-GVC in co-working with DECHEMA e.V since 2006. For the first time this competition will take place at the European Congress of Chemical Engineering (ECCE) on 25.-29.09.2011 in Berlin. **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: 18.03.2011
- Notification of nomination: 18.04.2011
- Submission of all relevant data sheets
 - Inspection records: 29.07.2011
 - List of hazardous materials: 02.09.2011
- Poster presentation and race: 26.09.2011



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3 Prerequisite

For the competition 12 teams will be nominated at maximum by the jury. Creative and original concepts will be favoured. 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 (see point 6: Safety).
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 50% of the team, including the team leader, have to attend to the competition on 26.09.2011.



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4 Registration and concept submission

The registration and the concept submission have to be done until 18.03.2011 by email at chemcar@googlemail.com. A template can be found at www.chemcar.de. Registrations behind 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.
2. A list of the used chemicals and their approximately needed amount.
3. First estimation of possible emissions and how those may be avoided.
4. Furthermore the registration has to contain the complete contact information of the qualified supervisor from the university (name, university, address, phone no, e-mail), the contact information of the team leader (name, university, address, phone no, 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 kjVI's by email. The registration of the team members to the ECCE-Conference will be done automatically by the kjVI's.



5 Requirements

The **ChemCar** has to fulfil some requirements which are listed below:

1. The energy source for running the **ChemCar** must only be predicated by (bio)chemical reaction.
2. A mechanical or electrical disengagement of the energy source from the drive mechanism is not allowed (e.g. by self closing valves)
3. Any device or physical principle for stopping the chemical reaction and/or the **ChemCar** is not allowed. This includes mechanical brakes, electronic timers, measuring the distance travelled in any way; stopping is set by the outflow of one component participating in any reaction and concepts/cases comparable to those. In case of doubts please refer to the organizers before submitting your concept.
4. Commercial acquirable batteries or fuel cells must not be used (excepting for the operation of mixers).
5. Any circuit in the "**ChemCar-System**" must not be manipulated during race by electrical switches, relays or similar components
6. Operating the **ChemCars** by remote controls is not allowed.
7. It has to be possible to dismantle 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 dismantle their car and check if it fits. Non-fulfillment will be punished with a five point deduction.
8. The **ChemCar** has to be able to carry an additional weight up to 30% of their own mass (see 7.2.3 for details).



6 Safety regulations

1. The safety analysis has to be submitted at VDI-GVC until 30.07.2011 (download template at www.chemcar.de) after validation by your tutor. The list of hazardous materials is necessary until the 03.09.2011.
2. No hazardous material may be exhausted into the environment! Emissions of harmless material may occur, if safety analysis documents that only small amounts¹ are emitted without any risk being exposed neither for persons nor for environment. Flammable or explosive gases must not leak into the atmosphere. The following material may be exhausted in small amounts:
 - a. Nitrogen
 - b. Carbon dioxide
 - c. Oxygen
 - d. Water vapour
3. Hot Surfaces and hot gases have to be handled with corresponding avoiding possibilities of scalds or burns.
4. Open flames are not allowed.
5. **ChemCars**, which are operated under pressure, have to be checked for pressure resistance. The product of chamber volume and pressure must not exceed 50 bar • l. The used pressure-vessel must not burst or deform at operating temperature and at 1.2-times of the operating pressure within 15 min. Pressure resistance tests have to be documented in the inspection sheets and must be done at least three times. The sheets have to be signed by a qualified person and submitted to the jury until 30.07.2011. Templates may be downloaded at www.chemcar.de
6. Biological hazardous substances of the first level of endangerment (by the German regulation BiostoffV) may be accepted. Toxic and radioactive classified materials are not permitted.
7. For storage of the chemicals and for the reaction only laboratory accepted vessels have to be used.

¹ Emission caps have to be agreed individual with the conference organisation and depend from the conference venue



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 in the morning at 26.09.2011. The exact time will be announced beforehand. If the given space is sufficient it is possible to present the **ChemCar** as well.

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 flowsheet

7.2 Race

1. Aim 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 marked area (fig. 1). A variation of ± 15 degrees to the starting point will be tolerated. If any model car hits the bar, the run will be aborted and the distance to this point will be taken with an additional penalty of 3 meters.
3. One hour before starting the jury will announce the conditions of additional load (0-30% of own mass) as well as the range (10-20 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 will be provided by the kjVI's.
4. A sufficient area on the **ChemCar** has to be considered. Until the start of the race the teams have time to prepare their vehicles.
5. The starting order of the teams will be drawn after their nomination by the kjVI's and will be the same in both attempts. The starting order will be communicated to the team leaders.
6. The teams have to be ready at the starting line 5 minutes before the start.
7. Each team has 3 minutes to carry out its attempt, while the run starts with the setting of the car at the starting line 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 within the first 4 minutes. From the beginning of the 4th minute the attempt will be assessed with 0 points.
8. At the start no part of the car may stick out beyond the starting line.



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9. To determine the distance to the finishing line the leading edge of the car will be used.
10. Each team has two attempts. For the score the superior result will be regarded.
11. Each team has 30 minutes preparation time at maximum for the 2nd 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. Protective gloves will be locally available.
13. Jury or Host have the right to deny the start of any team due to safety doubts at any time.
14. Details to the venue and the properties and condition of the racing track will be available at www.chemcar.de.

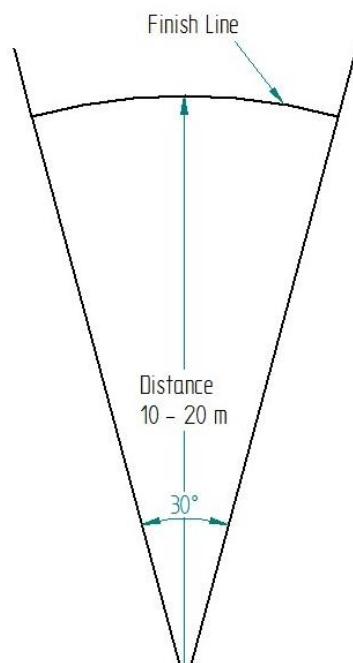


Figure 1: Sketch of the race area



7.3 Points allocation – Overview

The maximum available number of points is 50, which is composed of the following parts (fig. 2):

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

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

- Concept (9 points)
- Realization (8 points)
- Presentation (8 points)

The points from the race are distributed as the followed:

- The model car with smallest distance to the finishing line gains 20 Pkt. - every following car obtains 2 points less
- If a car accomplish in both attempts to reach the finishing line within a distance of $\pm 10\%$, the team will obtain 5 extra points.
- If two or more teams achieve the same distance to the finishing line in their superior attempt, their 2nd 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 (6.2)
- loss of any liquids (including water!)
- safety doubts by Jury or host

9 Pts	8 Pts	8 Pts	20 Pts	5 Pts
Concept	Realization	Presentation	Distance to finishing line	$\Delta x_{12} \leq 0,1$
Poster: max. 25 Points			Race: max. 25 Points	
ChemCar 2011: max 50 Pts.				

Figure 2: Point allocation



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8 Summary of the modifications

Note that the following changes to the regulations of 2010 have occurred:

- up to 12 teams can take part in 2011
- The use of more than one reaction is allowed again
- Electrical circuits must not be manipulated during race.

9 Prizes

The winners of the competition will receive the following prizes:

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

10 Contact

- Current information: www.chemcar.de
- Registration and questions: chemcar@googlemail.com
- General requests: kjVI@vdi.de