

Introduction

Welcome to the exciting world of the EWEB Solar Challenge! You have taken on a fun, exciting program that captures the imaginations and creativity of young people, while providing an opportunity for volunteers to share their skills and ideas.

This competition is an opportunity for local sixth, seventh and eighth-grade science students to use scientific know-how, creative thinking, experimentation, and teamwork to design and build small, solar-powered model cars. All participants will use a standardized solar cell and motor. With the exception of a few car specification regulations, unlimited ingenuity and inventiveness can be used in car construction. Awards will be given for design in addition to the track event itself.

The material included provides information on the location, race details, contest rules, etc.

The EWEB Solar Challenge is an example of a hands-on, multi-disciplinary project that motivates students and illustrates how pursuing careers in the fields of science, math, and engineering can be exciting and highly rewarding particularly when applied to renewable energy sources.

Teachers may send a team from each participating class for each of the following events:

- + Speed Race
- + Hill Climb
- + Art Concept Car
- + Science Concept Car

Common Questions About the EWEB Solar Challenge

What is the EWEB Solar Challenge?

The EWEB Solar Challenge is a classroom-based competition of solar-powered model cars for 6th, 7th and 8th grade students. The selected vehicles from each classroom compete in the local competition. The Challenge is not meant to be a single school activity. All participants work with identical solar panels and motors. Cars are judged on the basis of design and craftsmanship as well as performance.

What is the purpose of the EWEB Solar Challenge?

The EWEB Solar Challenge is more than just winning a race. It helps to teach principles of renewable energy in an atmosphere that is fun and exciting. Experience from events in previous years demonstrates that it meets its goals of stimulating interest in new technology among young students, encourages them to accept these technologies, and incorporate this area in their education, consumer practices and career plans.

Who runs the EWEB Solar Challenge?

The EWEB Solar Challenge is supported by the Eugene Water & Electric Board in partnership with Eugene 4J, Springfield, and Bethel School Districts.

EWEB Solar Challenge

Who, What, AND Where

Sixth, seventh and eighth-grade science classes in the Eugene area are invited to design, build and race solar-powered model cars. These small model cars -- powered entirely by solar energy and guided by wires -- should be built as team efforts under teacher guidance.

Date:

June

Location:

Race Site at Cal Young Middle School

Lack of Sun Location:

**Cal Young Middle School Gym
2555 Gilham Rd.**

A standardized solar car kit (consisting of a solar cell, motor, contest rules, and entry form) will be used by all participating teams. Schools will determine their entry through their own selection process. Participation will be limited to one entry per event from each classroom. Entry forms will be included with each kit.

RACE DETAILS AND DETERMINATION OF WINNERS

The race length is 20 meters with 1-meter-wide lanes. In order to keep the cars in their assigned lane, plastic lane separators are used. The race will be run in heats until the top performing cars are determined. Each car will run in 2-5 heats, depending upon the number of cars, weather conditions, etc. Prizes will be awarded to top performance cars.

The EWEB Solar Challenge is primarily a track event. In addition, design awards will be based on technology, craftsmanship, and appearance of the car. This year we will continue the very popular "Art Concept Car" competition and add a second Concept Car category, the "Science Concept Car". In addition to sending a representative to the Solar Challenge based on speed, each classroom may also send an "Art Concept Car" that will be evaluated solely on design and aesthetics. The EWEB Solar Challenge student participants will evaluate the Art Concept Car competition. Voting will take place during the day and Concept Car winners will be announced at the end of the race along with winners in other categories. A Science Concept Car may also be entered from each class. UO Physics students will judge these cars.

RACE DAY SCHEDULE

Registration: 9:30 a.m. - Cal Young Middle School Gym
Pick up your Race Packet
Will include: name tags, heat cards, lunch vouchers for team members, race schedule, inspection checklist, and design judging score sheet.

Inspection Requirements: If you are entering the speed competition, your car will need to be inspected prior to entering the race heats to make sure that it meets race specifications (See Inspection Checklist).

Design Competition: The car should also be judged in the design competition prior to the race. If you do not get the car judged for the design portion of the competition you will run the risk of having your car damaged during the race.

Team Photo: Your team will have the opportunity to have its picture taken with your vehicle.

Approximate Times:

Race 1:

Time	Heat	Team
11:00	1	Teams 1-8
11:07	2	Teams 9-16
11:15	3	Teams 17-24
11:22	4	Teams 25-32
11:30	5	Teams 33-40
11:37	6	Teams 41-48
11:45	7	Teams 49-56
11:52	8	Teams 57-64

Remaining races will be announced as time allows and will be posted on the scoreboard after these initial heats.

NOTE: You must report promptly to the staging area of the race course at your designated time slot. If you are not present for the designated heat this will count as a loss. If you miss both heats, your vehicle will be eliminated from the race competition. You will still be able to compete in the design competition.

EWEB Solar Challenge Race Rules and Vehicle Specifications

The EWEB Solar Challenge is a science class based design and track competition for solar-powered model cars. It is sponsored and organized by the EWEB Education Partnership a school district program funded by EWEB. The competition is open to science classes in sixth, seventh and eighth grades.

The object of the EWEB Solar Challenge competition is to design and build a vehicle that will compete in the category it is entered into.

Teams are given a kit containing a solar panel and a motor. Using any other materials, competitors will design and build a solar powered vehicle that will race on a 20 meter race course, climb a 10 foot hill, display artistry or illustrate a science concept. Each classroom determines its entry to the EWEB Solar Challenge Race. The winner of the competition will be the team whose vehicle is the top finisher in a series of head-to-head elimination rounds.

Good luck!

MATERIALS

1. You must use the solar panel and motor provided in the EWEB Solar Challenge Kit. The inspection judges will be checking for this during the inspection phase of the competition.
2. The remainder of the vehicle can be made from any other material(s).

VEHICLE SPECIFICATIONS:

1. The vehicle must be safe to contestants and spectators, e.g., no sharp edges, projectiles, etc.
2. The vehicle may not be larger than 30 cm wide by 60 cm long by 30 cm high.
3. A 2 cm by 2 cm space must be left for the assigned car number.
4. Due to sunlight variability, all speed car entries will be wired for both photovoltaic and battery power. A wiring harness and on-off switch will be provided for each speed car entered in the race.
5. Any energy-enhancing devices, like mirrors, must be attached to

the vehicle.

6. The body of the car must be three dimensional. Teams will NOT be allowed to bolt the axles and the wheels to the solar cell. The solar cell cannot be used as the body of the car.

CONDUCT OF THE RACE

The race length is 20 meters with 1/2-meter-wide lanes. Cars will race on rolled roofing felt layed down flat over an asphalt surface and will race from north to south.

(In the event of an indoor race, the race surface will be the same material on the gym floor.)

To start, one team member will place the vehicle at the starting gate and switch it on when directed. One team member must wait at the finish line to catch the car to prevent damage to the vehicle.

Team members may not accompany the car in its lane during the race. Team members may not push the car or give any other physical assistance. They may not change the car's mechanical/electrical characteristics (e.g. shift a transmission) after the start of the heat. Physical assistance, unauthorized repair, unauthorized people in the lane or unsportsmanlike conduct will result in disqualification from the heat, as determined by Race Officials.

One team member must be present at the Finish Line to stop the car. The car must remain in its lane at the Finish Line until the order of the cars has been established. Teams that leave the Finish Line prematurely or miss subsequent heats may be disqualified.

DETERMINATION OF WINNERS

The EWEB Solar Challenge is a design and a performance event. Design awards will be given to cars based on mass, a ramp test measuring air and rolling resistance, interview questions, and aesthetics.

The EWEB Solar Challenge will be run in heats. The total number of cars, weather conditions, etc. will determine the number of heats. A car will race until it accumulates two losses. Heats will continue until the top performing cars are determined.

EWEB Solar Challenge

Car Number _____

School _____

Inspection Checklist

- | | |
|--|---|
| <input type="checkbox"/> Car length not greater than 60 cm | <input type="checkbox"/> Eyelets on bottom of car |
| <input type="checkbox"/> Car width not greater than 30 cm | <input type="checkbox"/> Original motor (not modified) |
| <input type="checkbox"/> Car height not greater than 30cm
motor | <input type="checkbox"/> At least one wheel driven by |
| <input type="checkbox"/> Original solar panel (not modified) | <input type="checkbox"/> No radio control device |
| <input type="checkbox"/> Designed space for battery mount
of | <input type="checkbox"/> Number mounted on each side
car |

_____ Passes Inspection _____ Fails Inspection

Signature of Inspector

Design Scoring

1. Mass of racecar factor (measurements in grams)

$$\frac{\text{Standard Mass} - \text{Mass of car}}{\text{points}} = \frac{230 \text{ grams} - (\text{ }) \text{ grams}}{2} = \text{_____}$$

2. Kinetic/Potential Energy Ratio factor

$$\frac{\text{Kinetic Energy}}{\text{Potential Energy}} = \frac{1/2 mv^2}{mgh} \times 50 = \text{_____ points}$$

3. Interview Questions = _____
points

2 questions/ 15 points each

4. Craftsmanship and Innovation = _____ **points**

10 points possible

Total Points = _____ points

Signature(s) of Design Judge(s)

Car Number _____ School _____

Design Judging Worksheet

Interview Questions: The following is a list of design consideration questions. You will award points for answers on a **1 to 10 basis**. You will attempt to evaluate how well students can explain the design of their car.

Chassis Design _____ points

Evaluate if the students have attempted to keep the mass of the chassis down but also keep it strong and aerodynamic

- What did you consider when you built the chassis?
- What did you do to lighten the chassis but still keep it strong?
- What was the most important thing you considered when you built the car chassis?
- What changes did you make to the basic materials that were given in the race car kit?
- Did you use any materials that you found on your own and if so what materials and why?

Transmission Design _____ points

Evaluate if the student's understand why they chose the gear configuration they did. Evaluate student's concepts in the motor/gear configuration especially the concept of friction in the design.

- What is the most important factor in connecting the gears and motor?*
- How or why did you choose the gears that you did?*
- Why did you attach the motor and gears in the position you chose?*
- Did you have any problems with the drive gears and if so how did you solve them?*

Solar Array Design _____ points

Evaluate the student's concepts relating to the orientation of the solar panel.

- How has your design accounted for the fact that the sun's position changes during the day?
- Can your panel be moved? How many ways can it move (be adjusted)?
- What is the best angle for your solar panel and why?
- Which is more important in your design the best sun catching angle of the panel or the aerodynamics of the car? Why?

Friction or Antifriction Design _____ points

Evaluate the student's understanding of the role of friction in the design, the friction trouble spots and the solutions.

- What specific things have you done in your design to reduce friction?
- Where is the greatest friction in your racecar?
- What is friction and how does it effect your racecar?

Total Points _____

Be sure to transfer the total points to the scoring card

Car Number _____ School

Craftsmanship and Innovation

You are to award between 1-10 points for craftsmanship and innovation. You can award between 1 – 5 points in each of the two categories. This is a subjective decision on your part.

Scoring Guide

Poor 0-1	Fair 2	Good 3	Impressive 4	Awesome! 5
-----------------	---------------	---------------	-------------------------	-------------------

Appearance/Craftsmanship _____ Points

Innovation _____ Points

_____ Total
Points

Be sure to transfer the total points to the scoring card

The Concept Car (What a concept!)

The Solar Challenge 2012 will see the addition of the "Science" concept car to the Concept Car Contest. See details below.

The Art Concept Car

Who may enter? Each participating classroom may submit one entry.

The concept car could be:

A car with a fabulous appearance, **or**

A car with a great idea behind it, **or**

A car which students find inspirational for any other reason.

Qualifications: It **does not** have to race in the speed contest, but may do so, if the speed/design and concept entries are the same vehicle. (**Only** cars that will enter the speed/design contest will go through the design analysis and interview process. Concept cars will have their own inspection table.)

It **does**, however, have to follow these basic rules:

The size specs (30 cm wide x 60 cm long, 30 cm high) must apply.

The car must include a solar panel.

The concept car must function as a car; it must be able to move, powered by a solar panel, over a flat surface, a distance of 3 feet.

Cars that do not meet the requirements will be red-flagged and will not be eligible for voting.

The Winners: The winners will be decided by popular vote. There will be first, second and third place winners.

Voting: Each Solar Challenge participant will receive a voting ticket during registration, which will allow them to cast one vote on the concept car of their choice. Voting will commence when all concept cars have been tested, photographed and put on display (around 11:00).

The Science Concept Car

Who may enter? Each participating class may submit one entry.

The science concept car will:

Illustrate a scientific concept, or

Perform a task or accomplish some 'work'.

Qualifications:

The size specs (30 cm wide x 60 cm long, 30 cm high) must apply.

The car must include a solar panel (no battery pack required).

The concept car must function as a car; it must be able to move, powered by a solar panel, over a flat surface, a distance of 3 feet.

Cars that do not meet the requirements will be red-flagged and will not be eligible for voting.

Intramural Race

The purpose of the intramural race is to determine your school's entry to the regional race.

There are several options for determining your school's entry:

1. Teacher decision. It is not mandatory to conduct an intramural race.
2. By the clock. A school can set up one lane and race each car against the clock. The car with the best average time becomes the entry to the EWEB Solar Challenge.
3. Lane races. Construct (at least three) lanes and conduct a modified Double Elimination Race. Instructions for lane construction and race formats are enclosed. We have provided you with materials to construct one lane.
4. Full-scale intramural race. The EWEB Solar Challenge is a great opportunity for publicity at many levels (school, local, TV) and a good builder of school spirit. The intramural race can be held at any time prior to the EWEB Solar Challenge. Use the following instructions for lane construction and suggested race format.

TRACK SPECIFICATIONS

Track Length: 20 meters

Lane Width: 1 meter

Number of Lanes: The number of lanes depends on the total entrants and time available. Each heat takes about 5 minutes. Each car should run at least twice in a double elimination heat format.

Surface: The surface should be as smooth as possible, flat and level or slightly downhill in the direction of the race. The racing surface must be fully exposed to the sun all day. It should be oriented so that prevailing winds are behind the cars. Crosswinds are a real problem. Sweep the track before the race to clear it of any debris.

Layout: Security roping should be set up around the perimeter to protect the track. A second security roping should be used for team movement and to keep spectators off the track. In addition to the racing surface, there must be a staging area near the starting line and a run-off area beyond the finish line. A "pit" area is needed for "tune-ups" between races. The pit area should have two practice lanes. (See Lane Set Up)

Timer: Some method is needed to determine the placement of cars at the finish line. Finish line judges may use a timing device. The timer need not measure speed but must be able to determine each car's place. In the event of a photo finish, a video replay will determine 1st and 2nd place finishes.

Communication: Efficient communication is needed between the starting line, the finish line and the scoreboard. A loudspeaker or bullhorn is helpful for public announcements and crowd control.

**EWEB Solar Challenge Competition
Medical Form**

(one for each participant)

Confidential Medical Information and Emergency Notification Form

Name_____ Birth date_____ Sex: M F

Street Address_____ State_____ Zip

Code_____

Home Telephone_____

SSN_____

Date of Last Tetanus Shot_____ Drug

Allergies_____

Physician_____ Physician's

Phone_____

Medical Conditions or Previous Surgery

Regular Medications

Special Dietary Requirements (include food allergies)

Special Physical Needs

FAMILY INFORMATION

Parent or Guardian's Name_____ Work Phone

Parent or Guardian's Name_____ Work Phone

Emergency Contact_____ Phone

Relationship to Student _____
Medical/Hospital _____
Insurance Carrier _____
Policy # _____

CONSENT TO MEDICAL CARE AND TREATMENT

(Parental consent is required before a hospital's emergency department can give medical treatment to a minor. Every effort will be made to contact parents, but a completed consent form will expedite treatment) I hereby authorize and consent to the administration of all medical and/or surgical treatment(s) to my child by a licensed physician or hospital in the event I am not available to consult with the attending physician(s), attempts to contact me have been unsuccessful, and the attending physician(s) deem it advisable to proceed with such treatment(s).

_____ Date: _____
Signature of Parent or Legal Guardian