

CHEM-E-CAR COMPETITIONS

THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS STUDENT CHAPTER AT UCLA

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MISSION STATEMENT

The national American Institute of Chemical Engineers (AIChE) established the Chem-E-Car Competition in order to provide practical engineering experience for engineering students. The competition encourages students to design a small car in a team-oriented environment and apply their chemistry and engineering knowledge in order to accurately control the car's movement. The competition also provides awareness of the chemical engineering discipline to others, such as fellow students, educators, industry representatives, and the public. Attending conferences and joining the car team enables students to enter a professional society that can guide them toward their professional careers.

INTRODUCTION

Chem-E-Car at UCLA

The Chem-E-Car team at UCLA is part of the UCLA student chapter of AIChE. The Chem-E-Car team designs and builds shoebox-sized cars powered by chemical reactions. We then compete against car teams from other schools in the nation. The competition involves running the car for a specified distance while carrying a specified quantity of water as the load; the car that stops closest to the goal distance wins. Neither the load nor the distance is known until the day of the competition. The spirit of the competition is to inspire innovative ways to provide an alternate source of fuel.

Introducing the Bruin Car

The car we have been using for the past few competitions is powered by a hydrogen fuel cell, and it has been nicknamed the "Bruin Car." Several improvements have been made to this car in the last year. Older parts, such as the fuel cell, motor, wheels, wires, and tubing, were replaced. The most significant improvement is the addition of an iodine clock stopping mechanism; by making a system that can stop reliably and efficiently, we drastically improve our chances of winning, so long as we keep our calibrations consistent. Shown in Figure 1 is a picture of the Bruin Car.



Figure 1: Picture of the Bruin Car

Bruin Car Design

Shown in Figure 2 is a schematic of the Bruin Car. We use a hydrogen fuel cell to generate electric current to power the car. A reaction of 2M hydrochloric acid and magnesium produces the hydrogen for the fuel cell. ($\text{Mg} + 2 \text{HCl} \rightarrow \text{H}_2 + \text{MgCl}_2$). The hydrogen produced is then bubbled through water in a 500mL filter chamber in order to remove acidic vapor from and add moisture to the hydrogen gas. Finally, the filtered hydrogen gas enters the fuel cell to generate power for the motor. We provide an excess amount of hydrogen in the system; the stopping mechanism is the one that stops our car. By making an iodine clock solution and combining with it a relay, we can stop the car at any time, to a certain degree of error, depending on competition conditions.

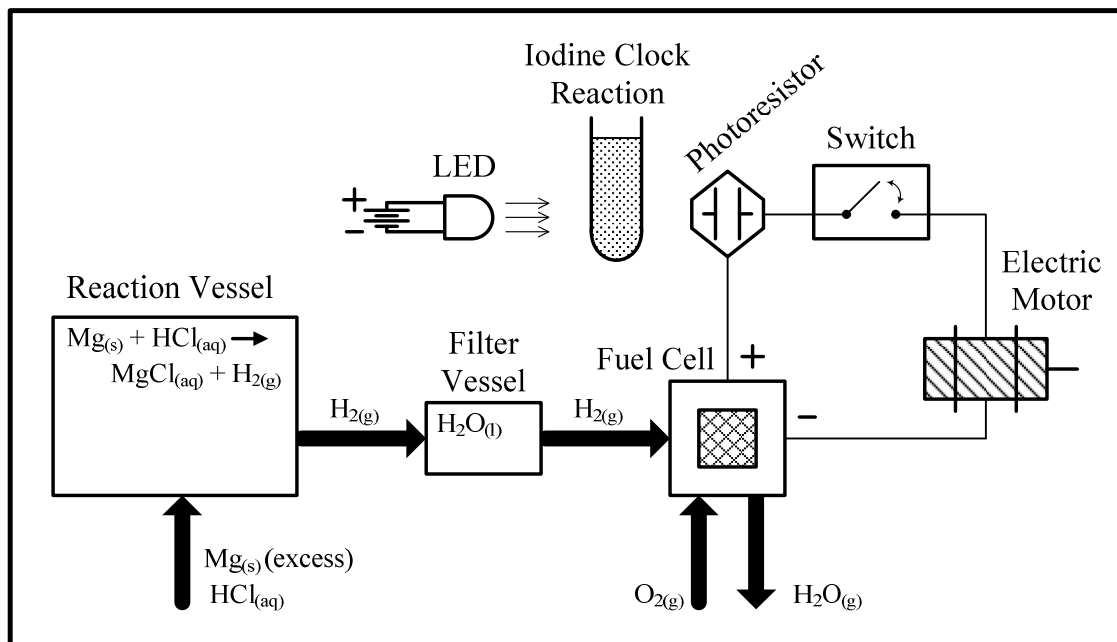


Figure 2: Schematic of Bruin Car

Chem-E-Car Competition Results

The Chem-E-Car Team at UCLA has competed in multiple National and Regional Conferences. The Regional Competition is the qualifying round for the National Competition. In the 2008-2009 school year we competed only in the Regional Competition due to shipping complications at the National Competition in Philadelphia, PA. At the Western Regional

Conference on April 4th, 2009 at UC Davis, we placed 2nd out of 8 teams. We also won the Spirit of Competition award, which is granted to the team with the most spirit.

TARGETS AND ACTIVITIES

In April 2009 we attended the Western Regional Conference at UC Davis, placing 2nd in the Chem-E-Car Competition. The top three teams of each Regional Competition qualify to compete at Nationals in November 2009 at Nashville, Tennessee. At the conference, we will be able to meet other teams, introduce ourselves to industry representatives, attend instructive workshops, and compete in the Chem-E-Car Competition.

Our current goal is to improve our preparations for the National Competition. Although our iodine clock stopping mechanism can be precise, certain conditions, such as temperature, concentrations, and even mixing procedures, can lead to discrepancies in our results. Therefore we must fully standardize our procedures and calibrate for conditions that we cannot control in order to stay consistent. After the competition, we plan to replace the hydrochloric-magnesium reaction with another reaction or replace the hydrogen fuel cell in order to obtain greater efficiency.

In addition to the Bruin Car that we have used during the past few competitions, we are currently researching a powering mechanism for a second car. Since our team has grown over the last year, we are able to concentrate on two cars. The second car will most likely be powered by a pneumatic engine, using a chemical reaction that creates pressure.

COSTS

Our current funding sources include Air Products and Chemicals, Inc., BP, the UCLA Engineering Alumni Association's Alumni Fund for Student Projects, the UCLA Undergraduate Students Association (USA) Student Organization's Operational Fund (SOOF), and the UCLA Undergraduate Students Association Contingency Fund.

Calibration Testing Cost Estimate				
Description	Quantity	Unit	Unit Cost	Total Cost
Chemicals – Hydrochloric Acid 500mL	1	Bottle	\$49.05	\$49.05
Chemicals – Magnesium, Reagent, Ribbon 99+%	2	Ribbon	\$56.20	\$112.40
TOTAL REQUESTED FOR CALIBRATION TESTING				\$161.45

National Conference Cost Estimate				
Description	Quantity	Unit	Unit Cost	Total Cost
Chemicals – Magnesium, Reagent, Ribbon 99+%	1	Ribbon	\$46.62	\$46.62
Registration Costs (\$60/\$70)	15	Person	\$62.67	\$940.00
Car Shipment	1	Shipment	\$30.90	\$30.90
Poster - 36" x 50"	12.5	Sq. Ft.	\$5.95	\$74.38
Chemical Shipment	1	Shipment	\$8.90	\$8.90
TOTAL REQUESTED FOR NATIONAL CONFERENCE 2009				\$1,100.80

Regional Conference Cost Estimate				
Description	Quantity	Unit	Unit Cost	Total Cost
Chemicals – Hydrochloric Acid 500mL	1	Bottle	\$49.05	\$49.05
Chemicals – Magnesium, Reagent, Ribbon 99+%	1	Ribbon	\$56.20	\$56.20
Registration Costs	20	Person	\$25.00	\$500.00
Chemical Shipment	2	Shipment	\$10.00	\$20.00
TOTAL REQUESTED FOR REGIONAL CONFERENCE 2010				\$625.25

CONTACT INFORMATION

Please feel free to contact our officers with any questions, comments, or suggestions. Thank you for your interest in contributing to our student chapter!

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