

Junior Solar Sprint Rules - OCPS



These rules are for the Junior Solar Sprint in-person competition at the Orange County STEM Saturday, which includes a head-to-head race of the cars. These rules are not valid for virtual Junior Solar Sprint competitions.

Each team is responsible for designing and building a solar powered race car. The kit your team purchases will contain a motor and solar panel. The chassis, wheels and transmission are made from any other materials that you choose. Cars are judged on design, innovation and performance. Each team's effort is focused toward the final stage - a 20 meter, wire-guided sprint race where the best design and construction techniques will pay off with the win!!

Junior Solar Sprint is open to teams of 2 - 4 students in grades 4 - 8. The competition is divided into two divisions: Green Division (4th - 6th grade), and Blue Division (7th & 8th grade). Teams of mixed grade levels will compete in the division of the highest grade level student. Each school may send up to two teams total to the Junior Solar Sprint competition.

Vehicle Design and Construction

The dimensions of a Junior Solar Sprint car cannot exceed:

- 30 cm in width
- 60 cm in length
- 30 cm in height

Each entry begins construction with a kit (Solar Made or Pitsco) containing:

- a 3V photovoltaic (PV) panel
- a motor matched to the PV panel

The solar panel and motor **may not** be modified. The specific motor supplied with the panel (in the kit) must be used. If a replacement motor is needed, the replacement must be purchased from the company that supplied the panel (or the FSEC Energy Research Center), and be the model of motor originally supplied with the panel. One solar cell and motor are permitted per car. Any modification to the solar panel or motor will result in disqualification.

Each vehicle must be designed to carry a standard, unmodified table tennis ball (aka ping-pong ball) of approximately 40mm in diameter, and be able to transport the ball (without losing it) down the entire track. The ball may not be glued, taped or otherwise permanently affixed to the vehicle, and it cannot just be wedged between the chassis and solar panel (using only those two things to hold the ball in). Since this is your 'passenger', the car design must allow for the purposeful removal of the ball with minimal effort.

As a precaution for inclement weather, each vehicle must include:

- a battery holder mounted on the vehicle that is capable of holding 2 AA batteries. (see Inclement Weather section below for information on the batteries). No batteries will be carried on the vehicle unless directed by the race officials on the day of the event.
- a switch or other easy to operate method of 'switching on' the battery power at the starting line.

Each team, on their own, will research and acquire the appropriate materials and parts needed to complete their car:

- wheels
- axles
- car body/chassis
- wiring
- connectors
- gears
- eyelet

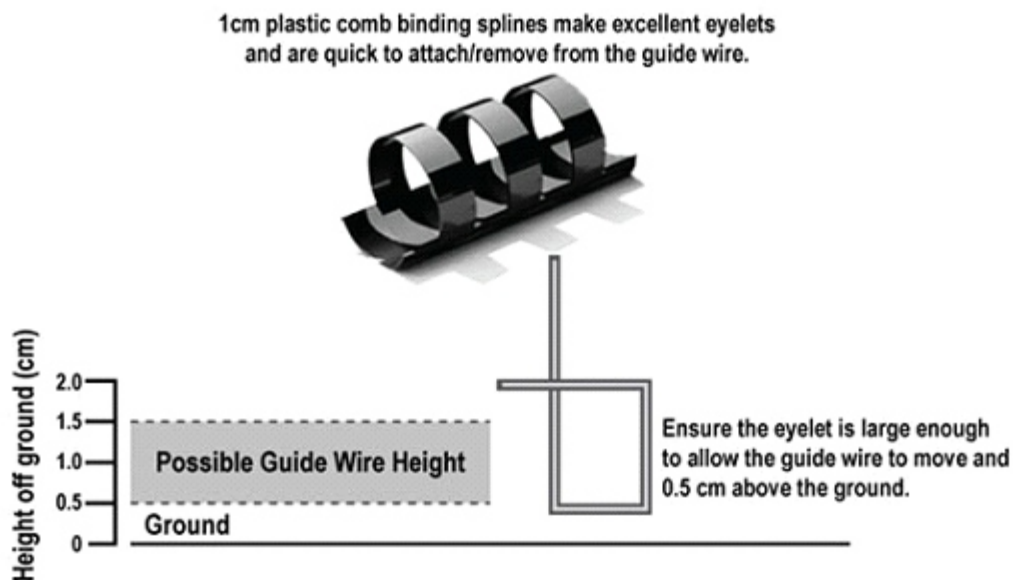
The solar panel is not to be used as the vehicle's chassis. If the axles and wheels are connected directly to the solar panel, the vehicle will be disqualified.

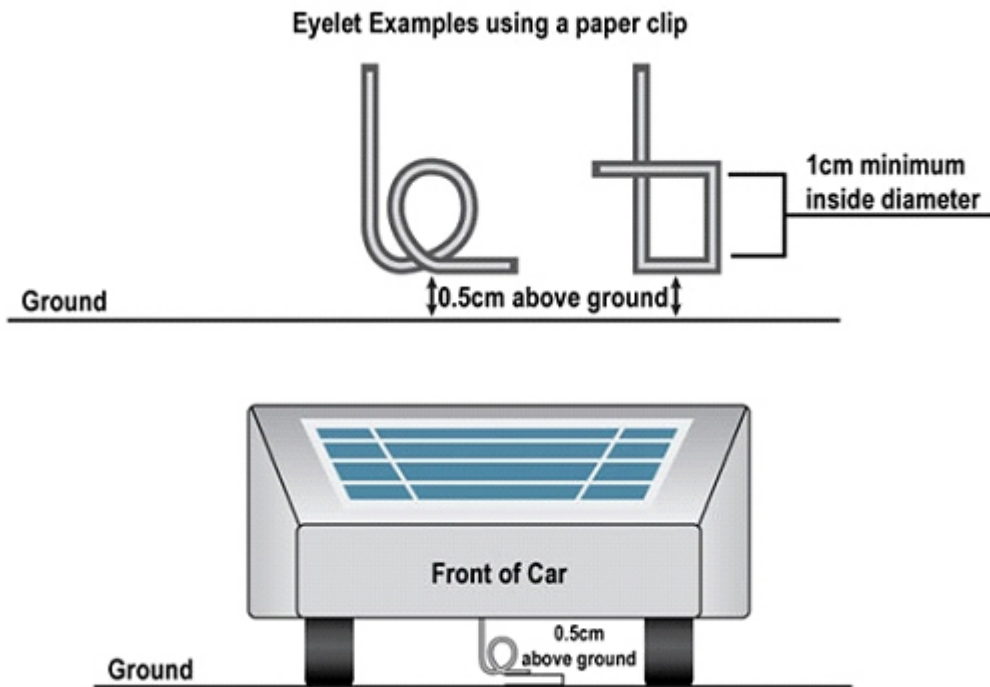
The body may be made of any lightweight material and decorated at the team's discretion. Individual decals may be affixed, but the vehicle must have a 3 cm. square space/panel on each side and the bottom that is left undecorated for the Sprint number decal (provided by the race committee).

At least one wheel must be driven by the motor.

Any energy enhancing devices, like mirrors, must be attached to the vehicle.

The Junior Solar Sprint car is guided down the track by a monofilament guide wire. On your car, an eyelet (see examples below) must be attached to the bottom of the car (our example is placed on the bottom front of the chassis, however any placement on the vehicle is okay). The guide wire, which is 1 cm.(+/- .5cm) from the surface of the track, will go through the eyelet, serve as the steering mechanism, and keep the car in its lane. The vehicle must be easily removable from the guide wire, without disconnecting the wire; meaning that the eyelet must have an opening–closed eyelets are not permitted on JSS cars.





No radio control is permitted in Junior Solar Sprint cars.

The vehicle must be safe (no jagged/sharp edges or projectiles).

Failure to meet these expectations will result in disqualification

Team Web Page Submission

Each team will populate a web page on the EnergyWhiz site (using Wordpress) that showcases their JSS vehicle. The web page will include basic team info, vehicle photos, notes on the design process, and a video describing important points of the car's design and decisions taken by the team. These pages will be used to judge the design of the car and will be viewed by other students and the public.

The web page must include:

1) Photo & Basic Info

- Car/team name
- School name
- First names(s) and last initial of students on the team (no last names on the public page)
- Grade level of each team member
- Close-up photo of completed vehicle (use this as the featured image on your page)

2) Design Documentation

- **Photos** – a minimum of six (6) photos of the completed car showing front, back, both sides, underside and top. Close-ups of special vehicle features may also be included and will help the judges understand the thought and effort that went into the vehicle's design and construction.

- **Project Log** - the entries in the project log document each team meeting or work session. Entries include:
 - ▶ the date
 - ▶ task(s) worked on
 - ▶ time spent on this task
 - ▶ team members present (initials or first names)
 - ▶ obstacles encountered (if any)
 - ▶ modifications to the car design (if any).
 This log can be a list, a table or an informal paper document that is scanned and inserted in the web page as photos.
- **Design drawings** (minimum of 2) that include measurements and dimensions.
- **Finished car specifications** that include: car size, weight, wheel size, gear ratio, and a list of the components used including the cost of each. Recycled and reused components should be included and listed as such.
- **Test results** (minimum of 3) that include one test under battery power, and at least two under only sun power. Each test must include the weather (sunny, hazy, cloudy, etc.), distance traveled, time elapsed, speed (distance divided by time), comments on performance, and ideas to help improve performance (if any).

3) Vehicle Features Video

Once your car is built, record a video that explains your vehicle's special features. One team member should hold the vehicle while that team member or other members describe and explain the following (maximum length 5 minutes):

- features of the vehicle that make it special and you believe make it a winner – the person holding the vehicle should point them out. Close-ups of these features are a must. Remember, the judges need to see them!
- any unexpected outcome or discovery made by any team member as a result of the engineering, design and building process
- how the vehicle performed when you ran it in the sunlight
- anything else you want the judges to know about your vehicle or your team.

The video will be included on your team's web page and hosted on our Vimeo site.

These are the minimum requirements for the web page. However, teams are encouraged to use the judging criteria as a guide to what extras they may want to include in their web page. For example, the web page **may** include:

- extra photos of the design, building and testing process
- electric schematics of the car
- videos of test runs of the vehicle
- formulas or calculations used
- any items that the team feels will showcase their car, or be helpful to the judges to pick them as the winning team!

Junior Solar Sprint web page submissions are due approximately one week before the event. The exact due date will be communicated to the team by the organizers of the OCPS STEM Saturday.

During the week leading up to the event and during STEM Saturday itself, all Junior Solar Sprint design pages will be available for public viewing. Students are encouraged to share their web page address with family and friends, and to visit other team pages.

Competition Day – Time to Race!

Inspection

Teams must submit their cars for inspection prior to racing. This time will be announced the day of the event.

Track Set-up and Rules

The Track

- The racetrack is 20 meters long and 60 centimeters wide.
- The track is set up on a hard, flat, smooth surface such as a tennis court.
- For the OCPS STEM Saturday event, a non-slick vinyl surface will be used for the track lanes.

The Starting Line

- One team member will hold a piece of cardboard or other shading device over the panel, and remove it when the start signal is given.
- Team members may not push a vehicle to start the vehicle.
- Team members may not accompany the vehicle in its lane during the race.

During the Heat

- Team members may not push the vehicle or give any other physical assistance.
- Team members may not change the vehicle's mechanical or electrical characteristics (e.g. shift a transmission) after the start of the heat.
- One team member may free the vehicle from wire binding or track imperfections should such problems occur.
- When 'Go' is called, vehicles that do not start moving before the other vehicle reaches the finish will be given a DNF (did not finish) and must be removed from the track immediately. If neither vehicle moves, the teams will be given 15 seconds after 'Go' is called before DNF's are given to both vehicles. Vehicles are then to be promptly removed from the track.
- A 'DNF' will be recorded for vehicles that lose their table tennis ball prior to crossing the finish line, drive off the track, cross over into another lane, do not cross the finish line, or are otherwise disqualified.
- If the car comes off the guide wire and interferes with another car, the car that left the guide wire will receive a DNF for that run and the opposing car(s) will be given another chance to run (time trials), or a win (double elimination).

Between Heats

- Repairs may be made to vehicles as necessary between heats. However, no extra time will be given for repairs, and the race will not be paused for repairs to be completed.

The Finish Line

- One team member must be present at the finish line to stop the vehicle, preventing any damage to it.
- The vehicle must remain in its lane at the finish line until the order of the race vehicles has been established.

The Junior Solar Sprint Race

The race will be conducted in two phases: time trials and a head-to-head double elimination format competition for each division (Green Division, 4th- 6th and Blue Division, 7th & 8th)

1) Time Trials

During the time trial phase of the race, teams have the opportunity to run their vehicle on the track up to three times. After each run, the vehicle's time will be recorded.

Time trials will be offered every two minutes for a given period of time. The starting time for each division's time trials will be posted the day of the race. Teams report to the starting line whenever they are ready to run—car numbers will not be called during the time trials. Teams are encouraged to perform their runs as soon as possible. It is a team's responsibility to line up and run their vehicle (up to three times) within the time allotted. Any teams in line when the end of the time trial is called by the judges will not be allowed to run.

The ten teams in each division with the fastest individual run times will move on to the head-to-head, double elimination competition. If there are less than ten teams in a division, all teams with cars who have successfully completed at least one time trial will move on to the head-to-head competition.

2) Head-to-Head Competition

The head-to-head competition is a ten-team, double elimination race; a team must lose twice before being eliminated from the competition. Teams who have not lost two races are to remain in the race area to wait for their next race to be called.

Teams will race against other teams in their division to determine the first, second, and third place winners.

Decisions made by the race officials are final

Inclement Weather

Partially Cloudy - Because weather in Florida is changeable, the race will not be postponed for partly cloudy or mostly cloudy weather. Teams should be prepared to race in all moderate weather conditions.

Severely Overcast - If the solar irradiance (amount of sunlight) averages less than 500 Wm² during a 15 minute period (as measured by equipment provided by the FSEC Energy Research Center) just prior to the start of either the Time Trials or one of the Head-to-Head Competitions, the race will be switched to a battery powered race. The FSEC Energy Research Center will loan the teams (2) AA rechargeable batteries that have been charged by solar and tested for charge level prior to distribution, as well as a 'shade' to cover the photovoltaic panel. Only the batteries supplied by FSEC may be used. From the time that the race is changed to batteries, it will remain battery powered and not switch back to solar, regardless of increasing irradiance levels. (Note: a typical full sun day at solar noon in Florida is usually 1000 Wm²)

Rain/Thunderstorms - If the solar irradiance averages less than 500 Wm² during a 15 minute period plus the amount of rain occurring makes the track unusable or unsafe, the race will be canceled. If one division has already raced, then only the second division's race will be canceled. If only the time trials have been run, those times will be used to award the race winners. If the time trial portion has not been completed, then only design awards will be given and no race will occur. The decision whether or not to cancel the race portion will be made by the JSS administrative team, and from the time that the race is canceled, it will not be reinstated even if the weather clears.

Judging Criteria

Awards (1st - 3rd) will be given for **Race Performance**, **Best Design**, and **Most Innovative** in each division.

Race Performance awards are given for the top three place teams at the end of the double elimination race for each division.

Best Design includes:

- **Chassis** - How well constructed is the frame? Were good design decisions used to improve the chassis over a plain flat sheet?
- **Wheels / Axles** - How well are the wheels, axles, bearings/bushings designed, built and mounted? Are the axles parallel so that the car will run straight?
- **Transmission** - How well mounted is the motor? Does the transmission (gears, belt, etc) effectively transmit power to the wheels?
- **Solar Array** - How well oriented is the solar panel for light reception? Does the car use a design to improve the way the solar panel is positioned, attached, or collecting sunlight?
- **Craftsmanship** - How well constructed is the car overall? Was care taken in the way the car was constructed?
- **Web page** - Does the contents of the team web page document the design, building and engineering process in a way that the viewer can see how the vehicle works and see the special features that the team incorporated in their design?

Most Innovative includes:

- **Unique Design** - Does the car include elements that are unusual, unique, and not typical for a JSS car design?
- **Creativity / Artistic** - Has the team added artistic elements, decorations, personality, or fun creative elements to their vehicle?
- **Material use** - Has the team used unusual materials or materials in an innovative way? Did the students use recycled or earth-friendly materials?
- **Web page** - How creative is the team web page? Is it enjoyable?