



Set of Rules 2017

Contents

I. Preface.....	3
II. Overview: Deadlines	3
III. Prerequisite.....	4
IV. Registration and concept submission	5
V. Rules	6
VI. Safety	8
VII. Competition Instructions	9
Poster.....	9
Race.....	10
Safety concept	13
Points allocation – Overview	14
VIII. Prizes.....	16
IX. Contact	16



I. 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 2017 the competition will take place at the “Jahrestreffen der Fachgemeinschaft Prozess-, Apparate- und Anlagentechnik (PAAT)” in Würzburg. 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 may be disqualified by the jury or the host.

II. Overview: Deadlines

Registration and concept submission:	15.05.2017
Notification of nomination:	29.05.2017
Submission of all relevant safety data sheets:	23.08.2017
Poster presentation and race:	20.11.2017



III. Prerequisite

For the competition nine teams will be nominated at maximum by the jury. Creative and original concepts will be favored. Concepts which show significant lack of safety aspects will be rejected. For the registration the following points should be taken into account:

1. Correct and punctual registration (see point 4).
2. Used chemical reaction contains neither safety nor environmental risks (see point 6).
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 teams have to be supervised by one 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 20.11.2017 and to poster presentation.
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.



IV. Registration and concept submission

The registration and the concept submission have to be done until 15.05.2017 by email at chemcar@googlemail.com. A template can be found at www.chemcar.de. Registrations after this deadline will not be taken into account.

The concept must contain the following information:

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. Furthermore a complete list of all used chemicals, their required input, expected pressures and temperatures has to be included (This information will be used to determine the risk potential of your ChemCar).
2. A first idea how the reaction/ChemCar will be started using the explained principle has to be provided. The starting mechanism has to be in agreement with point V.4. (see rules)
3. First estimation of possible emissions and how those may be avoided.
4. The first registration needs to contain a flowsheet (R&I) of the estimated process used in the ChemCar.
5. 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).



V. Rules

The compliance with the regulations will be verified by members of the kJVLs right before the competition.

If you have any questions regarding the rules, please contact the kJVLs by email at chemcar@googlemail.com.

1. The energy source for running the ChemCar must be based on a chemical reaction. The powering of the ChemCar's engine has to be stopped by exhausting of the main reaction (energy source) or by an additional chemical reaction (stop reaction).
2. The stop reaction must be started and proceeded simultaneously with the main reaction. A later activation of the stop reaction by e.g. monitoring/controlling the energy source parameters while driving of the ChemCar is prohibited.
3. Any device or physical principle for stopping the main chemical reaction and/or the ChemCar is not allowed. This includes mechanical brakes, any electronical or mechanical device for measuring the traveled distance. In case of doubts please refer to the organizers before submitting your concept.
4. 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.
5. Commercial acquirable batteries or fuel cells must not be used to power the ChemCar. Excluded are energy sources for secondary equipment (i.e. mixers).
6. Mechanical or electrical disengagement of the energy source from the drive mechanism is not allowed.

7. 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 travelled by the ChemCar. Any components detecting a special current, potential or pressure of the main reaction, or elements using these parameters to regulate the powering reaction, are not allowed, except these components are safety-relevant. In case of uncertainties or questions do not hesitate to ask the kJVs.
8. Operating the ChemCars by remote controls is not allowed.
9. The ChemCar must be able to be transported to the starting line in an open Box of the size 900 mm x 550 mm at the top (360 mm height) and 570 mm x 280 mm at the bottom (see Figure 1). It must be possible to transport the ChemCar securely without neither any transport device nor holding it additionally by a team member.
Non-fulfillment will exclude the ChemCar from the race!



Figure 1: Transport box.

10. The ChemCar must weigh at least 2 kg but not more than 30 kg. If the ChemCar's weight is below 2 kg, additional weight has to be attached. The non-observance of the upper limit of 30 kg results in disqualification. During the race an additional weight of up to 30% of the ChemCar's empty weight has to be carried.

VI. 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. All requirements described in the file “ChemCar Safety Rules Rev.1.0.2017.pdf” are part of the official rules and must be strictly adhered.

Three main rules should be noticed as an essential requirement at this point to enter the competition at this early stage:

1. The registration has to contain a list of **all** used chemicals (including a valid Material Safety Data Sheet) with the following minimum requirements
 - o name of substance
 - o CAS-number
 - o name of supplier
 - o hazardous classification (H/ P-phrases according to GHS)
 - o intended use
 - o total amount of substance for the competition
 - o operating conditions (temperatures, pressures...)

(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 the immediate disqualification from the competition.
3. The safety documentation needs to be signed by an official safety inspector from your university. The safety inspector must not be the supervisor of the ChemCar team. 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.



VII. Competition Instructions

The competition consists of three parts: the poster presentation, the race and the safety concept

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 20.11.2017. 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. It is proposed that the poster contains the following information:

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. If tested, a diagram of the route dimensioning
5. The Originality of the concept
6. Abstract of the constructional processing including a process flow sheet

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. In this case, the run is evaluated as not driven. The dimensions of the track are 20 m in length and 1 m in width at the starting line and 4.5 m in width at the end of the track.
3. One hour before starting the jury will announce the conditions of additional load (0-30% of own mass) as well as the range (8-17 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. The weights have to be returned after each run to the kJVs.



Figure 2: Used weights provided by the kjVIs.

4. The starting order of the teams will be drawn after their nomination by the kjVIs 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 4th 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 2nd run.
12. The teams must use personal protective equipment (especially safety goggles) during preparation and running of the model cars. Lab coats, safety goggles and gloves have to be organized by the teams. Also refer to the additional safety rules.
13. The safety representatives, the jury or the host have the right to refuse the start of any team due to safety doubts at any time of the competition until its official end.
14. If the ChemCar does not start in both runs, the team will not get any points for the race.



A seamless safety concept minimises the danger of a possible fault or malfunction and therefore potential risks for humans and the environment. The fulfilment of the safety requirements (please see the file “ChemCar Safety Rules Rev.1.0.2017.pdf”) won’t be evaluated. Safety is viewed as an integral component of this project and for negligence of safety rules your ChemCar team will be immediately disqualified.

In this part of the competition following issues will be evaluated:

1. Safety inspection (2 points). You will have to explain your ChemCar to a safety consulting company. These inspectors will analyse, whether you understand the risks and dangers of your ChemCar.
2. Safety documents (1 point). You will have to bring all relevant safety documents to the competition. If you forget to bring (for example) the material safety data sheets, you will not get this point.
3. Responsible behaviour (1 point). You need to declare all your carried chemicals in an appropriate way, wear safety goggles and needed all the time during the ChemCar preparation and keep your ‘table’ clean and safe. If you follow this ‘good safety praxis’ you will get this point.

Points allocation – Overview

The maximum available number of points is 49, which is composed of the following parts (Fig. 3):

- maximum 20 points for the poster presentation
- maximum 25 points for the race
- maximum 4 points for the safety concept

8 Pts	8 Pts	4 Pts	20 Pts	5 Pts	4 Pts
Concept	Realization	Presentation	Distance to finishing line	$\Delta x_{12} \leq 0,1$	Safety concept
Poster: max. 20 Points			Race: max. 25 Points		

Figure 3: Overview over point allocation.

The 20 points for the poster presentation consist of following parts:

1. Concept (8 Points)

- a. Innovation (4 Points)
- b. Originality (4 Points)

2. Realization (8 Points)

- a. Technical/scientific challenge (4 Points)
- b. Energy conversion (4 Points)

3. Presentation (4 Points)

- a. Comprehensibility (2 Points)
- b. Poster design (2 Points)

Keep in mind that a good evaluation requires either a new concept or an interesting technical realization of a known reaction.

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 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.

Please keep in mind that immediate disqualification occurs at:

- neglect of safety rules
- smoke emission (ChemCar Safety Rules Rev.1.0.2017.pdf)
- loss of any liquids (including water!)
- safety doubts by safety representatives, jury or host
- gross discrepancies between the concept and the ChemCar
- non-compliance of any rules



VIII. Prizes

The winners of the competition will receive the following prizes:

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

IX. Contact

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