Solar powered vehicles

(basic)

Stimulate problem solving	**Gold**	**Stimulate entrepreneurship**	**Gold**
Stimulate creativity	**Gold**	**Informal learning environment**	**Gold**
Stimulate critical thinking	**Silver**	**Technology use**	**Gold**
Stimulate group work	**Platinum**		

Preparation: 30 min

Duration: 2 hours

Material needs:
motorholder, motor, cords, solar panel, small pulley, big pulley, popsicle sticks, flower sticks, rubber bands, straws, balsa wood or cardboard, cutting mat, Knife blade, pens and paper, 400W halogen lamp
Optional: Paint, Paint Brushes

Group size range: 10 - 30
Ideal sub-group size: 3 - 4

Workshop made for: - 12
Easily transferable to workshops for ages between: +16

Environment FabLab necessary: No

Educational area:
* Engineering
* Science
* Technology
* (Visual) Arts

Precognition

It’s essential for the coach to have some knowledge about:

- The materials involved. The strength and limitations of the materials
- Basic Mechanics. Pulleys, Friction.

The educator should be familiar with the most common problems.

List of common problems

Wheels don’t turn	
Rubberband is to tight	Move the motor
Wheels are stuck	Pull the wheels so they don’t squeeze the main body
Axle is glued to the main body	Glue strawn to body and put axle thro straws
Solar panel is in wrong angle	Direct the panel toward the light source
Light from lamp is too weak	Hold the lamp closer
Vehicle goes in wrong direction	reverse polarity
Wheels turns on axle	Squeeze a small rubber band (10mm) between axle and the wheel

We recommend the educator to build at least two vehicles before performing the workshop.

Preparation

Put all the materials on a table. Put the small pulleys in a cup so they don't fall on the floor.

Do not include any pre-built vehicle or instructions on how to construct a vehicle.

Leave the paint and decoration in a box. Bringing that out too early takes focus from the technical design.

Workshop Guidelines

Phase 1: Getting started

Material needs:
Essential: motorholder, motor, cords, solar panel (5v min 400mA) , small pulley, big pulley, popsicle sticks, flower sticks, rubber bands, straws, balsa wood or cardboard, cutting mat, Knife blade, sunlight or lamp, Pen and paper

Goals:
Skill Goals (**Blue**)
S1 Work in groups
S2 Planning
S3 Simple Drawing
Content Goals (**Green**)
C1 Make is simple Mechanical Drawing

Goals	Activities	Duration
	Familiarize with the available materials The materials offer both possibilities med limitations. Start by putting all the materials on a table and let the participants see, feel and test the available material.	5 min
	Make is simple Mechanical Drawing The participants work in groups and make a design of a solar powered vehicle. The plan/drawing should help them focus and work in the same direction for the rest of the workshop.	10 min

Phase 2: Building a solar powered vehicle

Goals:
Skill Goals (**Blue**)
S1 Work in groups
S2 Splitting up a problem
S3 Testing part solutions
Content Goals (**Green**)
C1 Build a Solar powered vehicle

Goals	Activities	Duration
	Build the base for the vehicle The participants build according to the attached instruction, but adapt if there area problem. When a problem surfaces try to let the participants discover and solve it themselves. If it's possible: Do not point out any problem they haven't seen and do not give them any solutions.	30 min
	Mount solar panel and motor If the participants don't have any precognition of connecting circuits: Demonstrate how to connect the solar panel to the motor and let them try to get the motor running by putting the solar panel under a lamp or in the sun. Still leave as much as possible to discover and test for the participants themself.	15 min

Phase 3: Test, evaluate and redesign

Goals:
Skill Goals (**Blue**)
S1 Testing
S2 Evaluating
S3 Building
Content Goals (**Green**)
C1 Improve your vehicle

Goals	Activities	Duration
S1, S2	**Testing and Evaluating** Let the participants test there vehicles and discuss if any improvements can be made. Can the vehicle be more reliable, faster, go straighter ...	5 min
S3, C1	**Rebuilding** Rebuild according to evaluation.	15 min

Phase 4: Pimp your ride (optional)

Material needs:
Essential: Colour pens or acrylic paint
Optional: Pearls, coloured paper, wire, ...

Goals:
Skill Goals (**Blue**)
S1 Work in groups
S2 Creativity
S3 Design
Content Goals (**Green**)
C1 Improve the visual appearance of your vehicle

Goals	Activities	Duration
	Make the vehicle look good by adding visual features	30 min

Phase 6: CAR SHOW

Goals:
Skill Goals (**Blue**)
(S1) Work in groups
(S2) Talking in front of others
Content Goals (**Green**)
(C1) **…**

Goals	Activities	Duration
	Make a Sales pitch - Why is your vehicle special? A vehicle doesn't have to be fastest to be the best for a certain customer group. Big, small, cool, slow, nice, rough, plain, colorful, easily built or something else can all be good arguments for the right customer.	10 min
	CAR SHOW Present your vehicle to the rest of the participants	15 min

Pedagogical tips

If a problem arises KEEP CALM and do not give them a solution. If you wait they will start trying to solve it by themselves.

If you feel that it is absolutely necessary to help them on the way: Help splitting the problem into smaller parts. Can you get the motor running? Can you attach the wheels so they can turn?

Encourage along the way

KEEP IT SIMPLE!

How to transfer to non-Fablab environment

No FabLab necessary

Evaluation of achievements

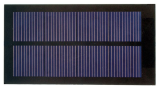
Evaluate the skills to follow instructions and how to plan and Build. Also observe the participants ability to adapt when something doesn't work.

Content links

MATERIAL

Simple Electric Motor
2- 5 V, 2mm axle

Solar panel
2V minimum 400mA



Crocodile clips wire

Small pulley
for 2mm axle on the motor

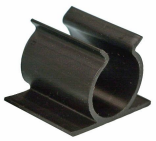
Big pulley
30mm - 40mm
for transmission to wheels

Rubber bands
for transmission

Wheels for 4mm axle
Plastic or wood
Need to be bigger than the big pulley
40mm - 50mm

Straws
6mm diameter
preferable without a bend
but bend can be cut off
for connection of wheel axle

Motor holder
Can be substituted with something sturdy
to hold the motor in place



balsa wood or cardboard,
Cardboard for a study box or preferably balsa wood for the chassis construction.

Flower sticks
4mm to be used as axis

Popsicle sticks for stability or/and decoration

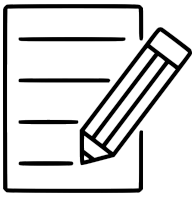
TOOLS

Box cutter
be careful

Cutting mat,
Any plastic mat och cutting board will do

Glue gun

Pen and paper



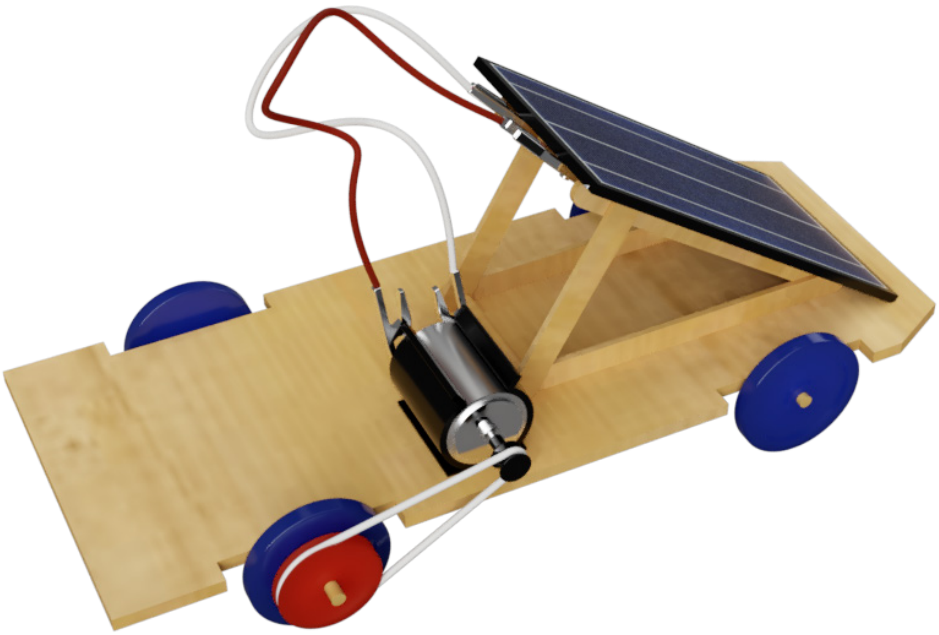
400W Halogen lamp
to be used for tests and if the sun is not bright enough
(Do NOT use LED)

OPTIONAL

Acrylic Paint, Paint Brushes, pearls, coloured paper and anything else you can think of.

Please contact us if there are any questions:
johan@karlstadmakers.se

Solar powered vehicles



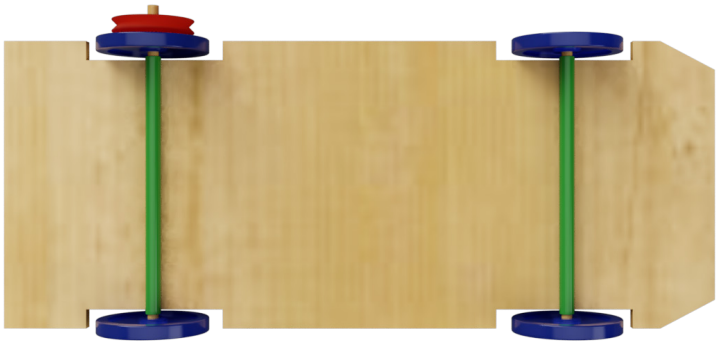
Building instructions for a simple car

Karlstadmakers 2019

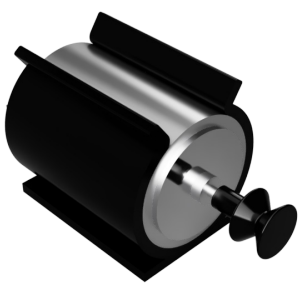
Cut out the base for your vehicle

Mount straws/tubes with flowersticks/rods. Make one rod a little longer so the pulley can be fitted.

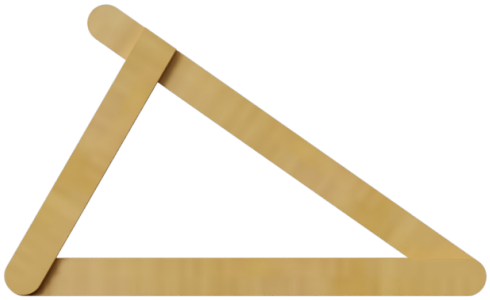
Mount whells and the pulley

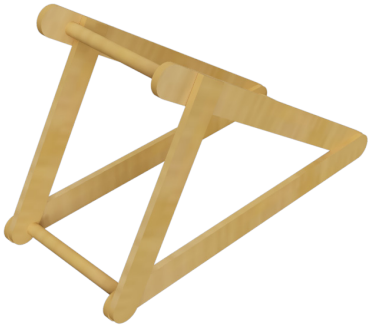


Mount the small pulley on the motor and mount the motor in the motorholder

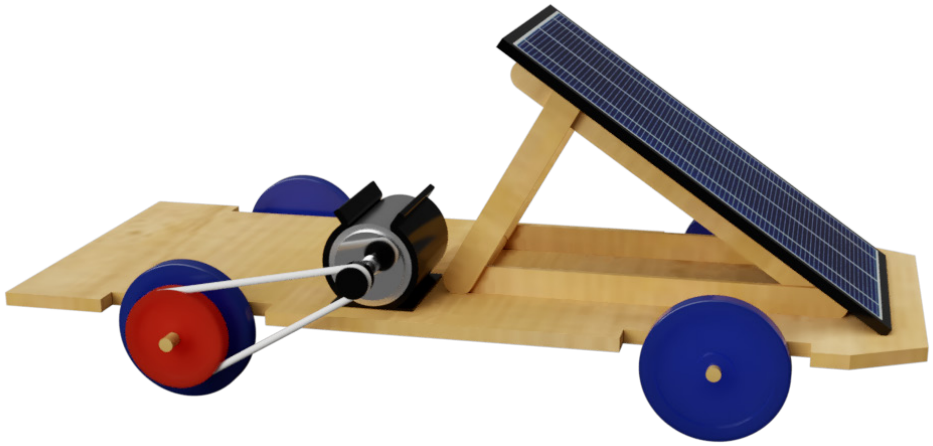


Make two triangles with three sticks each. Cut one of the sticks to make the angle to the right 30 degrees. Connect the two triangles with tree slowersticks/rods.

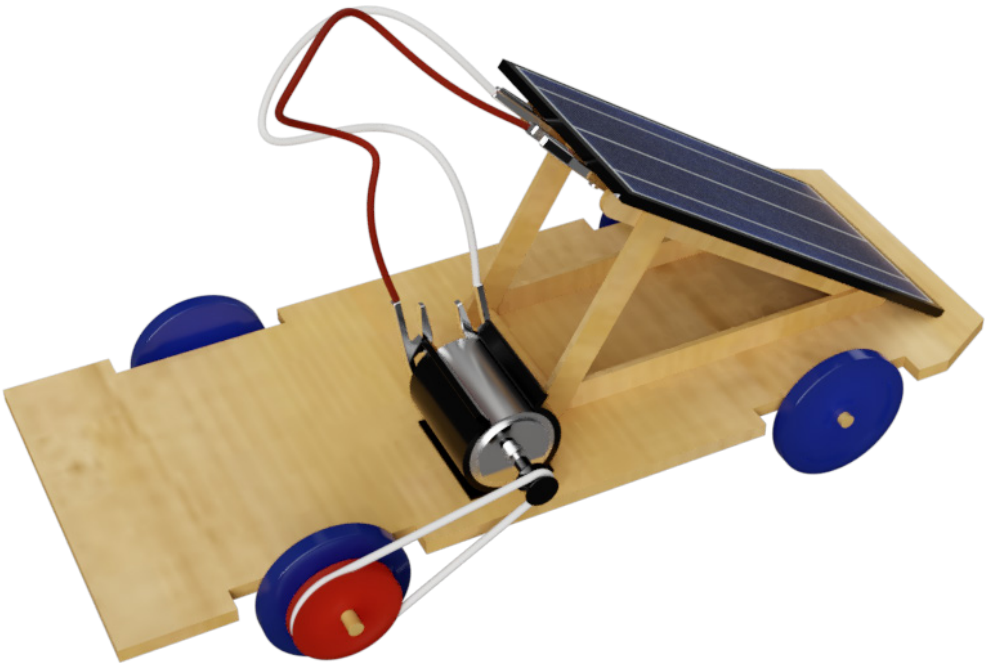




Mount the frame and the solar panel. Then mount motor and the driving belt.
Make sure the rubber band is not slacking and not too tight.



Mount the cords the put our car´s panel facing the sun och a 400w+ lamp



Good luck!