

NATIONAL MIDDLE SCHOOL SCIENCE BOWL MODEL HYDROGEN FUEL CELL CAR RACE 2007 COMPETITION RULES

Changes in bold/italic

Race Components

There are three components to the National Model Hydrogen Fuel Cell Competition. Teams will be judged on all three components.

1. ***Speed race:*** Each car will have three timed speed races. The top seven to ten fastest cars after ALL of the timed trails are complete will compete in the final “head-to-head” race to determine first, second, and third place. Student teams will be provided a fuel cell, motor, battery pack, valves and some tubing. Students must use the unaltered fuel cell, motor and battery pack that was provided in the fuel cell kits. Valves and tubing are also provided but may be altered or replaced. The rest of the car design and components will be up to the creativity and ingenuity of the students. They will need to design the chassis, gears, wheels, axles, hydrogen and oxygen gas collection system and electrical connection wires.
2. ***Hydrogen knowledge:*** Students must be able to answer a series of inquiry-based questions that test their knowledge of fuel cell and hydrogen technologies.
3. ***Design Interview:*** A Judge or team of judges will interview each team and ask design questions to assess the ability of the team to answer technical questions about their car. The teams will have their Car Journal that they can reference at the design interview.

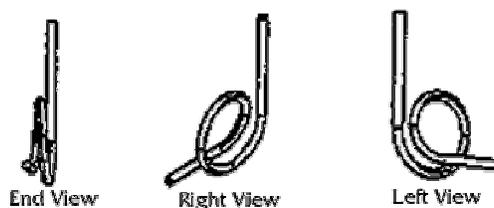
NOTE: All cars must be designed and built by the students with limited assistance from the coach or other adults. This is a student competition!

Materials

4. Fuel cell kits and a teacher activity guide will be provided to the winning regional teams following their regional event. The regional winning teams *must* bring completed and running hydrogen fuel cell cars to the National event in Denver, Colorado, June 21-24, 2007. There will be limited materials and supplies at the National event for student teams to modify their cars on site.
5. ***The vehicle must be the team’s design. Teams will be required to bring their Car Journal that will document the team’s strategy for their car design and the steps in the design, building and testing of the car.*** Teams will have time to alter their cars using limited materials provided to the teams at the National Middle School Science Bowl.

Vehicle Specifications

6. The vehicle must be safe to contestants and spectators, e.g., no sharp edges, projectiles, etc.
7. The vehicle must fit the following dimensions: 30 cm. by 60 cm. by 30 cm.
8. Decals of the sponsor organizations (provided at the National competition) must be visible from the side on the body of the car. A 3 cm. by 3 cm. space must be left for the assigned car number.
9. Energy Source: ***The electricity needed for the electrolysis procedure will be provided by the battery pack that was included in fuel cell kit.*** The electrolysis will be completed in a designated charging area prior to the start of the race. The only energy source permitted on the vehicle is the fuel cell with the hydrogen that was produced from the electrolysis procedure.
10. Steering: A guide wire attachment must be attached to the car. An example of a possible design is illustrated below. A guide wire, no more than 1.5 cm. from the surface of the track, will go through the attached guide wire attachment(s) on the car, serving as the steering mechanism, and keeping the car in its lane. The vehicle must be easily removed from the guide wire, without disconnecting the guide wire. This is the only allowable method of steering the car. No radio control is permitted in the cars. Lane changing or crossing will result in disqualification.



Above is an example of a guide wire attachment that was made from a paperclip.

Track Specifications

11. The length of the race course is 10 meters over flat terrain.
12. Race lanes are at least 60 cm. wide.
13. The guide wire will be located in the center of the track and will not be more than 1.5 cm. above the track surface.
14. The track can be a hard, flat, smooth surface such as a tennis court or running track. A large sheet of rolled material, i.e., plastic, rubber, heavy paper, roofing paper (half-lap), or hardwood taped or bolted together may be used to cover an uneven surface. ***For the National competition, the track will be a black neoprene rubber material. This surface is very smooth and slick.***

Race Conduct

15. ***Charging Station:*** *A battery pack will be provided in the kit to supply the electricity needed for the electrolysis procedure. Teams are required to use this battery pack at the National event. At regional competitions other sources can be used to supply the electricity, such as a solar cell, 6 volt battery, or AC Adaptor.* If using solar cells, and direct sunlight is not available, incandescent lamps can be used with the solar cells to produce hydrogen to fuel the cars.
16. **Race Day Electrolysis Procedure:** Before the scheduled race start, all teams must report to the designated charging station with their hydrogen fuel cell car. Distilled water will be provided at the charging station for the electrolysis process. To manage the charging area, teams that are in the staging area and are scheduled to race in the next heat, will be given priority in the charging area. There is no time limit on the electrolysis procedure – a team may report to the charging station as early or late as practical; however, teams will have ONE minute to be ready to start their race at the specified time. The only energy source permitted on the vehicle is the fuel cell with the hydrogen that it produced from the electrolysis procedure.
17. There will also be a repair table set up separate from the recharging area to help facilitate quick repairs to the cars. Again, teams that are scheduled to race in the next heat will be given priority in the repair area. There will be a 3 minute time limit for repairs.
18. At race time, the vehicle will be placed behind the starting line with all its wheels in contact with the ground. No more than two team members will be allowed in the start area.
19. An early start or push start may result in disqualification or a re-run of the heat. The determination will be left to the race judges.
20. All vehicles will be started when the official signal is given. Each car will have three timed speed trials. The top five to ten fastest cars after ALL of the timed trials are complete will compete in the final “head-to-head” race for first, second, and third place.
21. The judges will note the official time on the heat card. If the car does not finish the race, it will be noted as a Did Not Finish (DNF) on the heat card.
22. One team member must wait at the finish line to catch the vehicle.

23. Team members may not accompany or touch the vehicle on the track. Vehicles stalled on the track may be retrieved after the end of the race has been declared by the Lead Judge.
24. The vehicle and team member must remain at the finish line until the time of the race has been noted on the heat card.
25. Lane changing or crossing will result in a DNF.
26. Challenges must be made before the race judges begin the next heat. All challenges must come from the team members who are actively competing and directed to the lead judge. The decisions of the race judges are final.
27. Judges **will** inspect cars prior to the final heat or at anytime during/after heats.

RACE PROCEDURES

The heart of the Car Competition is the race and it must run smoothly. It is important that the judges thoroughly know the procedure. The Race Judges need to understand the steps of the race and their roles in enforcing the track rules. The following race procedures are to provide an example of what Nationals will look like. They can be adapted to fit your own event.

Schedule For Judges - Regional Coordinators

- Check in at registration by 11:00 a.m. Pick up your Registration Packet, T-shirt, Official Race Hat, Name Badge with Lunch Ticket and Program. You will need to park your car in the far lot of the Student Center Parking Lot.
- Lunch will be served from 12:00-1:00 in the Student Center. There will be a Race Judge meeting at 1:15 p.m. at the track in the parking lot of the Student Center.
- The first race is scheduled to start at 2:00. However, to allow for delays the schedule may extend beyond the posted race times.

Conduct of the Race

- Approximately twenty-eight teams will be competing in the race.
- The cars have been divided up into “heats.”
- There are six to ten 10 meters long tracks.
- There should be a Start Judge and Finish Judge for each track during the race. One extra Finish Judge will be assigned to work the video camera to record photo finishes of the races.
- Cars must pass inspection prior to racing their first heat. There will be a **green** dot sticker on the cars that have passed inspection.
- The Lead Judge will be provided all of the heat cards for every race. The Lead Judge and Start Judge will ensure that the correct cars are lined up ready to race.
- Competition is by process of time trials. Each team will have an opportunity to race their car three times. The top six to ten teams (depending on number of tracks) will continue to a final race.
- NOTE: If a scheduled car is not on the start line when the Lead Judge signals the heat to start, the team loses the opportunity to race in that heat. It is the responsibility of the students to be aware of when they are scheduled to race and to be on time. Consideration will be given by the Lead Judge and Inspection Judge if the car is being repaired and misses its designated heat.
- **Only students are allowed to participate in the race event. Coaches are not allowed in the race area.**

STAGE

- The Master of Ceremonies will call for a heat to “STAGE.”
- **Race Day Electrolysis Procedure:** Before the scheduled race start, teams in the staging area must report to the designated charging station with their hydrogen fuel cell car. Distilled water will be provided at the charging station for the electrolysis process. To manage the charging area, teams that are in the staging area and are scheduled to race in the next heat, will be given priority in the charging area. There is no time limit on the electrolysis procedure—a team may report to the charging station as early or late as practical; however, teams must be ready to start their race at the specified time. The only energy source permitted on the vehicle is the fuel cell with the hydrogen that it produces from the electrolysis procedure.
- The students will bring their cars to the start
 - **one student at the start (no more than two students at the start)**
 - **one student at the track finish line to catch the car**
- The Lead Judge and the Start Judge will check the heat cards to make sure that the right team is on the right lane
- The Start Judge will check each car at the start line for:
 - **green inspection sticker**
 - **car number**
- The Lead Judge will indicate any “no shows” on the heat card.
- The Lead Judge will hand out the heat cards to the Finish Line Judges.

START

- All spectators will be moved back and the announcement will be made that the heat is about to start.
- There are two judges assigned to each lane, a Start Judge and a Finish Judge.
- All students will set their cars behind the start line.
- The Lead Judge will signal the start by blasting the bullhorn. If the car cannot get going on its own, it is permissible to let the student **GENTLY** push the car to start the momentum.
- If a car starts down the track before the bullhorn sounded, the Start Judge indicates a false start and the race will be rerun.

RACE

- Students that are racing cars are not to leave their position at the start or end of the track during the race. This is true even if their car has become hung up on the guide wire or has stopped during the race. Start Judges may direct a student to retrieve his/her car along the track and disengage the car from the guide wire.
- No Judges should be distracted. They are required to watch every race thoroughly. ANYONE interfering with a Judge or the Judge's eye contact with the race should be told by the Judge to leave or stand back during the race.

FINISH

- At the end of each race the Finish Judges will indicate the car's time on the heat card.
- The Finish Judges will give the heat cards to the designated Runners to take to the Scorekeeper.
- The Start Judges will begin staging for the next heat.

DISPUTES AND CHALLENGES

- Be as fair as possible. Do not be afraid to call a false start and restage the heat if needed.
- Discourage any interruptions to your duties, because distractions will cause a delay in the event. Don't become a bottleneck trying to answer questions and help people. Refer people to the Competition Program Manager.
- Any challenge to the results of the race or a car's legitimacy should be registered as a protest to Science Bowl Central by the protesting school participants. Do not try to defend your call or judgment to parents or students. Refer them immediately to Science Bowl Central.
- You may be consulted on your ruling by this committee.
- **Science Bowl Central has the final call.**

OFFICIAL ROLES

INSPECTION JUDGES

- Beginning one hour prior to the race, Inspection Judges will inspect each car and make sure that it passes all of the Car Checklist requirements.
- If the car does not pass inspection, time will be allocated for the team to make adjustments prior to the start of the race.
- When the car passes inspection, the Inspection Judge will place a green dot sticker on the car to indicate to the Starting Judges that the car passed inspection.

TRACK JUDGES

- You are the track and race guards.
- Keep all people off the track and outside designated areas. The guide wire is fishing line and is very difficult to see.
- Only students competing in a heat should be at the track's start and finish.
- One student releases the car to start and one student catches the car at the finish. There are bags of bubble wrap at the finish so if the cars get past the student at the finish line, it will NOT crash into the cinder block.
- Do not let the students take the cars from the finish line until the Lead Judge indicates that the winners have been noted on the heat cards.
- Make sure that you have a clear visual perspective of the entire race to ensure fairness.
- No one should be between the tracks at any time. The only exception to this will be the Judges or an official event Photographer or Videographer who will not interfere with the race and the judge's view of all lanes.
- If a car gets hung up on the guide wire, the Start Judge may grant permission for the student to unhook the car from the guide wire.

LEAD OFFICIAL

The Lead Official is the person responsible for controlling the race competition. It is important that you are familiar with the hydrogen fuel cell model car race and all of the competition rules. It is, therefore, extremely important that you review the rules well in advance of the actual event.

1. The Master of Ceremonies will announce each heat by reading the team names and assigned lanes. The Lead Official collects the team heat cards at the start of each race and verifies with the Start Officials that each team is present and in the assigned lanes.
2. If a team is not ready to start the race, the Lead Official will announce the team name one more time. Consideration will be given by the Lead Official and Inspection Official if the car is being repaired and misses the designated heat.
3. The Lead Official will hand the heat cards to the Finish Officials for completion.
4. The Lead Official and Race Officials will make sure that the spectators are not blocking the lanes.
5. The Lead Official will announce the start of the race and will verify with the Start Officials that the students have their cars hooked to the guide wire.
6. The Lead Official will start the race by blasting the bullhorn.

7. Students will lower the drive wheels to the track to begin racing their cars. If a car is hooked to the guide wire or the car has stopped during the race, the Starting Official will give permission to the student to go and unhook their car from the guide wire.
8. Disputes and challenges to the competition can be directed to Science Bowl Central only by participating students before the next race. Science Bowl Central is comprised of external and impartial judges. Other Race Officials may be consulted by this committee.
9. Rules Committee has the final call.

START OFFICIAL

Your duties as a Start Official include:

1. Ensuring all competition rules are followed. To serve in this capacity, it is imperative that you fully understand all competition rules. Please review the competition rules before coming to the hydrogen fuel cell model car competition training session.
2. The Start Official reviews the heat card to make sure that the right car is in the right lane.
3. The Start Official makes sure that the car number and inspection sticker are on the car.
4. The Start Official assists the student in hooking the car to the guide wire.
5. The Start Official makes sure that the student has the fuel cell disconnected from the electric motor prior to the start of the race.
6. Move any spectators back from the racing lanes.
7. Make sure that your site of vision is not blocked.
8. Once the Lead Official calls for the start of the race, indicate to the Lead Official that your lane is ready to start the race.
9. The Start Official gives the "Ready Car" signal and the students connect the fuel cell to the electric motor.
10. If a student places the car on the track and releases it prior to the start signal, yell out "FALSE START" so the heat can be rerun.
11. If the student's car got hung up on the guide wire or has stopped in the middle of the track, you can give the student permission to go and unhook the car from the guide wire.
 12. If there are disputes to a race, you might be consulted by the Rules Committee to make a final decision.

FINISH OFFICIAL

Your duties as a Finish Official include:

1. Ensuring all competition rules are followed. To serve in this capacity, it is imperative that you fully understand all competition rules. Please review the competition rules before coming to the hydrogen fuel cell model car competition training session.
2. Prior to the start of the race, the Finish Official takes the heat card from the Lead Official for their appropriate lane.
3. Move any spectators back from the racing lanes.
4. Make sure that your site of vision is not blocked.
5. The Finish Official ensures that there is a student ready to catch the car after it passes the finish line.
6. Once the Lead Official calls for the start of the race, indicate to the Lead Official that your lane is ready to start the race.
7. Watch the race carefully and indicate to the other Finish Officials if the car in your lane is in first place (“finals” heat only).
8. Note the car race time on the heat card.
9. Inform the Lead Official so he/she can announce the winner of the heat (“finals” heat only).
10. If there is a dispute among the Finish Officials about the placement of the cars, review the video camera footage of the race to determine the winner (“finals” heat only).
11. The Finish Officials will hand the completed heat cards to the Runners who will take the heat cards to the Scorekeeper.
12. If there are disputes to a race, you might be consulted by the Rules Committee to make a final decision.

SCOREKEEPER

Your duty as a Scorekeeper is to:

1. Have the teams randomly select numbers to assign them in the initial heats.
2. Complete the heat cards with the first heat number and lane assignments.
3. Fill in the scoreboard with the initial heat information.
4. Give the completed heat cards to the Master of Ceremonies to distribute to the teams.
5. Make copies of the Heat Assignments for the Master of Ceremonies to announce the next heats.
6. Once the heats are run, the Runners will hand the completed heat cards to you for recording.
7. Assign the next heat assignments and hand the newly updated heat cards to the Master of Ceremonies to distribute to the teams.
8. Accurately record the competition results. Car race times will be recorded on a scoreboard, which should be visible to all competitors and Hydrogen Fuel Cell Model Car officials.
9. After the races are complete, provide the Master of Ceremonies a list of the teams and team members for the first, second and third place teams.

SCIENCE BOWL CENTRAL

The Hydrogen Fuel Cell Model Car Science Bowl Central is designed to provide a central location for information prior to and between races. Officials/volunteers and teams check here to receive information and heat assignments.

The Hydrogen Fuel Cell Model Car Science Bowl Central should be staffed by at least two individuals throughout the course of the event. Their responsibilities include: answering questions pertaining to the races, race times, advancement of teams, settlement of disputes, etc.

Items that should be available at Hydrogen Fuel Cell Model Car Science Bowl Central:

- Paper
- Pencils
- Magic Markers
- Extra Stopwatches, if possible
- Track Materials: Fishing Line, Hand Tools, Eyelets, etc.
- Duct Tape
- Incandescent lamps with extra bulbs
- Extra Solar Cells
- Extra 6 Volt Batteries
- Extra Fuel Cells
- Extra Motors
- Extra soldering irons and solder
- Extra glue guns and glue sticks

At the beginning of the competition, a few extra volunteers should remain at Hydrogen Fuel Cell Model Car Science Bowl Central to serve as “emergency” officials in the event that one of the scheduled officials does not arrive.